Phase I Offshore Investigation Report
for the
Sparrows Point Site

Baltimore, Maryland

Prepared for

Sparrows Point Environmental Trust
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LIST OF ACRONYMS AND ABBREVIATIONS

%D	Percent difference
µg/kg	Microgram(s) per kilogram
95%UCLM	95 Percent upper confidence limit of the mean
ABS	Fraction of contaminant absorbed dermally
ADI	Average daily intake
AF	Adherence factor
ATSDR	Agency for Toxic Substances and Disease Registry
AT	Averaging time
AVS	Acid volatile sulfide
BAF	Bioaccumulation factor
BSAF	Biota-sediment bioaccumulation factors
BSC	Bethlehem Steel Corporation
BTAG	Biological Technical Assistance Group
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm^2	Square centimeter(s)
COC	Contaminant of concern
COPC	Contaminant of potential concern
CSM	Conceptual site model
DO	Dissolved oxygen
DOJ	Department of Justice
EA	EA Engineering, Science, and Technology Inc., PBC
EcoSSL	Ecological Soil Screening Level
EEC	Environmental Engineering & Contracting, Inc.
EE/CA	Engineering Evaluation/Cost Analysis
EPC	Exposure point concentration
ERA	Ecological risk assessment
ER-L	Effects Range–Low
ER-M	Effects Range–Medium
FA	Fraction absorbed
FI	Food ingestion rate
ft	Foot (feet)
g	Gram(s)
GIABS	Gastrointestinal absorption factor
GPS	Global positioning system

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

HHRA	Human Health Risk Assessment
HI	Hazard index
HMW	High molecular weight
HQ	Hazard quotient
ID	Identification
IRIS	Integrated Risk Information System
ISG	International Steel Group Inc.
KCI	KCI Technologies
kg	Kilogram(s)
kg/kg bw-d	Kilogram(s) per kilogram body weight per day
LADI	Lifetime average daily intake
LCS	Laboratory control sample
LL	Low level
LMW	Low molecular weight
LOAEL	Lowest-observed-adverse-effect level
MDE	Maryland Department of the Environment
mg/cm^2	Milligram(s) per square centimeter
mg/kg	Milligram(s) per kilogram
mg/kg bw-day	Milligram(s) per kilogram body weight per day
mg/L	Milligram(s) per liter
Mittal	Netherlands Corporation Mittal Steel Company N.V.
mL	Milliter(s)
MPA	Maryland Port Administration
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NNS	Northeast/Near-Shore
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No-observed-adverse-effect level
NPDES	National Pollutant Discharge Elimination System
NRWQCs	National Recommended Water Quality Criteria
ORP	Oxidation-reduction potential
OSWER	Office of Solid Waste and Emergency Response
PAH	Polycyclic aromatic hydrocarbon
PC	Partition coefficient

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

PCB	Polychlorinated biphenyl
PEC	Probable effects concentration
PEL	Probable effects level
PPL	Priority pollutant list
QC	Quality control
RAGS	Risk Assessment Guidance for Superfund
RBC	Risk-based concentration
RCRA	Resource Conservation and Recovery Act
RfC	Reference concentration
RfD	Reference dose
RL	Reporting limit
RPD	Relative percent difference
RSL	Regional Screening Level
Rust	Rust Environment and Infrastructure
SA	Surface area
SAV	Submerged aquatic vegetation
SEM	Simultaneously extracted metals
SF	Slope factor
SLERA	Screening Level Ecological Risk Assessment
SSA	Special Study Area
SWMM	Stormwater Management Modeling
SWTM	Southwest/Tin Mill Canal Effluent
SVOC	Semivolatile organic compound
TEL	Threshold effects level
TOC	Total organic carbon
TRV	Toxicity reference value
UF	Uncertainty factor
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VOC	Volatile organic compound
VRS	Virtual Reference Station

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EXECUTIVE SUMMARY

The Sparrows Point Site (the Site), which was historically a steelmaking facility, is located on approximately 2,300 acres in Baltimore County, Maryland, approximately 6 miles southeast of downtown Baltimore. The Site is surrounded by the Patapsco River to the south and west, Old Road Bay to the east, and Bear Creek to the northwest. Since 2001, the Site has changed owners numerous times, and steelmaking operations ceased in 2012. The Sparrows Point Environmental Trust was established in 2014 to address potential Site-related offshore impacts in the water bodies surrounding the Site. This report presents the results of an offshore investigation, including risk assessments, for the Phase I area of the Site, which is located in Bear Creek adjacent to the northwest portion of the Site. The investigation was funded by the Sparrows Point Environmental Trust and conducted by EA Engineering, Science, and Technology, Inc., PBC (EA).

The Offshore Investigation for the Phase I area included collection of sediment, pore water, and stormwater samples to support delineation of offshore impacts to Bear Creek from the Site. Objectives of the investigation included the following: (1) identifying current Site-related impacts to the offshore environment by evaluating the quality of the sediment, pore water, and stormwater; (2) delineating impacts posing current risk identified during the investigation that are likely associated with the outlet of the Tin Mill Canal, which historically discharged wastewater from onsite industrial facilities; (3) conducting an assessment of offshore risk for the Phase I area; and (4) supporting remedial decision-making for Site-related impacts that are associated with elevated risk in Bear Creek.

Sediment sampling was conducted in two rounds: (1) surface sediment grab sampling along the shoreline, and (2) sediment coring focusing on delineation of the historical inputs in the southern portion of the Phase I area. Pore water samples were collected from selected surface sediment grab sampling locations near the shoreline, to assess potential inputs to Bear Creek via groundwater upwelling. Stormwater samples were collected from active outfalls and a stormwater pond along the shoreline during two events, to support assessment of current inputs from the Site to Bear Creek.

Results of sediment sampling and analysis indicated the concentrations of certain constituents (e.g., metals, polycyclic aromatic hydrocarbons [PAHs], bis(2-ethylhexyl)phthalate, and polychlorinated biphenyls [PCBs]) were elevated in fine-grained sediments, which are found near the center of Bear Creek and also near the outlet of the Tin Mill Canal. Additionally, select metals, PCBs, and oil and grease detected in sediment in the southern portion of the study area are likely derived from the Tin Mill Canal, based on the fact that their concentrations are highest near the outlet of the Canal, and decrease farther out in Bear Creek. Constituent concentrations reported in pore water were moderately correlated with those reported in nearby groundwater, and included metals, cyanide, bis(2-ethylhexyl)phthalate, and one PAH. Constituents detected in stormwater included metals, cyanide, PAHs, and other semivolatile organic compounds.

The results of the offshore investigation led to the division of the Phase I area into two areas for human health and ecological risk assessment, based on geography as well as the characteristics of the sediment: the Southwest/Tin Mill Canal Effluent grouping has silty-to-clayey sediments that exhibit evidence of impacts from the Tin Mill Canal effluent, while sediments in the Northeast/Near-Shore grouping are coarser and/or have fewer observable impacts.

Ecological and human health risk assessments for these two groupings were performed using the following: sediment data collected as part of this investigation, results from fish and crab tissue collected from around Coke Point and Sollers Point in Fall 2010, estimates of constituent concentrations in crab and fish tissue, and modeled surface water concentrations. Surface water concentrations were modeled using pore water and stormwater data, which yielded an estimate of current Site-related impacts to Bear Creek surface water.

In the Northeast/Near-Shore grouping, the investigation and risk assessments focused on current inputs of Site-related contaminants of potential concern (COPCs) to the offshore area via groundwater/pore water and stormwater. The lines of evidence considered in the ecological risk assessment (ERA) suggest that Site-related COPCs in this northeast area are not present in concentrations that pose a risk to wildlife; however, Site-related COPCs in sediment, as well as cyanide in surface water during storm events, may pose risks to aquatic and benthic organisms. The results of the human health risk assessment (HHRA) indicate that there are no human health concerns for exposures to Site-related COPCs in the Northeast/Near-Shore grouping compared to the federal 10^{-4} to 10^{-6} acceptable excess cancer risk range. The Northeast/Near-Shore grouping did reveal potential carcinogenic risks above the MDE acceptable excess cancer risk range of 10^{-6} to 10^{-5} for modeled PAH concentrations via fish and crab ingestion, but no excess risk for ingestion of field-collected tissue.

In the Southwest/Tin Mill Canal Effluent grouping, all constituents analyzed are potentially related to historical discharges from the Tin Mill Canal. Therefore, sediment data and modeled surface water concentrations for all constituents in the southwest area are applicable to the objective of delineating impacts from the Canal, and were used in the ERA and HHRA for this grouping. The ERA concluded that wildlife that consume aquatic and benthic organisms are potentially at risk from selenium and total PCBs in this portion of the Phase I area. Aquatic and benthic organisms are potentially at risk from COPCs in sediment, and from cyanide in surface water only during storm events. Benthic organisms are likely also at risk from oil and grease. The results of the HHRA for the Southwest/Tin Mill Canal Effluent grouping indicate potential human health concerns, primarily for modeled PCB and PAH concentrations via crab ingestion. Ingestion of field-collected fish and crab tissue posed no unacceptable hazard or carcinogenic risk compared to the federal 10^{-4} to 10^{-6} acceptable excess cancer risk range. However, carcinogenic risks from ingestion of field-collected fish and crab tissue were above the MDE acceptable excess cancer risk range of 10^{-6} to 10^{-5} based upon measured concentrations of total PCBs and arsenic and modeled concentrations of bis(2-ethylhexyl)phthalate.

Based on the results of the offshore investigation, including the risk assessments, the sediments in the southern portion of the Phase I area that were apparently impacted by historical Tin Mill

Canal effluents present potential concerns for both human health and wildlife. These impacts have been partially delineated horizontally, though vertical delineation of the identified contaminants would require additional coring and sediment sampling. The results of this investigation provide a basis for evaluating the objectives and potential approaches for remediation of Site-related impacts to the Bear Creek sediments that are associated with elevated risk.

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1. INTRODUCTION

This Phase I Offshore Investigation Report for the Sparrows Point Site (the Site) has been prepared by EA Engineering, Science, and Technology, Inc., PBC (EA) on behalf of the Sparrows Point Environmental Trust (the Trust). This report presents the results of the offshore investigation of the Phase I area, which was designed to provide information necessary to assess Site-related impacts to the Phase I area and, as needed, support evaluation of remedial alternatives.

1.1 SITE LOCATION, DESCRIPTION, AND HISTORY

The Sparrows Point Site is located on approximately 2,300 acres on the north side of the Patapsco River in Baltimore County, Maryland, approximately 6 miles southeast of downtown Baltimore. The Site is surrounded by the Patapsco River to the south and west, Old Road Bay to the east, and Bear Creek to the northwest. Two portions of the offshore area surrounding the Site were originally identified for investigation by the United States Environmental Protection Agency (USEPA) and Maryland Department of the Environment (MDE): Phase I, the northwest shoreline, and Phase II, the southeast shoreline. This report addresses only the Phase I area, which is located along the northwestern shoreline of the Site, along the Bear Creek shoreline (**Figure 1-1**).

Pennsylvania Steel built the first furnace at Sparrows Point in 1887. Bethlehem Steel Corporation (BSC) purchased the facility in 1916 and enlarged it by building mills to produce hot rolled sheet, cold rolled sheet, galvanized sheet tin mill products, and steel plate. During peak steel production in 1959, the facility operated 12 coke-oven batteries, 10 blast furnaces, and 4 open-hearth furnaces.

BSC declared bankruptcy in 2001. After the bankruptcy of BSC, the assets at Sparrows Point were acquired in May 2003 by International Steel Group Inc. (ISG). The Sparrows Point assets were held by ISG's subsidiary corporation ISG Sparrows Point LLC (ISG 2005). ISG was subsequently acquired in 2005 by Netherlands Corporation Mittal Steel Company N.V. (Mittal). When Mittal proposed to acquire the Luxemburg-based Arcelor SA, the United States Department of Justice (DOJ) raised anti-trust concerns regarding tin plate production. In February 2007, DOJ notified ArcelorMittal that it had to divest itself of the Sparrows Point steel mill under the Consent Decree filed by the DOJ in August 2006. In March 2008, the Russian firm OAO Severstal announced its purchase of the Sparrows Point plant from ArcelorMittal. An article in the *Baltimore Sun* indicated that Severstal completed the acquisition for $810 million in May 2008. In 2011, RG Steel, a subsidiary of Renco Group, Inc., purchased the Site from Severstal.

After RG Steel declared bankruptcy in 2012, the Site was bought by Environmental Liability Transfer, Inc., a liquidation firm specializing in redevelopment of commercial and industrial properties, and Hilco Sparrows Point LLC, which oversaw the auctioning of much of the remaining mill equipment in 2013. During this sale, funds were designated for investigation of

impacts to the offshore area, as required under the Consent Decree. These funds are owned and managed by the Trust, and are being used to conduct the offshore investigation described in this document. As stated in the Trust Agreement (RG Steel and Silver 2014), "the Sale Order for this property transfer provided that RG Steel deposit $500,000 of the purchase price into an escrow account to fund the costs for an offshore site-wide investigation and a corrective measures study."

1.2 PREVIOUS INVESTIGATIONS

This section presents information gathered during the review of existing documents performed as a preliminary task in the Offshore Investigation. Information is presented for the Site as a whole, with a focus on information pertinent to the Phase I area.

Corrective Action activities under the Resource Conservation and Recovery Act (RCRA) have been conducted at the Site under a Consent Decree by USEPA and MDE issued to BSC in 1997. Waste management at the Site includes air pollution controls throughout the manufacturing processes, two solid waste landfills, and waste treatment. The Consent Decree provided a synopsis of activities and conditions of concern at the Site, outlined corrective measures to be performed, and mandated a waste minimization plan. Corrective measures defined in the Consent Decree also included requirements for interim measures, a Site Wide Investigation, and a Corrective Measures Study. The Site Wide Investigation includes (1) characterization of the environmental setting, (2) source characterization, (3) contamination characterization, and (4) a risk assessment, including evaluation of the potential for current and future risk to human health and the environment from current and past releases of hazardous constituents at the Site.

Environmental investigations relating to the Phase I area are summarized in **Table 1-1**. In 1998, as part of the Site Wide Investigation, BSC submitted a *Description of Current Conditions* report (Rust Environment and Infrastructure [Rust] 1998), which described the potential contaminant sources at the Site and proposed a detailed framework for future investigations. BSC then submitted a *Site Wide Investigation Groundwater Study Report* (CH2M Hill 2001), presenting characterization of the hydrogeology of the peninsula, followed by a *Site-Wide Investigation Release Site Characterization Study* (CH2M Hill 2002), which focused on contamination in the five Special Study Areas (SSAs), including Greys Landfill in the northern portion of the Phase I area and Humphrey Impoundment at the southern end. Additional groundwater sampling was begun in 2002 to further characterize the nature and extent of contamination in the five SSAs, but was delayed in 2003 due to ownership change of the facility during Summer 2003. The sampling required was completed in 2004 and the results were presented in the *Site Wide Investigation Report, Nature and Extent of Releases to Groundwater from the Special Study Areas* (URS 2005, 2006).

Among the interim measures described in the Consent Decree was continued operation of a groundwater pump and treat system to address metals contamination of groundwater at the Rod & Wire Mill Sludge Bin Remediation Area, which is located near the center of the Phase I area. This treatment system was reinstated in 2000, and semiannual groundwater sampling and

analysis is performed in this area under the work plan for re-establishment of the interim measures. The results of semiannual sampling from 2001 to 2013 consist of cadmium and zinc concentrations in groundwater, which are contained in recent annual reports for this interim measure (URS 2011 and 2012, Environmental Engineering & Contracting, Inc. [EEC] 2013, EnviroAnalytics Group 2014a).

The Consent Decree also required groundwater monitoring at Greys Landfill, which is located in the northern portion of the Phase I area. Recent sampling events include the following: two events in 2009, two events in 2010, one event in 2011, and two events in 2013. Groundwater samples collected were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals, and results were presented in groundwater monitoring reports (KCI Technologies [KCI] 2010 and 2011; EnviroAnalytics Group 2013 and 2014b).

Independent of the Consent Decree for Sparrows Point, a study of sedimentary contaminants in Baltimore Harbor, the Patapsco River, and Back River system was submitted to MDE in 1997 (Baker et al. 1997). This study included collection of surficial sediment samples from 80 locations in these water bodies in June 1996. These included a sample from Site 28, offshore of the Rod & Wire Mill in the Phase I area of Bear Creek. Most of the sediments collected were analyzed for polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides, and metals (including mercury); however, the sample from Site 28 contained "considerable oil and tar" that prevented accurate analysis of organics. Another study of contaminant trends in Baltimore Harbor was conducted in 2007 (Klosterhaus et al. 2007), and included collection of sediment, pore water, and a gravity core from a location in the Phase I area of Bear Creek. These samples were analyzed for PAHs, PCBs, brominated diphenyl ethers, and butyltins.

1.3 RISK ASSESSMENTS FOR SURROUNDING AREAS

Risk assessments for onshore and offshore areas surrounding the Phase I area have been prepared by the Sparrows Point property owners, the Maryland Port Administration (MPA), and USEPA Region III. Although these studies do not directly relate to the Phase I area, they were referenced in planning for the Offshore Investigation (EA 2014).

ISG submitted a *Screening Level Ecological Risk Assessment for On-Site Areas* (URS 2009a), which was followed by a *Baseline Ecological Risk Assessment for On-Site Areas* submitted by Severstal (URS 2010). However, these assessments focused only on risks on the Peninsula, and deferred evaluation of offshore risks.

MPA prepared a *Risk Assessment of Offshore Areas Adjacent to the Proposed Coke Point Dredged Material Containment Facility at Sparrows Point* (EA 2011a) for the offshore areas surrounding the Coke Point area of Sparrows Point, which is located approximately 1 mile south of the Phase I area. The bases of this risk assessment were data from studies conducted by MPA in support of its proposal to build a dredged material containment facility on Coke Point. These studies included analysis of sediment and surface water samples for VOCs, PAHs, PCBs, dioxins

and furans, metals, butyltins, and cyanide. Results were presented in the *Site Assessment for the Proposed Coke Point Dredged Material Containment Facility at Sparrows Point* (EA 2009) and the *Additional Offshore Delineation for the Proposed Coke Point Dredged Material Containment Facility* (EA 2010). Samples of blue crab (meat and mustard) and fish tissue were also collected from around Coke Point to support this risk assessment, and laboratory bioaccumulation studies were conducted using clams (*Macoma nasuta*) and aquatic worms (*Nereis virens*) with sediments from offshore areas near Coke Point. These studies were part of the *Laboratory Bioaccumulation and Field-Collected Tissue Study* (EA 2011b).

In 2011, USEPA Region III issued a *Data Evaluation and Screening Level Human Health and Ecological Risk Assessment for Bear Creek Sediment* (Prince 2011). This study relied on existing sediment and tissue data from Bear Creek, including sediment data collected in 2009 from portions of Bear Creek north and west of the Phase I area for the Chesapeake Bay Foundation, crab and fish tissue analyzed by MPA as part of the 2011 Risk Assessment, and sediment data for metals from one location in the Phase I area which was used for temporal comparison, from the *Spatial Mapping of Sedimentary Contaminants in the Baltimore Harbor/Patapsco River/Back River System* (Baker et al. 1997). The evaluation concluded that there is no expectation of unacceptable risk for any possible human health exposure from contact with sediment or consumption of crab or fish in Bear Creek, and that population-level adverse effects are not expected for wildlife. However, the sediment data used in this screening level risk assessment did not include data from the Phase I area.

1.4 SPARROWS POINT TRUST AGREEMENT

The Sparrows Point Trust Agreement, which was signed in January 2014 (RG Steel and Silver 2014), stated that the purpose of the Environmental Trust includes "managing and/or funding implementation of activities in the offshore environment at the Site consistent with the Consent Decree and Sale Order" (RG Steel and Silver 2014). Schedule 4 of the Agreement is a Scope of Work for Sparrows Point Offshore Investigation and Corrective Measures Study. This document is the basis for the scope of the offshore investigation.

1.5 PROJECT OBJECTIVES AND TECHNICAL APPROACH

The primary original objectives of the Phase I offshore investigation, as defined in the Offshore Investigation Work Plan (EA 2014), were as follows:

- To identify current Site-related impacts to the offshore environment by evaluating the quality of the sediment, pore water, and stormwater

- To conduct an assessment of offshore risk for the Phase I area, focusing on risk associated with current impacts from the Site

- To support evaluation of the objectives and potential approaches for remediation of Site-related impacts in the Phase I offshore area.

To meet these objectives, an investigation was designed to support evaluation of potential ecological and human health risk resulting from exposure to environmental media (sediment and surface water) in the Phase I offshore area of Bear Creek. Components of the Phase I offshore investigation as defined in the work plan included the following:

- A first round of sampling and analysis of surface sediments from Bear Creek, near the Phase I shoreline

- Sampling of stormwater from active and potentially active outfalls, to assess their potential effects on the Phase I area of Bear Creek, also during the first round of sampling

- A second round of sampling and analysis of surface and/or subsurface sediment from Bear Creek, to be scoped based on the results of the first round of sampling

- Sampling and analysis of pore water from Bear Creek sediments, also as part of the second round of sampling, to characterize potential effects from discharge of groundwater from the Site into the Phase I area.

The analytical suite for pore water was specifically selected from analytes that exceeded screening values in groundwater and stormwater, to allow a focus on how these onshore media affect the offshore area. In place of surface water sampling, a numerical model of constituent concentrations in surface water was designed to assess how current inputs via pore water and stormwater affect surface water quality. The concentrations of chemical constituents analyzed in sediment and modeled surface water form the basis of the risk assessment. The findings of the risk assessment, in turn, will inform the objectives of the Engineering Evaluation/Cost Analysis (EE/CA), which is currently being planned in place of a corrective measures study for the Phase I area.

Although the investigation was originally designed to identify only current Site-related impacts, the first round of surface sediment sampling indicated substantial contamination in the southern portion of the Phase I area, possibly associated with more historical discharges from the Tin Mill Canal. Because of the magnitude of southern sediment contamination, this finding led to the objective of delineating the horizontal and vertical extent of contamination in the second round of sediment sampling.

The delineation of potential Tin Mill Canal-related impacts, which was scoped along with the pore water sampling in a memorandum (EA 2015), entailed sediment coring in the southern portion of the Phase I area. Despite the evolution of the objective for the southern area, the primary objective for the northern portion of the Phase I area (outside the apparent radius of impacts from the Tin Mill Canal) remained focused on potential current impacts from pore water

and stormwater. The two areas were therefore treated as separate data groupings in the risk assessments, reflecting the different objectives and sources of impacts.

1.6 DOCUMENT ORGANIZATION

Chapter 2 summarizes preliminary data collection and screening performed in support of the offshore investigation. Chapter 3 describes the preliminary conceptual site model (CSM) for the project area. Field activities and methodologies are described in Chapter 4. Results of the investigation are presented in Chapter 5. Chapter 6 presents the detailed ecological and human health conceptual site models. Chapter 7 describes surface water modeling performed to aid in assessment of current pore water and stormwater impacts. Chapter 8 describes how the data collected were used in calculation for exposure point calculations, for use in the risk assessment. Chapter 9 and 10 present the ecological and human health risk assessments, respectively.

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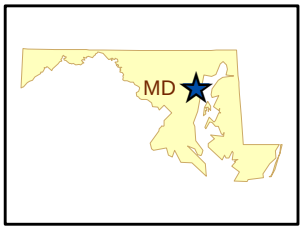

0 500 1,000 2,000
Feet

1 inch = 2,250 feet

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Legend

- Phase I Northwest Shoreline
- Phase II Southeast Shoreline

Figure 1-1
Phase I and Phase II
Offshore Investigation Areas
Baltimore, Maryland

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

EA Engineering, Science, and Technology, Inc.

TABLE 1-1 CHRONOLOGICAL SUMMARY OF PREVIOUS STUDIES RELEVANT TO THE PHASE I INVESTIGATION AREA, SPARROWS POINT, MARYLAND

Reference	Summary
Baker et al. 1997. Spatial Mapping of Sedimentary Contaminants in the Baltimore Harbor/Patapsco River/Back River System.	Presented polycyclic aromatic hydrocarbon (PAH), polychlorinated biphenyl (PCB), pesticide, and metals (including mercury) concentrations for surficial sediment samples collected in June 1996 from 80 locations. Data were screened against the effects range-low (ER-L) and effects range-median (ER-M). A sample from Site 28, in the Phase I area of Bear Creek, contained "considerable oil and tar" that prevented accurate analysis of organics. All metals analyzed at Site 28 exceeded the ER-L, and chromium, nickel, lead, and mercury also exceeded the ER-M.
Rust Environment & Infrastructure. 1998. Description of Current Conditions, Bethlehem Steel Corporation, Sparrows Point, Maryland.	Described the potential contaminant sources and proposed a detailed framework for future investigations.
CH2M Hill. 2001. Site-Wide Investigation: Groundwater Study Report, Bethlehem Steel Corporation, Sparrows Point Division.	Study (1) developed improved understanding of geologic material from surface to 120 feet deep, (2) investigated permeability and hydraulic head between layers, (3) characterized inputs and outputs of groundwater flow, (4) modeled site-wide groundwater flow, and (5) provided better data regarding onsite and offsite groundwater use.
CH2M Hill. 2002. Site-Wide Investigation Release Site Characterization Study.	Study focused on five Special Study Areas (SSAs), including Greys Landfill and Humphrey Impoundment. Included measurement of water levels and collection of groundwater samples for analysis of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals. Defined the stratigraphy of 100–120 feet of subsurface materials.
URS 2005, 2006. Site Wide Investigation, Report of Nature and Extent of Releases to Groundwater from the Special Study Areas.	Evaluated the nature and extent of releases to groundwater from the SSAs. Included collection of groundwater samples from the vicinity of Greys Landfill and Humphrey Impoundment, which were analyzed for VOCs, SVOCs, and metals.
Klosterhaus et al. 2007. Toxicity Identification and Evaluation and Long-Term Contaminant Trends in the Baltimore Harbor.	Included collection of surficial sediment, pore water, and a gravity core at location BSM 28 in the Phase I area of Bear Creek. Sediments were analyzed for PCBs, PAHs, brominated diphenyl ethers, and butyltins.
KCI Technologies. 2010 and 2011. Greys Landfill Groundwater Monitoring Reports.	These reports include water level measurements and analytical results for groundwater samples collected from monitoring wells in the vicinity of Greys Landfill.
EnviroAnalytics Group. 2013 and 2014. Coke Point and Greys Landfills 1st Half and 2nd Half 2013 Groundwater Monitoring Reports	These reports include water level measurements and analytical results for groundwater samples collected from monitoring wells in the vicinity of Greys Landfill (as well as Coke Point Landfill).
2011-2014. Interim Measures Annual Reports, Former Sludge Bin Storage Area, Rod and Wire Mill. Area	Include semi-annual measurement of water levels and sampling and analysis of groundwater collected from monitoring wells in the vicinity of the former Rod & Wire Mill, where a pump and treat interim measure is ongoing. Groundwater samples are analyzed for cadmium and zinc, the primary contaminants addressed by the interim measure.

2. PRELIMINARY DATA COLLECTION AND SCREENING

2.1 SUBAQUEOUS SURVEY

A subaqueous survey of the Phase I area was completed in May 2014, to characterize the offshore water depths and bottom structure, and inform the selection of sampling locations for the offshore investigation. The survey was comprised of two principal study elements: (1) a detailed subaqueous survey, including bathymetry and side scan sonar, and (2) a visual shoreline survey.

2.1.1 Bathymetry and Side Scan Sonar

The bathymetric and side scan sonar elements were performed in the shallow waters of Bear Creek over areas of riverbed that have the potential to be impacted by stormwater discharge and groundwater seepage. The subaqueous survey was designed to provide a base map of subaqueous topography and benthic habitat, as well as determine the presence and abundance of possible obstructions and submerged hazards. Visual observation of sediments was also conducted, to ground-truth the side scan sonar data. Results of these surveys were included in an appendix to the Offshore Investigation Work Plan (EA 2014). The general location of the boundary between sand and fine-grained sediment, based on the surveys, is shown on **Figure 2-1**.

2.1.2 Visual Shoreline Survey

A visual shoreline survey was conducted on 12 May 2014 to characterize the general existing conditions of the shoreline, upland area along the shoreline, and the intertidal zone. Results of the survey were included in an appendix to the Offshore Investigation Work Plan (EA 2014).

2.2 SCREENING OF GROUNDWATER DATA TO IDENTIFY SITE-RELATED CONTAMINANTS OF POTENTIAL CONCERN

Groundwater data from monitoring wells along the shoreline of the Phase I area were screened against risk-based surface water criteria to identify Site-related contaminants of potential concern (COPCs) for sediment and pore water in the offshore. This screening was based on the assumption that contaminants in groundwater are also potential contaminants in offshore sediment and pore water because groundwater flow is a primary mechanism of potential contaminant transport from the onshore to the offshore environment.

In the Phase I area, existing groundwater monitoring data associated with other sampling efforts were available from the vicinity of Greys Landfill, the Rod & Wire Mill, and Humphrey Impoundment. As described in Section 1.2, historical data were collected in 2002 and 2004, in association with the Nature and Extent Report (URS 2005, 2006). The data included in the Nature and Extent Report were the most recent groundwater data from the Humphrey Impoundment area. VOC, SVOC, and metals data are collected semiannually as part of

monitoring required at Greys Landfill (KCI 2010 and 2011; EnviroAnalytics Group 2013 and 2014b). Additionally, groundwater from the Rod & Wire Mill is regularly monitored for cadmium and zinc, in conjunction with a pump and treat system (URS 2011 and 2012; EEC 2013; EnviroAnalytics Group 2014a); however, no data for other potential COPCs were available for groundwater from this area.

Due to the lack of recent groundwater data from the Rod & Wire Mill and Humphrey Impoundment areas, additional groundwater data were collected in support of the Offshore Investigation, in June 2014, from 10 wells. The samples collected were analyzed for priority pollutant list (PPL) VOCs, SVOCs, metals, and cyanide. Methods and results of groundwater sampling were presented in an appendix to the Offshore Investigation Work Plan (EA 2014).

2.2.1 Groundwater Screening Criteria

Existing and new groundwater data were screened against the USEPA National Recommended Water Quality Criteria (NRWQCs) (USEPA 2009) for ecological risk (Saltwater Aquatic Life Continuous Criterion Concentration) and Human Health, Organism Only, where available. If NRWQCs for both ecological risk and human health risk were available for a given analyte, the lower of the two criteria was used for screening. For analytes with no NRWQCs, Biological Technical Assistance Group (BTAG) surface water benchmarks were used for screening. Marine benchmarks were used if available; if no marine benchmark was available for an organic analyte, the freshwater benchmark was used.

2.2.2 Identification of Site-Related Constituents of Potential Concern

Groundwater data from 12 wells or well clusters within approximately 400 feet (ft) of the Phase I shoreline (**Figure 2-1**) were screened using the screening criteria presented in Section 2.2.1.

Table 2-1 presents a summary of the constituents that have exceeded screening criteria in groundwater from monitoring wells adjacent to the Phase I area, from screening of both historical and 2014 datasets. Constituent concentrations that are at least five times the screening criteria are shaded blue, and concentrations that are at least two times the screening criteria are shaded green.

Based on the screening results, Site-related COPCs were identified for groups of monitoring wells, which correspond to sediment and pore water sampling transects (see Chapter 4). Site-related COPCs were identified as constituents with concentrations that exceeded the screening criteria by at least five-fold, at least once during the period of interest, or which exceeded the criteria by two-fold at least three times in a single well during the period of interest. If data from 2010–2014 were available, then only these data were used in determining Site-related COPCs. However, prior exceedances were taken into account for SVOCs and cyanide, due to no or few data available from 2010–2014.

Site-related COPCs for each group of wells are summarized below:

Monitoring Wells	Site-Related COPCs
GL16, GL02, TS01	copper, nickel, zinc, bis(2-ethylhexyl)phthalate
GL05, GL15	chromium, copper, nickel, silver, zinc, bis(2-ethylhexyl)phthalate
GL12	mercury, nickel, silver, zinc, bis(2-ethylhexyl)phthalate
RW18-20, TS04	cadmium, copper, lead, nickel, zinc, cyanide, bis(2-ethylhexyl)phthalate, PAHs
HI08	copper, lead, cyanide, bis(2-ethylhexyl)phthalate, PAHs

These Site-related COPCs were used to select analytical suites for sediment and pore water from the northern area, outside of the zone of influence of the Tin Mill Canal. Although stormwater analysis was also included in identification of Site-related COPCs (see Section 5.2), stormwater did not add any additional COPCs beyond those identified in groundwater. The risk assessment for this northern area was also limited to assessment of these Site-related COPCs, consistent with the original objectives of the study, focusing on current impacts from the Site to the Phase I area.

As described in Section 1.5, a modification in objectives was made for the southern area, where impacts near the mouth of the Tin Mill Canal became apparent during round 1 sediment sampling. Therefore, the full suite of constituents considered as potential inputs from the Canal were analyzed in the southern area during the second round of sediment sampling, and were also considered in the risk assessment.

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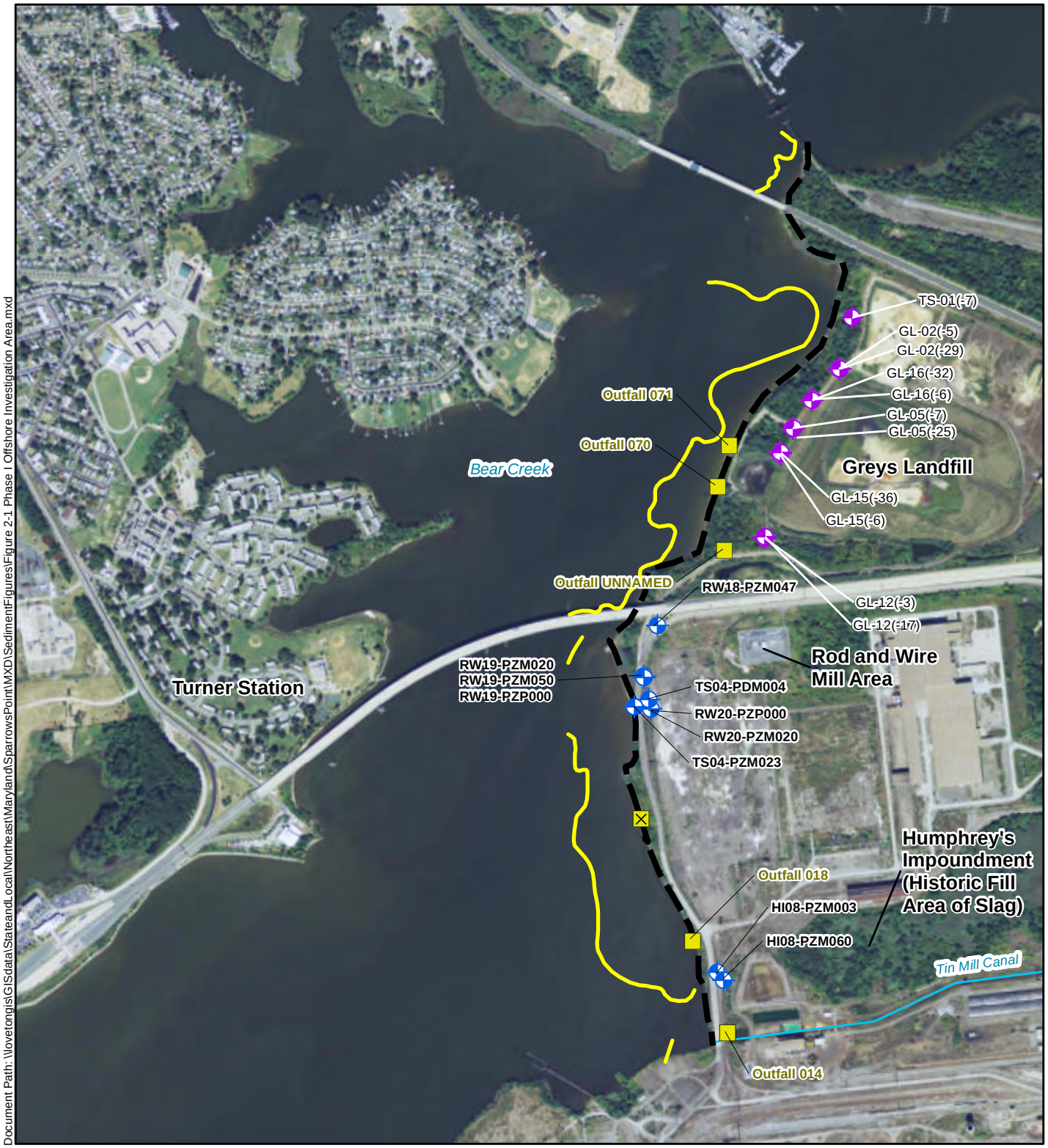
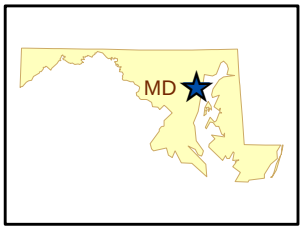


Document Path: \\lovetongis\GISdata\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\SedimentFigures\Figure 2-1 Phase I Offshore Investigation Area.mxd



0 250 500 1,000
Feet

1 inch = 1,200 feet

N

Legend

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

Figure 2-1
Phase I Offshore Investigation Area
Phase I Northwest Shoreline
Baltimore, Maryland

Map Date: September 2014
Image Source: ESRI 2011
Projection: NAD 1983 StatePlane
Maryland FIPS 1900 (US Feet)

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TABLE 2-1 SUMMARY OF CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER IN THE PHASE I AREA, 2001-2014

ALL UNITS UG/L

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Only concentrations exceeding screening values are shown. Concentrations more than 5 times the corresponding screening value are shaded blue. Concentrations more than 2 times the corresponding screening value are shaded green.

GREYS LANDFILL

	Screening Value	Dec-01	Jan-02	Jul-04	Jul-09	Oct-09	Mar-10	Jun-10	Apr-11	Mar-13
GL02-PZM006 / GL02(-5)										
TOTAL METALS										
Copper	3.1	--	NA	4.4	14	8.2	8.5	--	6.1	NA
Lead	8.1	--	NA	--	59	34	28	--	--	NA
Nickel	8.2	--	NA	30	25	27	22	20	31	NA
Silver	0.23	--	NA	--	--	--	0.7	--	--	NA
Thallium	0.47	--	NA	--	--	--	--	--	0.49	NA
Zinc	81	--	NA	87	630	400	250	--	120	NA
DISSOLVED METALS										
Copper	3.1	NA	NA	3.5	NA	NA	NA	NA	NA	NA
Nickel	8.2	NA	NA	30	NA	NA	NA	NA	NA	NA
MISC										
Cyanide, available	1	900	NA	NA	NA	NA	NA	NA	NA	NA
VOC										
1,1-Dichloroethane	47	69	NA	--	--	--	--	--	--	--
Vinyl Chloride	2.4	8.6	NA	--	--	--	2.5	--	--	--
SVOC										
Bis(2-Ethylhexyl)phthalate	2.2	--	NA	--	17	6.9	--	--	NA	NA
GL02-PZM028 / GL-02(-29)										
TOTAL METALS										
Arsenic	36	66	NA	90	--	--	--	--	--	--
Copper	3.1	--	NA	8.6	8.2	--	6.4	--	--	4.2
Nickel	8.2	--	NA	12	--	--	--	--	--	--
Silver	0.23	--	NA	--	--	--	0.63	--	--	--
Thallium	0.47	11.2	NA	--	--	--	--	--	--	--
Zinc	81	--	NA	--	81	--	--	--	--	--
DISSOLVED METALS										
Arsenic	36	NA	NA	91	NA	NA	NA	NA	NA	NA
Copper	3.1	NA	NA	8.2	NA	NA	NA	NA	NA	NA
Nickel	8.2	NA	NA	12	NA	NA	NA	NA	NA	NA
Thallium	0.47	NA	NA	--	NA	NA	NA	NA	NA	NA
SVOC										
Bis(2-Ethylhexyl)phthalate	2.2	--	NA	--	54	--	--	--	NA	NA

TABLE 2-1 SUMMARY OF CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER IN THE PHASE I AREA, 2001-2014

ALL UNITS UG/L

-- = Concentration did not exceed the screening value; NA = Not Analyzed

Only concentrations exceeding screening values are shown. Concentrations more than 5 times the corresponding screening value are shaded blue. Concentrations more than 2 times the corresponding screening value are shaded green.

	Screening Value	Dec-01	Jan-02	Jul-04	Jul-09	Oct-09	Mar-10	Jun-10	Apr-11	Mar-13
GL-16(-6)										
Note: A well with designation GL16-PZP003 was sampled in December 2001; however, the Release Site Characterization Study indicates that this well was located on the north side of the landfill.										
TOTAL METALS										
Copper	3.1	NA	NA	NA	6.1	5.3	20	--	--	20
Nickel	8.2	NA	NA	NA	380	360	380	380	340	400
Silver	0.23	NA	NA	NA	--	--	0.57	--	--	--
Zinc	81	NA	NA	NA	700	750	760	640	620	750
SVOC										
bis(2-Ethylhexyl)phthalate	2.2	NA	NA	NA	23	24	--	--	NA	NA
GL-16(-32)										
TOTAL METALS										
Copper	3.1	NA	NA	NA	20	18	11	6	--	--
Lead	8.1	NA	NA	NA	--		29	--	--	--
Nickel	8.2	NA	NA	NA	10	--	36	34	--	--
Silver	0.23	NA	NA	NA	--	--	0.55	--	--	--
SVOC										
bis(2-Ethylhexyl)phthalate	2.2	NA	NA	NA	11	6.6	--	--	NA	NA
TS-01(-7)										
TOTAL METALS										
Copper	3.1	NA	NA	NA	19	3.3	11	9.3	5.2	--
Lead	8.1	NA	NA	NA	--	8.5	--	--	--	--
Nickel	8.2	NA	NA	NA	20	23	16	14	16	--
Silver	0.23	NA	NA	NA	--	--	0.64	--	--	--
GL12(-3)										
TOTAL METALS										
Copper	3.1	NA	NA	NA	4.2	3.3	--	--	5.3	6.2
Mercury	0.94	NA	NA	NA	--	--	--	--	--	5.2
Nickel	8.2	NA	NA	NA	150	120	260	170	260	220
Silver	0.23	NA	NA	NA	--	--	1.8	--	--	--
Thallium	0.47	NA	NA	NA	2.3	--	--	--	--	--
Zinc	81	NA	NA	NA	300	340	270	310	340	323
SVOC										
Bis(2-Ethylhexyl)phthalate	2.2	NA	NA	NA	63	110	--	--	NA	NA
GL12(-17)										
TOTAL METALS										
Nickel	8.2	NA	NA	NA	--	--	--	--	20	--
Silver	0.23	NA	NA	NA	--	--	0.81	--	--	--
SVOC										
Bis(2-Ethylhexyl)phthalate	2.2	NA	NA	NA	--	7.9	--	--	NA	NA

TABLE 2-1 SUMMARY OF CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER IN THE PHASE I AREA, 2001-2014

ALL UNITS UG/L

-- = Concentration did not exceed the screening value; NA = Not Analyzed

Only concentrations exceeding screening values are shown. Concentrations more than 5 times the corresponding screening value are shaded blue. Concentrations more than 2 times the corresponding screening value are shaded green.

	Screening Value	Dec-01	Jan-02	Jul-04	Jul-09	Oct-09	Mar-10	Jun-10	Apr-11	Mar-13
GL05(-7)										
TOTAL METALS										
Arsenic	36	NA	NA	NA	--	41	--	--	--	--
Chromium	50	NA	NA	NA	--	140	--	--	--	--
Copper	3.1	NA	NA	NA	5.1	85	12	--	--	4.2
Lead	8.1	NA	NA	NA	--	61	8.6	--	--	--
Nickel	8.2	NA	NA	NA	170	290	290	260	220	240
Silver	0.23	NA	NA	NA	--	--	2.2	--	--	--
Zinc	81	NA	NA	NA	160	620	240	210	150	210
SVOC										
Bis(2-Ethylhexyl)phthalate	2.2	NA	NA	NA	50	28	--	--	NA	NA
GL05(-25)										
Note: A well with designation GL05-PZM020 was sampled in December 2001; however, the Release Site Characterization Study indicates that this well was not in the same location as the current wells GL05.										
TOTAL METALS										
Copper	3.1	NA	NA	NA	4.9	--	--	--	--	--
Silver	0.23	NA	NA	NA	--	--	0.92	--	--	--
SVOC										
Bis(2-Ethylhexyl)phthalate	2.2	NA	NA	NA	50	40	--	--	NA	NA
GL15(-6)										
Note: A well with designation GL15-PZP003 was sampled in December 2001; however, the Release Site Characterization Study indicates that this well was not in the same location as the current wells GL15.										
TOTAL METALS										
Chromium	50	NA	NA	NA	--	--	310	150	--	--
Copper	3.1	NA	NA	NA	15	9.5	10	4.8	3.8	--
Lead	8.1	NA	NA	NA	--	--	22	--	--	--
Nickel	8.2	NA	NA	NA	11	160	--	--	17	--
Silver	0.23	NA	NA	NA	--	--	2.1	--	--	--
Thallium	0.47	NA	NA	NA	2.4	--	--	--	--	--
Zinc	81	NA	NA	NA	--	240	170	--	--	--
SVOC										
Bis(2-Ethylhexyl)phthalate	2.2	NA	NA	NA	11	88	--	--	NA	NA
GL15(-36)										
Note: A well with designation GL15-PZM022 was sampled in December 2001; however, the Release Site Characterization Study indicates that this well was not in the same location as the current wells GL15.										
TOTAL METALS										
Chromium	50	NA	NA	NA	--	--	--	--	170	88
Copper	3.1	NA	NA	NA	5.2	--	6.8	3.3	8.1	8.3
Nickel	8.2	NA	NA	NA	--	--	19	18	17	--
Silver	0.23	NA	NA	NA	--	--	0.64	--	--	--
Thallium	0.47	NA	NA	NA	2.3	--	--	--	--	--
SVOC										
Bis(2-Ethylhexyl)phthalate	2.2	NA	NA	NA	26	--	--	--	NA	NA

TABLE 2-1 SUMMARY OF CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER IN THE PHASE I AREA, 2001-2014

ALL UNITS UG/L

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Only concentrations exceeding screening values are shown. Concentrations more than 5 times the corresponding screening value are shaded blue. Concentrations more than 2 times the corresponding screening value are shaded green.

ROD & WIRE MILL

Note: Cadmium and zinc data collected semiannually 2001-2013. If both results for a given year exceeded the screening value, the higher value is shown.

	Screening Value	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Jun-14
RW18-PZM047															
TOTAL METALS															
Cadmium	8.8	--	--	--	870	41	--	--	--	--	--	--	--	--	--
Copper	3.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12
Nickel	8.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	26
Zinc	81	15,000	7,000	13,000	26,000	12,000	6,900	4,700	6,900	1,200	5,700	3,300	520	8,950	1,600
SVOC															
Benzo(a)anthracene	0.018	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.056
bis(2-Ethylhexyl)phthalate	2.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.2
Chrysene	0.018	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.041
Naphthalene	1.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.9
RW19-PZP000															
TOTAL METALS															
Zinc	81	88	--	140	--	--	--	--	--	--	--	--	150	--	--
MISC															
Cyanide, available	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,000
RW19-PZM020															
TOTAL METALS															
Arsenic	36	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	65
Cadmium	8.8	30	150	82	280	320	200	150	110	130	96	29	13	24	38
Copper	3.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.4
Nickel	8.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	13
Zinc	81	3,400	14,000	6,000	24,000	26,000	24,000	22,000	17,000	17,000	11,000	5,600	5,000	4,720	5,800
SVOC															
bis(2-Ethylhexyl)phthalate	2.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	16
RW19-PZM050															
TOTAL METALS															
Cadmium	8.8	--	--	--	15	23	--	--	--	14	--	--	--	--	--
Nickel	8.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11
Zinc	81	530	430	230	240	92	220	86	330	540	190	160	76	129	170
SVOC															
bis(2-Ethylhexyl)phthalate	2.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.2
RW20-PZM020															
TOTAL METALS															
Cadmium	8.8	580	130	340	220	190	22	22	46	19	--	--	13	48	100
Nickel	8.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	18
Zinc	81	190,000	160,000	150,000	160,000	150,000	130,000	130,000	52,000	120,000	56,000	120,000	130,000	99,600	23,000
MISC															
Cyanide, available	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.7
	Screening Value	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**Jun-14**

TABLE 2-1 SUMMARY OF CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER IN THE PHASE I AREA, 2001-2014

ALL UNITS UG/L

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RW20-PZP000															
TOTAL METALS															
Arsenic	36	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	85
Cadmium	8.8	--	--	--	180	--	--	--	25	--	--	--	--	--	--
Copper	3.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.6
Nickel	8.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11
Zinc	81	--	--	81	130	--	--	--	100,000	--	--	--	--	--	--
SVOC															
Benzo(a)anthracene	0.018	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.16
bis(2-Ethylhexyl)phthalate	2.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.5
Chrysene	0.018	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.26
MISC															
Cyanide, available	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	160
TS04-PDM004															
TOTAL METALS															
Arsenic	36	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	40
Cadmium	8.8	--	12	--	25	10	--	--	--	--	--	--	--	--	--
Copper	3.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	15
Lead	8.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	25
Nickel	8.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	51
Zinc	81	5,500	15,000	8,200	14,000	15,000	310	240	150	--	120	--	410	227	2,400
MISC															
Cyanide, available	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3
TS04-PZM023															
TOTAL METALS															
Cadmium	8.8	11,000	4,300	3,200	1,200	1,100	800	380	190	280	390	250	--	--	--
Copper	3.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	25
Lead	8.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	160
Nickel	8.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	21
Zinc	81	220,000	110,000	78,000	34,000	39,000	32,000	17,000	140,000	12,000	19,000	9,000	5,200	247	6,600

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TABLE 2-1 SUMMARY OF CONSTITUENTS EXCEEDING SCREENING CRITERIA IN GROUNDWATER IN THE PHASE I AREA, 2001-2014

ALL UNITS UG/L

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HUMPHREY IMPOUNDMENT

	Screening Value	Jul-04	Jun-14
HI08-PZM003			
TOTAL METALS			
Chromium	50	--	52
Copper	3.1	6	35
Lead	8.1	--	92
Nickel	8.2	--	16
Zinc	81	--	210
DISSOLVED METALS			
Copper	3.1	4.8	NA
SVOC			
Benzo(a)anthracene	0.018	--	0.21
bis(2-Ethylhexyl)phthalate	2.2	28	11
Chrysene	0.018	--	0.22
MISC			
Cyanide, available	1	NA	21
HI08-PZM060			
TOTAL METALS			
Copper	3.1	3.7	--
DISSOLVED METALS			
Copper	3.1	3.3	NA
SVOC			
bis(2-Ethylhexyl)phthalate	2.2	--	14

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3. POTENTIAL CONTAMINANT SOURCES AND TRANSPORT PATHWAYS

This section presents a summary of the potential contaminant sources at the Site and transport mechanisms from the Site to the Phase I area, which were the basis for design of the offshore investigation.

3.1 CHEMICAL SOURCES

Potential sources of chemicals that have affected the Phase I area include the equipment, waste, and facilities associated with the steel-making process, including Greys Landfill, the Rod & Wire Mill, Humphrey Impoundment, and the Tin Mill Canal.

The following were among the waste types identified in the Description of Current Conditions (Rust 1998) as having been disposed in Greys Landfill: oily sludge, centrifuge cake from the wastewater treatment plant, blast furnace and sinter plant centrifuge cake, spill cleanup material, and dredged material from the Tin Mill Canal. Currently, debris from demolition and non-hazardous waste from the onsite wastewater treatment facility is placed in Greys Landfill; industrial waste generated during steel production was also disposed in the landfill historically (EnviroAnalytics 2014b).

At the Rod Mill, from the 1940s to the 1980s, zinc ore was roasted with sulfuric acid, yielding high-purity zinc powder and a sludge rich in iron and cadmium. The Sludge Bin Storage Area was used for temporary storage of the dewatered sludge, until storage bins were installed in the early 1970s. Groundwater pump and treat began in this storage area in 1986, to address elevated concentrations of cadmium and zinc in the shallow and intermediate groundwater zones (Rust 1998).

Humphrey Impoundment was open water until 1970, and received wastewater from onsite industrial facilities. After this wastewater was diverted into the Tin Mill Canal, the impoundment was used as a dewatering area for various sludges and slurries generated onsite (Rust 1998).

The Tin Mill Canal received wastewater discharges from 23 discharge pipes from manufacturing facilities in the Rod & Wire Mill and Pipe Mill area, including the finishing mills and the primary rolling mills. Discharges to the canal historically included wastewater from electroplating, oily wastes, and process wastewater from steel-making operations. Five oil skimming devices were used to recover oil from the canal. The recovered oil included palm oil, which was used as a lubricant in the rolling mill, and which was transferred to the Palm Oil Recovery Plant after removal from the canal (Rust 1998).

3.2 CHEMICAL TRANSPORT

Fate and transport pathways govern the transfer of materials and chemicals between different environmental media and from the onshore to the offshore environment.

Chemicals in leachate from Greys Landfill may migrate into groundwater. Historically, the metals from the sludge in the Sludge Bin Storage Area also likely migrated to groundwater. Chemicals in wastewater that entered Humphrey Impoundment and the Tin Mill Canal likely flowed into Bear Creek historically, prior to installation of a treatment plant to control this discharge. Chemicals present in soil onshore may also erode, leach, or desorb into runoff and be transported to the offshore environment via stormwater.

The following currently active transport mechanisms responsible for moving chemicals from the Sparrows Point facility to the Phase I offshore area were evaluated in this offshore investigation:

- Groundwater transport – As described in Section 2.2, contaminants are present in groundwater near the Phase I area. These contaminants have the potential to migrate into surface water via groundwater seepage into Bear Creek. It is expected that preferential pathways for groundwater flow may exist in areas where slag fill was placed historically, such as north of Greys Landfill and Humphrey Impoundment. The existing ground surface elevations and groundwater potentiometric surface maps suggest that potential groundwater seeps may intersect the surface water at the tide line. Chemicals transported via this pathway can either become bound in the sediments or remain dissolved and move from the pore water into the surface water. It is expected that concentrations in surface water contributed by seeps would be highest at ebb tide.

- Stormwater discharge – Active stormwater outfalls present in the Phase I area provide another potential release mechanism for transport of contaminants from the onshore to the offshore area. Chemicals transported by stormwater may become associated with sediments in Bear Creek or may remain in the surface water. The majority of stormwater in the vicinity of the Phase I area is directed to the Tin Mill Canal. Water in the canal is then pumped to the adjacent water treatment plant, and treated water is discharged to Bear Creek through National Pollutant Discharge Elimination System (NPDES) permitted Outfall 014 (**Figure 2-1**), which is monitored daily. However, water has been observed to flow from two outfalls (UNNAMED, between I-695 and Greys Landfill, and 018, in the southern portion of the Phase I area); the origin of the water flowing from these outfalls is unknown. The Greys Landfill stormwater pond, in the northern portion of the Phase I area, collects stormwater from the landfill. It is possible that, when cumulative precipitation increases the water level sufficiently, the pond overflows via Outfall 071. Additionally, Outfall 070 is an overflow channel that may flow during prolonged periods of heavy precipitation. No overflow from Outfall 070 or 071 was observed during the Offshore Investigation.

The partitioning of chemicals between sediments and surface water is determined by the properties of the chemical as well as the surrounding geochemistry. Chemicals such as VOCs and PAHs demonstrate variable dissolution. Metals vary in their solubility based on pH, concentration, and the presence of oxygen. Reducing conditions in brackish, permanently submerged sediments tend to produce forms of most cationic metals (e.g., copper, lead, nickel, zinc) that remain bound in sediment, but these same reducing conditions may favor solubilization of anionic metals (e.g., arsenic).

Bioaccumulation is also a relevant transport pathway. Plants and animals that come in contact with elevated concentrations of chemicals in sediment or water may uptake chemicals, and, depending on the chemical and the organism, these chemicals may accumulate in tissue. Several metals (i.e., arsenic and lead) and PCBs are known bioaccumulators. PAHs may bioaccumulate in crustaceans and other organisms.

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4. FIELD ACTIVITIES

The offshore investigation for the Phase I area was conducted in two phases – Round 1 and Round 2, consisting of the following elements:

Round 1

- Collection of 20 surface sediment samples on 13–14 October 2014
- Collection of stormwater samples from 3 outfalls on 16 November 2014
- Collection of 4 stormwater samples, from 3 outfalls and the Greys Landfill stormwater pond, on 1 December 2014.

Round 2

- Collection of sediment pore water from 8 locations near the Phase I shoreline, including 6 locations where surface sediment was collected during Round 1
- Collection of 2 additional surface sediment samples, from the pore water sampling locations where no sediment was collected during Round 1
- Collection of sediment cores from 22 locations in the southern portion of the Phase I area, to a maximum depth of approximately 6 ft.

The investigation was conducted in accordance with the approved Work Plan (EA 2014), with exceptions noted in the sections below.

4.1 PRECISION NAVIGATION AND HORIZONTAL CONTROL

A roving Trimble SPS 461 global positioning system (GPS) receiver was used for precision positioning information during the sediment and pore water collection effort. Differential corrections for the satellite positioning data were received real-time through a subscription to the KeyNetGPS Virtual Reference Station (VRS) Network (www.kenetgps.com). A broadband cellular modem aboard the vessel allowed the GPS receiver to interface directly with the VRS network and derive correctors to the satellite positioning information. Following the application of the VRS correctors, the positional information generated by the roving GPS unit provided positioning information with a geodetic accuracy 10 centimeters in the horizontal plane at an update frequency of 2 hertz.

Prior to initiating sample collection, the National Geodetic Survey benchmark located in Cockeysville, Maryland (GENT – PID-JV5657) was used as the cross-check mark to confirm geodetic accuracy for this field operation. In addition, daily performance and quality

control (QC) checks of the positioning system were also performed by verifying the GPS positioning information relative to the known position of Daymark No 5, a United States Coast Guard-maintained aid to navigation off of Long Point in Bear Creek.

The verified positioning information provided by the Trimble receiver was ported directly to HYPACK navigation and data acquisition software running on a laptop computer via a serial connection. The HYPACK software served as the primary survey management system, logging time, position, and depth data, as well as providing a helmsman display that allowed the vessel operator to maneuver the vessel to the appropriate sampling locations described above. Once in HYPACK, the geographic position data were converted to Maryland State Plane coordinates (FIPS-1900) in the units of United States Survey Feet and the horizontal control of North American Datum of 1983.

4.2 SEDIMENT SAMPLE COLLECTION AND ANALYSIS

4.2.1 Collection and Analysis of Surface Sediment Samples

During sampling Round 1, surface sediment samples were collected from 20 locations, along eight transects (A–H) oriented perpendicular to the shoreline, with locations designated by the transect letter and numbered consecutively away from the shoreline (**Figure 4-1**). The Round 1 sediment sampling locations were chosen to provide good spatial coverage of the Phase I area, and also to fulfill the following objectives:

- Assess potential transport of contaminants in groundwater to the offshore as follows:
  - Sample sediment adjacent to contaminated groundwater, and
  - Sample sediment in near-shore areas where groundwater seeps likely occur
- Assess potential transport of contaminants to the offshore environment via stormwater, by sampling sediment in proximity to one or more active stormwater outfalls
- Collect sediment from areas with a variety of sediment types and thus a variety of habitats
- Collect sediment from locations in the southern portion of the Phase I area where petroleum odor and sheen were observed during the subaqueous survey.

Following receipt of analytical data for the Round 1 surface sediments, the results were reported in a Technical Memorandum, which also provided scoping and methodology information for the Round 2 sampling (EA 2015). Round 2 focused on pore water sampling and sediment coring; however, surface sediments were collected from two additional locations (DE01 and F05), co-located with pore water sampling locations (see Section 4.4).

Surface sediment sampling operations were conducted from a 23-ft Monark aluminum hull survey boat during Round 1, and from a 26-ft boat, which was also used for pore water sampling, during Round 2. The boat was navigated to each targeted sampling location and surface sediment samples were collected to approximately 6 inches below the sediment surface using a Ponar grab sampler. Where 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 independent analysis by the Chesapeake Bay Foundation). Each grab sample was taken within 10 ft of the target location for the sample; **Table 4-1** presents the coordinates and a description of each grab sample. The field logbook documenting the sampling is included in **Appendix A,** and descriptions of the sediment grab samples collected are recorded in **Table 4-1.**

Following collection of the required sample volume, each sample was homogenized using a decontaminated stainless steel spoon in a stainless steel pot. Sub-samples for analysis of VOCs and simultaneously extracted metals (SEM)/acid volatile sulfide (AVS) 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 locations (see **Table 4-1** and photographic log, **Appendix B**). Rather, these sub-samples were collected expediently following homogenization, and placed in laboratory-cleaned, 4-ounce bottles with no headspace. The other required sub-samples were then placed 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 (see Section 4.6).

Two field duplicate surface sediment samples were collected during Round 1, from locations SD-B02 and SD-F01, and a trip blank was included in each cooler containing bottles for analysis 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.

Samples were packaged as described in Section 4.5.5, and shipped via overnight delivery to TestAmerica–Pittsburgh in Pittsburgh, Pennsylvania, on the day following collection.

The suites of analytes for which surface sediment samples were analyzed included the following:

- PPL VOCs by USEPA Method 8260C
- Low-level (LL) PPL SVOCs by USEPA Method 8270D LL
- Low-level PCB Aroclors by USEPA Method 8082A LL
- PPL metals by USEPA Method 6020A
- Mercury by USEPA Method 7471B
- Cyanide by USEPA Method 9014
- Oil and Grease by USEPA Method 9071B
- SEM/AVS by USEPA Methods 6010B and 9034
- Total Solids by USEPA Method SM 2540G
- Total Organic Carbon (TOC) by Lloyd Kahn

- Grain Size by ASTM D422
- Moisture Content by D2216-90.

Samples from transects adjacent to active stormwater outfalls (transects B, C, F, G, and H) were analyzed by TestAmerica for all potential COPCs: VOCs, SVOCs (including PAHs), PCB Aroclors, PPL metals, mercury, cyanide, and oil and grease. Sediments from other areas (transects A, D, DE, and E) were analyzed for the COPCs that had been identified from groundwater data (see Section 2.2.2): PAHs, bis(2-ethylhexyl)phthalate (an SVOC), PPL metals, and cyanide. All surface sediment samples were also analyzed for AVS and SEM, to provide information regarding bioavailability of metals for the risk assessment, as well as total solids and TOC. Additionally, sediment from two transects (B and E), where sediments of a variety of textures were observed during the subaqueous survey, were analyzed for grain size and moisture content, to provide information regarding the hydraulic conductivity of the sediment. Grain size analysis of the sample from location C02 was also added, due to the finding of unexpectedly coarse sediment, possibly associated with a washout from the shoreline.

4.2.2 Sediment Core Samples

Subsurface sediment cores were collected from 22 locations during Round 2, from the vicinity of Transect G (locations G01 to G06) and Transect H (locations H01 to H07), where Round 1 results indicated that the lateral and vertical extent of contamination required delineation to support a future Corrective Measures Study for the Phase I area. Coring locations and brief descriptions are presented in **Table 4-1**.

Cores were advanced using an electric vibracorer deployed from a 28-ft, aluminum-hull survey and research vessel, to refusal at penetration depths up to approximately 6 ft below the sediment-water interface. If less than 5.5 ft of sediment was recovered, due to shallow refusal or other factors, then up to three attempts were made to collect a core of at least 5.5 ft in length. These replicate cores were named "A," "B," and "C," and the replicate with the best recovery was selected for sampling and laboratory analysis. Upon recovery, the cores were held at 4 degrees Celsius, and the replicates selected for sampling were transferred to a processing facility, then split, described and photographed as described below. Boring logs were completed for the core replicates that were sampled (**Appendix C**). Observable impacts (sheen and/or odor) were assessed and recorded.

Sediment cores were sampled on 2-ft intervals below the sediment-water interface (0–2 ft, 2–4 ft, 4–6 ft, etc.). A surface interval sample from every core was submitted for analysis. If a core had no observable impacts, then the next deeper interval (2–4 ft) was also submitted for analysis. Alternatively, if multiple intervals in the middle and/or bottom portions of a core contained observable impacts, then only the lowest of the impacted intervals, and any un-impacted intervals below the lowest impacted interval, were submitted for laboratory analysis. The samples submitted for analysis in each core, and corresponding rationale, are summarized in **Table 4-2** and detailed in the boring logs (**Appendix C**).

Each interval for analysis was homogenized using decontaminated stainless steel mixing equipment. Sub-samples for VOC and SEM/AVS analyses were collected from the core as soon as possible after sample homogenization and placed in laboratory-cleaned, 4-ounce bottles with no headspace, as with the surface sediment samples. The other required sub-samples were then placed into appropriate laboratory-cleaned containers using stainless steel sampling tools. Sample processing equipment that came into direct contact with the sediment was decontaminated according to the protocols specified in Section 4.6.

Samples from each core were packaged as described in Section 4.5.5 and shipped via overnight delivery to TestAmerica–Pittsburgh on the day that the core was processed or the following day.

Sediment core samples were analyzed for the following:

- PPL VOCs by USEPA Method 8260C
- LL PPL SVOCs by USEPA Method 8270D LL
- Low-level PCB Aroclors by USEPA Method 8082A LL
- PPL metals by USEPA Method 6020A
- Mercury by USEPA Method 7471B
- Cyanide by USEPA Method 9014
- Oil and Grease by USEPA Method 9071B
- Total Solids by USEPA Method SM 2540G
- TOC by Lloyd Kahn
- SEM/AVS by USEPA Methods 6010B and 9034 (surface interval only).

4.3 STORMWATER SAMPLE COLLECTION AND ANALYSIS

Stormwater samples were collected to assess potential inputs of contaminants to the offshore via outfalls. Stormwater samples for analysis were collected during two storm events, on 16 November and 1 December 2014, from two active outfalls in the Phase I area (018 and UNNAMED), and one NPDES-permitted outfall (014). During the second sampling event, a sample was also collected from the Greys Landfill stormwater pond (**Figure 4-1**).

Outfall 014 is monitored regularly for metals (chromium and lead), phosphorus, nitrogen, and chlorine, and periodically also for other parameters (e.g., cyanide and VOCs), under the NPDES permit.

Effort was made to collect grab samples of stormwater from Outfalls 018 and UNNAMED during approximately the first two hours of the storm event, to capture the "first flush" of runoff. Outfall 014 was sampled last. *In situ* water quality (temperature, conductivity, pH, dissolved oxygen [DO], and turbidity) was measured during sampling. Generally, pH was between 6.5 and 9.5, with the exception of outfall ST018 during the second event, where a pH of 11.02 and a sulfur-like odor were observed. Turbidity was relatively low, between 0.4 and 7.5 nephelometric turbidity units, with the highest turbidity in the stormwater pond.

Stormwater samples were collected in certified cleaned, laboratory-prepared containers with appropriate preservatives, packaged as described in Section 4.5.5, and shipped via overnight delivery to TestAmerica–Pittsburgh. Samples were analyzed for VOCs, SVOCs (including PAHs), PCB Aroclors, PPL metals, mercury, cyanide, oil and grease, and suspended solids.

Note that sample collection was originally planned from stormwater outfalls 070 and 071, which drain overflow from the Greys Landfill stormwater pond. However, during reconnaissance visits and during the first sampling event, it was observed that the pond water level was not sufficiently high to cause overflow into these outfalls. Therefore, in accordance with the contingency from the Work Plan (EA 2014), EA coordinated with USEPA, MDE, and the Site owner, to sample directly from the pond. The concentrations of COPCs from the pond were therefore used in modeling flow from Outfall 070 (see Chapter 7).

4.4 PORE WATER SAMPLE COLLECTION AND ANALYSIS

Pore water samples were collected from eight surface sediment grab sampling locations (**Figure 4-1**) during Round 2 and analyzed for COPCs.

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

- Offshore locations near onshore monitoring wells where groundwater COPCs exceeded the BTAG surface water screening criteria by at least five-fold (or consistently exceeded the criteria by two-fold) (see Section 2.2.2).

- Sandy (or silty) locations within approximately 200 ft of the shoreline, where pore water upwelling is thought to be likely. Upwelling is thought to be most likely in the near-shore area because the underlying geology does not include prominent shallow confining layers, and because sandy sediment lithology had been observed in the near-shore area.

- Locations without highly impacted sediments, such that any inputs from groundwater in the pore water would not be overshadowed by impacts from sediment.

In selecting locations, preference was given to locations where surface sediments were collected during Round 1, so that co-located sediment and pore water concentrations could be compared. However, sampling locations DE01 and F05 were not sampled during Round 1 and therefore required additional collection of co-located surface sediments during Round 2 (see Section 4.2.1).

The locations of pore water sampling were adjusted somewhat based on field observations:

- Locations F03 and F04 were initially scoped for sampling; however, sediments at these locations were found to be heavily impacted. Locations A02 and B02 were considered as substitutes, but the water depth at these locations was found to be greater than 6 ft, and

therefore too deep for sampling using the readily available sampling equipment. Ultimately, therefore, C02 was sampled in place of F03 and F04, to provide a sandy-to-silty transect with location C01.

- Location D02 was substituted for location D01, due to refusal encountered at 6–8 inches at location D01. This refusal was interpreted to likely indicate the presence of a hard clay layer which would also limit groundwater upwelling. Both locations D01 and D02 had sandy sediment at the surface.

- Pore water extraction at Location F01 was found to be slow/intermittent and turbid, due to soft clay underlying the sand. Similar difficulties were encountered at location F04, which was attempted as an alternative sampling location due to its proximity to groundwater well HI08, despite the impacts described above. Ultimately, the sample from this location was moved southeast to new location F05, where sand was found to overlie impacted silt. Although the presence of sediment impacts at F05 contradicted the third criterion for selecting pore water sampling locations, the project team selected this location for sampling to attempt to capture any impacts from impacted groundwater in the vicinity of well HI08.

Although the Work Plan stated that pore water samples would be collected at times of low tide, boat access challenges associated with the shallow depth of the selected pore water sampling locations prevented this, and samples were collected when access was obtainable.

Pore water samples were collected using push-point samplers, from approximately 1 ft below the sediment-water interface. Collection of pore water from this depth was selected to 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. *In situ* water quality measurements (temperature, conductivity, pH, DO and/or oxidation-reduction potential (ORP), and turbidity) were used to monitor for potential incursion of surface water. As expected, these data indicated that pore water had generally higher conductivity and lower DO and ORP than the overlying surface water (**Table 4-3**). Differences in temperature were also observed. The least clear distinction between pore water and surface water quality was observed at location C02, where sediments contained 28.7 percent gravel; however, the temperature of pore water at this location was substantially lower than that of surface water. These measurements confirmed that the pore water samples were collected from a unique water body, separate from the surface water.

Each pore water sample was analyzed for the COPCs identified in the associated monitoring wells (see Section 2.2.2, and also for dissolved organic carbon, and magnesium and calcium (to allow calculation of surface water screening criteria).

Pore water results were used in modeling steady-state concentrations of COPCs in surface water (Chapter 7), and were also evaluated directly as part of the ecological risk assessment (Chapter 9).

4.5 SAMPLE LABELING, CHAIN-OF-CUSTODY, AND DOCUMENTATION

4.5.1 Field Logbook

Field notes for the field sampling were recorded in permanently bound, dedicated field logbooks (**Appendix A**). Information including the time and location of sampling, water depth, *in situ* water quality, and core recoveries were recorded in the log in indelible ink. Personnel names, local weather conditions, and other information with the potential to impact the field sampling program were also recorded during sampling as well as sample processing and shipping. Each page of the logbooks was dated and signed by the personnel entering information. Corrections to documentation were made with a single line through the error with the author's initials and date.

4.5.2 Sample Numbering System

Field samples collected during this investigation were assigned unique sample identifiers. Sample designations were based on an alpha-numeric code which identifies each sample by the matrix and location. The matrices were identified by two-letter codes (SD = Sediment, ST = Stormwater, PW = Pore Water).

- Each sediment sampling transect was assigned a letter, and sediment sampling locations within each transect were numbered consecutively, generally moving away from the shoreline. Surface sediment samples were identified by "SD" with the transect letter and location number. For samples from sediment cores, the depths (in feet) over which the sample was collected were added (for example, 0204 indicates the 2–4 ft core interval).

SD -	**A**	**01**	**0204**
Sample Matrix	Sediment Transect	Location on Transect	Depth

- Stormwater samples were named with "ST" followed by the outfall number, and the date of sampling.

ST -	**014 -**	**111614**
Sample Matrix	Outfall Number	Date

- Pore water samples were assigned identifiers similar to their co-located surface sediment samples, but with "PW" rather than "SD."

PW -	**A**	**01**
Sample Matrix	Sediment Transect	Location on Transect

Field QC Samples

Sediment duplicate samples, collected for quality assurance/quality control purposes, were designated by the parent sample identification (ID), with the addition of "-FD." The stormwater duplicate, collected from outfall UNNAMED on 16 November 2014, was designated ST-DUP1-111614.

Rinsate blanks and field blanks collected during sediment sampling were named sequentially, with the "RB" prefix for rinsate blanks and "FB" prefix for field blanks.

4.5.3 Sample Labeling

Sample containers were affixed with sample labels that were filled out at the time of collection. Information on the sample label included the following:

- Client
- EA project number
- Site location
- Sample location
- Date and time of collection
- Name of sampler
- Sample preservative(s).

Sample Label Template:

EA Engineering – Sparrows Point
Project Number: 15131.01 , Task 0004 , Dept. 2123
Sample ID: __Matrix: _____
Collection Date: _____ Time: _____
Sampled by:_____ Bottle: _____
Sample type: _____ 1 of 2

4.5.4 Chain-of-Custody Records

Samples collected in the field were documented on a chain-of-custody sheet that included the date and time the sample was collected, the analyses requested, and the signatures of the personnel who collected and relinquished the samples. These chains of custody accompanied all samples shipped for sample analyses, and are included in the laboratory analytical reports in **Appendix D**.

4.5.5 Sample Packaging and Shipping

Samples and QC samples were stored in an ice-filled cooler on the work platform until the end of each sampling day. Samples for laboratory analysis were packaged in bubble wrap, placed in an ice-filled cooler (or cooler with blue ice), and shipped via overnight delivery to TestAmerica–Pittsburgh in Pittsburgh, Pennsylvania. Bubble wrap was used to line the bottom and sides of the sample cooler and fill voids where needed to cushion the sample containers during transportation. Cooler(s) 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.

4.6 EQUIPMENT DECONTAMINATION PROCEDURES

Equipment that came into direct contact with sediment or water during sampling was decontaminated prior to deployment in the field, and between sampling locations, to minimize cross-contamination. This included ponar samplers, core samplers, core catchers, and stainless steel processing equipment (knives, bowls, scoops, etc.). While performing the decontamination procedure, phthalate-free nitrile gloves were used to prevent phthalate contamination of the sampling equipment or the samples.

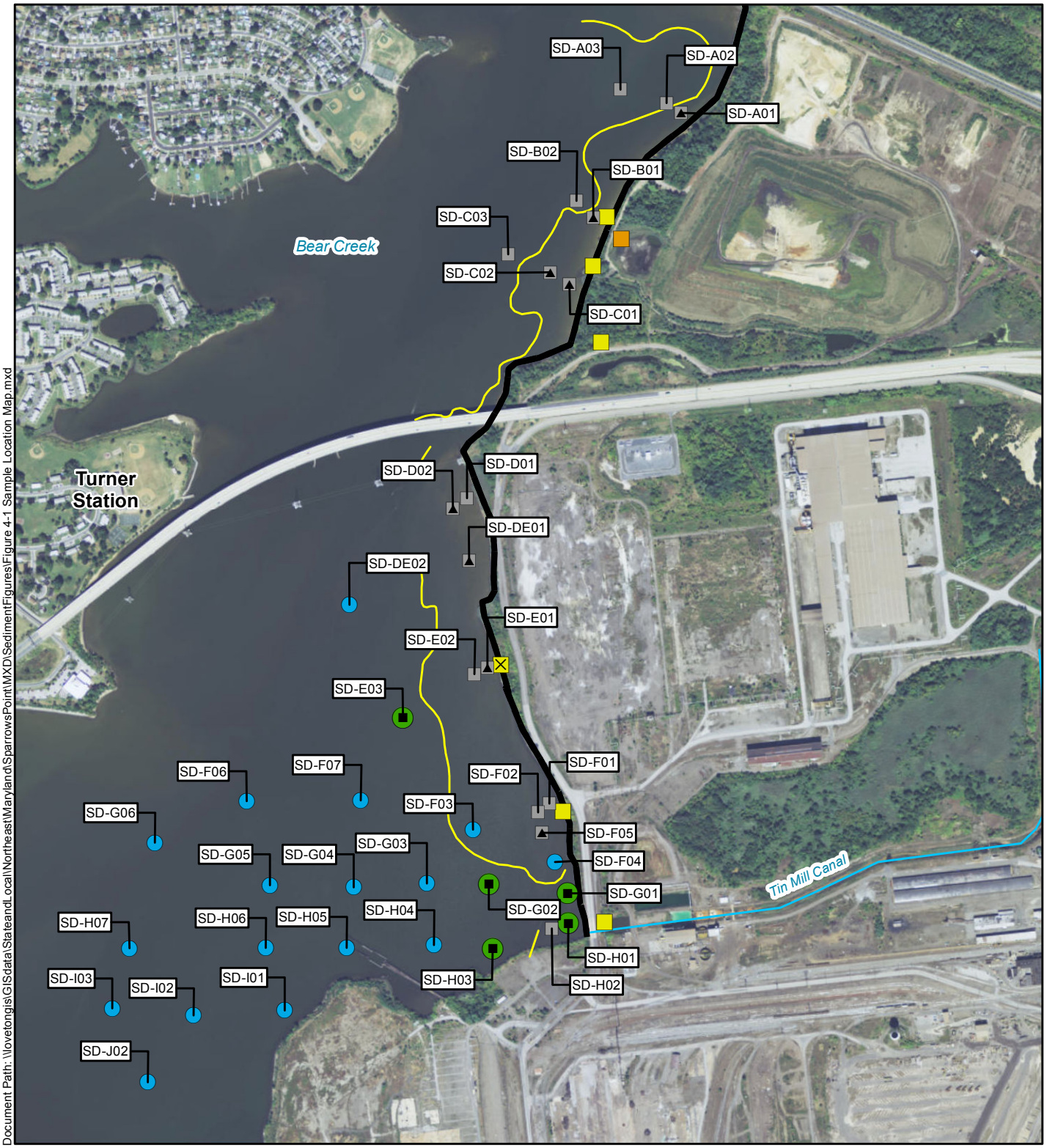
The decontamination procedure is described below:

- Rinse with site water
- Rinse with 10 percent nitric acid
- Rinse with distilled or de-ionized water
- Rinse with methanol followed by hexane
- Rinse with distilled or de-ionized water.

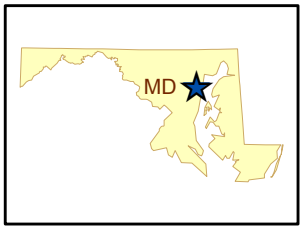
Waste liquids were contained during decontamination procedures and transferred to EA's facility in Hunt Valley, Maryland, for disposal.

4.7 INVESTIGATION-DERIVED WASTE

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 were used to characterize the material for disposal.



Document Path: \\lovetongis\GISdata\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\SedimentFigures\Figure 4-1 Sample Location Map.mxd



0 250 500 1,000
Feet

1 inch = 1,000 feet

N

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

Sample Location

- Coring Location
- Surface Grab and Coring Location
- Surface Grab
- Surface Grab and Pore Water Sampling Location
- Stormwater Pond Sampling Location

Figure 4-1
Sample Location Map
Phase I Northwest Shoreline
Baltimore, Maryland

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

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TABLE 4-1 SAMPLING LOCATIONS, DESCRIPTIONS, AND NOTES
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

Transect	Location	Replicate	Sampling Coordinates (Maryland State Plane North American Datum 1983, feet) Northing	Easting	Description/Notes
Round 1 Surface Sediment Samples					
A	SD-A01	1	574690.52	1457218.52	Tan/brown sand with limited silt; live *Rangia*
		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*Macoma*
		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 *Macoma*
		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 *Rangia* ; woody debris
	SD-D02	1	571880.12	1455597.76	Brown fine to medium sand with limited silt; live *Rangia*
		2	571881.24	1455593.22	
E	SD-E01	1	570752.56	1455847.24	Fine to medium brown sand with limited silt; live *Rangia*
	SD-E02	1	570703.47	1455752.80	Brown fine to medium sand; pebbles; live *Rangia* ; 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 silt; live*Macomb* ; 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 *Rangia* 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 *Rangia* 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 odo
	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

TABLE 4-1 SAMPLING LOCATIONS, DESCRIPTIONS, AND NOTES
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

Transect	Location	Replicate	Sampling Coordinates (Maryland State Plane North American Datum 1983, feet) Northing	Easting	Description/Notes
Round 2 Surface Sediment Samples					
DE	SD-DE01	1	571507.18	1455712.52	Medium brown sand (3 inch) at surface; black impacted sand at lower depth
		2	571507.18	1455712.52	
F	SD-F05	1	569574.24	1456230.94	Brown sand over black impacted silt
		2	569574.24	1456230.94	
Round 2 Sediment Cores					
DE	SD-DE02	B	571195.36	1454862.70	Black, impacted estuarine silt over soft dark gray clay with a light sheen from surface sediments; recovery of 6.3 ft.
E	SD-E03	B	570389.68	1455241.92	Black, impacted estuarine silt over soft gray clay underlain by denser gray clay and oyster shells at the bottom of core; light to moderate sheen from surface sediments; recovery of 4.8 ft.
F	SD-F03	B	569596.99	1455740.35	Core encountered refusal just below surface-water interface; black, impacted estuarine silt over cohesive yellow clay/sand; recovery of 1.4 ft.
	SD-F04	A	569367.73	1456323.76	Black, impacted estuarine silt with a visible sheen over gray sand at depth without visible impacts; recovery of 6.0 ft.
	SD-F06	A	569799.08	1454133.12	Black, impacted estuarine silt throughout with a light to moderate sheen; recovery of 6.2 ft.
	SD-F07	A	569803.84	1454943.07	Black, impacted estuarine silt with a light sheen over dark gray clay; recovery of 6.2 ft.
G	SD-G01	A	569140.65	1456414.40	Black, impacted estuarine silt with a heavy sheen in surface sediments overlying soft to semi-firm gray clay; recovery of 6.0 ft.
	SD-G02	A	569199.38	1455851.70	Black, impacted silts throughout with a heavy sheen in rinsates from surface sediments, and heavy odor in bottom sediments; recovery of 4.0ft. and 5.9 ft.
		B	569196.56	1455852.14	
	SD-G03	A	569222.31	1455410.12	Black, impacted silt throughout with a heavy sheen in rinsates; recovery of 5.9 ft.
	SD-G04	A	569186.32	1454896.30	Black, impacted silt with a light sheen overlying soft, clean gray clay; recovery of 5.6 ft.
	SD-G05	A	569195.34	1454296.32	Black, impacted silt with no sheen over soft gray clay; recovery of 5.4ft. and 6.7 ft.
		B	569209.39	1454300.33	
	SD-G06	A	569503.76	1453481.21	Black, impacted silt over gray clay; appears less impacted than other sites with a lighter color and deeper RPD; recovery of 5.5 ft.
H	SD-H01	A	568928.12	1456414.22	Black, impacted silt with a heavy sheen in surface sediments over soft gray clay; recovery of 6.4 ft.
	SD-H03	A	568796.70	1455914.04	Sampling location was shifted 50 ft NE due to water depths; black, impacted silt over soft gray clay; appears to be alternating layering in core potentially due to runoff events; recovery of 6.7 ft.
	SD-H04	A	568778.06	1455464.14	Sampling location was shifted 40 ft NE to avoid floating and subsurface conduit; black, impacted silt with heavy sheen in surface sediments over soft gray clay; recovery of 6.5 ft.
	SD-H05	A	568757.40	1454845.69	Black, impacted silt throughout with contaminant/heavy sheen present at bottom of cores; recovery of 5.5 ft and 6.1 ft.
		B	568758.62	1454842.52	
	SD-H06	A	568756.63	1454267.96	Black, impacted silt throughout, heavy sheen in surface sediments and lighter sheen in bottom sediments; core reached refusal, recovery of 4.3 ft and 4.0 ft.
		B	1454274.65	568753.05	
		C	568776.26	1454266.84	
	SD-H07	A	568748.96	1453315.68	Black, impacted silt at surface with a lighter sheen over soft gray clay; recovery of 4.6 ft and 5.5 ft.
		B	568753.79	1453300.59	
I	SD-I01	B	568312.91	1454403.47	Minimal black silt, multiple layers of fine sand over firm, gray clayey sand; core met refusal, recovery of 2.0 ft.
	SD-I02	A	568278.11	1453756.79	Black, impacted silt with a heavy sheen in surface sediments over soft gray clay; recovery of 4.9 ft.
	SD-I03	A	568326.84	1453177.58	Black, likely impacted silt over clean gray clay; light sheen with noticeable oxidized layer at the sediment-water interface; recovery of 6.3 ft.
J	SD-J02	A	567802.77	1453430.73	Black, impacted silt with a light sheen over soft gray clay; recovery of 5.0 ft.

TABLE 4-1 SAMPLING LOCATIONS, DESCRIPTIONS, AND NOTES
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

Transect	Location	Replicate	Sampling Coordinates (Maryland State Plane North American Datum 1983, feet)		Description/Notes
			Northing	Easting	
Round 2 Pore Water Samples					
A	PW-A01	1	574689.12	1457228.49	Probes deployed on either side of vessel
B	PW-B01	1	573957.01	1456608.58	Probes deployed on either side of vessel
C	PW-C01	1	573467.44	1456424.78	Probes deployed on either side of vessel
	PW-C02	1	573563.19	1456278.45	Probes deployed on port side of vessel
D	PW-D02	1	571875.77	1455581.16	Probes deployed on either side of vessel
DE	PW-DE01	1	571514.94	1455712.80	Original attempts to insert probes resulted in refusal at 6-8 inches; site was relocated to the west to allow for full penetration, a single probe was deployed off the bow of the boat due to vessel drift
E	PW-E01	1	570752.22	1455827.01	Probes deployed on either side of vessel
F	PW-F01 (not sampled)	1	569766.69	1456274.86	Probes deployed on either side of vessel, sampling discontinued due to lack of yield, approximately 250 mL captured
	PW-F04 (not sampled)	1	569363.41	1456323.03	Probes deployed on either side of vessel, after 25 minutes of pumping, there was no yield. Site abandonded, will be relocated for future efforts.
	PW-F05	1	569582.12	1456233.24	Probes deployed on starboard side of vessel

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

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TABLE 4-2 SEDIMENT CORE SAMPLING SUMMARY AND RATIONALE
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

Core ID	Core Length (feet)	Depth Range(s) of Visible Contamination	Sample Identification	Beginning of Interval	End of Interval	Analyzed (Y/N)	Rationale
DE02B	6.3	0-5.8	SD-DE02-0002	0	2	Y	Surface sample analyzed for each location. Visible contamination/sheen, strong petroleum odor.
			SD-DE02-0204	2	4	N	Visible contamination extending into deeper interval.
			SD-DE02-0406	4	6.3	Y	Dark gray to black clay in last 0.5 ft of core; possibly contaminated, not enough volume for separate analytical sample so included it in -0406 sample.
E03B	4.8	0-3.9	SD-E03-0002	0	2	Y	Surface sample analyzed for each location. Visible contamination/sheen, strong petroleum odor.
			SD-E03-0204	2	4	Y	Based on observation, deepest extent of contamination
			SD-E03-0406	4	4.8	Y	Cleaner clay sample
F03B	1.2	0-0.8	SD-F03-0002	0	2	Y	Surface sample analyzed for each location. Visible contamination/sheen, strong petroleum odor from 0-0.8 ft.
F04A	6.0	0-2.2; 2.8-4.8	SD-F04-0002	0	2	Y	Surface sample analyzed for each location. Visible contamination/sheen, strong petroleum odor.
			SD-F04-0204	2	4	N	Visible contamination extending into deeper interval.
			SD-F04-0406	4	6.3	Y	Higher sand content in last 1.2 ft of core; likely less contaminated than above material.
F06A	6.2	0-6.2	SD-F06-0002	0	2	Y	Surface sample analyzed for each location. Visible contamination/sheen, strong petroleum odor.
			SD-F06-0204	2	4	N	Visible contamination extending into deeper interval.
			SD-F06-0406	4	6.2	Y	Entire core visibly contaminated; sample contains deepest collected depth of contamination.
F07A	6.2	0-6.2	SD-F07-0002	0	2	Y	Surface sample analyzed for each location. Visible contamination/sheen, strong petroleum odor.
			SD-F07-0204	2	4	N	Visible contamination extending into deeper interval.
			SD-F07-0406	4	6.2	Y	Entire core visibly contaminated; sample contains deepest collected depth of contamination.
G01A	6.0	0-2.5; 3.4-4.0; 4.8-5.3; 5.9-6.0	SD-G01-0002	0	2	Y	Surface sample analyzed for each location. Visible contamination/sheen, strong petroleum odor.
			SD-G01-0204	2	4	N	Visible contamination extending into deeper interval.
			SD-G01-0406	4	6	Y	Entire core layered with visibly contaminated material; sample contains deepest collected depth of contamination.
G02B	5.9	0-1; 3.3-3.6; 4.2-4.5; 4.7-5.9	SD-G02-0002	0	2	Y	Surface sample analyzed for each location. Visible contamination/sheen, strong petroleum odor.
			SD-G02-0204	2	4	N	Visible contamination extending into deeper interval.
			SD-G02-0406	4	5.9	Y	Entire core layered with visibly contaminated material; sample contains deepest collected depth of contamination.
G03A	5.9	0-5.9	SD-G03-0002	0	2	Y	Surface sample analyzed for each location. Visible contamination/sheen, strong petroleum odor.
			SD-G03-0204	2	4	N	Visible contamination extending into deeper interval.
			SD-G03-0406	4	5.9	Y	Entire core visibly contaminated; sample contains deepest collected depth of contamination.
G04A	5.6	0-5.6	SD-G04-0002	0	2	Y	Surface sample analyzed for each location. Visible contamination/sheen, strong petroleum odor.
			SD-G04-0204	2	4	N	Visible contamination extending into deeper interval.
			SD-G04-0406	4	5.6	Y	Entire core visibly contaminated; sample contains deepest collected depth of contamination.
G05B	6.7	0-6.3	SD-G05-0002	0	2	Y	Surface sample analyzed for each location. Visible contamination/sheen, strong petroleum odor.
			SD-G05-0204	2	4	N	Visible contamination extending into deeper interval.
			SD-G05-0406	4	6	Y	Entire core visibly contaminated; sample contains deepest collected depth of contamination.
			SD-G05-0607	6	6.7	Y	Clean clay sample.

TABLE 4-2 SEDIMENT CORE SAMPLING SUMMARY AND RATIONALE
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

Core ID	Core Length (feet)	Depth Range(s) of Visible Contamination	Sample Identification	Beginning of Interval	End of Interval	Analyzed (Y/N)	Rationale
G06A	5.5	0-3.3	SD-G06-0002	0	2	Y	Surface sample analyzed for each location. Visible contamination/sheen, strong petroleum odor.
			SD-G06-0204	2	4	N	Visible contamination extending into deeper interval.
			SD-G06-0406	4	5.5	Y	Possibly cleaner silty clay sample; last 0.6 ft of core less impacted than material above.
H01A	6.4	0-6.3	SD-H01-0002	0	2	Y	Surface sample analyzed for each location. Visible contamination/sheen, strong petroleum odor.
			SD-H01-0204	2	4	N	Visible contamination extending into deeper interval.
			SD-H01-0406	4	6.4	Y	Clean clay in deepest 1 inch of core. Not enough volume for analytical sample, included in -0406 sample. Above clay, entire core visibly contaminated; sample contains deepest collected depth of contamination.
H03A	6.7	0-6.2	SD-H03-0002	0	2	Y	Surface sample analyzed for each location. Visible contamination/sheen, strong petroleum odor.
			SD-H03-0204	2	4	N	Visible contamination extending into deeper interval.
			SD-H03-0406	4	6	Y	Sample contains deepest collected depth of contamination.
			SD-H03-0607	6	6.7	Y	Cleaner clay sample, still somewhat impacted (hydrocarbon odor evident).
H04A	6.5	0-6.5	SD-H04-0002	0	2	Y	Surface sample analyzed for each location. Visible contamination/sheen, strong petroleum odor.
			SD-H04-0204	2	4	N	Visible contamination extending into deeper interval.
			SD-H04-0406	4	6.5	Y	Entire core visibly contaminated; sample contains deepest collected depth of contamination.
H05B	6.1	0-6.1	SD-H05-0002	0	2	Y	Surface sample analyzed for each location. Visible contamination/sheen, strong petroleum odor.
			SD-H05-0204	2	4	N	Visible contamination extending into deeper interval.
			SD-H05-0406	4	6.1	Y	Entire core visibly contaminated; sample contains deepest collected depth of contamination.
H06A	4.3	0-4.3	SD-H06-0002	0	2	Y	Surface sample analyzed for each location. Visible contamination/sheen, strong petroleum odor.
			SD-H06-0204	2	4.3	Y	Entire core visibly contaminated; sample contains deepest collected depth of contamination.
H07B	5.5	5.5	SD-H07-0002	0	2	Y	Surface sample analyzed for each location. Visible contamination/sheen, strong petroleum odor.
			SD-H07-0204	2	4	N	Visible contamination extending into deeper interval.
			SD-H07-0406	4	5.5	Y	Entire core visibly contaminated; sample contains deepest collected depth of contamination.
I01B	2.0	0-1	SD-I01-0001	0	1	Y	Surface sample analyzed for each location. Visible contamination, strong petroleum odor.
			SD-I01-0102	1	2	Y	Cleaner clay sample, higher sand content
I02A	4.9	0-3.2	SD-I02-0002	0	2	Y	Surface sample analyzed for each location. Visible contamination/sheen, strong petroleum odor.
			SD-I02-0204	2	4	Y	Sample contains deepest depth of visible contamination.
			SD-I02-0406	4	4.9	Y	Clean clay sample.
I03A	6.3	0-3.6	SD-I03-0002	0	2	Y	Surface sample analyzed for each location. Visible contamination/sheen, strong petroleum odor.
			SD-I03-0204	2	4	Y	Sample contains deepest depth of visible contamination.
			SD-I03-0406	4	6.3	Y	Cleaner clay sample.
J02A	5.8	0-3.4	SD-J02-0002	0	2	Y	Surface sample analyzed for each location. Visible contamination/sheen, strong petroleum odor.
			SD-J02-0204	2	4	Y	Sample contains deepest depth of visible contamination.
			SD-J02-0406	4	5.8	Y	Clean clay sample.

TABLE 4-3 COMPARISON OF SURFACE WATER AND PORE WATER QUALITY PARAMETERS
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

		Temperature (°C)			Conductivity (mS/cm)			DO (mg/L)			ORP (mV)		
Location	**Sampling Date**	**SW**	**PW**	**% Difference**	**SW**	**PW**	**% Difference**	**SW**	**PW**	**% Difference**	**SW**	**PW**	**Difference**
A01	4/10/2015	9.04	10.13	11%	9.591	14.51	41%	7.45	2.12	-111%	195	36.5	-159
B01	4/10/2015	9.42	9.56	1%	8.941	16.56	60%	6.22	2.86	-74%	49.7	-104.3	-154
C01	4/10/2015	9.2	9.67	5%	8.909	10.46	16%	5.66	2.8	-68%	40.4	-66.9	-107
C02	4/17/2015	14.36	21.9	42%	6.81	8.661	24%	1.43	1.69	17%	-174.5	-176	-2
D02	4/17/2015	14.34	16.42	14%	5.115	12.89	86%	9.89	1.94	-134%	-7.7	-306	-298
DE01	4/23/2015	14.51	12.64	-14%	10.87	18.56	52%	10.69	8.19	-26%	175.2	-21.9	-197
E01	4/16/2015	15.13	16.4	8%	6.403	11.32	55%	9.33	2.12	-126%	220.7	-121.8	-343
F05	4/23/2015	13.81	12.79	-8%	10.539	20.856	66%	11.33	2.97	-117%	126.4	-149	-275

Notes:
°C = Degrees Celsius
mg/L = Milligrams per liter
mS/cm = Milli-Siemens per centimeter
mV = Millivolts
ORP = Oxidation-Reduction Potential
PW = Pore Water
SW = Surface Water

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5. ANALYTICAL RESULTS

5.1 SEDIMENT DATA

5.1.1 Surface Sediment Grab Samples

Results from analysis of surface sediment grab samples collected in October 2014 (Round 1) and April 2015 (Round 2) are presented in **Tables 5-1 through 5-7**. Note that not all data included in these tables were used in the risk assessments; additional tables presenting data used in the risk assessments are provided in Chapter 8. **Figures 5-1 through 5-7** display the highest concentrations of selected analytes reported in surface sediment from each sampling location (either grab samples or the surface intervals of sediment cores, see Section 5.1.2).

For all metals for which BTAG benchmarks are available, at least one sediment grab sample had a reported concentration exceeding the benchmark. Additionally, cadmium, chromium, copper, lead, nickel, and zinc were reported in multiple samples at concentrations exceeding the probable effects concentration (PEC). Nickel and zinc were chosen to represent metals in the figures (**Figures 5-1 and 5-2**), as they show spatial distribution similar to other metals. The highest concentrations of nickel and zinc among the surface grab samples (170 and 10,000 milligrams per kilogram [mg/kg], respectively) were reported in sample SD-H03, from the southern end of the Phase I area near the outlet of the Tin Mill Canal. Other sediment grab samples from Transect G (locations G01 and G02) and Transect H (H01 and H02), 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).

Total PAH concentrations exceeded the BTAG sediment benchmark of 2,900 micrograms per kilogram (µg/kg) in sediment grab samples from locations C03, E03, F05, G02, H01, H02, and H03, with concentrations generally higher farther offshore, where sediment has higher clay and silt content. No sediment grab samples had reported Total PAH concentrations exceeding the PEC (22,800 µg/kg). The highest concentrations of Total PAHs (**Figure 5-3**) in surface sediment grab samples were reported in samples SD-E03, SD-G02, and SD-H03 (10,360, 14,330, and 11,600 µg/kg, respectively).

Sediment grab samples from the DE, E, F, G, and H transects were observed to have sheen and/or odor indicating likely petroleum contamination. Sample 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. Samples 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. Samples SD-DE01, F01, F02, and F05 contained sediment that appeared oily at depths greater than a few inches. A slight odor and sheen were also noted in sample SD-C03.

All samples were analyzed for TOC, 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

G02 and H03. To better assess which areas show impacts by groundwater COPCs in the near-shore sediments, the metals and PAH data for the surface sediment grab samples were normalized to TOC concentrations (**Figures 5-8, 5-9, and 5-10**). 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. **Figures 5-8 and 5-9** illustrate that the highest concentrations of metals per mass of organic carbon overall were reported for surface sediment from locations D01, D02, E01, and F02, in the vicinity of the Rod & Wire Mill. Thus it appears that metals impacting groundwater upwelling in this area, where an active treatment system is now present, may have also resulted in impacts to sediments. As shown in **Figure 5-10**, the highest concentrations of PAHs per mass of organic carbon were reported in surface sediments from locations G01 and G02. PAHs were detected in groundwater adjacent to the G transect; thus, the elevated PAH concentrations in these sediments may reflect some groundwater impacts, in addition to likely impacts from the historical discharges from the Tin Mill Canal.

Analyses of PCB Aroclors and oil and grease were performed only on samples from transects associated with active stormwater outfalls (B, C, F, G, and H). PCB concentrations were higher than the PEC (676 µg/kg) in H transect locations H01 and H03 and in the sample from location F01 (**Figure 5-4**). All sediment grab samples except those from locations B01, C01, and F05 contained PCBs at concentrations exceeding the BTAG sediment benchmark (40 µg/kg). Oil and grease concentrations exceeding 80,000 mg/kg (i.e., 8 percent) were reported in samples from the G transect (locations G01 and G02) and the H transect (**Figure 5-5**). In other transects, oil and grease concentrations varied from 260 to 18,000 mg/kg.

Cyanide concentrations showed a similar pattern to the metals, with the highest concentration (21 mg/kg) in the sample from location G02, and concentrations over 1 mg/kg also in samples from locations C03, DE01, E03, H01, H02, and H03 (**Figure 5-6**).

Bis(2-ethylhexyl)phthalate was the only SVOC detected in multiple sediment grab samples, while phenol was also detected in one sample (from F05). However, several of the samples were diluted prior to SVOC analysis, at a factor of up to 25, due to matrix interference from constituents in the sediment; this resulted in elevated reporting limits, particularly for samples from the G and H transects. The sediment grab sample from location H03 contained the highest concentration of bis(2-ethylhexyl)phthalate among the grab samples (33,000 µg/kg). Concentrations exceeding the PEC (2,647 µg/kg) were reported in all grab samples from the G and H transects, in the grab sample location E03, and in none of the samples collected farther north (although in two samples the reporting limit for this compound exceeded the PEC). Concentrations exceeding the BTAG benchmark but less than the PEC were reported in grab samples from locations A02, B02, F01, F02, and F05 (**Figure 5-7**).

Like PCB Aroclors, VOCs were also analyzed only in samples from transects associated with active stormwater outfalls (B, C, F, G, and H). Chlorobenzene was the only VOC detected at a concentration exceeding the BTAG benchmark.

All of the surface sediment grab samples collected were analyzed for AVS and SEM, to aid with assessment of bioavailability for toxicity. These results are discussed in Chapter 9, *Ecological Risk Assessment*.

Sediments from the B and E transects (locations B01, B02, E01, E02, and E03), along with the sample from location SD-C02, underwent grain size analysis. As expected, the near-shore samples (SD-B01, SD-E01, and SD-E-01) contained the highest percentages of sand (92.5, 96.8, 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.

Overall, an observable trend exists between the elevation of these constituents and grain size: higher concentration associated with finer grained sediments, which are found near the center of Bear Creek and also near the outlet of the Tin Mill Canal. The most elevated concentrations of metals, PAHs, bis(2-ethylhexyl)phthalate, and PCBs in sediment grab samples were associated with fine-grained sediments toward the southern end of the study area, adjacent to the outlet of the Tin Mill Canal. Therefore, the sediment core sampling focused on this area (see Section 5.1.2).

5.1.2 Sediment Core Samples

The lithology of the sediment cores collected in March and April 2015 in the southern portion of the Phase I area indicated that the river bottom in this area consists of silty sediments underlain by low permeability, natural gray clay. In most locations, indications of impacts (odor and/or sheen) were observed throughout the column of silty sediments, but were not observed in the clay (**Tables 4-1 and 4-2** and **Appendix C**). The shallowest depth at which clay was encountered was approximately 3 ft, while in some locations, clay was not observed in cores extending to a depth of more than 6 ft. Where sufficient clay was encountered in sediment cores, samples consisting only of clay were collected: SD-E03-0406, SD-G05-0607, SD-H03-0607, SD-I01-0102, SD-I02-0406, SD-I03-0406, SD-J02-0406. Results from analysis of the sediment core samples are presented in **Tables 5-8 through 5-13**. Note that not all data included in these tables were used in the risk assessments; additional tables presenting data used in the risk assessments are provided in Chapter 8. **Figures 5-1 through 5-7** display the highest concentrations of selected analytes reported in surface sediment from each sediment location (either grab samples or the surface intervals of sediment cores), while **Figures 5-11 through 5-17** display the highest concentration of a given analyte reported in surface or subsurface sediment at each location. **Figures 5-18 through 5-24** illustrate the vertical trends in concentration along two cross sections. Results indicate that elevated concentrations of potential contaminants are largely

limited to the shallow silty sediments, with much lower or non-detectable concentrations in the underlying gray clay.

As with the fine-grained (silty) sediment grab samples, metals concentrations in sediment core samples exceeded BTAG benchmarks and PECs. Concentrations of certain metals (cadmium, chromium, copper, nickel, silver, and zinc) were generally highest in samples from cores in the G transect (locations G01 through G06) and H transect (locations H01 and H03 through H07), which are most directly offshore from the Tin Mill Canal (**Figures 5-1, 5-2, 5-11, and 5-12**). Concentrations of these metals also generally decreased with distance from the shoreline in these transects, suggesting that the Tin Mill Canal may have been a historical source of these metals. Concentrations of these metals in the cores taken farthest from the shoreline in this southern area were similar in magnitude to the concentrations reported in fine-grained grab samples A03, B02, and C03. If these concentrations are taken to approximate the upstream background values in fine-grained Bear Creek samples, then the offshore investigation appears to have achieved at least partial delineation of horizontal impacts of these metals related to Tin Mill Canal.

Vertical trends in metals concentrations varied within each sediment core (**Table 5-14**). In the DE, E, F, I, and J transects, and certain cores in the G and H transects, concentrations of the metals listed above generally decreased with depth within the silty sediments. However, at other locations in the G and H transects, impacts of these metals were generally more pronounced in silty sediments at depth. This suggests burial of the most impacted sediments at these locations. Relatively low metals concentrations, below the PEC values, were reported in samples of the gray clay that underlies the impacted silty sediments.

Total PAH concentrations exceeded the PEC (22,800 µg/kg) in at least one sediment sample from each coring location except E03, F03, G05, G06, I01, I02, and J02. Although the highest concentrations of Total PAHs (**Figures 5-3 and 5-13**) in sediment core samples were in the H transect, there was no clear trend in PAH concentrations from near-shore to offshore cores. The highest concentrations of Total PAHs were reported in the surface sediment interval (0–2 ft below sediment surface) at locations SD-H04 (82,800 µg/kg in the surface interval), SD-H01 (79,500 µg/kg in the surface interval), and SD-H07 (62,850 µg/kg in the surface interval). Vertical trends in PAH concentrations were similar to those for metals; however, the highest PAH concentration in each location was more often at the surface (**Table 5-14** and **Figures 5-3, 5-13, 5-19, and 5-20**). Again, the clay underlying the silt was found to be relatively less impacted. PAH concentrations throughout the coring area were higher than concentrations observed in surface grabs from the northern portion of the Phase I area. Based on these results, the observed PAH impacts appear to be less clearly tied to impacts from Tin Mill Canal than the impacts of certain metals, and do not appear to have been well delineated by the offshore investigation.

Total PCB concentrations exceeded the PEC (676 µg/kg) in at least one sediment sample from each coring location except G06, I01, and I03 (**Figure 5-14**). The highest concentrations of total PCBs in sediment core samples were in the G and H transects. Although there was no clear

spatial trend in PCB concentrations across these transects, the cores farthest offshore (G05, G06, and H07) had the lowest reported PCB concentrations. Vertically, PCB concentrations showed similar trends to the metals discussed above, but with the highest concentrations more often in the subsurface (**Table 5-14** and **Figures 5-4, 5-14, 5-21 and 5-22**). Overall, the spatial distribution suggests a possible historical source of PCBs, as well as metals, from the Tin Mill Canal. As with metals, PCB concentrations in the core from locations G06 and I03 were similar in magnitude to the concentrations reported in fine-grained grab samples B02 and C03. Thus, the offshore investigation appears to have achieved at least partial horizontal delineation of PCB impacts related to Tin Mill Canal.

Oil and grease concentrations in the sediment core samples were substantially lower (0.025 to 0.125 times) than the concentrations reported in co-located sediment grab samples (at G01, G02, H01 and H03). Photographs of the cores from these locations (**Appendix B**) in some cases show darker gray/black sediment at in the top 6 inches, which may have been diluted by the remainder of the surface intervals (0-2 ft), leading to lower concentrations than in the grab samples collected from 0-6 inches. However, the generally dark color of the sediments in the southern portion of the Phase I area makes it difficult to visually evaluate the amount of oil and grease impacts in the sediments, and to compare between samples and intervals. The highest concentration reported in a core sample was 11,000 mg/kg in surface sediment at location G01; the grab sample collected from this location contained 89,000 mg/kg oil and grease. Oil and grease concentrations in the southern portion of the Phase I area generally decrease with distance from the Tin Mill Canal; however, concentrations in grab samples from locations B02 and C03 exceeded concentrations reported in many of the southern cores (**Figure 5-15**). Vertically, oil and grease was generally higher in the surface interval, and extended only minimally into the clay underlying the silt. (**Table 5-14** and **Figures 5-5, 5-15, 5-23, and 5-24**), as expected based on the dramatically higher concentrations observed in grab samples of the top 6 inches. The distribution of oil and grease seems to indicate historical impacts from the Tin Mill Canal, as expected based on historical uses. The offshore investigation delineated these impacts horizontally, to a concentration of less than 1,500 mg/kg.

Cyanide concentrations exceeded the BTAG benchmark in all but three of the sediment core samples. The highest concentrations (27–36 mg/kg) were reported at locations H07 and E03 (**Figure 5-16**). Cyanide did not show a consistent vertical trend within cores, and did not closely track the trends seen in metals concentrations (**Table 5-14**). The overall spatial distribution of cyanide concentrations does not suggest that cyanide in the Bear Creek sediments is derived from the Tin Mill Canal.

As with surface sediment grab samples, bis(2-ethylhexyl)phthalate was the SVOC most often detected in sediment core samples. The following SVOCs were also detected at concentrations exceeding BTAG benchmarks: 2,4-dimethylphenol, benzoic acid, and phenol. The highest concentrations of bis(2-ethylhexyl)phthalate reported in the core samples were from locations H03, H04, H05, G01, and G02 (**Figure 5-17**). Concentrations exceeding the BTAG benchmark and PEC from MacDonald (1996) were reported in samples from all coring locations except G06

and I01. The distribution of phthalate concentrations indicate that this constituent may be Site-related, although the highest concentrations are not centered on the Tin Mill Canal.

TOC concentrations in the sediment core samples ranged from 6,800 to 270,000 mg/kg, with most samples containing at least 50,000 mg/kg TOC.

No VOCs were detected at concentrations exceeding BTAG benchmarks in sediment core samples.

A SEM/AVS ratio was calculated for the surface interval of each core. These results are discussed in Chapter 9, *Ecological Risk Assessment*.

The sediment core results indicate that, of the contaminants identified, select metals, PCBs, and oil and grease show the strongest association with the Tin Mill Canal, and the impacts by these contaminants have been at least partially delineated. PAHs, cyanide, and bis(2-ethylhexyl)phthalate do not appear to be clearly associated with the Canal and are less well delineated horizontally, with elevated concentrations extending to the farthest extent of coring. Vertical delineation of the identified contaminants was achieved where the relatively unimpacted gray clay was encountered; more complete delineation (e.g., in areas where the clay was not encountered) would require additional coring, using equipment capable of reaching the depth of clay throughout the area.

5.2 STORMWATER DATA

Results from analysis of stormwater samples collected on 16 November and 1 December 2014 are presented in **Tables 5-15 through 5-19**.

The only analyte reported at a concentration exceeding screening criteria was cyanide, in samples from Outfalls 014 and 018. Therefore, cyanide was identified as the primary COPC in stormwater.

Metals reported at concentrations below screening criteria were antimony, arsenic, chromium, copper, mercury, nickel, selenium, and zinc. All outfalls had detections of at least four of these metals.

PAHs were detected, at concentrations below screening levels, primarily during the 16 November sampling event. The highest PAH concentrations were reported in samples from Outfall 014, with multiple detections in Outfall 018 as well. No PAHs were detected in the sample from the Greys landfill stormwater pond (named after Outfall 071). Concentrations of oil and grease near the detection limit were also reported in all of the outfalls sampled.

Other SVOCs detected, at concentrations below screening levels, included 2,4-dimethylphenol, phenol, and four phthalates.

Total suspended solids concentrations were between 2 and 3.6 milligrams per liter (mg/L) in the November samples, and between non-detectable and 30 mg/L in the December samples. The solids concentration in Outfall 018 increased the most between November and December; however, chemical constituent concentrations reported in samples from this outfall were not consistently higher in December than November, as would be expected if the constituents were associated with solid particles.

No PCB detections, and only one VOC detection (chloroform in the sample from Outfall 014) were reported.

Because cyanide at Outfalls 014 and 018 was the only constituent exceeding the screening criteria used in identification of Site-related COPCs (Section 2.2.1), and because the exceedances were reported in the southern portion of the Phase I area where cyanide was already identified as a COPC based on groundwater data (see Section 2.2.2), the stormwater results do not result in addition of any Site-related COPCs.

5.3 PORE WATER DATA

Results from analysis of pore water samples are presented in **Table 5-20.**

Site-related COPC metals reported at concentrations exceeding ecological surface water screening values were lead, mercury, nickel, and zinc. Mercury and zinc exceeded screening values in sample PW-C02, located offshore from Greys Landfill. All three Site-related COPCs for the C transect, identified based on results from groundwater well GL12, were detected in the sample PW-C02. Lead, nickel, and zinc exceeded screening values in the sample from PW-DE01, located offshore from the Rod & Wire Mill. Cadmium and copper were also COPCs for the DE transect, identified based on results from groundwater well clusters RW18, RW19, RW20, and TS04, but these metals were not detected in pore water.

Cyanide was reported at concentrations exceeding ecological surface water screening values in the samples for which it was analyzed (PW-D02, PW-DE01, PW-E01, and PW-F05). The highest concentration was reported in sample PW-F05, near the location of the highest stormwater cyanide concentration (Outfall 018). The concentration in PW-05 (24 µg/L) was similar to the concentration reported in nearby groundwater well HI08 (21 µg/L) (**Table 2-1**). However, the highest cyanide concentration in groundwater was 1,000 µg/L in the RW-19 well cluster (**Table 2-1**), adjacent to the DE transect, where the cyanide concentration in pore water was only 2.5 µg/L. This discrepancy could be partially attributable to the pump and treat system in the Rod & Wire Mill, which effectively reverses the groundwater gradient (toward the shore) in portions of this area.

Only one PAH (naphthalene) was detected in pore water, at a concentration below screening levels, in sample PW-DE01. In comparison, multiple PAHs were detected at low concentrations

in groundwater from throughout the Rod & Wire Mill and Humphrey Impoundment/Tin Mill Canal areas.

Bis(2-ethylhexyl)phthalate was detected, at concentrations exceeding the human health screening value for surface water, in samples PW-C01 and PW-F05. The reported concentrations in pore water (0.24 to 1.1 µg/L) were one to two orders of magnitude lower than those reported in nearby shallow groundwater wells (5.5-110 µg/L) (**Table 2-1**).

5.4 DATA QUALITY ASSESSMENT

To support the assessment of data quality, the data underwent 20 percent Level IV and 80 percent Level III validation, in accordance with the pertinent USEPA National Functional Guidelines for Organic and Inorganic Data Review. Validation was conducted by a third-party validator (Environmental Data Services, Inc.) (**Appendix E**).

The findings of the data validation are summarized in this section.

5.4.1 General Data Qualifiers

As required by USEPA protocols, analytes that were identified at concentrations greater than their respective method detection limit, but less than their respective reporting limit, were assigned a "J" qualifier on the data summary reports and data tables to indicate that the results are quantitative estimates.

5.4.2 Quality Control Samples

Field Duplicates—Field duplicates are separate samples collected in the field at the same time and place as the parent sample. Duplicates are utilized to determine the accuracy and precision of field sampling and laboratory analytical activities. Field duplicates are also indicative of sample homogeneity. Duplicate samples were collected, processed, and transported in the same manner as the parent samples. Field duplicate samples were collected, analyzed, and evaluated at a frequency of approximately 10 percent for all media except for pore water, as summarized below:

	# Duplicates	# Project Samples
Round 1 Sediment Sampling	2	20
Stormwater Sampling	1	7
Round 2 Sediment Sampling	5	51

Rinsate Blanks—Rinsate blanks are collected to determine the extent of contamination, if any, from the sampling equipment used as part of the project. Rinsate blanks were collected by pouring deionized water, provided by EA's Ecotoxicology Laboratory, over or through sampling equipment (e.g., Ponar samplers or push-point samplers) that had been decontaminated using the

procedure outlined in Section 4.6. Rinsate water was preserved and treated in the same manner as the field samples. The rinsate water was placed in laboratory-prepared containers, submitted to the analytical laboratory with the project samples, and tested for the same chemical parameters as the sediments and site water. Rinsate blanks were collected in association with sediment and pore water sampling, which utilized reusable equipment. The results of the rinsate blanks are used to evaluate the effectiveness of the field decontamination procedures.

Field Blanks—Field blanks were also collected in association with sediment and pore water sampling. The field blanks were prepared by pouring deionized water directly into a sample container. The results of the field blanks are used to help evaluate whether any analytes detected in rinsate blanks are associated with the decontaminated equipment, or whether they are associated with the deionized water or a source of contamination present in the sampling or sample storage environment.

Trip Blanks—A trip blank (also called a transport blank) is a sample of laboratory reagent water (preserved with hydrochloric acid) that is provided with the sample containers by the laboratory. It accompanies the sample containers into the field and back to the laboratory. Analysis of trip blanks was used to identify possible contamination associated with the residence of samples and containers during the collection, transport, and laboratory time. Trip blanks were analyzed for VOCs only. One trip blank was included in each cooler containing water samples for VOC analysis.

Method Blanks—The method (reagent) blank is used to monitor laboratory contamination. The method blank is usually a sample of laboratory reagent water processed through the same analytical procedure as the sample (i.e., digested, extracted, distilled). One method blank is analyzed at a frequency of one per every analytical preparation batch of 20 or fewer samples.

Laboratory Control Samples—The laboratory control sample (LCS) is a fortified method blank consisting of reagent water or solid fortified with the analytes of interest for single-analyte methods and selected analytes for multi-analyte methods according to the appropriate analytical method. LCSs are prepared and analyzed with each analytical batch, and analyte recoveries are used to monitor analytical accuracy and precision.

Matrix Spike (MS) / Matrix Spike Duplicate (MSD)—A fortified sample (MS) is an aliquot of a field sample that is fortified with the analyte(s) of interest and analyzed to monitor matrix effects associated with a particular sample. Samples to be spiked were chosen at random. The final spiked concentration of each analyte in the sample should be at least 10 times the calculated method detection limit. A duplicate-fortified sample (MSD) is also performed with each MS. Analysis of site-specific MS/MSDs was performed on sediment and water samples, where sample volumes allowed.

Laboratory Sample Duplicates—A sample duplicate is a second aliquot of a field sample that is analyzed to monitor analytical precision associated with that particular sample. Sample

duplicates were performed on sediment, stormwater, and pore water samples for every batch of 20 samples, or for batches of fewer samples for those analytes that do not have MS/MSD analyses.

Surrogates—Surrogates are organic compounds that are similar to analytes of interest in chemical composition, extraction, and chromatography, but are not normally found in environmental samples. These compounds were spiked into all blanks, samples, and spiked samples prior to analysis for organic parameters. Generally, surrogates are not used for inorganic analyses. Percent recoveries were calculated for each surrogate. Surrogates were spiked into samples according to the requirements of the reference analytical method. Surrogate spike recoveries were evaluated against the laboratory recovery limits and used to assess method performance and sample measurement bias. If sample dilution caused the surrogate concentration to fall below the quantitation limit, surrogate recoveries were calculated.

5.4.3 Validation Results

The validation reports are provided in **Appendix E**. Data were qualified during validation due to minor issues with data quality, as prescribed by USEPA methodology. Data tables referenced above incorporate these validation qualifiers. Substantial data quality issues (e.g., rejected data), and quality issues resulting in qualification of results for analytes detected in project samples are summarized below, by sampling medium/round.

5.4.3.1 Round 1 Sediment Sampling

SVOCs
Results for two SVOCs (benzidine and hexachlorocyclopentadiene) in one sample (SDG J37750) were rejected due to severely low MS/MSD recoveries.

The continuing calibration percent difference (%D) was reported high for 4-nitrophenol, resulting in J or UJ qualification of associated results (SDG J37750).

Low internal standard area counts resulted in J or UJ-qualification of associated SVOCs (SDG J37760).

PAHs
No data were qualified during validation.

VOCs
The following constituent was detected in method blanks, resulting in U-qualification of associated results: toluene (SDGs J37750 and J37760).

PCBs
Results for PCB-1248 and PCB-1260 were J-qualified due to high %D between two gas chromatography columns used for the laboratory analysis (SDGs J37750 and J37760).

Metals and AVS/SEM
Results for the following metals were J- or UJ-qualified due to MS/MSD percent recoveries and/or relative percent differences (RPDs) outside control limits: beryllium and selenium (SDG J37750).

Results for the following metals were J- or UJ-qualified due to serial dilution %D outside control limits: antimony and zinc (SDG J37750).

Results for the following SEM metals were J- or UJ-qualified due to MS/MSD percent recoveries and/or RPDs outside control limits: cadmium SEM (SDG J37750) and copper SEM (SDGs J37750 and J37760).

The following results were J-qualified due to field duplicate RPDs exceeding 100 percent: cadmium SEM, copper SEM, lead SEM, and nickel SEM in the duplicate and parent sample SD-F01 (SDG J37760).

Oil and Grease, TOC, and Cyanide
No data were qualified during validation.

5.4.3.2 Stormwater Sampling

SVOCs
SVOC results from the re-analysis of samples ST-018-111614 and ST-DUP-111614 were J- or UJ-qualified due to re-extraction of the samples after 9 days, outside the recommended holding time of 7 days. However, the validator determined that the results from re-analysis should be used because acceptable surrogate recoveries were achieved during re-analysis.

PAHs
No data were qualified during validation.

VOCs
VOC results for sample ST-018-120114 were UJ-qualified due to low recovery of one surrogate.

PCBs
No PCB data were qualified during validation.

Metals
The following metals were detected in method blanks, resulting in U-qualification of associated results: antimony (SDG J39026), lead, and thallium (SDGs J39026 and J39432), and copper (SDG J39432).

Oil and Grease, TSS, and Cyanide
No results for these analytes were qualified during validation.

5.4.3.3 Round 2 Sediment Sampling

Greater than 70 percent moisture in the following samples from the sediment cores resulted in J- or UJ-qualification of all results for these samples during validation: SD-DE02-0002, SD-E03-0002, SD-F06-0002, SD-F07-0002, SD-G01-0406, SD-G02-0002, SD-G03-0002, SD-G04-0002, SD-G05-0002, SD-H01-0406, SD-H03-0002, SD-H04-0002 (and duplicate), SD-H05-0406, SD-H06-0002 (and duplicate), SD-H06-0204, SD-H07-0002, SD-I02-0002, and SD-J02-0002.

Additional qualification of results for specific analytes detected in project samples is described below.

SVOCs
The continuing calibration %D was reported high for the following VOCs, resulting in J or UJ qualification of associated results: benzoic acid and 4-nitrophenol (SDG J43699).

One phenol result was J-qualified due to low surrogate recovery (SDG J43699).

Seven SVOC results were rejected due to severely low internal standard area counts (SDG J43699).

Multiple SVOC results were J- or UJ-qualified due to high internal standard area count (SDG J43699).

One pyrene result was J-qualified due to a field duplicate RPD exceeding 50 percent.

Note that the field blank and rinsate blank results were not considered in the validation. Bis(2-ethylhexyl)phthalate was the only SVOC detected at a concentration exceeding the reporting limit. The concentrations of this phthalate in rinsate blanks were higher than in field blanks, indicating that some phthalate exposure may have occurred in the field, despite use of non-plastic equipment whenever possible. However, the concentrations detected in the blanks are not expected to have substantially impacted the sediment concentrations, which were in many cases orders of magnitude higher.

VOCs
The following constituent was detected in method blanks, resulting in U-qualification of associated results: toluene (SDG J43411).

The toluene result for one sample was J-qualified due to high MS/MSD percent recovery.

PCBs
Detected PCB results for the following samples were J-qualified due to patterns that did not closely match the Aroclor standards, presumably due to weathering: SD-H05-0002, SD-F07-0406, SD-G03-0002, SD-H06-0002 (and duplicate), SD-G02-0002, SD-DE02-0002, SD-DE02-0406, SD-H07-0002 (and duplicate), SD-G06-0002, SD-I03-0204, SD-I03-0406, SD-I02-0002, SD-I02-0406, SD-G05-0002.

Several additional PCB results were J-qualified due to low surrogate recovery and due to high %D between two gas chromatography columns used for the laboratory analysis (SDG J43699).

Metals and AVS/SEM
Results for the following metals were J- or UJ-qualified due to MS/MSD percent recoveries and/or RPDs outside control limits: antimony, cadmium, copper SEM, nickel, selenium, and silver (SDG J43699).

Results for the following metals were J-qualified due to serial dilution %D outside control limits: copper SEM and zinc SEM (SDG J43699).

Note that the field blank and rinsate blank results were not considered in the validation. Metals detected in the blanks at concentrations exceeding the reporting limits included antimony, nickel, and zinc, with higher concentrations in the blanks associated with field sampling than in those associated with core processing. The concentrations of these metals in rinsate blanks and field blanks were similar, indicating a source independent of the sampling equipment. The metals concentrations detected in the blanks are not expected to have substantially impacted the sediment concentrations, which were orders of magnitude higher.

Oil and Grease and Cyanide
Cyanide results for multiple samples were J- or UJ-qualified due to MS/MSD percent recoveries outside control limits (SDG J43699).

5.4.3.4 Pore Water Sampling

PAHs/Phthalate
No data were qualified during validation.

Note that the field blank and rinsate blank results were not considered in the validation. Bis(2-ethylhexyl)phthalate was detected in these blanks at concentrations just above the reporting limit.

Metals

The following metals were detected in method blanks, resulting in U-qualification of associated results: antimony (SDG J42982), copper (SDG 43409), lead (SDG 43409), and thallium (SDG J42982).

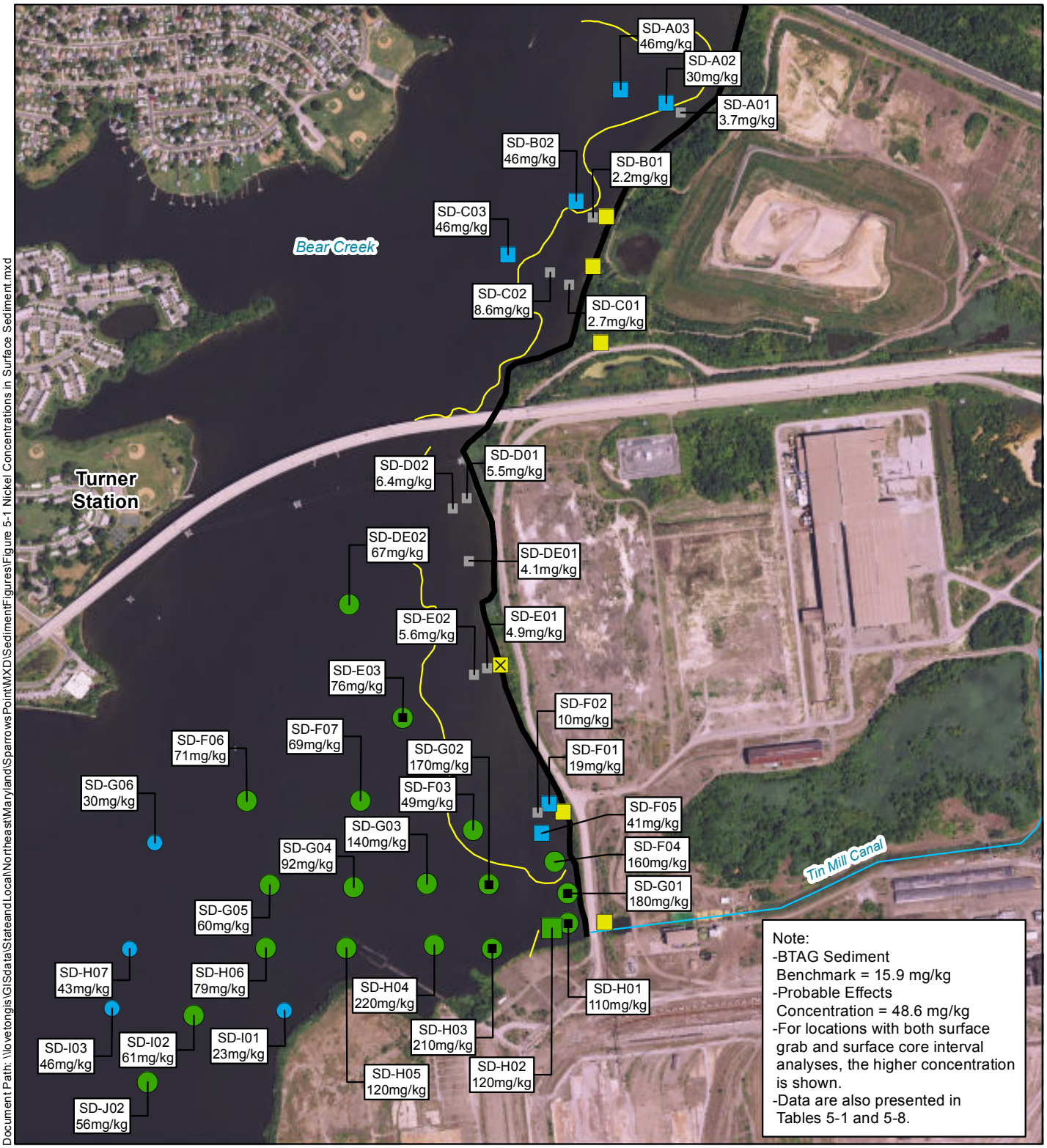
Note that the field blank and rinsate blank results were not considered in the validation. The following metals were detected in both of these blanks at concentrations below the average reporting limits: chromium, copper, lead, nickel, and zinc.

Cyanide

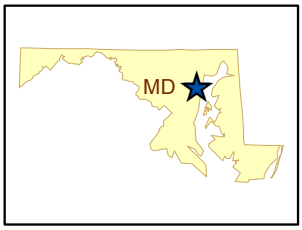
No cyanide data were qualified during validation.

5.4.4 Data Usability

As noted above, the only data rejected during validation were two SVOC results for one Round 1 sediment sample, and seven SVOC results for one Round 2 sediment sample. The data validation results and subsequent data usability assessment indicate that, with the exception of these rejected data, the data are fully usable for the purposes intended, for characterization of the Phase I Offshore Area and use in the risk assessments (Chapters 9 and 10).



Document Path: \\lovetongis\GIS\data\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\SedimentFigures\Figure 5-1 Nickel Concentrations in Surface Sediment.mxd



0 250 500 1,000
Feet

1 inch = 1,000 feet

N

Legend

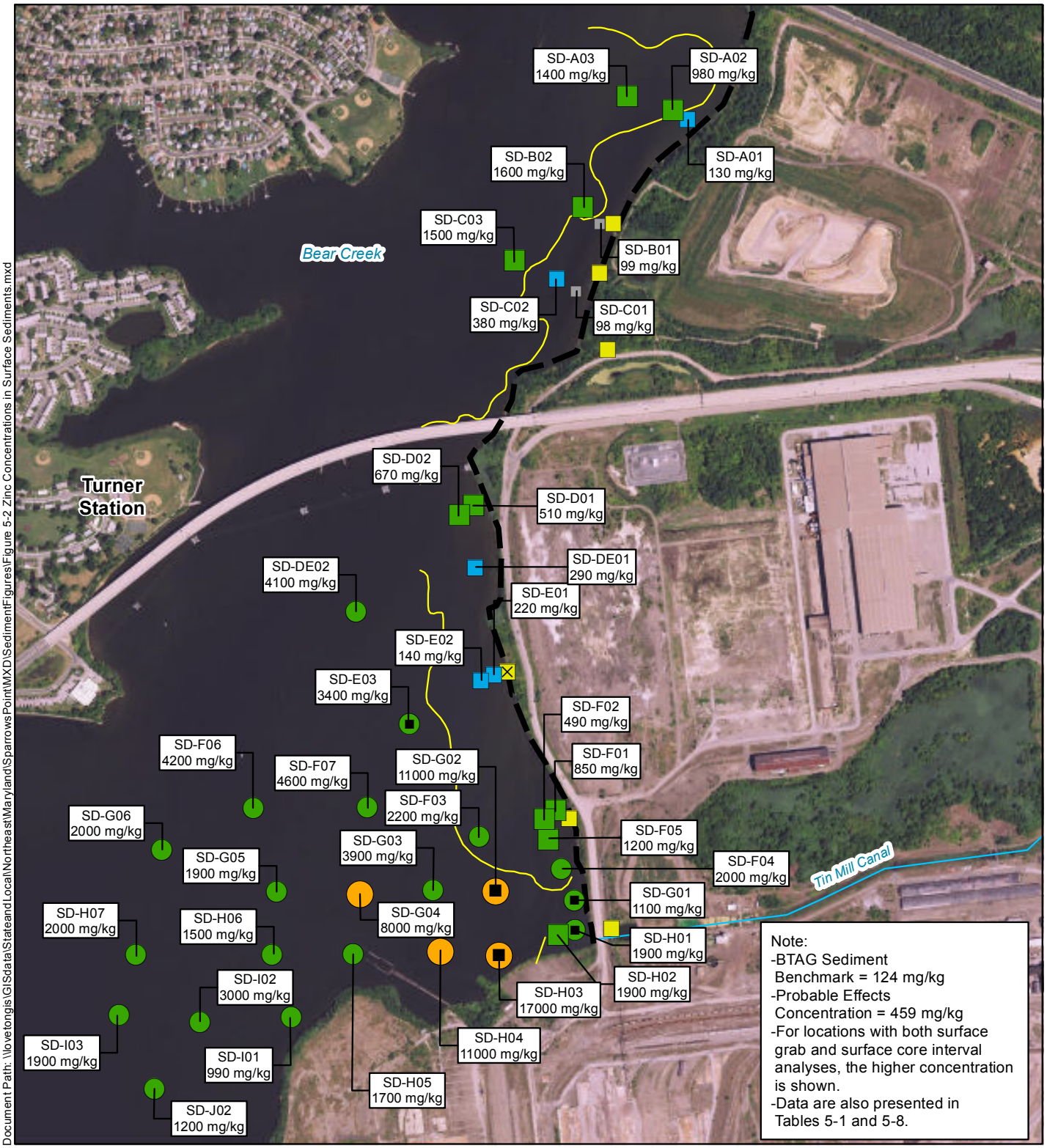
- Phase 1 Northwest Shoreline
- Perennial Creek/Stream
- Boundary between Sand and Fine Grained Sediment
- Approximate Location of Active Stormwater Outfall
- Approximate Location of Inactive Stormwater Outfall

Nickel Concentration in Sediment

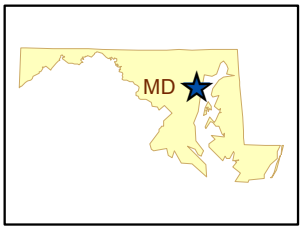
- Coring Location 15.9-48.6 mg/kg
- Coring Location >48.6 mg/kg
- Surface Grab and Coring Location >48.6 mg/kg
- Surface Grab <15.9 mg/kg
- Surface Grab 15.9-48.6 mg/kg
- Surface Grab >48.6 mg/kg

Figure 5-1
Nickel Concentrations in Surface Sediment
Phase I Northwest Shoreline
Baltimore, Maryland

Map Date: January 2016
Image Source: ESRI 2011
Projection: NAD 1983 StatePlane Maryland FIPS 1900 (US Feet)



Document Path: \\lovetongis\GIS\data\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\SedimentFigures\Figure 5-2 Zinc Concentrations in Surface Sediments.mxd



0 250 500 1,000
Feet

1 inch = 1,000 feet

N

Legend

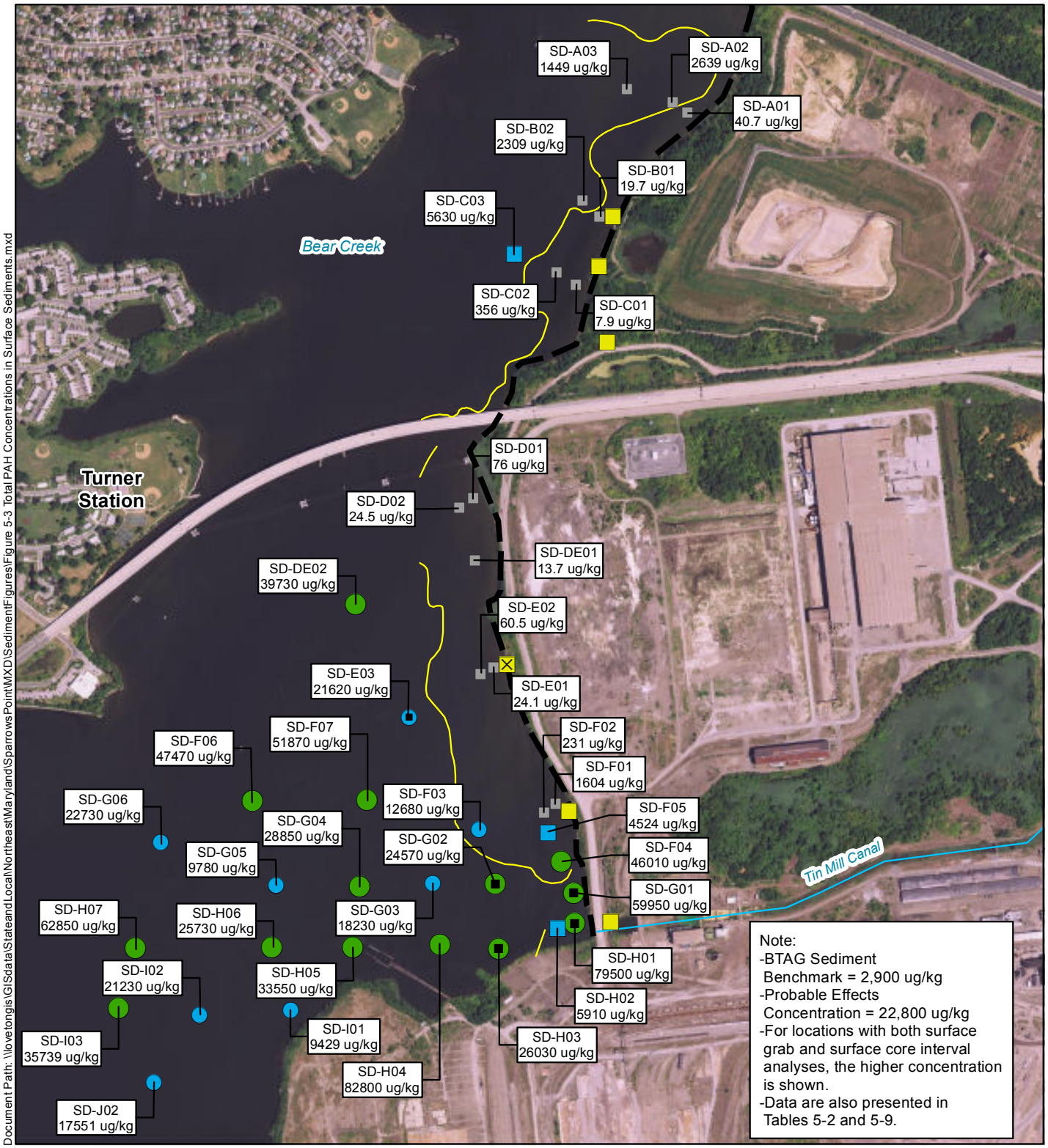
- Phase 1 Northwest Shoreline
- Perennial Creek/Stream
- Boundary between Sand and Fine Grained Sediment
- Approximate Location of Active Stormwater Outfall
- Approximate Location of Inactive Stormwater Outfall

Zinc in Sediments

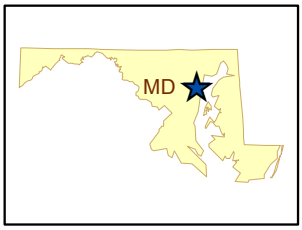
- Coring Location 459-5,000 mg/kg
- Coring Location >5,000 mg/kg
- Surface Grab and Coring Location 459-5,000 mg/kg
- Surface Grab and Coring Location >5,000 mg/kg
- Surface Grab < 124 mg/kg
- Surface Grab 124-459 mg/kg
- Surface Grab 459-5,000 mg/kg

Figure 5-2
Zinc Concentrations in Surface Sediment
Phase I Northwest Shoreline
Baltimore, Maryland

Map Date: January 2016
Image Source: ESRI 2011
Projection: NAD 1983 StatePlane Maryland FIPS 1900 (US Feet)



Document Path: \\lovetongis\GIS\data\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\SedimentFigures\Figure 5-3 Total PAH Concentrations in Surface Sediments.mxd



0 250 500 1,000
Feet

1 inch = 1,000 feet

N

Legend

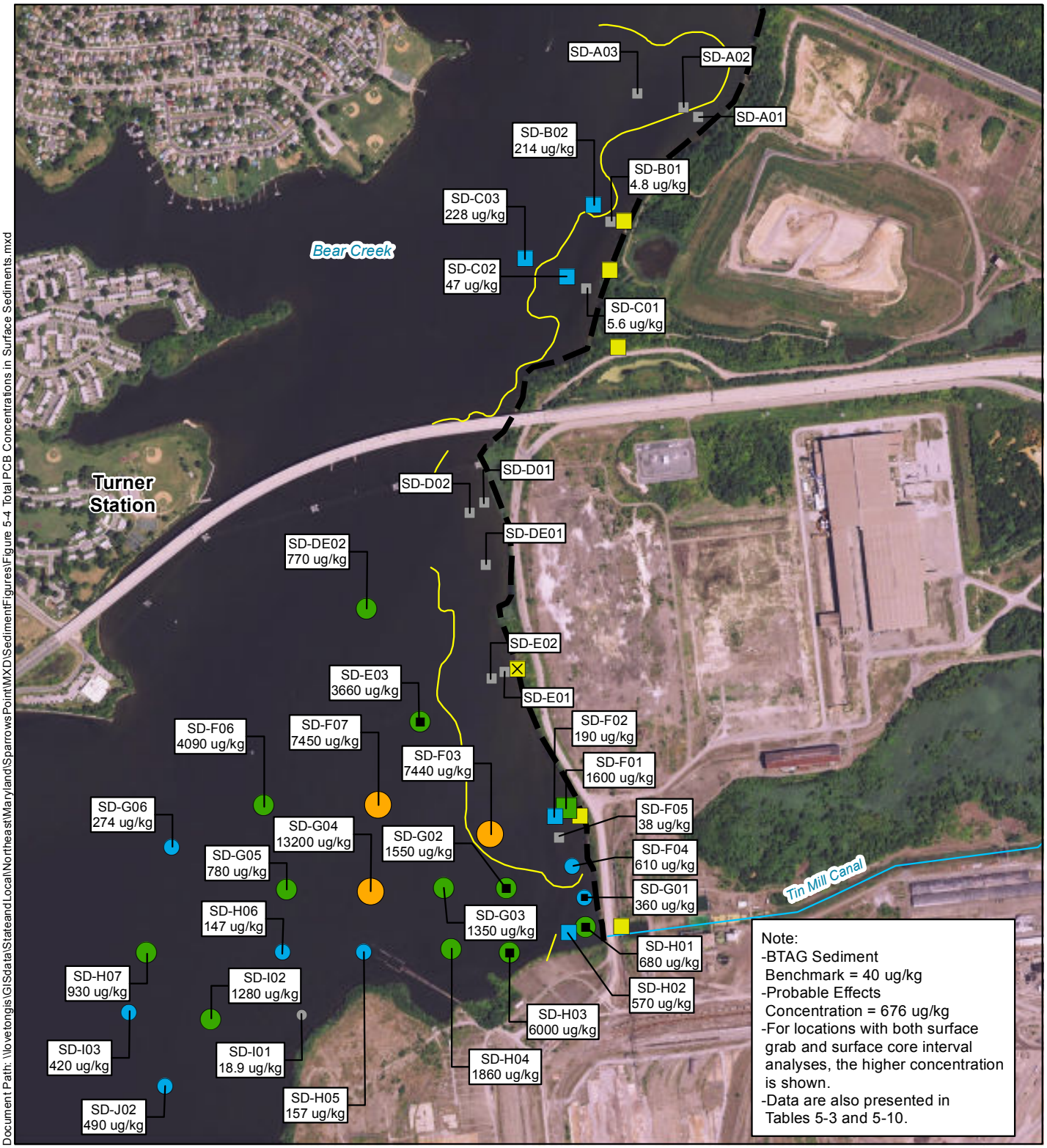
- Phase 1 Northwest Shoreline
- Perennial Creek/Stream
- Boundary between Sand and Fine Grained Sediment
- Approximate Location of Active Stormwater Outfall
- Approximate Location of Inactive Stormwater Outfall

Total PAH in Sediments

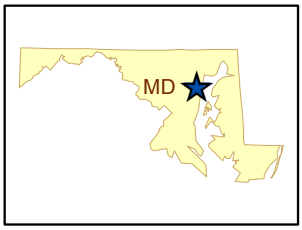
- Coring Location 2,900-22,800 ug/kg
- Coring Location >22,800 ug/kg
- Surface Grab and Coring Location 2,900-22,800 ug/kg
- Surface Grab and Coring Location >22,800 ug/kg
- Surface Grab <2,900 ug/kg
- Surface Grab 2,900-22,800 ug/kg

Figure 5-3
Total PAH Concentrations in Surface Sediment
Phase I Northwest Shoreline
Baltimore, Maryland

Map Date: January 2016
Image Source: ESRI 2011
Projection: NAD 1983 StatePlane Maryland FIPS 1900 (US Feet)



Document Path: \\lovetongis\GIS\data\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\SedimentFigures\Figure 5-4 Total PCB Concentrations in Surface Sediments.mxd



0 250 500 1,000
Feet

1 inch = 1,000 feet

N

Legend

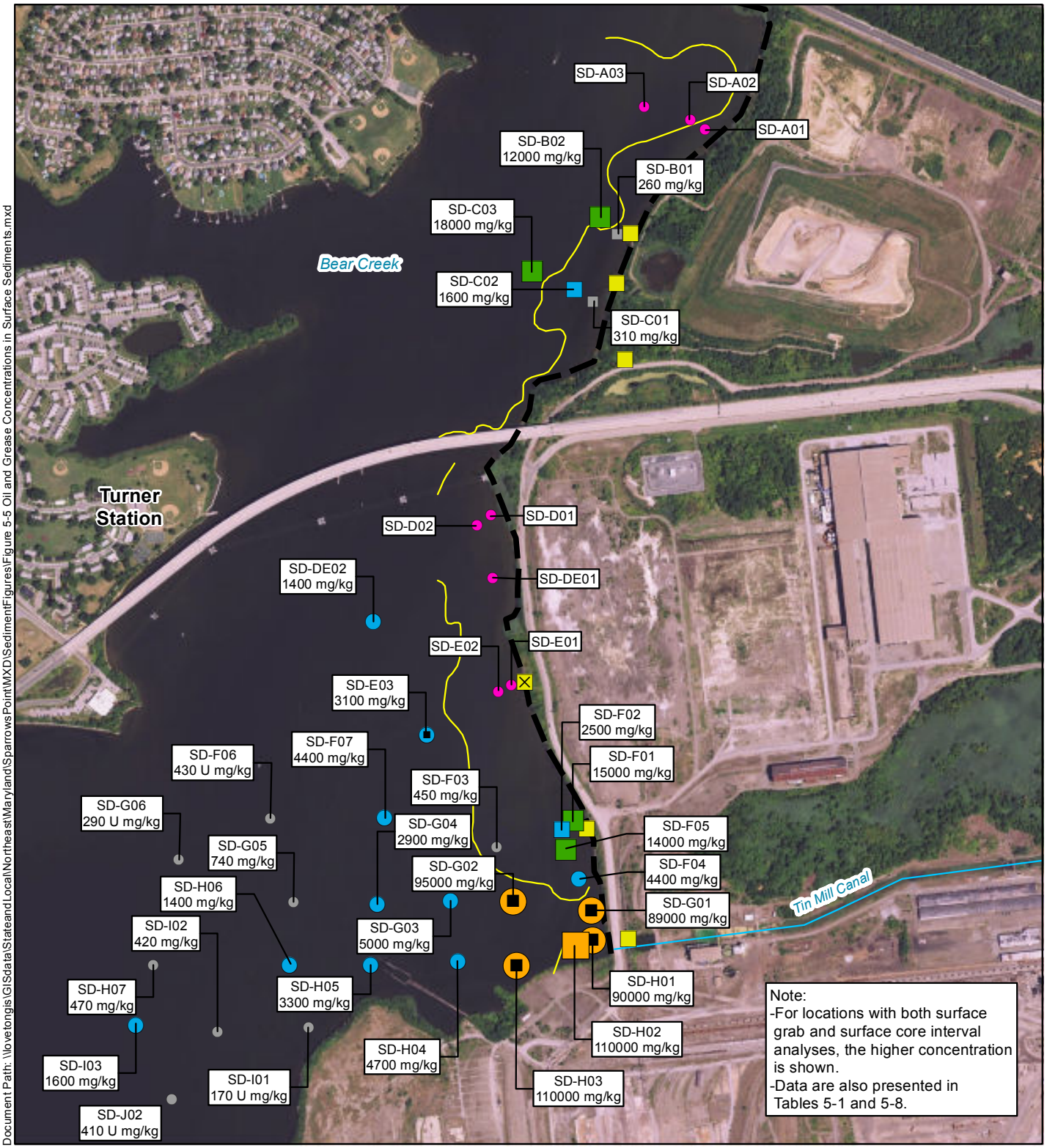
- Phase 1 Northwest Shoreline
- Perennial Creek/Stream
- Boundary between Sand and Fine Grained Sediment
- Approximate Location of Active Stormwater Outfall
- Approximate Location of Inactive Stormwater Outfall

Total PCBs in Sediments

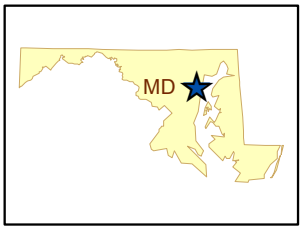
- Coring Location <40 ug/kg
- Coring Location 40-676 ug/kg
- Coring Location 676-6,000 ug/kg
- Coring Location >6,000 ug/kg
- Surface Grab and Coring Location 40-676 ug/kg
- Surface Grab and Coring Location 676-6,000 ug/kg
- Surface Grab and Coring Location >6,000 ug/kg
- Surface Grab <40 ug/kg
- Surface Grab 40-676 ug/kg
- Surface Grab 676-6,000 ug/kg

Figure 5-4
Total PCB Concentrations in Surface Sediment
Phase I Northwest Shoreline
Baltimore, Maryland

Map Date: January 2016
Image Source: ESRI 2011
Projection: NAD 1983 StatePlane Maryland FIPS 1900 (US Feet)



Document Path: \\lovetongis\GIS\data\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\SedimentFigures\Figure 5-5 Oil and Grease Concentrations in Surface Sediments.mxd



0 250 500 1,000
Feet

1 inch = 1,000 feet

N

Legend

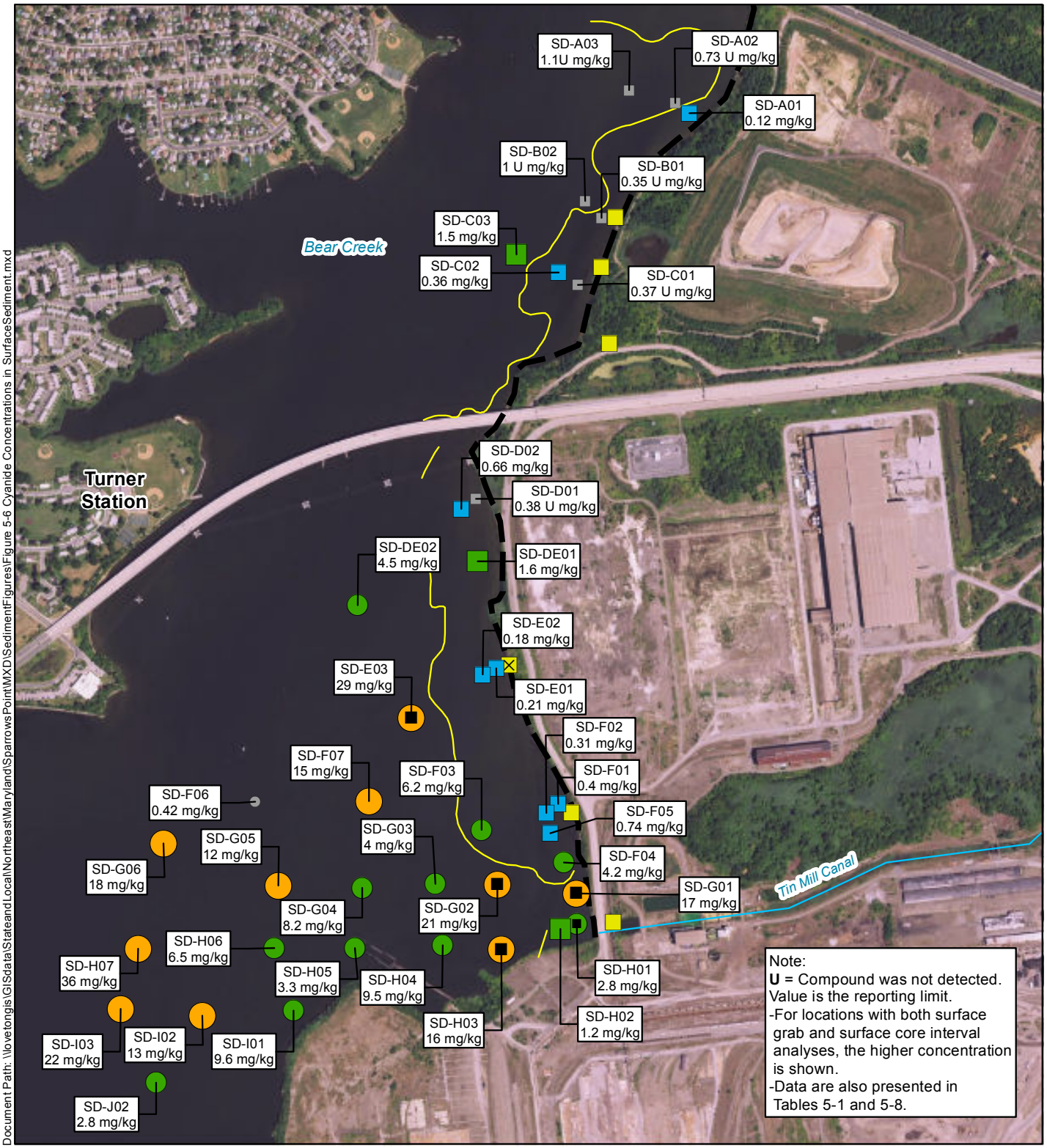
- Not Sampled for Oil or Grease
- Phase 1 Northwest Shoreline
- Perennial Creek/Stream
- Boundary between Sand and Fine Grained Sediment
- Approximate Location of Active Stormwater Outfall
- Approximate Location of Inactive Stormwater Outfall

Oil and Grease in Sediments

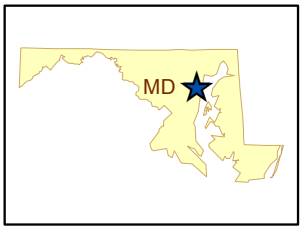
- Coring Location <1,000 mg/kg
- Coring Location 1,000-10,000 mg/kg
- Surface Grab and Coring Location 1,000-10,000 mg/kg
- Surface Grab and Coring Location >50,000 mg/kg
- Surface Grab <1,000 mg/kg
- Surface Grab 1,000-10,000 mg/kg
- Surface Grab 10,000-50,000 mg/kg
- Surface Grab >50,000 mg/kg

Figure 5-5
Oil and Grease Concentrations in Surface Sediment
Phase I Northwest Shoreline
Baltimore, Maryland

Map Date: January 2016
Image Source: ESRI 2011
Projection: NAD 1983 StatePlane
Maryland FIPS 1900 (US Feet)



Document Path: \\lovetongis\GIS\data\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\SedimentFigures\Figure 5-6 Cyanide Concentrations in SurfaceSediment.mxd



0 250 500 1,000
Feet

1 inch = 1,000 feet

N

Legend

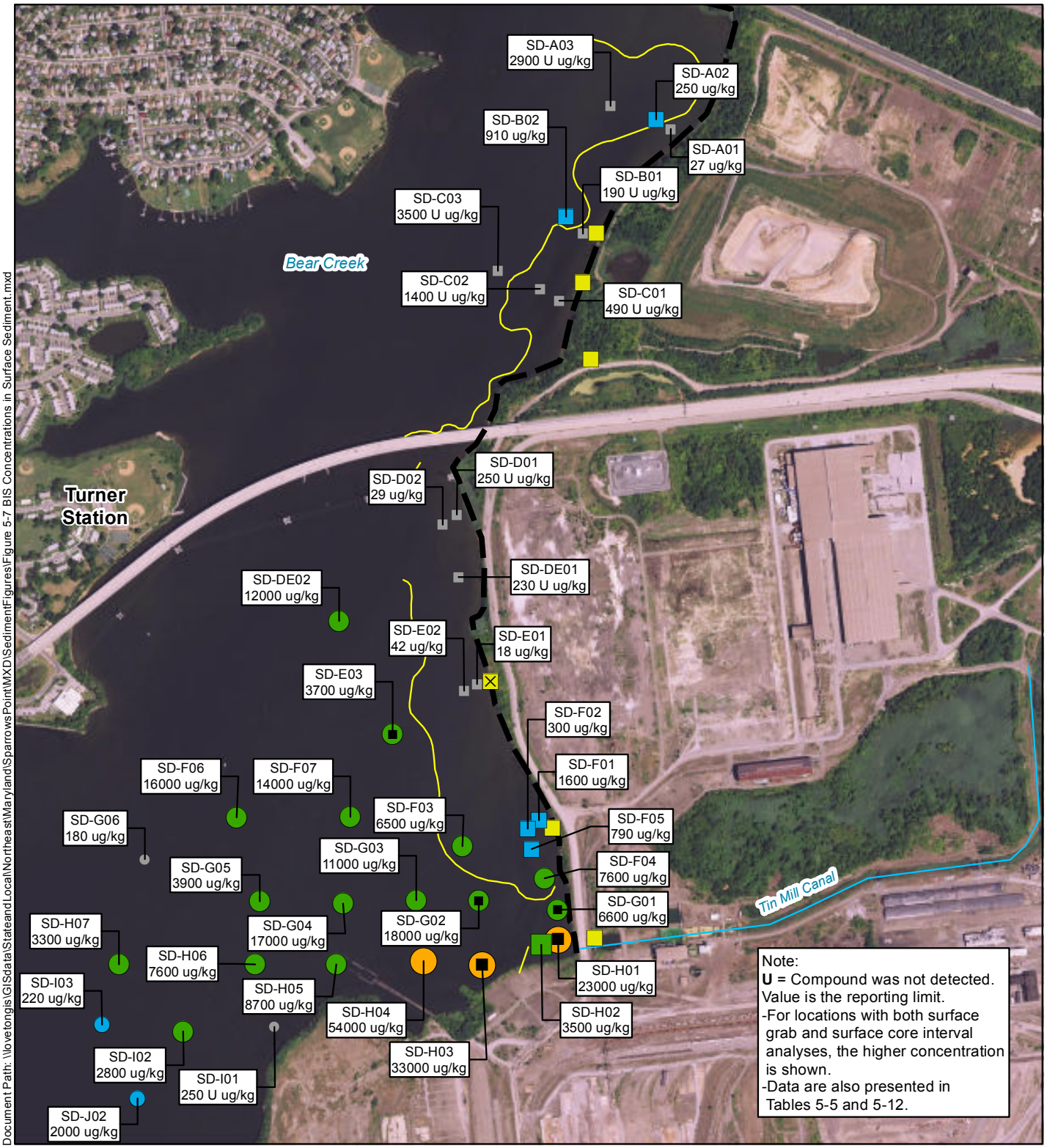
- Phase 1 Northwest Shoreline
- Perennial Creek/Stream
- Boundary between Sand and Fine Grained Sediment
- Approximate Location of Active Stormwater Outfall
- Approximate Location of Inactive Stormwater Outfall

Total Cyanide in Sediment

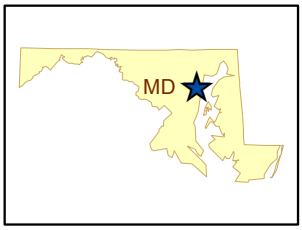
- Coring Location <1 ug/kg
- Coring Location 1-10 mg/kg
- Coring Location >10 mg/kg
- Surface Grab and Coring Location 1-10 mg/kg
- Surface Grab and Coring Location >10 mg/kg
- Surface Grab <0.1 (BTAG) mg/kg
- Surface Grab 0.1 (BTAG) -1 mg/kg
- Surface Grab 1-10 mg/kg

Figure 5-6
Total Cyanide Concentrations in Surface Sediment
Phase I Northwest Shoreline
Baltimore, Maryland

Map Date: January 2016
Image Source: ESRI 2011
Projection: NAD 1983 StatePlane Maryland FIPS 1900 (US Feet)



Document Path: \\lovetongis\GISdata\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\SedimentFigures\Figure 5-7 BIS Concentrations in Surface Sediment.mxd



0 250 500 1,000
Feet

1 inch = 1,000 feet

N

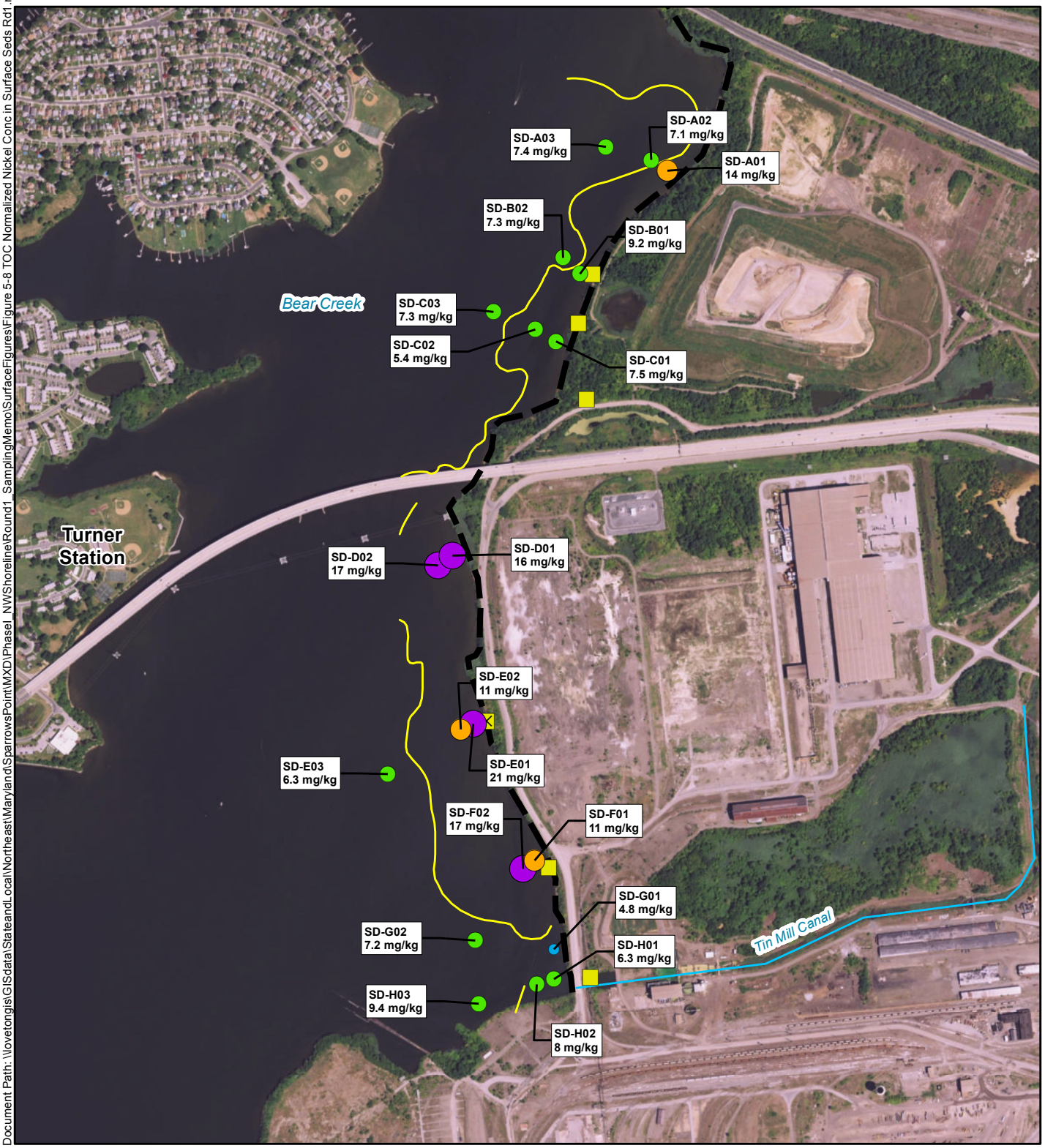
Legend

- 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

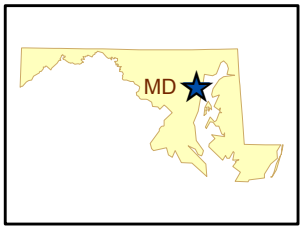
Bis(2-ethylhexyl)phthalate in Sediments

- Coring Location <182 (BTAG) ug/kg
- Coring Location 182 (BTAG) - 2647 (PEC) ug/kg
- Coring Location 2647 (PEC) - 20,000 ug/kg
- Coring Location >20,000 ug/kg
- Surface Grab and Coring Location 2647 (PEC) - 20,000 ug/kg
- Surface Grab and Coring Location >20,000 ug/kg
- Surface Grab <182 (BTAG) ug/kg
- Surface Grab 182 (BTAG) - 2647 (PEC) ug/kg
- Surface Grab 2647 (PEC) - 20,000 ug/kg
- Surface Grab >20,000 ug/kg

Figure 5-7
Bis(2-ethylhexyl)phthalate Concentrations in Surface Sediment
Phase I Northwest Shoreline
Baltimore, Maryland
Map Date: January 2016
Image Source: ESRI 2011
Projection: NAD 1983 StatePlane Maryland FIPS 1900 (US Feet)



Document Path: \\lovetongis\GISdata\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\Phase I NWShoreline\Round1 SamplingMemo\SurfaceFigures\Figure 5-8 TOC Normalized Nickel Conc in Surface Seds Rd1.mxd



0 250 500 1,000
Feet

1 inch = 1,000 feet

N

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

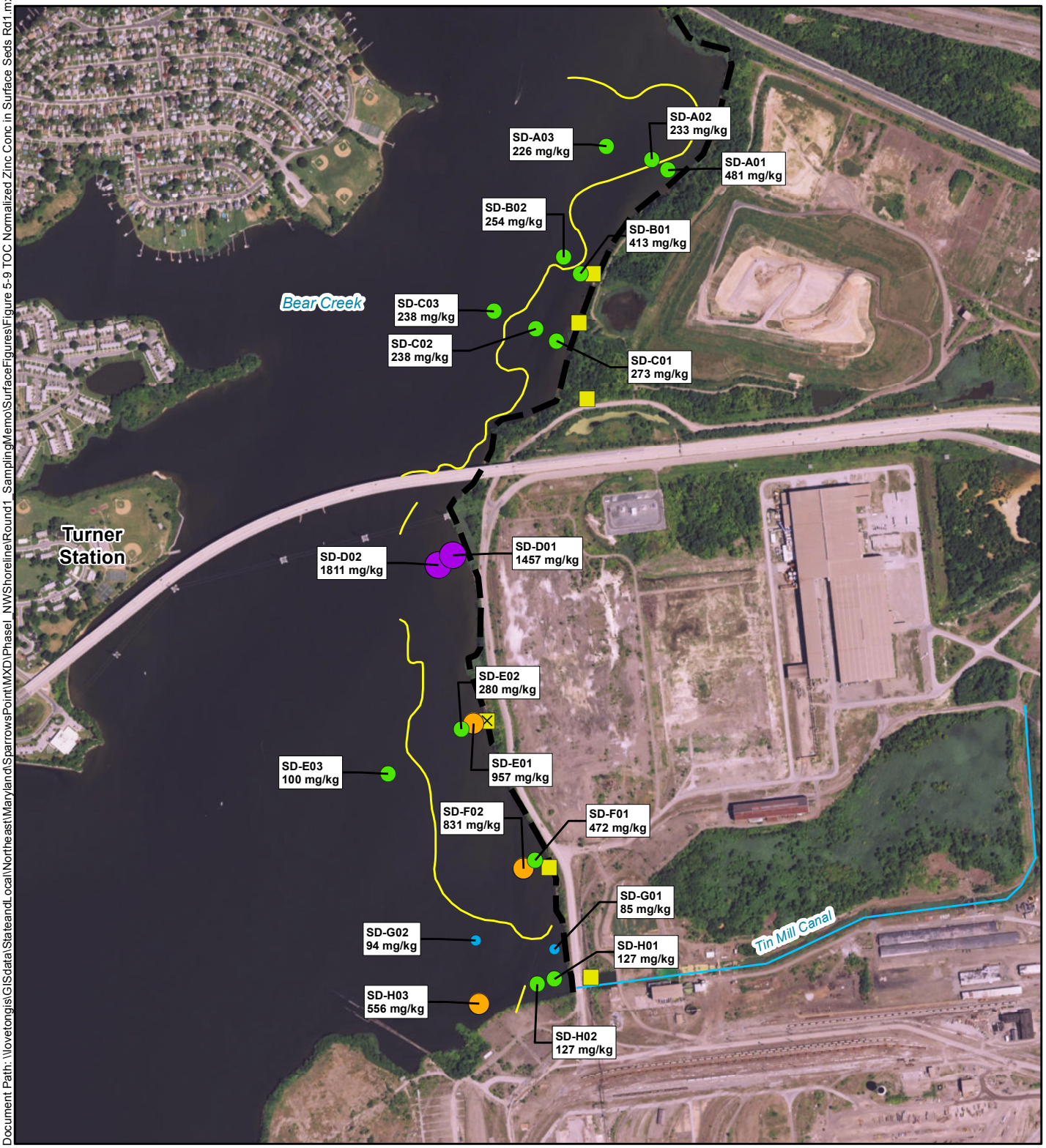
Nickel in Sediments (milligrams nickel per decagram organic carbon)

- <5
- 5-10
- 10-15
- >15

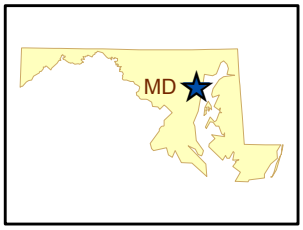
Figure 5-8
TOC-Normalized Nickel Concentrations in Surface Sediment Grab Samples
Phase I Northwest Shoreline
Baltimore, Maryland

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 2016
Image Source: ESRI 2011
Projection: NAD 1983 StatePlane Maryland FIPS 1900 (US Feet)



Document Path: \\lovetongis\GISdata\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\Phase I NWShoreline\Round1 SamplingMemo\SurfaceFigures\Figure 5-9 TOC Normalized Zinc Conc in Surface Seds Rd1.mxd



0 250 500 1,000
Feet

1 inch = 1,000 feet

N

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

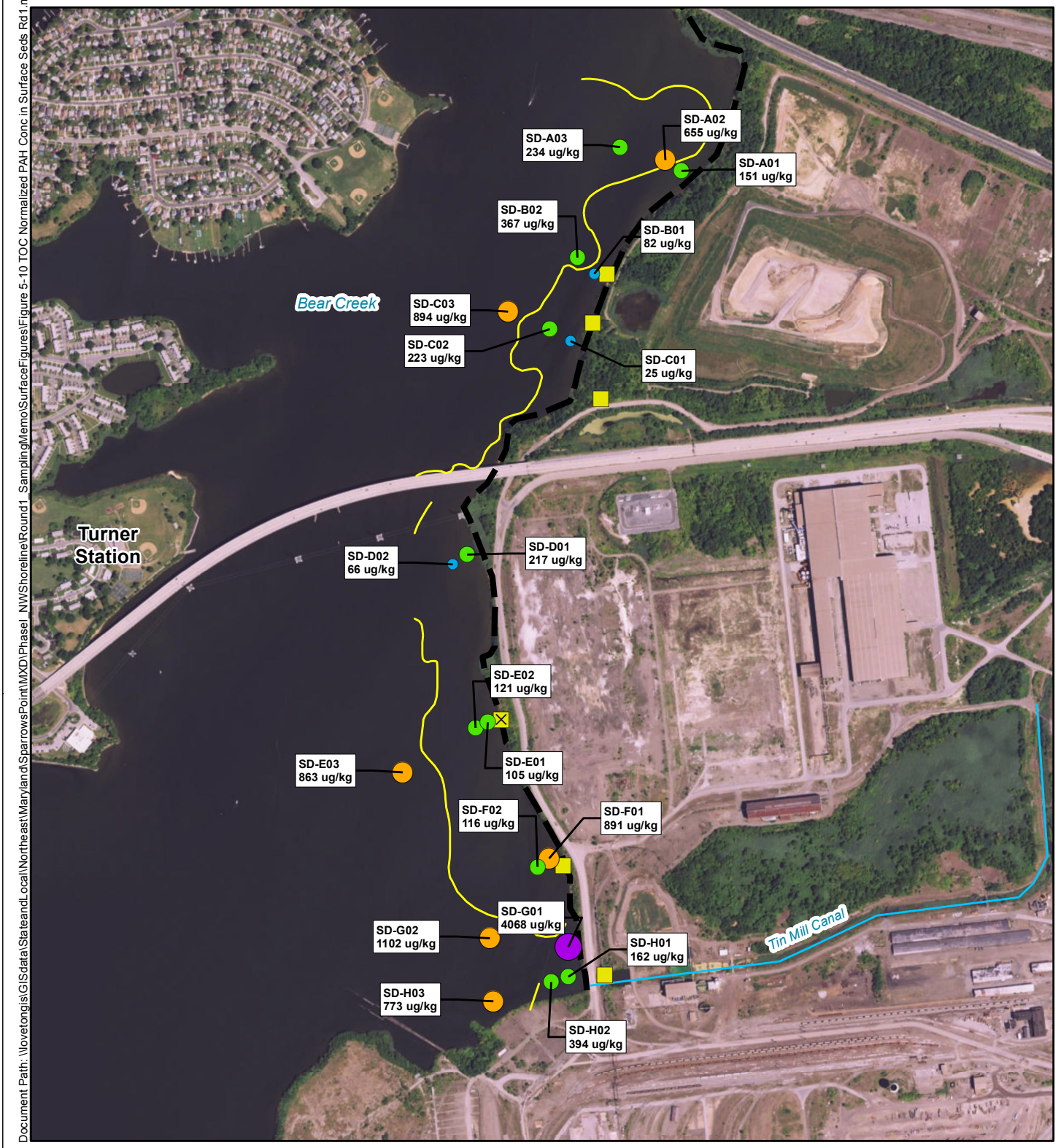
Zinc in Sediments (milligrams zinc per decagram organic carbon)

- <100
- 100-500
- 500-1,000
- >1,000

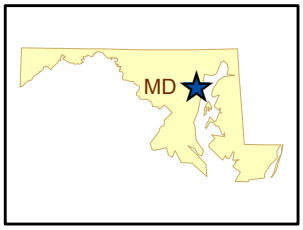
Figure 5-9
TOC-Normalized Zinc Concentrations in Surface Sediment Grab Samples
Phase I Northwest Shoreline
Baltimore, Maryland

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 2016
Image Source: ESRI 2011
Projection: NAD 1983 StatePlane Maryland FIPS 1900 (US Feet)



Document Path: \\lovetongis\GISdata\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\Phase I NWShoreline\Round1 SamplingMemo\SurfaceFigures\Figure 5-10 TOC Normalized PAH Conc in Surface Seds Rd1.mxd



0 250 500 1,000
Feet

1 inch = 1,000 feet

N

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

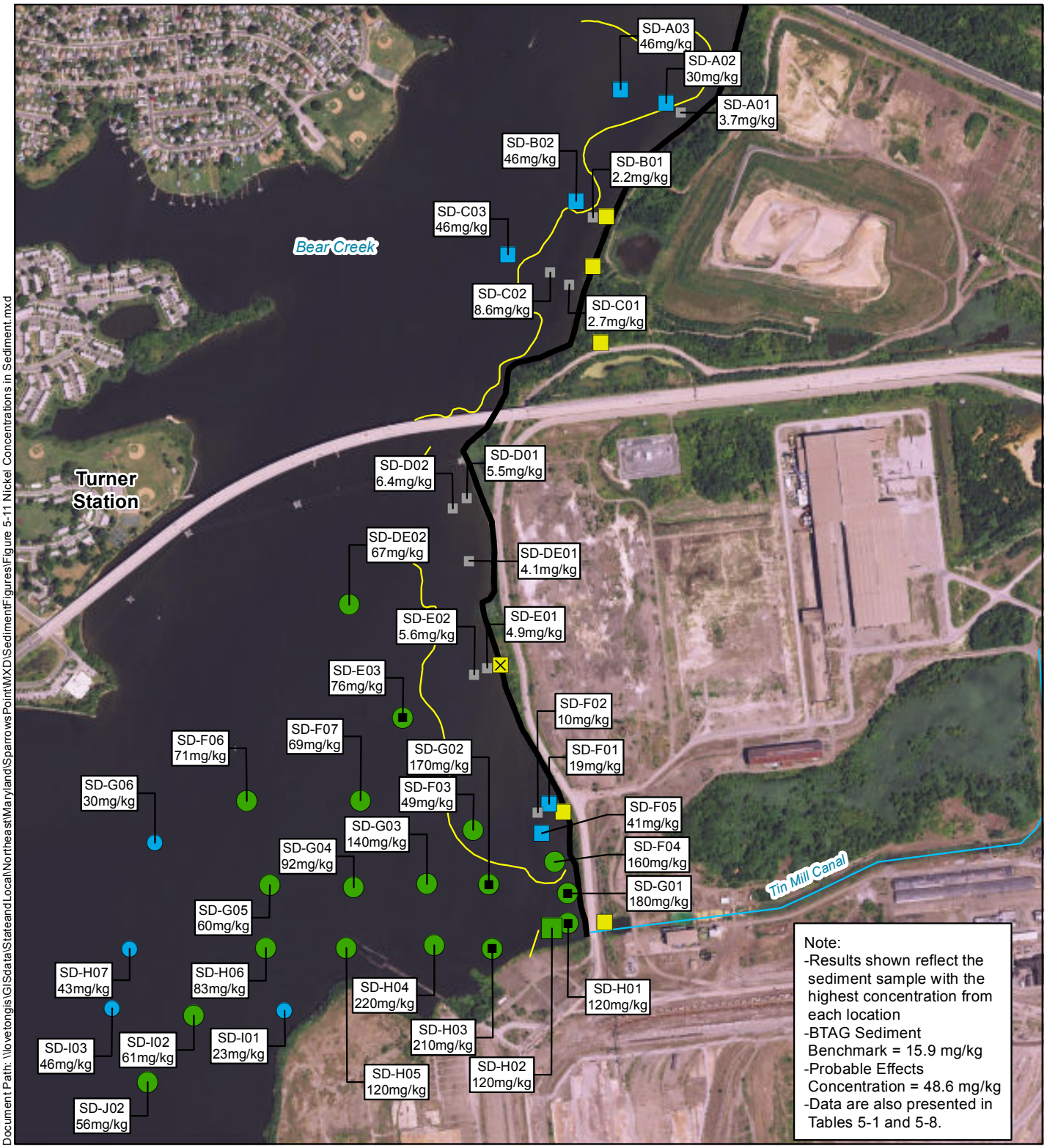
Total PAH in Sediments (micrograms PAH per decagram organic carbon)

- <100
- 100-500
- 500-1,500
- >1,500

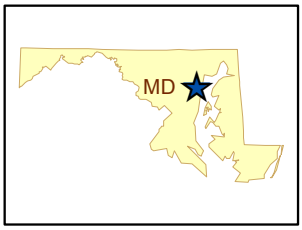
Figure 5-10
TOC-Normalized PAH Concentrations in Surface Sediment Grab Samples
Phase I Northwest Shoreline
Baltimore, Maryland

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 2016
Image Source: ESRI 2011
Projection: NAD 1983 StatePlane Maryland FIPS 1900 (US Feet)



Document Path: \\lovetongis\GIS\data\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\SedimentFigures\Figure 5-11 Nickel Concentrations in Sediment.mxd



0 250 500 1,000
Feet

1 inch = 1,000 feet

N

Legend

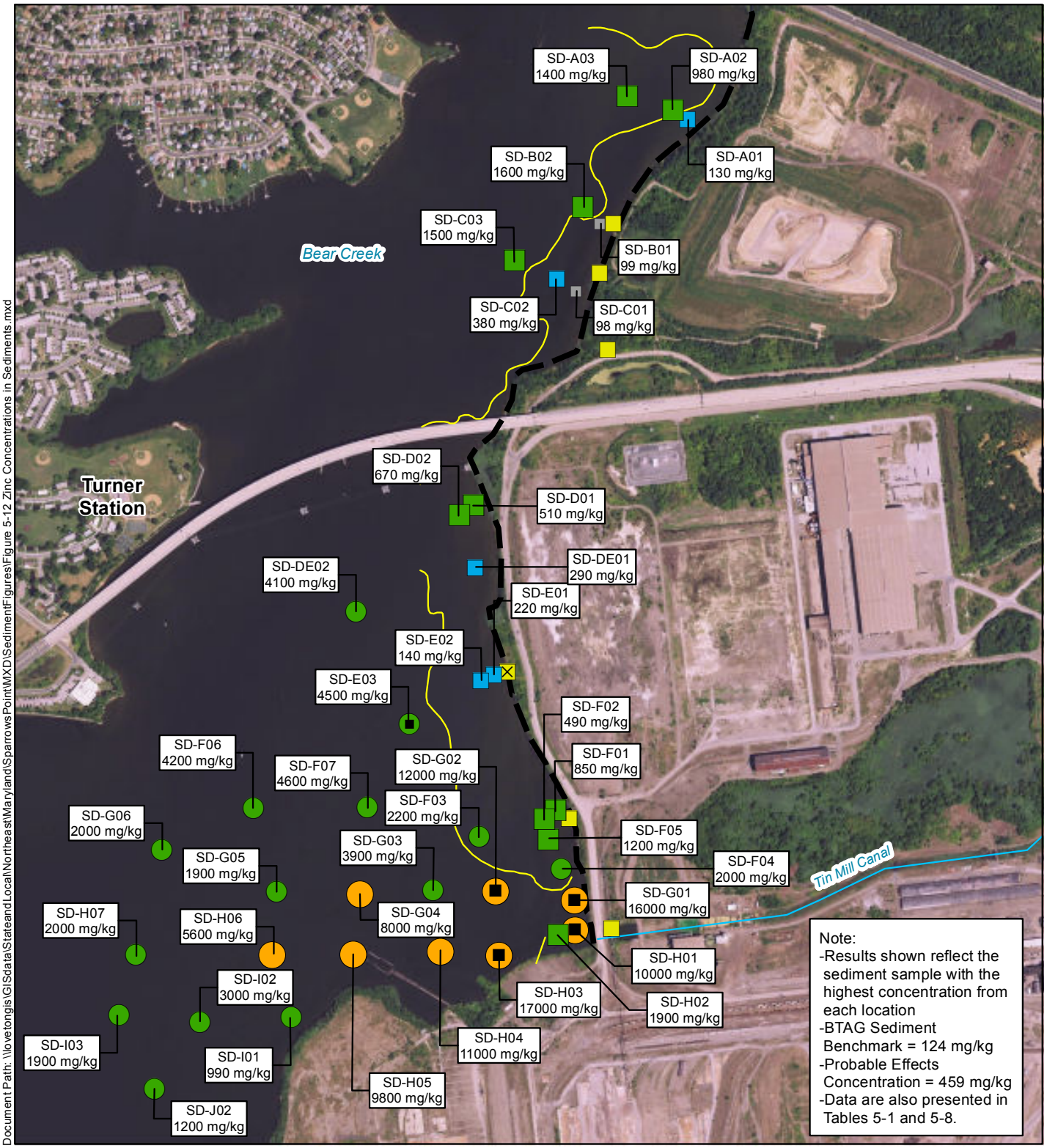
- Phase 1 Northwest Shoreline
- Perennial Creek/Stream
- Boundary between Sand and Fine Grained Sediment
- Approximate Location of Active Stormwater Outfall
- Approximate Location of Inactive Stormwater Outfall

Nickel Concentration in Sediment

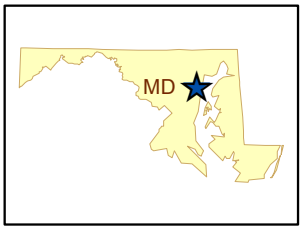
- Coring Location 15.9-48.6 mg/kg
- Coring Location >48.6 mg/kg
- Surface Grab and Coring Location >48.6 mg/kg
- Surface Grab <15.9 mg/kg
- Surface Grab 15.9-48.6 mg/kg
- Surface Grab >48.6 mg/kg

Figure 5-11
Nickel Concentrations in Surface and Subsurface Sediment
Phase I Northwest Shoreline
Baltimore, Maryland

Map Date: January 2016
Image Source: ESRI 2011
Projection: NAD 1983 StatePlane Maryland FIPS 1900 (US Feet)



Document Path: \\lovetongis\GIS\data\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\SedimentFigures\Figure 5-12 Zinc Concentrations in Sediments.mxd



0 250 500 1,000
Feet

1 inch = 1,000 feet

N

Legend

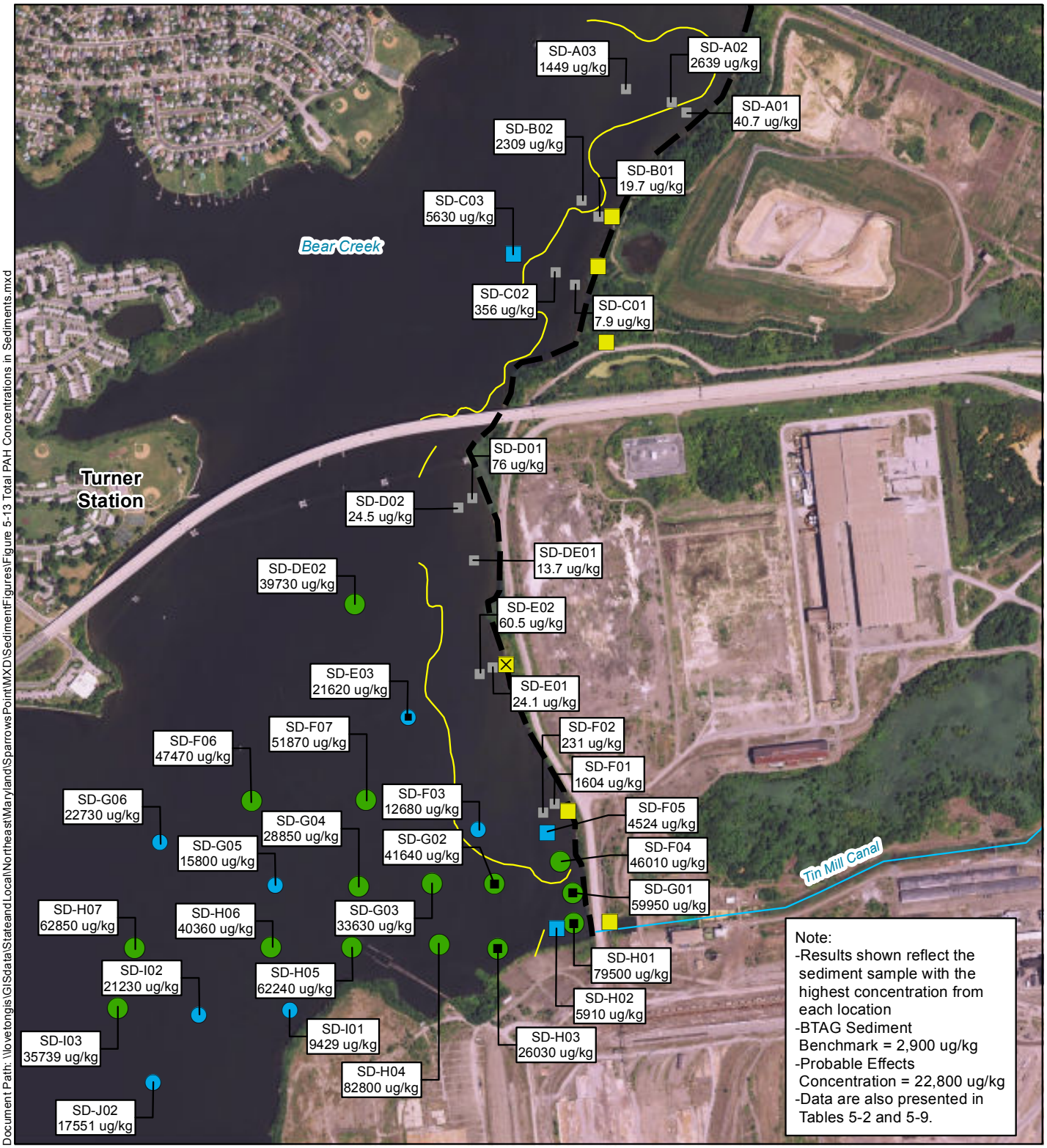
- Phase 1 Northwest Shoreline
- Perennial Creek/Stream
- Boundary between Sand and Fine Grained Sediment
- Approximate Location of Active Stormwater Outfall
- Approximate Location of Inactive Stormwater Outfall

Zinc in Sediments

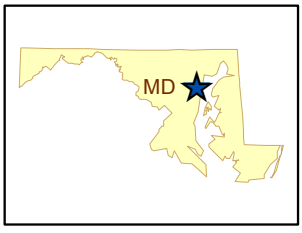
- Coring Location 459-5,000 mg/kg
- Coring Location >5,000 mg/kg
- Surface Grab and Coring Location 459-5,000 mg/kg
- Surface Grab and Coring Location >5,000 mg/kg
- Surface Grab < 124 mg/kg
- Surface Grab 124-459 mg/kg
- Surface Grab 459-5,000 mg/kg

Figure 5-12
Zinc Concentrations in Surface and Subsurface Sediment
Phase I Northwest Shoreline
Baltimore, Maryland

Map Date: January 2016
Image Source: ESRI 2011
Projection: NAD 1983 StatePlane Maryland FIPS 1900 (US Feet)



Document Path: \\lovetongis\GIS\data\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\SedimentFigures\Figure 5-13 Total PAH Concentrations in Sediments.mxd



0 250 500 1,000
Feet

1 inch = 1,000 feet

N

Legend

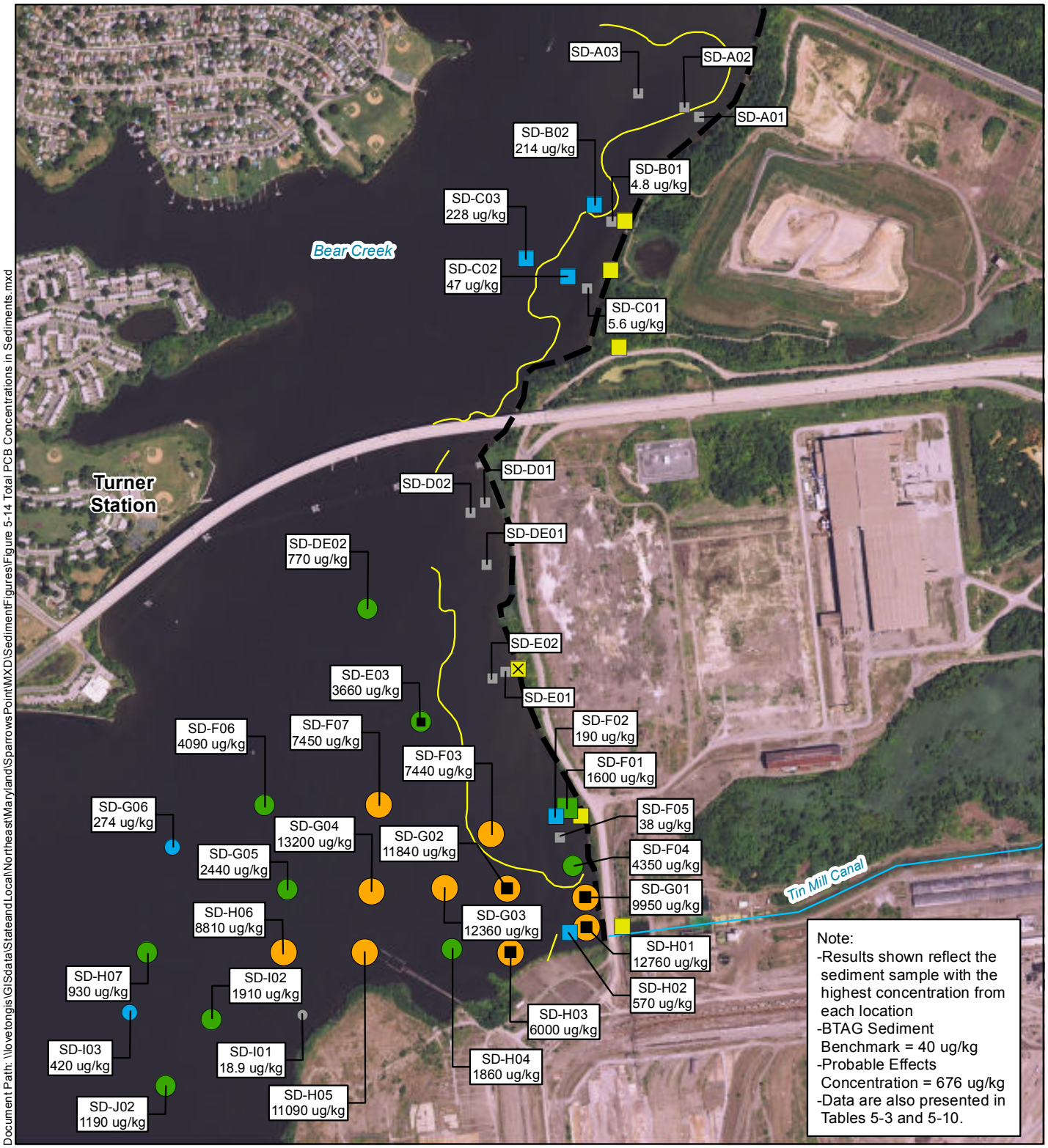
- Phase 1 Northwest Shoreline
- Perennial Creek/Stream
- Boundary between Sand and Fine Grained Sediment
- Approximate Location of Active Stormwater Outfall
- Approximate Location of Inactive Stormwater Outfall

Total PAH in Sediments

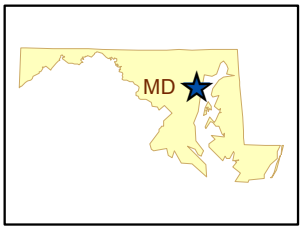
- Coring Location 2,900-22,800 ug/kg
- Coring Location >22,800 ug/kg
- Surface Grab and Coring Location 2,900-22,800 ug/kg
- Surface Grab and Coring Location >22,800 ug/kg
- Surface Grab <2,900 ug/kg
- Surface Grab 2,900-22,800 ug/kg

Figure 5-13
Total PAH Concentrations in Surface and Subsurface Sediment
Phase I Northwest Shoreline
Baltimore, Maryland

Map Date: January 2016
Image Source: ESRI 2011
Projection: NAD 1983 StatePlane Maryland FIPS 1900 (US Feet)



Document Path: \\lovetongis\GIS\data\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\SedimentFigures\Figure 5-14 Total PCB Concentrations in Sediments.mxd



0 250 500 1,000
Feet

1 inch = 1,000 feet

N

Legend

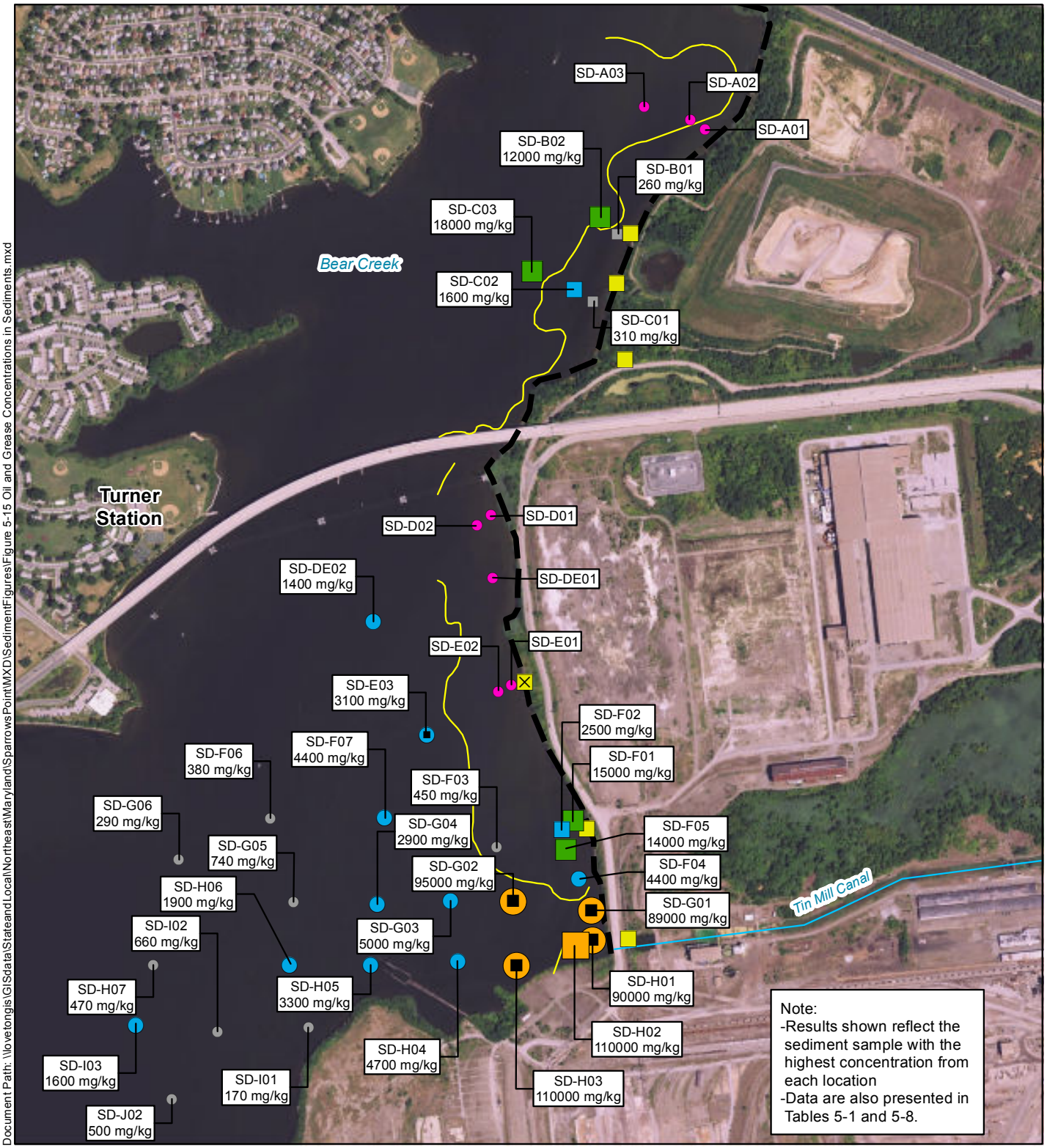
- Phase 1 Northwest Shoreline
- Perennial Creek/Stream
- Boundary between Sand and Fine Grained Sediment
- Approximate Location of Active Stormwater Outfall
- Approximate Location of Inactive Stormwater Outfall

Total PCBs in Sediments

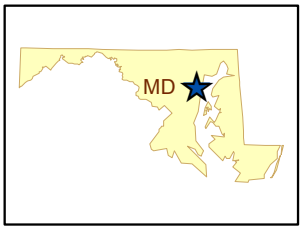
- Coring Location <40 ug/kg
- Coring Location 40-676 ug/kg
- Coring Location 676-6,000 ug/kg
- Coring Location >6,000 ug/kg
- Surface Grab and Coring Location 676-6,000 ug/kg
- Surface Grab and Coring Location >6,000 ug/kg
- Surface Grab <40 ug/kg
- Surface Grab 40-676 ug/kg
- Surface Grab 676-6,000 ug/kg

Figure 5-14
Total PCB Concentrations in Surface and Subsurface Sediment
Phase I Northwest Shoreline
Baltimore, Maryland

Map Date: January 2016
Image Source: ESRI 2011
Projection: NAD 1983 StatePlane Maryland FIPS 1900 (US Feet)



Document Path: \\lovetongis\GIS\data\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\SedimentFigures\Figure 5-15 Oil and Grease Concentrations in Sediments.mxd



0 250 500 1,000
Feet

1 inch = 1,000 feet

N

Legend

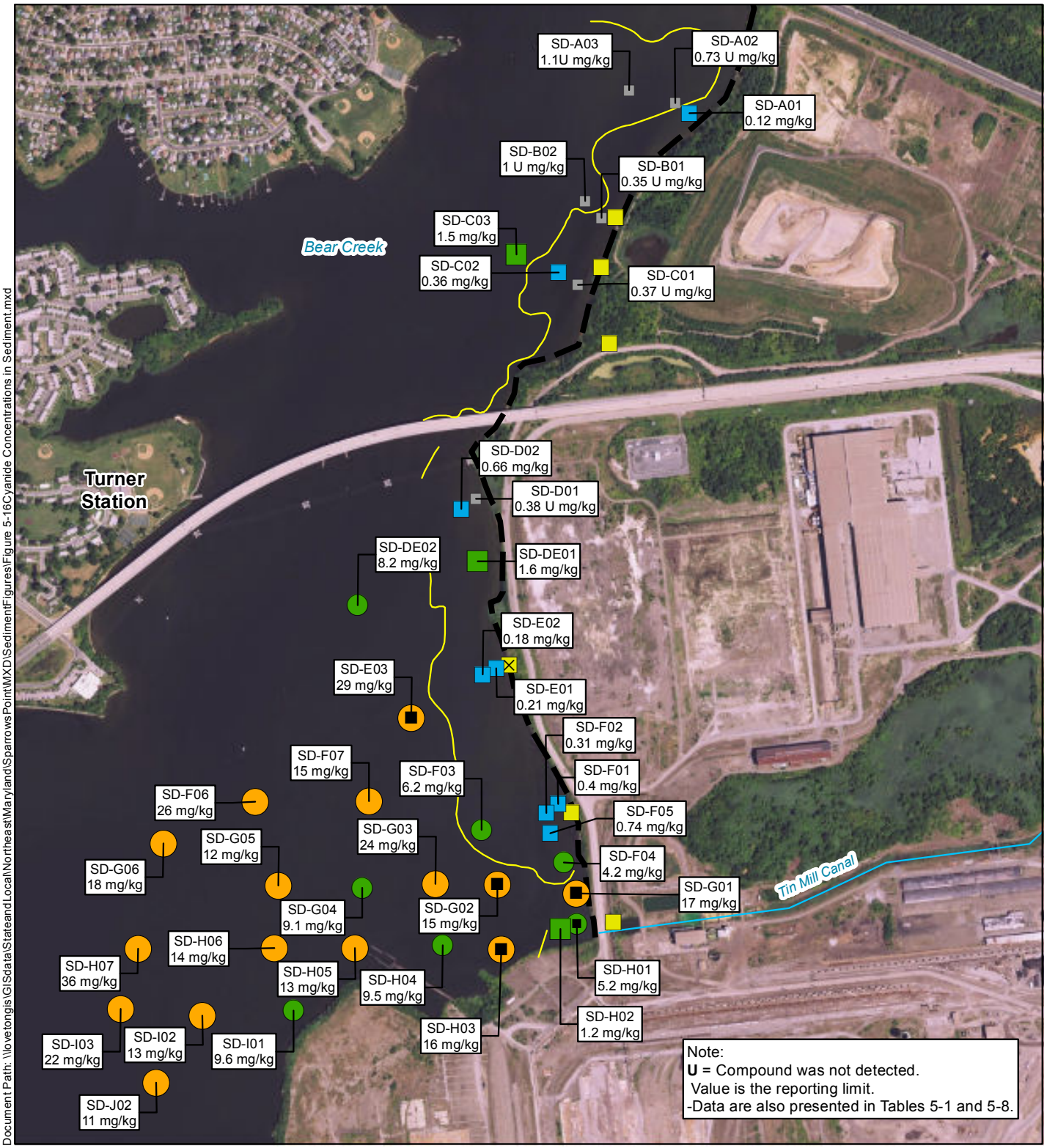
- Not Sampled for Oil or Grease
- Phase 1 Northwest Shoreline
- Perennial Creek/Stream
- Boundary between Sand and Fine Grained Sediment
- Approximate Location of Active Stormwater Outfall
- Approximate Location of Inactive Stormwater Outfall

Oil and Grease in Sediments

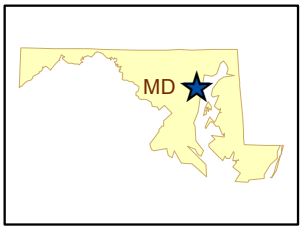
- Coring Location <1,000 mg/kg
- Coring Location 1,000-10,000 mg/kg
- Surface Grab and Coring Location 1,000-10,000 mg/kg
- Surface Grab and Coring Location >50,000 mg/kg
- Surface Grab <1,000 mg/kg
- Surface Grab 1,000-10,000 mg/kg
- Surface Grab 10,000-50,000 mg/kg
- Surface Grab >50,000 mg/kg

Figure 5-15
Oil and Grease Concentrations in Surface and Subsurface Sediment
Phase I Northwest Shoreline
Baltimore, Maryland

Map Date: January 2016
Image Source: ESRI 2011
Projection: NAD 1983 StatePlane Maryland FIPS 1900 (US Feet)



Document Path: \\lovetongis\GIS\data\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\SedimentFigures\Figure 5-16Cyanide Concentrations in Sediment.mxd



0 250 500 1,000
Feet

1 inch = 1,000 feet

N

Legend

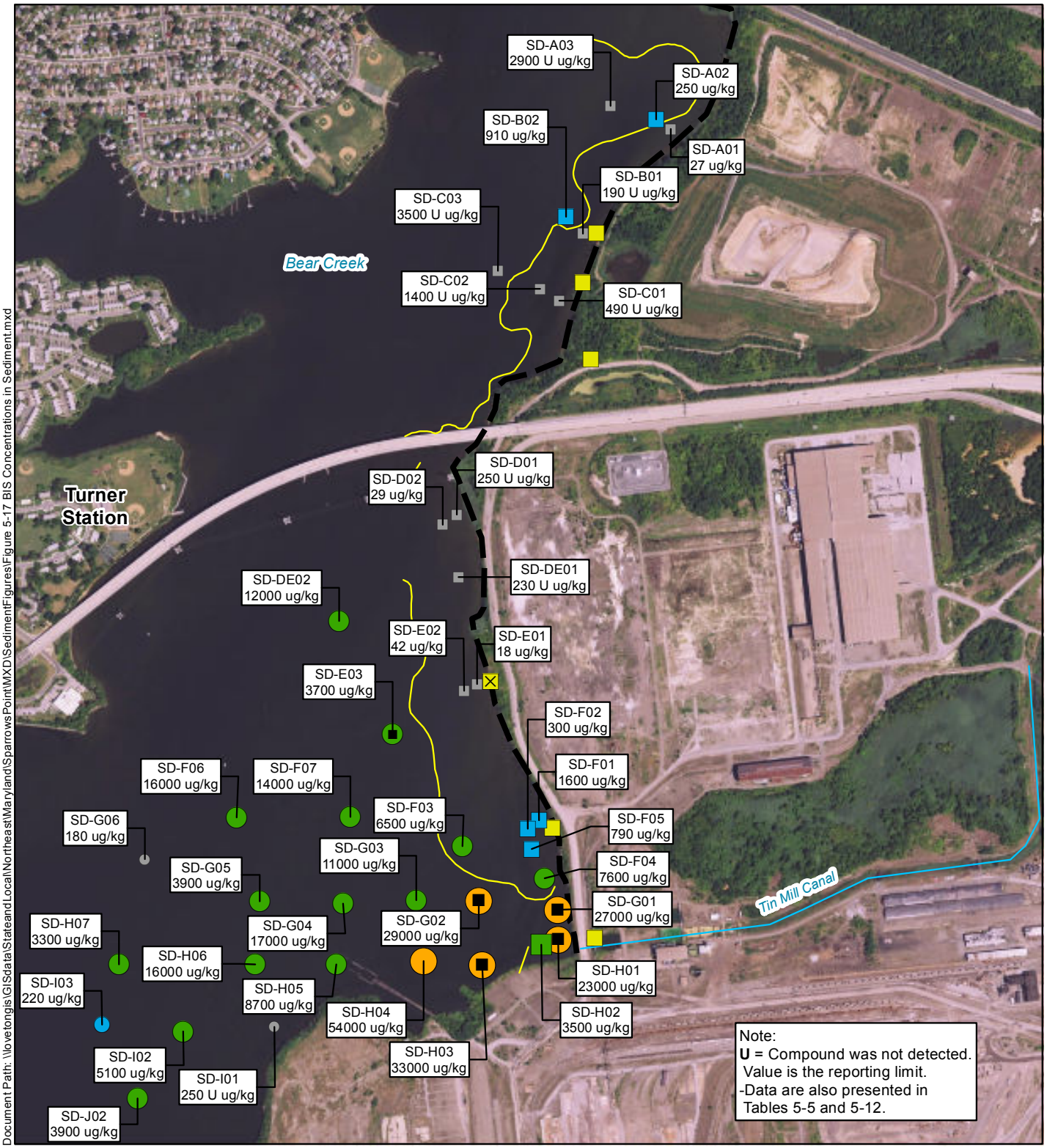
- Phase 1 Northwest Shoreline
- Perennial Creek/Stream
- Boundary between Sand and Fine Grained Sediment
- Approximate Location of Active Stormwater Outfall
- Approximate Location of Inactive Stormwater Outfall

Total Cyanide in Sediment

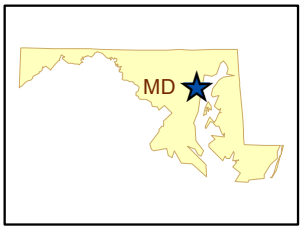
- Coring Location 1-10 mg/kg
- Coring Location >10 mg/kg
- Surface Grab and Coring Location 1-10 mg/kg
- Surface Grab and Coring Location >10 mg/kg
- Surface Grab <0.1 (BTAG) mg/kg
- Surface Grab 0.1 (BTAG)-1 mg/kg
- Surface Grab 1-10 mg/kg

Figure 5-16
Total Cyanide Concentrations in Surface and Subsurface Sediment
Phase I Northwest Shoreline
Baltimore, Maryland

Map Date: January 2016
Image Source: ESRI 2011
Projection: NAD 1983 StatePlane
Maryland FIPS 1900 (US Feet)



Document Path: \\lovetongis\GIS\data\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\SedimentFigures\Figure 5-17 BIS Concentrations in Sediment.mxd



0 250 500 1,000
Feet

1 inch = 1,000 feet

N

Legend

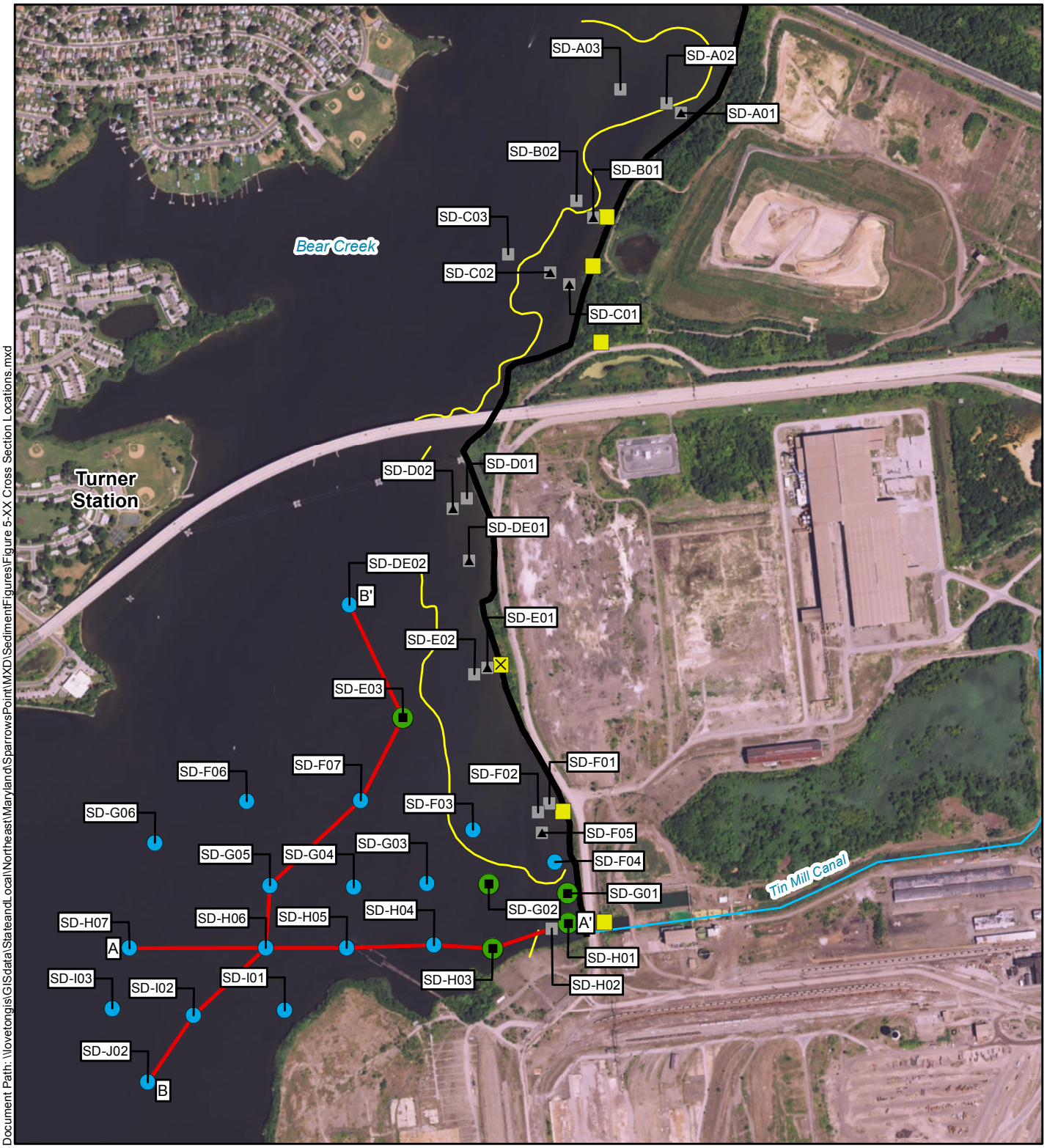
- Phase 1 Northwest Shoreline
- Perennial Creek/Stream
- Boundary between Sand and Fine Grained Sediment
- Approximate Location of Active Stormwater Outfall
- Approximate Location of Inactive Stormwater Outfall

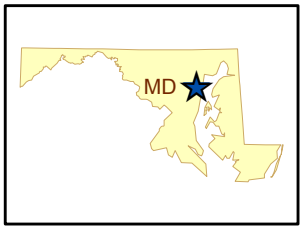
Bis(2-ethylhexyl)phthalate in Sediments

- Coring Location <182 (BTAG) ug/kg
- Coring Location 182 (BTAG) - 2647 (PEC) ug/kg
- Coring Location 2647 (PEC) - 20,000 ug/kg
- Coring Location >20,000 ug/kg
- Surface Grab and Coring Location 2647 (PEC) - 20,000 ug/kg
- Surface Grab and Coring Location >20,000 ug/kg
- Surface Grab <182 (BTAG) ug/kg
- Surface Grab 182 (BTAG) - 2647 (PEC) ug/kg
- Surface Grab 2647 (PEC) - 20,000 ug/kg
- Surface Grab >20,000 ug/kg

Figure 5-17
Bis(2-ethylhexyl)phthalate Concentrations in Surface and Subsurface Sediment
Phase I Northwest Shoreline
Baltimore, Maryland

Map Date: January 2016
Image Source: ESRI 2011
Projection: NAD 1983 StatePlane Maryland FIPS 1900 (US Feet)





0 250 500 1,000
Feet

1 inch = 1,000 feet

N

Legend

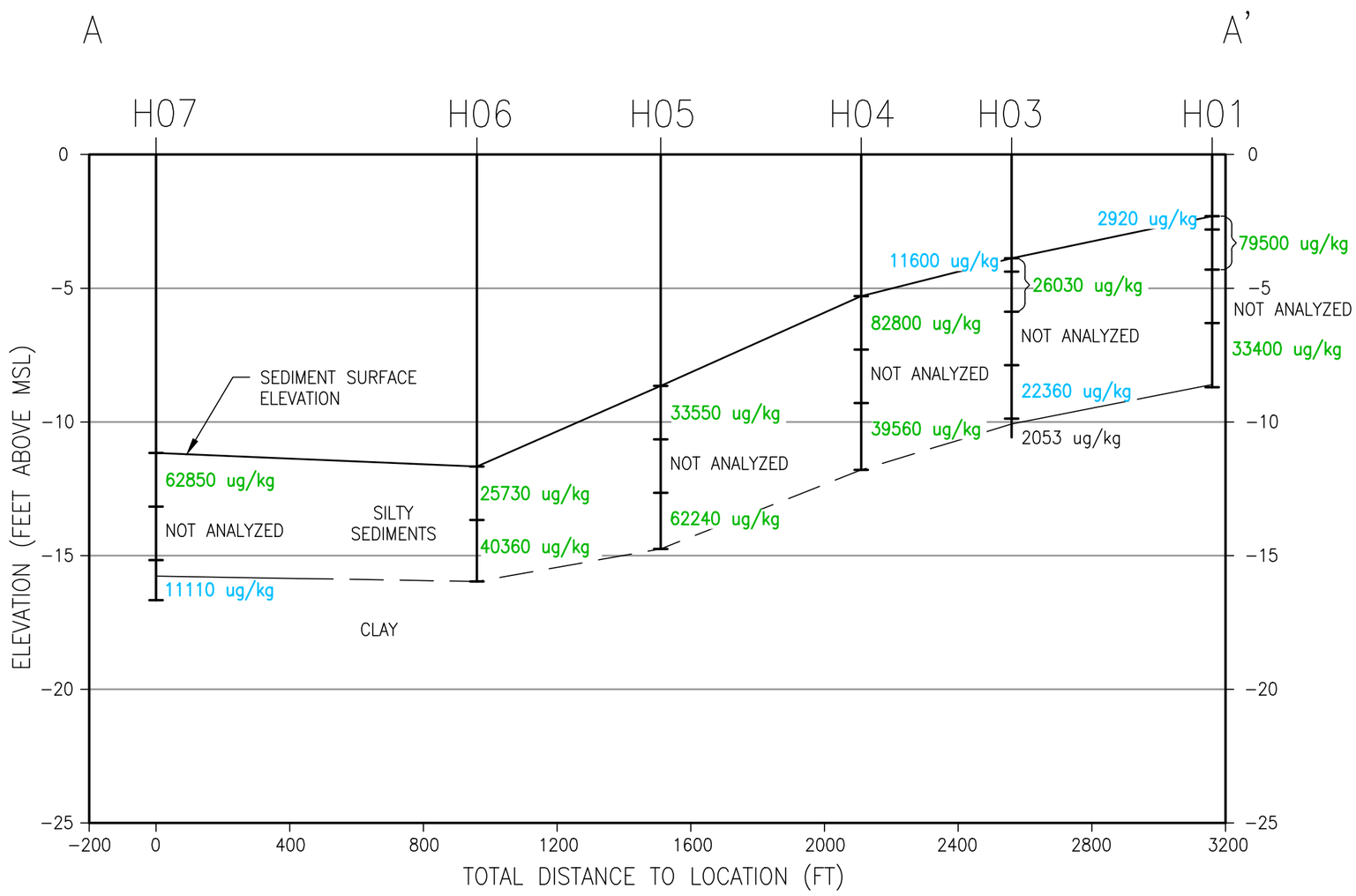
- Transect Survey
- Phase 1 Northwest Shoreline
- Perennial Creek/Stream
- Boundary between Sand and Fine Grained Sediment
- Approximate Location of Active Stormwater Outfall
- Approximate Location of Inactive Stormwater Outfall

Sample Location

- Coring Location
- Surface Grab and Coring Location
- Surface Grab
- Surface Grab and Pore Water Sampling Location

Figure 5-18
Cross-Section Locations
Phase I Northwest Shoreline
Baltimore, Maryland

Map Date: January 2016
Image Source: ESRI 2011
Projection: NAD 1983 StatePlane
Maryland FIPS 1900 (US Feet)



NOTES:

1. DASHED LINES INDICATE AREAS WHERE DEPTH TO CLAY WAS NOT DELINEATED.
2. CONCENTRATIONS IN BLUE EXCEED THE BIOLOGICAL TECHNICAL ASSISTANCE GROUP (BTAG) SEDIMENT BENCHMARK (2900 ug/kg).
3. CONCENTRATIONS IN GREEN EXCEED THE PROBABLE EFFECTS CONCENTRATION (22800 ug/kg).

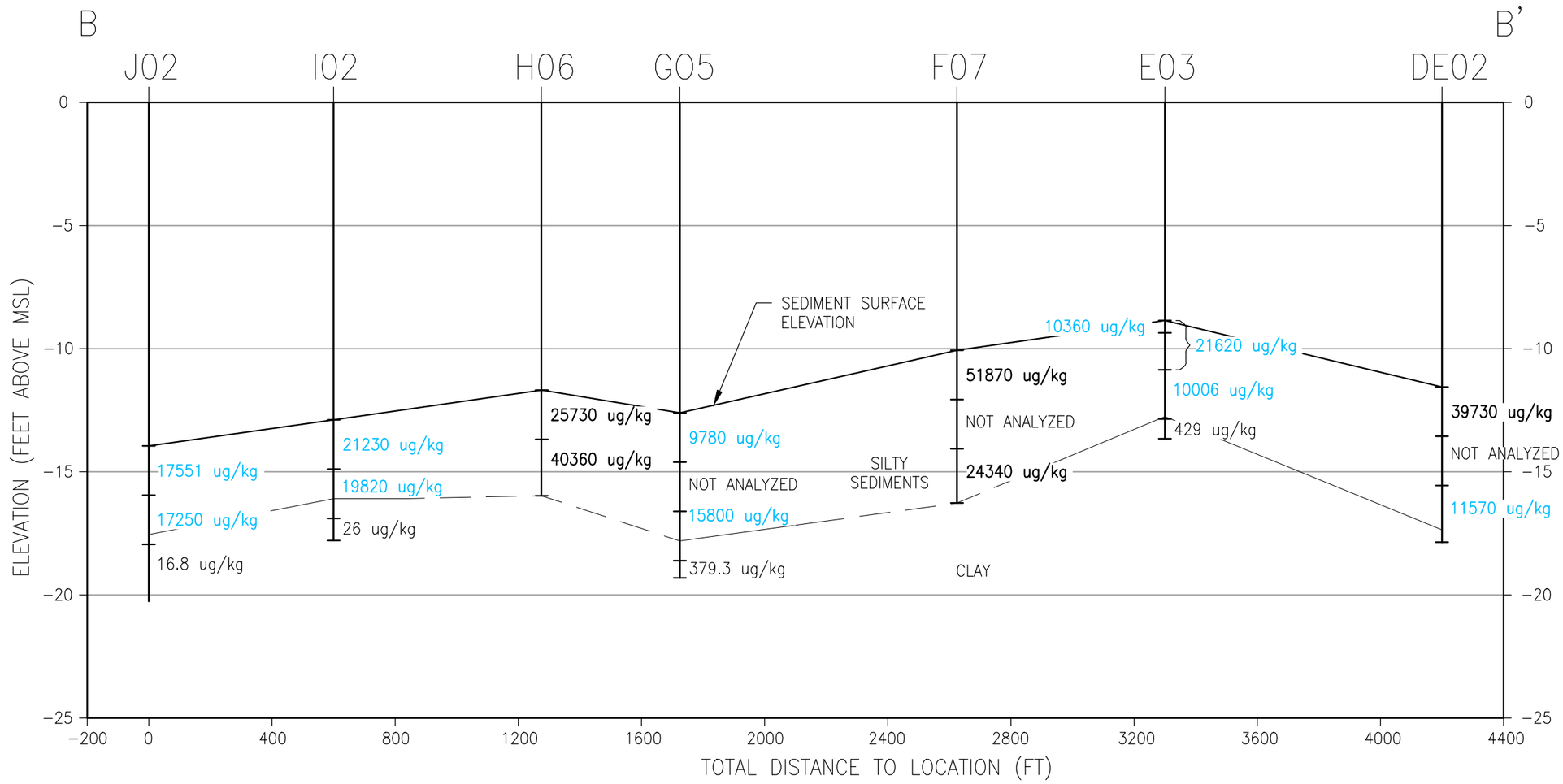
400 200 0 400
GRAPHIC SCALE IN FEET
HORIZONTAL

5 2.5 0 5
GRAPHIC SCALE IN FEET
VERTICAL

EA Engineering, Science, and Technology, Inc., PBC

FIGURE 5–19
CROSS–SECTION A–A' – TOTAL PAH CONCENTRATIONS
PHASE I NORTHWEST SHORELINE
BALTIMORE, MARYLAND

FILE PATH: Q:\PROJECTS\1513101 – SPARROWS POINT\PAH CROSS SECTION A–A'.DWG [LAYOUT1]



NOTES:

1. DASHED LINES INDICATE AREAS WHERE DEPTH TO CLAY WAS NOT DELINEATED.
2. CONCENTRATIONS IN BLUE EXCEED THE BIOLOGICAL TECHNICAL ASSISTANCE GROUP (BTAG) SEDIMENT BENCHMARK (2900 ug/kg).
3. CONCENTRATIONS IN **GREEN** EXCEED THE PROBABLE EFFECTS CONCENTRATION (22800 ug/kg).

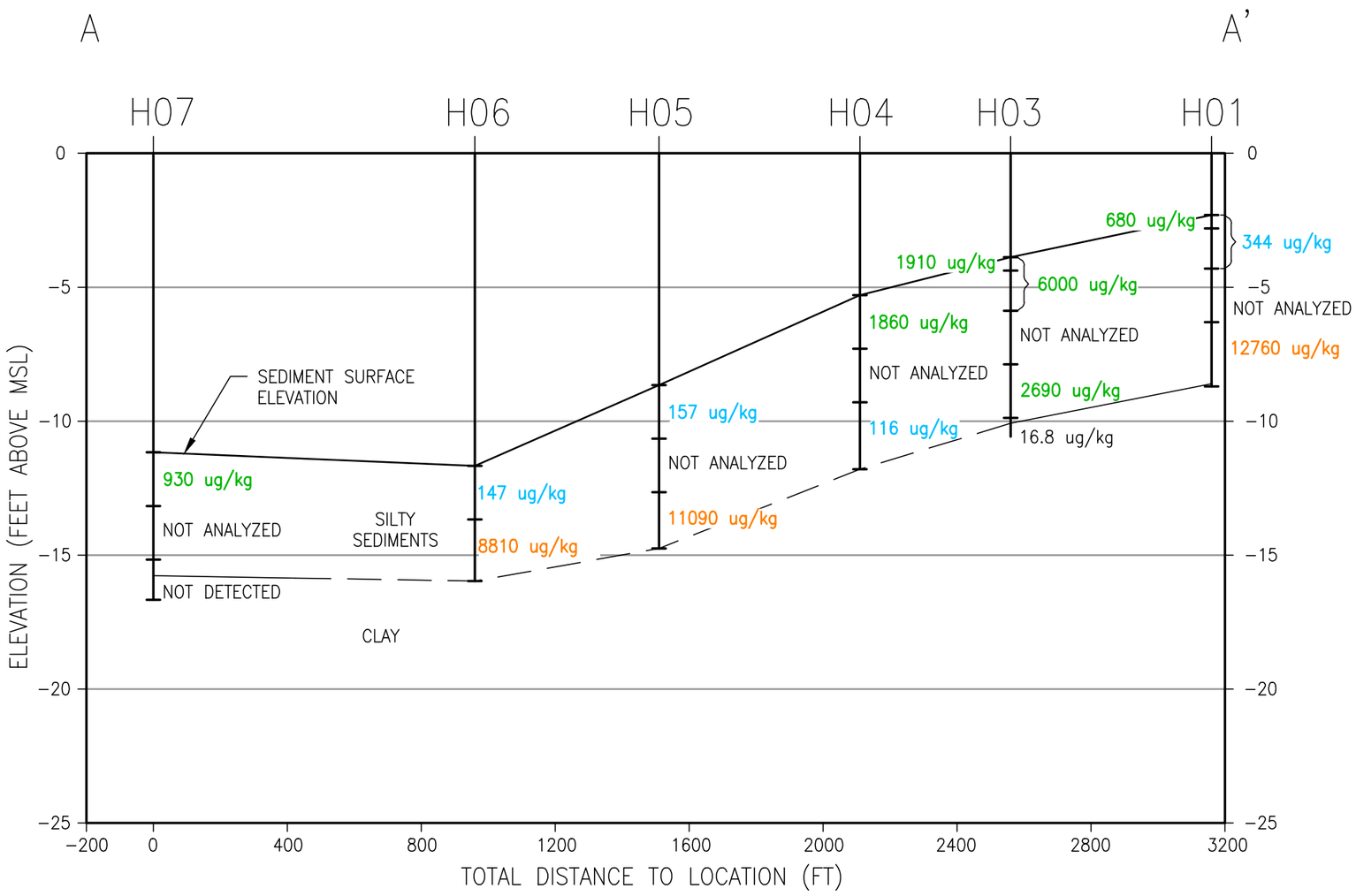
400 200 0 400
GRAPHIC SCALE IN FEET
HORIZONTAL

5 2.5 0 5
GRAPHIC SCALE IN FEET
VERTICAL

EA Engineering, Science, and Technology, Inc., PBC

FIGURE 5–20
CROSS–SECTION B–B' – TOTAL PAH CONCENTRATIONS
PHASE I NORTHWEST SHORELINE
BALTIMORE, MARYLAND

FILE PATH: Q:\PROJECTS\1513101 – SPARROWS POINT\PAH CROSS SECTION B–B'.DWG [LAYOUT1]



NOTES:

1. DASHED LINES INDICATE AREAS WHERE DEPTH TO CLAY WAS NOT DELINEATED.
2. CONCENTRATIONS IN BLUE EXCEED THE BIOLOGICAL TECHNICAL ASSISTANCE GROUP (BTAG) SEDIMENT BENCHMARK (40 ug/kg).
3. CONCENTRATIONS IN GREEN EXCEED THE PROBABLE EFFECTS CONCENTRATION (676 ug/kg).
4. CONCENTRATIONS IN ORANGE EXCEED 6000 ug/kg.

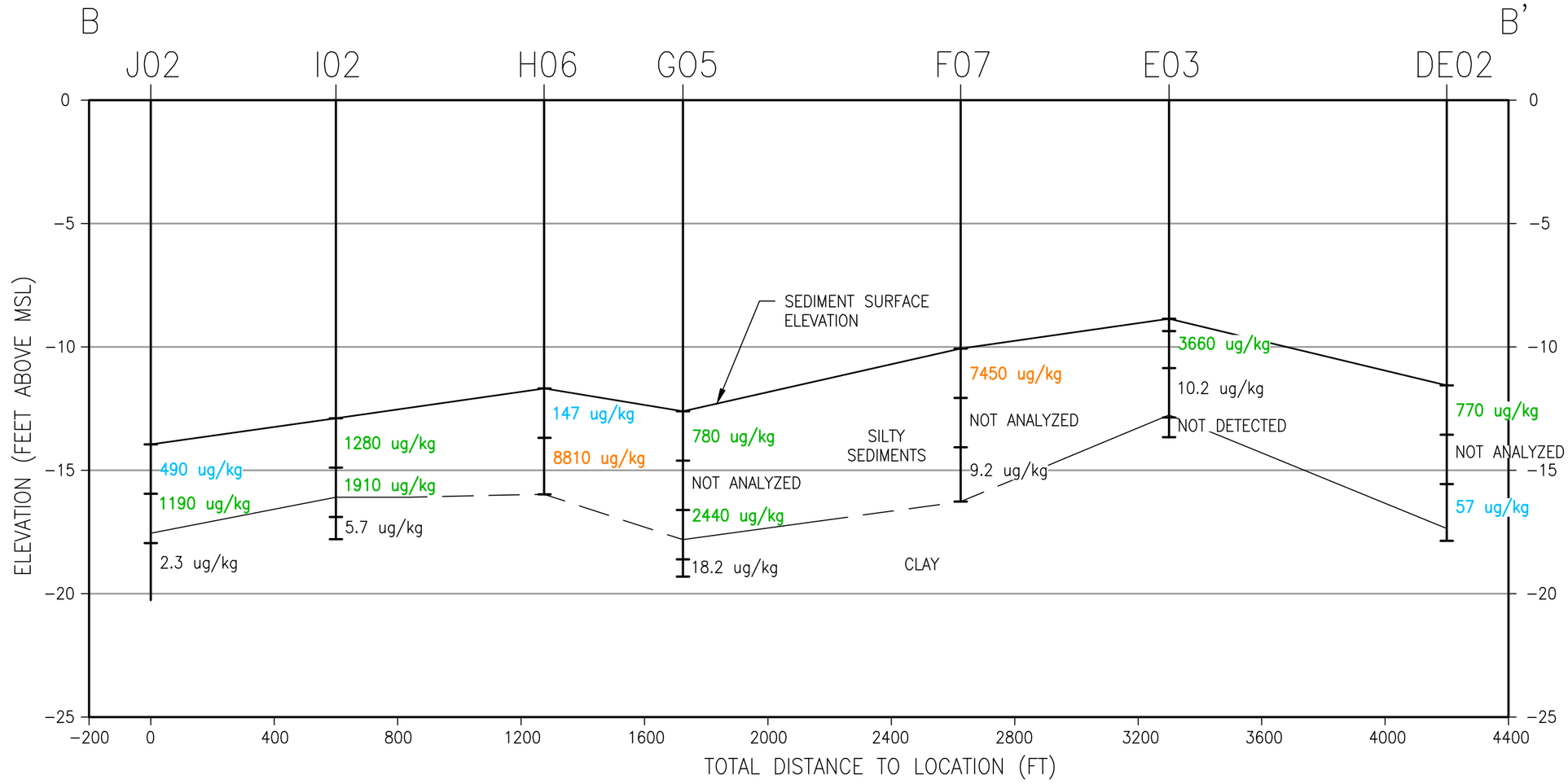
400 200 0 400
GRAPHIC SCALE IN FEET
HORIZONTAL

5 2.5 0 5
GRAPHIC SCALE IN FEET
VERTICAL

EA Engineering, Science, and Technology, Inc., PBC

FIGURE 5-21
CROSS-SECTION A-A' – TOTAL PCB CONCENTRATIONS
PHASE I NORTHWEST SHORELINE
BALTIMORE, MARYLAND

FILE PATH: Q:\PROJECTS\1513101 – SPARROWS POINT\PCB CROSS SECTION A-A'.DWG [LAYOUT1]



NOTES:

1. DASHED LINES INDICATE AREAS WHERE DEPTH TO CLAY WAS NOT DELINEATED.
2. CONCENTRATIONS IN BLUE EXCEED THE BIOLOGICAL TECHNICAL ASSISTANCE GROUP (BTAG) SEDIMENT BENCHMARK (40 ug/kg).
3. CONCENTRATIONS IN GREEN EXCEED THE PROBABLE EFFECTS CONCENTRATION (676 ug/kg).
4. CONCENTRATIONS IN ORANGE EXCEED 6000 ug/kg.

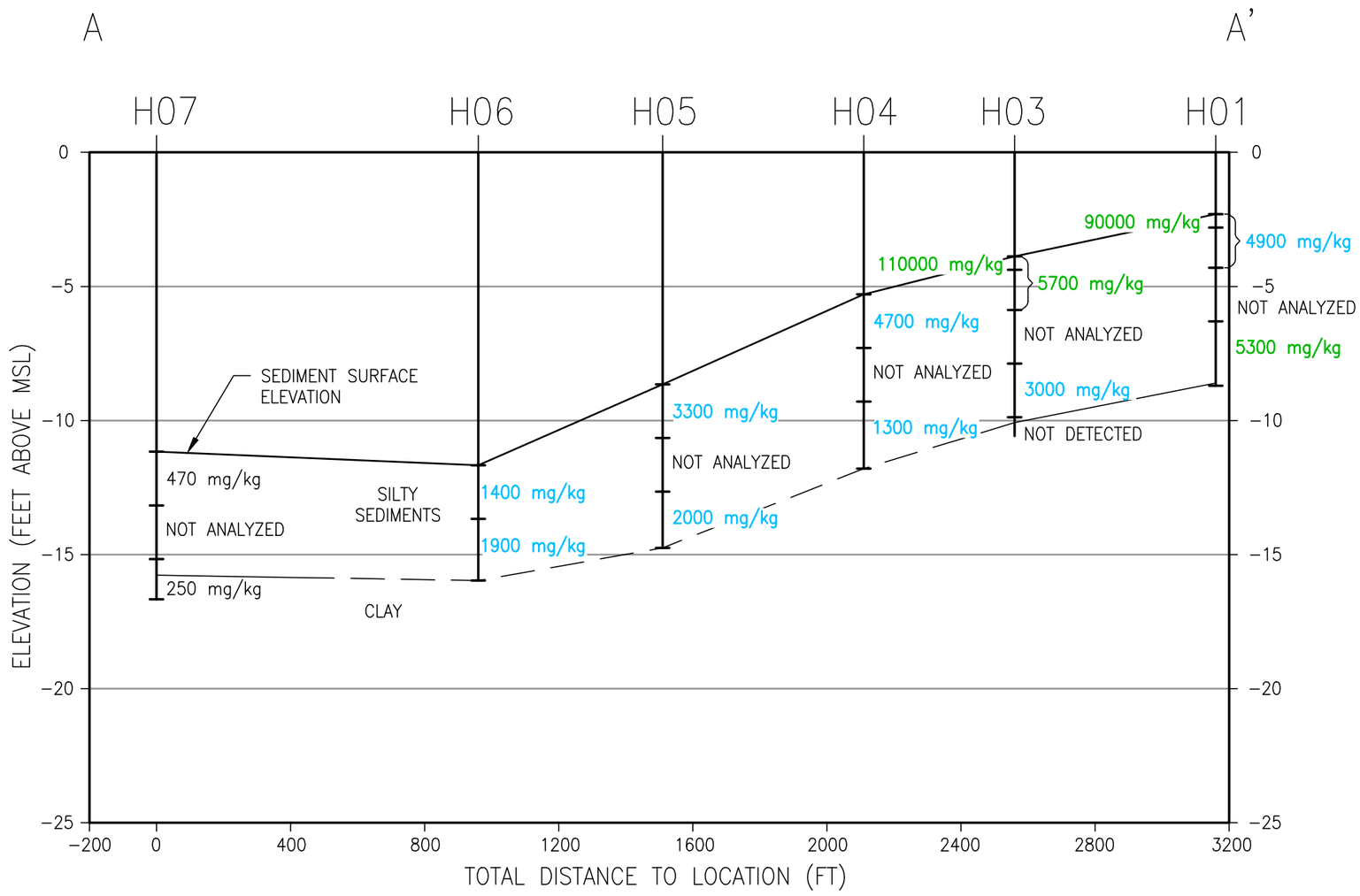
400 200 0 400
GRAPHIC SCALE IN FEET HORIZONTAL

5 2.5 0 5
GRAPHIC SCALE IN FEET VERTICAL

EA Engineering, Science, and Technology, Inc., PBC

FIGURE 5–22
CROSS–SECTION B–B' – TOTAL PCB CONCENTRATIONS
PHASE I NORTHWEST SHORELINE
BALTIMORE, MARYLAND

FILE PATH: Q:\PROJECTS\1513101 - SPARROWS POINT\PCB CROSS SECTION B-B'.DWG [LAYOUT1]



NOTES:

1. DASHED LINES INDICATE AREAS WHERE DEPTH TO CLAY WAS NOT DELINEATED.
2. CONCENTRATIONS IN BLUE EXCEED 1000 mg/kg.
3. CONCENTRATIONS IN GREEN EXCEED 5000 mg/kg.

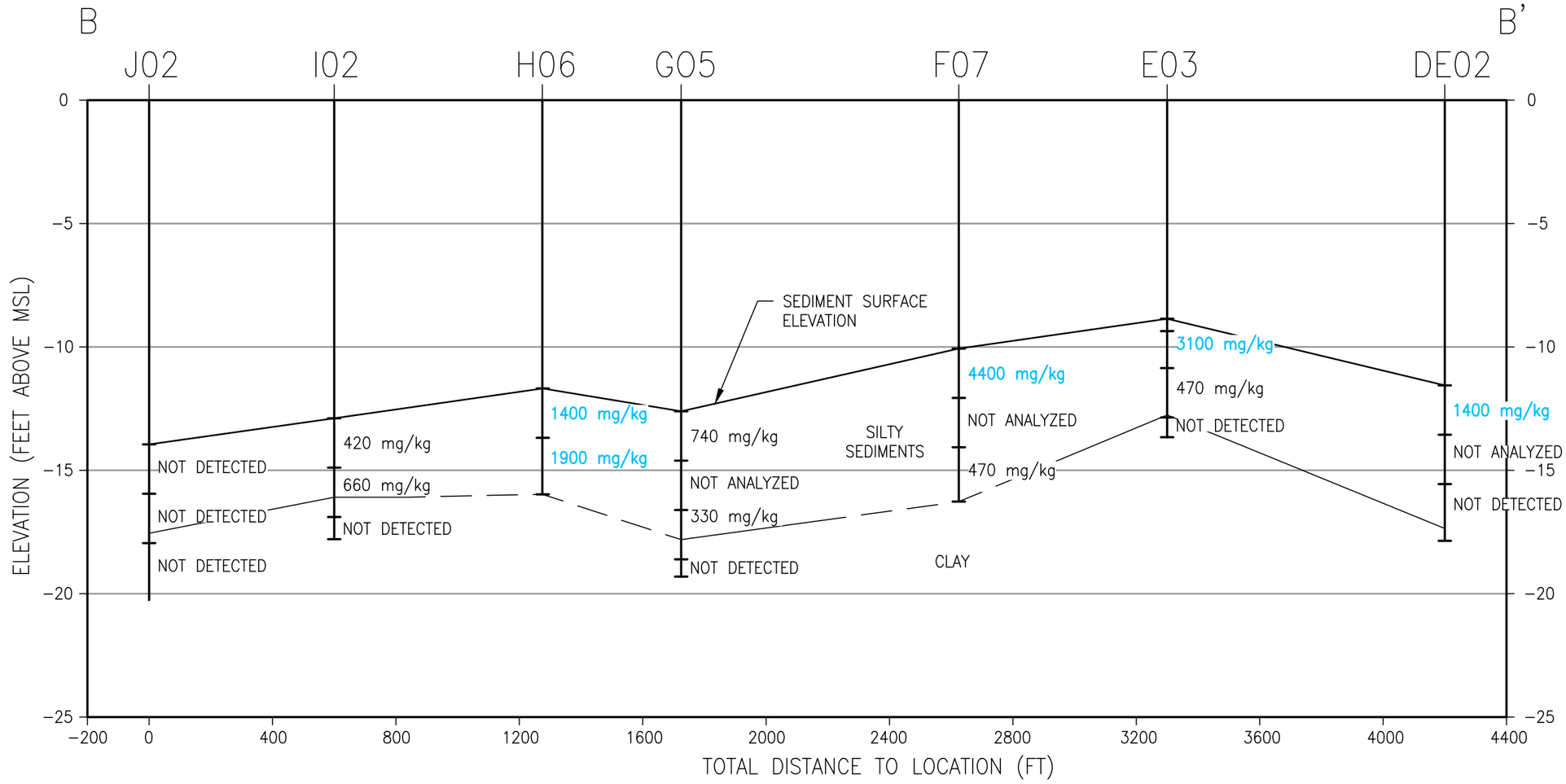
400 200 0 400
GRAPHIC SCALE IN FEET
HORIZONTAL

5 2.5 0 5
GRAPHIC SCALE IN FEET
VERTICAL

EA Engineering, Science, and Technology, Inc., PBC

FIGURE 5–23
CROSS–SECTION A–A' – OIL AND GREASE CONCENTRATIONS
PHASE I NORTHWEST SHORELINE
BALTIMORE, MARYLAND

FILE PATH: Q:\PROJECTS\1513101 – SPARROWS POINT\OIL AND GREASE CROSS SECTION A–A'.DWG [LAYOUT1]



NOTES:

1. DASHED LINES INDICATE AREAS WHERE DEPTH TO CLAY WAS NOT DELINEATED.
2. CONCENTRATIONS IN BLUE EXCEED 1000 mg/kg.

400 200 0 400
GRAPHIC SCALE IN FEET
HORIZONTAL

5 2.5 0 5
GRAPHIC SCALE IN FEET
VERTICAL

EA Engineering, Science, and Technology, Inc., PBC

FIGURE 5–24
CROSS–SECTION B–B' – OIL AND GREASE CONCENTRATIONS
PHASE I NORTHWEST SHORELINE
BALTIMORE, MARYLAND

FILE PATH: Q:\PROJECTS\1513101 – SPARROWS POINT\OIL AND GREASE CROSS SECTION B-B'.DWG [LAYOUT1]

TABLE 5-1 METALS, CYANIDE, OIL AND GREASE, AND GENERAL CHEMISTRY CONCENTRATIONS IN SURFACE SEDIMENT GRAB SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

						Northeast/Near-Shore Grouping																Southwest/Tin Mill Canal Effluent Grouping					
ANALYTE	**UNITS**	**AVG RL**	**BTAG[1]**	**PEC[2]**	**HHRA[3]**	**SD-A01**	**SD-A02**	**SD-A03**	**SD-B01**	**SD-B02**	**SD-B02-FD**	**SD-C01**	**SD-C02**	**SD-C03**	**SD-D01**	**SD-D02**	**DE01-SD[4]**	**SD-E01**	**SD-E02**	**SD-F01**	**SD-F01-FD**	**SD-F02**	**F05-SD[4]**	**SD-E03**	**SD-G01**	**SD-G02**	**SD-H01**	**SD-H02**	**SD-H03**
ANTIMONY	MG/KG	0.51	--	--	410	**0.17 J**	**1.5 J**	**2.5 J**	**0.12 J**	**2.7 J**	**2.5 J**	**0.13 J**	**0.41 J**	**2.6 J**	**0.27**	**0.36**	**0.29**	**0.27**	**0.22**	**1.1**	**1.1**	**0.68**	**1.9**	**4.1**	**7.8**	**7**	**6.1**	**6.6**	**6.8**
ARSENIC	MG/KG	0.14	7.24	33	92	**1.8**	**17**	**26**	**1.7**	**27**	**24**	**1.6**	**7.1**	**28**	**4.8**	**5.4**	**5**	**3.5**	**2.8**	**9.7**	**10**	**6.1**	**5.9**	**25**	**17**	**23**	**20**	**23**	**27**
BERYLLIUM	MG/KG	0.25	--	--	96	**0.082 J**	**0.72 J**	**1 J**	**0.053 J**	**1 J**	**0.94 J**	**0.056 J**	**0.24 J**	**1 J**	**0.15**	**0.13**	**0.1**	**0.082**	**0.15**	**0.18**	**0.16**	**0.13**	**0.1**	**0.92**	**0.24 J**	**0.46 J**	**0.35 J**	**0.31 J**	**0.29 J**
CADMIUM	MG/KG	0.25	0.68	4.98	1706	**0.94**	**5.4**	**7.1**	**0.78**	**9.2**	**8.3**	**0.73**	**3**	**8.5**	**4.4**	**4.8**	**1.8**	**0.97**	**0.72**	**4**	**4.1**	**2.5**	**5.3**	**5.3**	**2.5**	**5.7**	**4.9**	**4.5**	**45**
CHROMIUM	MG/KG	0.67	52.3	111	133098	**46**	**400**	**760**	**33**	**790**	**710**	**32**	**130**	**800**	**44**	**170**	**110**	**97**	**66**	**530**	**530**	**250**	**860**	**1400**	**800**	**2700**	**1400**	**1700**	**2600**
COPPER	MG/KG	0.51	18.7	149	273022	**8.7**	**98.00**	**160**	**5.5**	**160**	**140**	**5.6**	**28**	**170**	**11**	**19**	**8.5**	**9.1**	**11**	**77**	**80**	**29**	**66**	**190**	**110**	**260**	**180**	**190**	**470**
LEAD	MG/KG	0.25	30.2	128	--	**13**	**160**	**240**	**9.7**	**260**	**230**	**11**	**51**	**250**	**16**	**25**	**15**	**16**	**16**	**110**	**110**	**46**	**75**	**190**	**67**	**130**	**110**	**120**	**260**
MERCURY	MG/KG	0.05	0.18*	1.06	48	**0.018 J**	**0.26**	**0.36**	**0.0096 J**	**0.46**	**0.36**	**0.0079 J**	**0.086**	**0.42**	---	---	---	---	---	**0.26**	**0.17**	**0.072**	**0.088**	---	**0.26**	**0.53**	**0.38**	**0.36**	**0.83**
NICKEL	MG/KG	0.25	15.9	48.6	136511	**3.7**	**30**	**46**	**2.2**	**46**	**41**	**2.7**	**8.6**	**46**	**5.5**	**6.4**	**4.1**	**4.9**	**5.6**	**19**	**19**	**10**	**41**	**76**	**63**	**130**	**95**	**120**	**170**
SELENIUM	MG/KG	1.28	2*	--	34128	**0.17 J**	**2 J**	**2.8 J**	**0.12 J**	**3.1 J**	**2.6 J**	**0.12 J**	**0.77 J**	**3.1 J**	**0.22 J**	**0.25 J**	**0.13 J**	**0.14 J**	**0.22 J**	**0.54**	**0.56**	**0.3 J**	**0.34**	**2.6**	6 U	8.7 U	5.2 U	4.9 U	7.7 U
SILVER	MG/KG	0.25	0.73	--	1365	**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**	**0.073**	**0.063**	**0.075 J**	**1.1**	**1**	**0.28**	**0.8**	**2.5**	**0.89 J**	**5.4**	**1.9**	**2**	**4.8**
THALLIUM	MG/KG	0.25	--	--	68	**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**	**0.032 J**	**0.032 J**	**0.054 J**	**0.12**	**0.11**	**0.079**	**0.093**	**0.49**	**0.14 J**	**0.3 J**	**0.3 J**	**0.27 J**	**0.2 J**
ZINC	MG/KG	1.83	124	459	2047665	**130 J**	**980 J**	**1400 J**	**99 J**	**1600 J**	**1500 J**	**98 J**	**380 J**	**1500 J**	**510**	**670**	**290**	**220**	**140**	**850**	**850**	**490**	**1200**	**1200**	**1100**	**1700**	**1900**	**1900**	**10000**
CYANIDE, TOTAL	MG/KG	0.72	0.1*	--	4095	**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**	**1.60**	**0.21 J**	**0.18 J**	**0.4**	**0.22 J**	**0.31 J**	**0.74**	**7.3**	**0.37 J**	**21**	**2.8**	**1.2**	**12**
OIL AND GREASE	MG/KG	364.57	--	--	--	--	--	--	**260**	**12000**	**12000**	**310**	**1600**	**18000**	--	--	--	--	--	**15000**	--	**2500**	**14000**	--	**89000**	**95000**	**90000**	**110000**	**110000**
PERCENT MOISTURE	%	0.10	--	--	--	**32**	**66**	**77**	**29**	**76**	**73**	**32**	**42**	**77**	**34**	**27**	**28**	**20**	**35**	**39**	**33**	**31**	**29**	**77**	**62**	**75**	**57**	**59**	**74**
TOTAL ORGANIC CARBON	MG/KG	2873.00	--	--	--	**2700**	**42000**	**62000**	**2400**	**63000**	**55000**	**3100**	**16000**	**63000**	**3500**	**3700**	**3200**	**2300**	**5000**	**18000**	**20000**	**5900**	**17000**	**120000**	**130000**	**180000**	**150000**	**150000**	**180000**

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

This table includes data that were not considered in the risk assessment (i.e., data for constituents that are not Site-related COPCs for the Northeast Grouping). Tables 8-5 through 8-10 present data used in the risk assessment for each grouping.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater sediment benchmark

[2] Probable Effects Concentrations from MacDonald, 2000.

[3] Calculated site-specific human health screening levels, Appendix H.

[4] Samples DE01-SD and F05-SD are identified on data figures as SD-DE01 and SD-F05, respectively, for consistency.

Value exceeds BTAG benchmark

Value exceeds PEC

-- = no screening criterion or not analyzed, as applicable

mg/kg = milligrams per kilogram

RL = reporting limit

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

U = compound was analyzed, but not detected

TABLE 5-2 POLYCYCLIC AROMATIC HYDROCARBON CONCENTRATIONS IN SURFACE SEDIMENT GRAB SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

						Northeast/Near-Shore Grouping															Southwest/Tin Mill Canal Effluent Grouping					
ANALYTE	**UNITS**	**AVG RL**	**BTAG[1]**	**PEC[2]**	**HHRA[3]**	**SD-A01**	**SD-A02**	**SD-A03**	**SD-B01**	**SD-B02**	**SD-B02-FD**	**SD-C01**	**SD-C02**	**SD-C03**	**SD-D01**	**SD-D02**	**DE01-SD[4]**	**SD-E01**	**SD-E02**	**SD-F01**	**SD-F02**	**F05-SD[4]**	**SD-E03**	**SD-G01**	**SD-G02**	**SD-H01**	**SD-H02**	**SD-H03**
ACENAPHTHENE	UG/KG	298.57	6.71	--	3.15E+07	20 U	49 U	300 U	19 U	350 U	310 U	49 U	140 U	360 U	25 U	18 U	23 U	17 U	26 U	82 UJ	48 U	23 U	730 U	880 UJ	660 UJ	1200 UJ	1200 UJ	1900 UJ
ACENAPHTHYLENE	UG/KG	298.57	5.87	--	3.15E+07	20 U	**76**	**110 J**	19 U	**89 J**	310 U	49 U	140 U	**120 J**	25 U	18 U	23 U	17 U	**8.5 J**	82 UJ	48 U	**110**	**320 J**	880 UJ	660 UJ	1200 UJ	1200 UJ	1900 UJ
ANTHRACENE	UG/KG	298.57	46.9	845	1.58E+08	20 U	**73**	**79 J**	19 U	**110 J**	310 U	49 U	**28 J**	**140 J**	25 U	18 U	23 U	17 U	26 U	82 U	48 U	**62**	730 U	880 UJ	660 UJ	1200 UJ	1200 UJ	1900 UJ
FLUORENE	UG/KG	298.57	21.2	536	2.10E+07	20 U	**29 J**	300 U	19 U	350 U	310 U	49 U	140 U	360 U	25 U	18 U	23 U	17 U	26 U	82 UJ	48 U	23 U	730 U	880 UJ	660 UJ	1200 UJ	1200 UJ	1900 UJ
NAPHTHALENE	UG/KG	298.57	34.6	561	1.05E+07	**8.7 J**	**200**	**310**	**4.1 J**	**380**	**330**	**7.9 J**	**74 J**	**560**	25 U	**4.2 J**	23 U	17 U	**17 J**	**34 J**	**16 J**	**37**	**530 J**	**200 J**	**430 J**	**220 J**	**210 J**	**4000**
PHENANTHRENE	UG/KG	298.57	86.7	1170	1.58E+07	20 U	**120**	**180 J**	19 U	**220 J**	310 U	49 U	**54 J**	**200 J**	25 U	18 U	23 U	17 U	26 U	82 U	48 U	**37**	730 U	880 UJ	660 UJ	1200 UJ	1200 UJ	1900 UJ
BENZO[A]ANTHRACENE	UG/KG	298.57	74.8	1050	1.68E+04	20 U	**160**	300 U	19 U	**280 J**	**210 J**	49 U	140 U	**270 J**	**14 J**	18 U	23 U	17 U	26 U	**130**	48 U	**320**	**610 J**	880 U	**2300**	1200 U	1200 U	1900 U
BENZO[A]PYRENE	UG/KG	298.57	88.8	1450	1.68E+03	20 U	**210**	300 U	19 U	350 U	**380**	49 U	140 U	**500**	25 U	18 U	23 U	17 U	26 U	82 U	48 U	**400**	**1300**	880 U	**1700**	1200 U	1200 U	1900 U
BENZO[B]FLUORANTHENE	UG/KG	298.57	27.2	--	1.68E+04	20 U	**310**	300 U	19 U	350 U	310 U	49 U	140 U	**690**	**11 J**	18 U	23 U	17 U	26 U	82 U	48 U	**370**	**1700**	880 U	660 U	1200 U	1200 U	1900 U
BENZO[G,H,I]PERYLENE	UG/KG	298.57	170*	--	--	20 U	**260**	300 U	19 U	350 U	310 U	49 U	140 U	**670**	25 U	18 U	23 U	17 U	26 U	82 U	48 U	**500**	**1000**	880 U	660 U	1200 U	1200 U	1900 U
BENZO[K]FLUORANTHENE	UG/KG	298.57	240*	--	1.68E+05	20 U	**110**	300 U	19 U	350 U	310 U	49 U	140 U	**280 J**	25 U	18 U	23 U	17 U	26 U	82 U	48 U	**160**	**280 J**	880 U	660 U	1200 U	1200 U	1900 U
CHRYSENE	UG/KG	298.57	108	1290	1.68E+06	20 U	**210**	300 U	19 U	**250 J**	**260 J**	49 U	140 U	**360**	**13 J**	18 U	23 U	17 U	26 U	**240**	48 U	**280**	**720 J**	880 U	**2200**	1200 U	1200 U	1900 U
DIBENZ(A,H)ANTHRACENE	UG/KG	298.57	6.22	--	1.68E+03	20 U	**61**	300 U	19 U	350 U	310 U	49 U	140 U	360 U	25 U	18 U	23 U	17 U	26 U	82 U	48 U	**45**	730 U	880 U	660 U	1200 U	1200 U	1900 U
FLUORANTHENE	UG/KG	298.57	113	2230	2.10E+07	**18 J**	**410**	**390**	**7.7 J**	**490**	**430**	49 U	**110 J**	**680**	**22 J**	**14 J**	**7.2 J**	**17**	**17 J**	**450**	**75**	**1400**	**1900**	**1200 J**	**4900 J**	**1400 J**	**3200 J**	**2600 J**
INDENO[1,2,3-CD]PYRENE	UG/KG	298.57	17	--	1.68E+04	20 U	**250**	300 U	19 U	350 U	310 U	49 U	140 U	**470**	25 U	18 U	23 U	17 U	26 U	82 U	48 U	**310**	730 U	880 U	660 U	1200 U	1200 U	1900 U
PYRENE	UG/KG	298.57	153	1520	1.58E+07	**14 J**	**270**	**380**	**7.9 J**	**490**	**440**	49 U	**90 J**	**690**	**16 J**	**6.3 J**	**6.5 J**	**7.1 J**	**18 J**	**750**	**140**	**690**	**2000**	**1000**	**2800**	**1300**	**2500**	**5000**
TOTAL PAHs ND=0	UG/KG	--	2900	22800	--	40.7	2639	1449	19.7	2309	2050	7.9	356	5630	76	24.5	13.7	24.1	60.5	1604	231	4524	10360	2400	14330	2920	5910	11600

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

This table includes data that were not considered in the risk assessment (i.e., data for constituents that are not Site-related COPCs for the Northeast Grouping). Tables 8-5 through 8-10 present data used in the risk assessment for each grouping.

Samples were diluted (by factors of 4 to 25) to address matrix interference, resulting in RLs elevated to varying degrees.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater sediment benchmark

[2] Probable Effects Concentrations from MacDonald, 2000.

[3] Calculated site-specific human health screening levels, Appendix H.

[4] Samples DE01-SD and F05-SD are identified on data figures as SD-DE01 and SD-F05, respectively, for consistency.

Value exceeds BTAG benchmark

Value exceeds PEC

Value exceeds human health screening level

-- = no screening criterion

ug/kg = micrograms per kilogram

RL = reporting limit

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

U = compound was analyzed, but not detected

*BTAG value from freshwater sediment screening values

TABLE 5-3 POLYCHLORINATED BIPHENYL CONCENTRATIONS IN SURFACE SEDIMENT GRAB SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

						Northeast/Near-Shore Grouping									Southwest/Tin Mill Canal Effluent Grouping				
ANALYTE	**UNITS**	**AVG RL**	**BTAG[1]**	**PEC[2]**	**HHRA[3]**	**SD-B01**	**SD-B02**	**SD-B02-FD**	**SD-C01**	**SD-C02**	**SD-C03**	**SD-F01**	**SD-F02**	**F05-SD[4]**	**SD-G01**	**SD-G02**	**SD-H01**	**SD-H02**	**SD-H03**
PCB-1016	UG/KG	26.56	---	---	3.41E+04	5.9 U	17 U	15 U	6.1 U	7.2 U	18 U	6.8 U	6 U	2.9 U	22 U	17 U	19 U	20 U	32 U
PCB-1221	UG/KG	26.56	---	---	1.48E+04	5.9 U	17 U	15 U	6.1 U	7.2 U	18 U	6.8 U	6 U	2.9 U	22 U	17 U	19 U	20 U	32 U
PCB-1232	UG/KG	26.56	---	---	1.48E+04	5.9 U	17 U	15 U	6.1 U	7.2 U	18 U	6.8 U	6 U	2.9 U	22 U	17 U	19 U	20 U	32 U
PCB-1242	UG/KG	26.56	---	---	---	5.9 U	17 U	15 U	6.1 U	7.2 U	18 U	6.8 U	6 U	2.9 U	22 U	17 U	19 U	20 U	32 U
PCB-1248	UG/KG	26.56	---	---	1.48E+04	5.9 U	**78 J**	**130**	6.1 U	**26**	**140 J**	**1600**	**190**	2.9 U	**260**	**230**	**680**	**570**	**910 J**
PCB-1254	UG/KG	26.56	---	---	9.75E+03	**2.9 J**	17 U	15 U	**3.7 J**	7.2 U	18 U	6.8 U	6 U	**38**	22 U	17 U	19 U	20 U	32 U
PCB-1260	UG/KG	26.56	---	---	1.48E+04	**1.9 J**	**49**	**84**	**1.9 J**	**21 J**	**88**	6.8 U	6 U	2.9 U	22 U	17 U	19 U	20 U	**1000 J**
Total PCBs ND=0 [5]	UG/KG	---	40	676	---	4.8	127	214	5.6	47	228	1600	190	38	260	230	680	570	1910

NOTES: Bold values represent detected concentrations. RL is reported for non-detected constituents.
This table includes data that were not considered in the risk assessment (i.e., data for constituents that are not Site-related COPCs for the Northeast Grouping). Tables 8-5 through 8-10 present data used in the risk assessment for each grouping.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group.

[2] Probable Effects Concentrations from MacDonald, 2000.

[3] Calculated site-specific human health screening levels, Appendix H.

[4] Sample F05-SD is identified on data figures as SD-F05 for consistency.

[5] Sum of detected Aroclors (including J-qualified). Non-detects not included.

Value exceeds BTAG benchmark

Value exceeds PEC

-- = no screening criterion

ug/kg = micrograms per kilogram

RL = reporting limit

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

U = compound was analyzed, but not detected

TABLE 5-4 VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN SURFACE SEDIMENT GRAB SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

					Northeast/Near-Shore Grouping									Southwest/Tin Mill Canal Effluent Grouping				
ANALYTE	UNITS	AVG RL	BTAG[1]	HHRA[2]	SD-B01	SD-B02	SD-B02-FD	SD-C01	SD-C02	SD-C03	SD-F01	SD-F02	F05-SD[3]	SD-G01	SD-G02	SD-H01	SD-H02	SD-H03
1,1,1-TRICHLOROETHANE	UG/KG	15.11	--	--	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 U	19 U
1,1,2,2-TETRACHLOROETHANE	UG/KG	15.11	--	--	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 U	19 U
1,1,2-TRICHLOROETHANE	UG/KG	15.11	--	--	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 U	19 U
1,1-DICHLOROETHANE	UG/KG	15.11	--	--	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 U	19 U
1,1-DICHLOROETHENE	UG/KG	15.11	--	--	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 U	19 U
1,2-DICHLOROBENZENE	UG/KG	15.11	989	6.14E+07	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	**8.8 J**	12 U	12 U	19 U
1,2-DICHLOROETHANE	UG/KG	15.11	--	--	7.1 UJ	21 UJ	18 UJ	7.4 UJ	8.6 UJ	21 UJ	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 UJ	19 UJ
1,2-DICHLOROPROPANE	UG/KG	15.11	--	--	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 U	19 U
1,3-DICHLOROBENZENE	UG/KG	15.11	--	6.14E+07	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 U	19 U
1,4-DICHLOROBENZENE	UG/KG	15.11	--	7.67E+06	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 U	19 U
2-CHLOROETHYL VINYL ETHER	UG/KG	30.27	--	--	14 U	42 U	37 U	15 U	17 U	43 U	16 U	14 U	14 U	26 U	40 U	23 U	24 U	38 U
ACROLEIN	UG/KG	302.72	--	--	140 U	420 U	370 U	150 U	170 U	430 U	160 U	140 U	140 U	260 U	400 U	230 U	240 U	380 U
ACRYLONITRILE	UG/KG	302.72	--	--	140 U	420 U	370 U	150 U	170 U	430 U	160 U	140 U	140 U	260 U	400 U	230 U	240 U	380 U
BENZENE	UG/KG	15.11	137	1.51E+08	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 U	**6.9 J**
BROMOFORM	UG/KG	15.11	--	--	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 U	19 U
BROMOMETHANE	UG/KG	15.11	--	--	7.1 UJ	21 UJ	18 UJ	7.4 UJ	8.6 UJ	21 UJ	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 UJ	19 UJ
CARBON TETRACHLORIDE	UG/KG	15.11	--	--	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 UJ	19 UJ
CHLOROBENZENE	UG/KG	15.11	162	1.37E+07	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	**16 J**	12 U	**2.4 J**	**250**
CHLORODIBROMOMETHANE	UG/KG	15.11	--	--	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 U	19 U
CHLOROETHANE	UG/KG	15.11	--	--	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 U	19 U
CHLOROFORM	UG/KG	15.11	--	--	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 U	19 U
CHLOROMETHANE	UG/KG	15.11	--	--	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 U	19 U
CIS-1,3-DICHLOROPROPENE	UG/KG	15.11	--	--	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 U	19 U
DICHLOROBROMOMETHANE	UG/KG	15.11	--	--	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 U	19 U
ETHYLBENZENE	UG/KG	15.11	305	1.26E+07	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	**2.1 J**	**5.8 J**	12 U	12 U	**33**
METHYLENE CHLORIDE	UG/KG	15.11	--	--	7.1 UJ	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 U	19 U
TETRACHLOROETHENE	UG/KG	15.11	--	--	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 U	19 U
TOLUENE	UG/KG	15.11	1090*	1.82E+08	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	**1.8 J**	**1.6 J**	7 U	**3.6 J**	**5.3 J**	**2.6 J**	12 U	**16 J**
TRANS-1,2-DICHLOROETHENE	UG/KG	15.11	--	--	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 U	19 U
TRANS-1,3-DICHLOROPROPENE	UG/KG	15.11	--	--	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 U	19 U
TRICHLOROETHENE	UG/KG	15.11	--	--	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 U	13 U	20 U	12 U	12 U	19 U
VINYL CHLORIDE	UG/KG	15.11	--	--	7.1 U	21 U	18 U	7.4 U	8.6 U	21 U	8.2 U	7.2 U	7 UJ	13 U	20 U	12 U	12 U	19 U

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

This table includes data that were not considered in the risk assessment (i.e., data for constituents that are not Site-related COPCs for the Northeast Grouping). Tables 8-5 through 8-10 present data used in the risk assessment for each grouping.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater sediment benchmark

[2] Calculated site-specific human health screening levels, Appendix H.

[3] Sample F05-SD is identified on data figures as SD-F05 for consistency.

Value exceeds BTAG benchmark

-- = no screening criterion

ug/kg = micrograms per kilogram

RL = reporting limit

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

U = compound was analyzed, but not detected

TABLE 5-5 SEMIVOLATILE ORGANIC COMPOUND CONCENTRATIONS IN SURFACE SEDIMENT GRAB SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

						Northeast/Near-Shore Grouping															Southwest/Tin Mill Canal Effluent Grouping					
ANALYTE	**UNITS**	**AVG RL**	**BTAG[1]**	**PEC[2]**	**HHRA[3]**	**SD-A01**	**SD-A02**	**SD-A03**	**SD-B01**	**SD-B02**	**SD-B02-FD**	**SD-C01**	**SD-C02**	**SD-C03**	**SD-D01**	**SD-D02**	**DE01-SD[4]**	**SD-E01**	**SD-E02**	**SD-F01**	**SD-F02**	**F05-SD[4]**	**SD-E03**	**SD-G01**	**SD-G02**	**SD-H01**	**SD-H02**	**SD-H03**
1,2,4-TRICHLOROBENZENE	UG/KG	1419.15	473	--	--	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	240 U	120 U	---	4300 U	3300 U	5800 U	5900 U	9400 U
1,2-DIPHENYLHYDRAZINE(AS AZOBENZ	UG/KG	1419.15	--	--	--	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	240 U	120 U	---	4300 UJ	3300 UJ	5800 UJ	5900 UJ	9400 UJ
2,2'-OXYBIS[1-CHLOROPROPANE]	UG/KG	289.25	--	--	--	---	---	---	19 U	350 U	310 U	49 U	140 U	360 U	---	---	---	---	---	82 U	48 U	23 U	---	880 U	660 U	1200 U	1200 U	1900 U
2,4,6-TRICHLOROPHENOL	UG/KG	1419.15	2650	--	--	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 UJ	240 U	120 U	---	4300 UJ	3300 UJ	5800 UJ	5900 UJ	9400 UJ
2,4-DICHLOROPHENOL	UG/KG	289.25	117*	--	--	---	---	---	19 U	350 U	310 U	49 U	140 U	360 U	---	---	---	---	---	82 U	48 U	23 U	---	880 U	660 U	1200 U	1200 U	1900 U
2,4-DIMETHYLPHENOL	UG/KG	1419.15	29*	--	1.37E+07	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	240 U	120 U	---	4300 U	3300 U	5800 U	5900 U	9400 U
2,4-DINITROPHENOL	UG/KG	7311.47	41.6*	--	--	---	---	---	480 U	8800 U	7800 U	1200 U	3700 U	9000 U	---	---	---	---	---	2100 UJ	1200 U	600 U	---	22000 UJ	17000 UJ	30000 UJ	31000 UJ	49000 UJ
2,4-DINITROTOLUENE	UG/KG	1419.15	41.60	--	--	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 UJ	240 U	120 U	---	4300 UJ	3300 UJ	5800 UJ	5900 UJ	9400 UJ
2,6-DINITROTOLUENE	UG/KG	1419.15	--	--	--	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 UJ	240 U	120 U	---	4300 UJ	3300 UJ	5800 UJ	5900 UJ	9400 UJ
2-CHLORONAPHTHALENE	UG/KG	289.25	--	--	--	---	---	---	19 U	350 U	310 U	49 U	140 U	360 U	---	---	---	---	---	82 UJ	48 U	23 U	---	880 UJ	660 UJ	1200 UJ	1200 UJ	1900 UJ
2-CHLOROPHENOL	UG/KG	1419.15	344	--	--	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	240 U	120 U	---	4300 U	3300 U	5800 U	5900 U	9400 U
2-NITROPHENOL	UG/KG	1419.15	--	--	--	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	240 U	120 U	---	4300 U	3300 U	5800 U	5900 U	9400 U
3,3'-DICHLOROBENZIDINE	UG/KG	1419.15	2060	--	--	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	240 U	120 U	---	4300 U	3300 U	5800 U	5900 U	9400 U
4,6-DINITRO-2-METHYLPHENOL	UG/KG	7311.47	--	--	--	---	---	---	480 U	8800 U	7800 U	1200 U	3700 U	9000 U	---	---	---	---	---	2100 U	1200 U	600 U	---	22000 UJ	17000 UJ	30000 UJ	31000 UJ	49000 UJ
4-BROMOPHENYL PHENYL ETHER	UG/KG	1419.15	1230*	--	--	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	240 U	120 U	---	4300 UJ	3300 UJ	5800 UJ	5900 UJ	9400 UJ
4-CHLORO-3-METHYLPHENOL	UG/KG	1419.15	--	--	--	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	240 U	120 U	---	4300 U	3300 U	5800 U	5900 U	9400 U
4-CHLOROPHENYL PHENYL ETHER	UG/KG	1419.15	--	--	--	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 UJ	240 U	120 U	---	4300 UJ	3300 UJ	5800 UJ	5900 UJ	9400 UJ
4-NITROPHENOL	UG/KG	7311.47	--	--	--	---	---	---	480 U	8800 UJ	7800 UJ	1200 UJ	3700 UJ	9000 UJ	---	---	---	---	---	2100 UJ	1200 U	600 U	---	22000 UJ	17000 UJ	30000 UJ	31000 UJ	49000 UJ
BENZIDINE	UG/KG	28924.85	--	--	--	---	---	---	**R**	35000 U	31000 U	4900 U	14000 U	36000 U	---	---	---	---	---	8200 U	4800 U	2300 U	---	88000 U	66000 U	120000 U	120000 U	190000 U
BENZOIC ACID	UG/KG	7311.47	650*	--	2.73E+09	---	---	---	480 U	8800 U	7800 U	1200 U	3700 U	9000 U	---	---	---	---	---	2100 U	1200 U	600 U	---	22000 U	17000 U	30000 U	31000 U	49000 U
BIS(2-CHLOROETHOXY)METHANE	UG/KG	1419.15	--	--	--	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	240 U	120 U	---	4300 U	3300 U	5800 U	5900 U	9400 U
BIS(2-CHLOROETHYL)ETHER	UG/KG	289.25	--	--	--	---	---	---	19 U	350 U	310 U	49 U	140 U	360 U	---	---	---	---	---	82 U	48 U	23 U	---	880 U	660 U	1200 U	1200 U	1900 U
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	2689.99	182.16	2647	2.96E+06	**27 J**	**250 J**	2900 U	190 U	**910 J**	3100 U	490 U	1400 U	3500 U	250 U	**29 J**	230 U	**18 J**	**42 J**	**1600**	**300 J**	**790**	**3700 J**	**3300 J**	**13000**	**7500 J**	**3500 J**	**33000**
BUTYL BENZYL PHTHALATE	UG/KG	1419.15	16800	--	--	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	240 U	120 U	---	4300 U	3300 U	5800 U	5900 U	9400 U
DIETHYL PHTHALATE	UG/KG	1419.15	218	--	--	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 UJ	240 U	120 U	---	4300 UJ	3300 UJ	5800 UJ	5900 UJ	9400 UJ
DIMETHYL PHTHALATE	UG/KG	1419.15	--	--	--	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 UJ	240 U	120 U	---	4300 UJ	3300 UJ	5800 UJ	5900 UJ	9400 UJ
DI-N-BUTYL PHTHALATE	UG/KG	1419.15	1160	--	6.83E+07	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	240 U	120 U	---	4300 UJ	3300 UJ	5800 UJ	5900 UJ	9400 UJ
DI-N-OCTYL PHTHALATE	UG/KG	1419.15	--	--	--	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	240 U	120 U	---	4300 U	3300 U	5800 U	5900 U	9400 U
HEXACHLOROBENZENE	UG/KG	289.25	20*	--	--	---	---	---	19 U	350 U	310 U	49 U	140 U	360 U	---	---	---	---	---	82 U	48 U	23 U	---	880 UJ	660 UJ	1200 UJ	1200 UJ	1900 UJ
HEXACHLOROBUTADIENE	UG/KG	289.25	--	--	--	---	---	---	19 U	350 U	310 U	49 U	140 U	360 U	---	---	---	---	---	82 U	48 U	23 U	---	880 U	660 U	1200 U	1200 U	1900 U
HEXACHLOROCYCLOPENTADIENE	UG/KG	1419.15	139	--	--	---	---	---	**R**	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 UJ	240 U	120 U	---	4300 UJ	3300 UJ	5800 UJ	5900 UJ	9400 UJ
HEXACHLOROETHANE	UG/KG	1419.15	804	--	--	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	240 U	120 U	---	4300 U	3300 U	5800 U	5900 U	9400 U
ISOPHORONE	UG/KG	1419.15	--	--	--	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	240 U	120 U	---	4300 U	3300 U	5800 U	5900 U	9400 U
NITROBENZENE	UG/KG	2869.99	--	--	--	---	---	---	190 U	3500 U	3100 U	490 U	1400 U	3500 U	---	---	---	---	---	820 U	480 U	230 U	---	8800 U	6600 U	12000 U	12000 U	19000 U
N-NITROSODIMETHYLAMINE	UG/KG	1419.15	--	--	--	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	240 U	120 U	---	4300 U	3300 U	5800 U	5900 U	9400 U
N-NITROSODI-N-PROPYLAMINE	UG/KG	289.25	--	--	--	---	---	---	19 U	350 U	310 U	49 U	140 U	360 U	---	---	---	---	---	82 U	48 U	23 U	---	880 U	660 U	1200 U	1200 U	1900 U
N-NITROSODIPHENYLAMINE	UG/KG	1419.15	422000	--	--	---	---	---	93 U	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	240 U	120 U	---	4300 UJ	3300 UJ	5800 UJ	5900 UJ	9400 UJ
PENTACHLOROPHENOL	UG/KG	1419.15	7970	--	--	---	---	---	93 UJ	1700 U	1500 U	240 U	710 U	1800 U	---	---	---	---	---	410 U	240 U	120 U	---	4300 UJ	3300 UJ	5800 UJ	5900 UJ	9400 UJ
PHENOL	UG/KG	289.25	420*	--	2.05E+08	---	---	---	19 U	350 U	310 U	49 U	140 U	360 U	---	---	---	---	---	82 U	48 U	**20 J**	---	880 U	660 U	1200 U	1200 U	1900 U

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

This table includes data that were not considered in the risk assessment (i.e., data for constituents that are not Site-related COPCs for the Northeast Grouping). Tables 8-5 through 8-10 present data used in the risk assessment for each grouping.

Samples were diluted (by factors of 4 to 25) to address matrix interference, resulting in RLs elevated to varying degrees.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater sediment benchmark

[2] Probable Effects Concentrations from MacDonald, 1996.

[3] Calculated site-specific human health screening levels, Appendix H.

[4] Samples DE01-SD and F05-SD are identified on data figures as SD-DE01 and SD-F05, respectively, for consistency.

Value exceeds BTAG benchmark

Value exceeds PEC

-- = no screening criterion or not analyzed, as applicable

ug/kg = micrograms per kilogram

R = data point rejected during validation (see Appendix E)

RL = reporting limit

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

U = compound was analyzed, but not detected

TABLE 5-6 GRAIN SIZE AND MOISTURE CONTENT OF SURFACE SEDIMENT GRAB SAMPLES.
SPARROWS POINT TRUST OFFSHORE INVESTIGATION

		Northeast/Near-Shore Grouping					Southwest/Effluent Grouping
ANALYTE	**UNITS**	**SD-B01**	**SD-B02**	**SD-C02**	**SD-E01**	**SD-E02**	**SD-E03**
Hydrometer Analysis							
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**
SILT+CLAY	%	**7.5**	**77.4**	**14.7**	**3.2**	**14.9**	**73.8**
MOISTURE CONTENT	%	**36.6**	**228.7**	**49.6**	**29.5**	**29.1**	**312.6**

TABLE 5-7 SIMULTANEOUSLY EXTRACTED METALS AND ACID VOLATILE SULFIDE CONCENTRATIONS IN SURFACE SEDIMENT GRAB SAMPLES.
SPARROWS POINT TRUST OFFSHORE INVESTIGATION

			Northeast/Near-Shore Grouping																	Southwest/Tin Mill Canal Effluent Grouping					
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**	**DE01-SD[1]**	**SD-E01**	**SD-E02**	**SD-F01**	**SD-F01-FD**	**SD-F02**	**F05-SD[1]**	**SD-E03**	**SD-G01**	**SD-G02**	**SD-H01**	**SD-H02**	**SD-H03**
CADMIUM SEM	UMOL/G	0.00	**0.0082 J**	**0.034 J**	**0.057 J**	**0.0072 J**	**0.073 J**	**0.063 J**	**0.0058 J**	**0.025 J**	**0.07 J**	**0.032**	**0.026**	**0.022**	**0.0071**	**0.015**	**0.085 J**	**0.027 J**	**0.062**	**0.027**	**0.11**	**0.072**	**0.11**	**0.11**	**0.1**	**0.81**
COPPER SEM	UMOL/G	0.03	**0.11 J**	**0.62 J**	**1.8 J**	**0.075 J**	**1.8 J**	**1.5 J**	**0.067 J**	**0.37 J**	**0.86 J**	**0.094 J**	**0.14 J**	**0.14**	**0.078 J**	**0.28 J**	**1.7 J**	**0.45 J**	**1.4 J**	**0.34**	**4.2 J**	**3.6 J**	**5 J**	**4.7 J**	**5.2 J**	**7.2 J**
LEAD SEM	UMOL/G	0.01	**0.049**	**0.41**	**0.79**	**0.037**	**0.85**	**0.73**	**0.035**	**0.18**	**0.84**	**0.043**	**0.052**	**0.067**	**0.047**	**0.13**	**0.84 J**	**0.21 J**	**0.62**	**0.16**	**1.5**	**0.73**	**1.1**	**1.1**	**1.1**	**2.2**
NICKEL SEM	UMOL/G	0.07	**0.033**	**0.26**	**0.49**	**0.029**	**0.5**	**0.47**	**0.027**	**0.13**	**0.55**	**0.047**	**0.047**	**0.059**	**0.041**	**0.13**	**0.48 J**	**0.14 J**	**0.35**	**0.28**	**2.2**	**2.3**	**3.5**	**2.8**	**3.5**	**5.6**
ZINC SEM	UMOL/G	0.11	**2**	**10**	**18**	**1.6**	**21**	**19**	**1.4**	**5.5**	**20**	**5.9**	**6.2**	**6.4**	**2.6**	**5.1**	**26**	**9.2**	**21**	**8.7**	**40**	**37**	**41**	**56**	**46**	**280**
ACID VOLATILE SULFIDES (AVS)	UMOL/G	62.01	0.68 U	**23**	**41**	0.66 U	**39**	**32**	0.69 U	**11**	**23**	0.71 U	**0.17 J**	**0.35 J**	**0.29 J**	1.5 U	**31**	**25**	**16**	**34**	**83**	**51**	**150**	**32**	**34**	**15**
SEM/AVS RATIO	NONE	0.00	NC	**0.51**	**0.53**	NC	**0.63**	**0.67**	NC	**0.57**	**1**	NC	**38**	**19**	**9.7**	NC	**0.92**	**0.4**	**1.5**	**0.28**	**0.58**	**0.87**	**1**	**2.00**	**1.7**	**21**

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

[1] Samples DE01-SD and F05-SD are identified on data figures as SD-DE01 and SD-F05, respectively, for consistency.

AVS = Acid volatile sulfide

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

NC = not calculated because AVS was not detected

RL = reporting limit

SEM = simultaneously extracted metal

U = compound was analyzed, but not detected

umol/g = micromoles per gram

TABLE 5-8 METALS, CYANIDE, OIL AND GREASE, AND GENERAL CHEMISTRY CONCENTRATIONS IN SEDIMENT CORE SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

						Southwest/Tin Mill Canal Effluent Grouping												
ANALYTE	**UNITS**	**AVG RL**	**BTAG[1]**	**PEC[2]**	**HHRA[3]**	**SD-DE02-0002**	**SD-DE02-0406**	**SD-E03-0002**	**SD-E03-0204**	**SD-E03-0204-FD**	**SD-E03-0406**	**SD-F03-0002**	**SD-F04-0002**	**SD-F04-0406**	**SD-F06-0002**	**SD-F06-0406**	**SD-F07-0002**	**SD-F07-0406**	**SD-G01-0002**
ANTIMONY	MG/KG	0.51	--	--	410	**3.7 J**	**3.2**	**6.2 J**	**2.3 J**	**2.7 J**	**0.37 J**	**3.2 J**	**6.3 J**	**1.5 J**	**4.6 J**	**3.7 J**	0.48 UJ	**3.3**	**6.2 J**
ARSENIC	MG/KG	0.14	7.24	33	92	**35 J**	**83**	**60 J**	**65**	**72**	**29**	**22**	**27**	**5.3**	**79 J**	**140**	**77 J**	**97**	**21**
BERYLLIUM	MG/KG	0.25	--	--	96	**1.3 J**	**1.1**	**0.5 J**	**0.86**	**0.83**	**1.2**	**0.2**	**0.36**	**0.11**	**1.6 J**	**0.94**	**1.1 J**	**1.3**	**0.17**
CADMIUM	MG/KG	0.25	0.68	4.98	1706	**26 J**	**3.5 J**	**13 J**	**6.6 J**	**6.5 J**	**0.4 J**	**7.5**	**4.6**	**2.7**	**27 J**	**6.5**	**22 J**	**6.1 J**	**2.1 J**
CHROMIUM	MG/KG	0.67	52.3	111	133098	**2300 J**	**440**	**1600 J**	**330**	**360**	**67**	**1500**	**3100**	**340**	**3300 J**	**560**	**2700 J**	**460**	**2900**
COPPER	MG/KG	0.51	18.7	149	273022	**290 J**	**190**	**330 J**	**200**	**200**	**58**	**260**	**250**	**54**	**540 J**	**300**	**480 J**	**270**	**200**
LEAD	MG/KG	0.25	30.2	128	--	**320 J**	**1000**	**860 J**	**1000**	**1100**	**88**	**290**	**130**	**82**	**710 J**	**1200**	**920 J**	**1300**	**77**
MERCURY	MG/KG	0.05	0.18*	1.06	48	**0.69 J**	**1**	**1 J**	**0.86**	**0.87**	**0.29**	**0.77**	**0.4**	**0.31**	**1.3 J**	**0.88**	**1.6 J**	**1.5**	**0.32**
NICKEL	MG/KG	0.25	15.9	48.6	136511	**67 J**	**36**	**56 J**	**45**	**48**	**32**	**49 J**	**160 J**	**15 J**	**71 J**	**34 J**	**69 J**	**43**	**180**
SELENIUM	MG/KG	1.28	2*	--	34128	**4.4 J**	**15 J**	**9.7 J**	**17**	**25**	**1.5**	**1.9 J**	**1.3 J**	**0.44 J**	**14 J**	**21 J**	**13 J**	**30 J**	**0.88**
SILVER	MG/KG	0.25	0.73	--	1365	**3.9 J**	**1**	**3.8 J**	**1**	**0.8**	**0.16**	**3.5 J**	**2.3 J**	**0.79 J**	**5.5 J**	**1.4 J**	**6.2 J**	**1**	**2**
THALLIUM	MG/KG	0.25	--	--	68	**0.7 J**	**0.49**	**0.51 J**	**0.57**	**0.52**	**0.25**	**0.16**	**0.22**	**0.043 J**	**0.98 J**	**0.63**	**0.86 J**	**0.7**	**0.16**
ZINC	MG/KG	1.83	124	459	2047665	**4100 J**	**2100**	**3400 J**	**4000**	**4500**	**190**	**2200**	**2000**	**650**	**4200 J**	**2300**	**4600 J**	**2400**	**880**
CYANIDE, TOTAL	MG/KG	0.72	0.1*	--	4095	**4.5 J**	**8.2**	**29 J**	**27 J**	**13 J**	**0.26 J**	**6.2**	**4.2**	**0.63**	**0.42 J**	**26 J**	**15 J**	**13**	**17 J**
OIL AND GREASE	MG/KG	364.57	--	--	--	1400 J	280 U	3100 J	470	310 U	200 U	450	4400	660	430 UJ	380	4400 J	470	11000
PERCENT MOISTURE	%	0.10	--	--	--	81	67	80	68	68	52	37	61	31	78	68	79	68	64
TOTAL ORGANIC CARBON	MG/KG	2873	--	--	--	120000	47000	84000	38000	40000	22000	34000	180000	44000	140000	59000	180000	50000	190000

						Southwest/Tin Mill Canal Effluent Grouping												
ANALYTE	**UNITS**	**AVG RL**	**BTAG[1]**	**PEC[2]**	**HHRA[3]**	**SD-H01-0002**	**SD-H01-0406**	**SD-H03-0002**	**SD-H03-0406**	**SD-H03-0607**	**SD-H04-0002**	**SD-H04-0002-FD**	**SD-H04-0406**	**SD-H05-0002**	**SD-H05-0406**	**SD-H06-0002**	**SD-H06-0002-FD**	**SD-H06-0204**	**SD-H07-0002**
ANTIMONY	MG/KG	0.51	--	--	410	**10 J**	**7.7 J**	**3.8 J**	**6 J**	**0.29 J**	**7.4 J**	**10 J**	**4.6 J**	**6.8**	**11 J**	**4.2 J**	**4 J**	**5.9 J**	**3.2 J**
ARSENIC	MG/KG	0.14	7.24	33	92	**25**	**42 J**	**43 J**	**56**	**16**	**28 J**	**37 J**	**90**	**31**	**69 J**	**26 J**	**28 J**	**62 J**	**67 J**
BERYLLIUM	MG/KG	0.25	--	--	96	**0.35**	**0.35 J**	**0.26 J**	**0.53**	**1.6**	**0.37 J**	**0.35 J**	**0.88**	**0.63**	**0.7 J**	**1 J**	**1.2 J**	**1 J**	**1.2 J**
CADMIUM	MG/KG	0.25	0.68	4.98	1706	**3.5 J**	**81 J**	**110 J**	**32**	**0.73**	**21 J**	**22 J**	**7.6**	**4.6 J**	**62 J**	**4.4 J**	**5.4 J**	**36 J**	**8.6 J**
CHROMIUM	MG/KG	0.67	52.3	111	133098	**1900**	**5300 J**	**4600 J**	**3700**	**68**	**3400 J**	**4300 J**	**420**	**2100**	**6900 J**	**1600 J**	**2100 J**	**4000 J**	**1100 J**
COPPER	MG/KG	0.51	18.7	149	273022	**180**	**400 J**	**550 J**	**510**	**38**	**350 J**	**510 J**	**300**	**240**	**940 J**	**200 J**	**240 J**	**610 J**	**290 J**
LEAD	MG/KG	0.25	30.2	128	--	**94**	**940 J**	**500 J**	**1000**	**63**	**300 J**	**410 J**	**1200**	**130**	**1000 J**	**150 J**	**190 J**	**680 J**	**570 J**
MERCURY	MG/KG	0.05	0.18*	1.06	48	0.053 U	0.046 UJ	**0.74 J**	**1.3**	**0.2**	**0.74 J**	**0.67 J**	**0.91**	**0.38**	**2.3 J**	**0.47 J**	**0.54 J**	**1.5 J**	**0.91 J**
NICKEL	MG/KG	0.25	15.9	48.6	136511	**110**	**120 J**	**210 J**	**130 J**	**35 J**	**140 J**	**220 J**	**36 J**	**120**	**120 J**	**78 J**	**79 J**	**83 J**	**43 J**
SELENIUM	MG/KG	1.28	2*	--	34128	**1.2**	**1.8 J**	**1.3 J**	**5.4 J**	**1.8 J**	**1.8 J**	**2.2 J**	**17 J**	**2.1 J**	**7.6 J**	**2.6 J**	**2.8 J**	**7.7 J**	**9.9 J**
SILVER	MG/KG	0.25	0.73	--	1365	**2.1**	**8.6 J**	**6 J**	**6.6 J**	**0.15 J**	**5.4 J**	**6.3 J**	**1.1 J**	**3.1**	**15 J**	**2.4 J**	**3.2 J**	**7.5 J**	**2.5 J**
THALLIUM	MG/KG	0.25	--	--	68	**0.23**	**0.18 J**	**0.65 J**	**0.38**	**0.26**	**0.35 J**	**0.44 J**	**0.54**	**0.41**	**1.1 J**	**0.4 J**	**0.48 J**	**0.85 J**	**0.81 J**
ZINC	MG/KG	1.83	124	459	--	**1400**	**10000 J**	**17000 J**	**8600**	**250**	**5500 J**	**11000 J**	**3500**	**1700**	**9800 J**	**1300 J**	**1500 J**	**5600 J**	**2000 J**
CYANIDE, TOTAL	MG/KG	0.72	0.1*	--	4095	0.81 UJ	**5.2 J**	**16 J**	**6.4**	**7 J**	**7.1 J**	**9.5 J**	**7.2 J**	**3.3**	**13 J**	**2.5 J**	**6.5 J**	**14 J**	**34 J**
OIL AND GREASE	MG/KG	364.57	--	--	--	4900	5300 J	5700 J	3000	210 U	4700 J	2300 J	1300	3300	2000 J	1100 J	1400 J	1900 J	470 J
PERCENT MOISTURE	%	0.1	--	--	--	69	73	78	66	54	75	75	64	69	72	78	79	76	70
TOTAL ORGANIC CARBON	MG/KG	2873	--	--	--	260000	220000	250000	130000	19000	240000	200000	81000	210000	230000	150000	140000	150000	87000

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

This table includes data that were not considered in the risk assessments (i.e., data for subsurface sediments). Tables 8-6 through 8-10 present data used in the risk assessment for the Southwest Grouping.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater sediment benchmark

[2] Probable Effects Concentrations from MacDonald, 2000.

[3] Calculated site-specific human health screening levels, Appendix H.

Value exceeds BTAG benchmark

Value exceeds PEC

Value exceeds human health screening level

-- = no screening criterion or not analyzed

mg/kg = milligrams per kilogram

RL = reporting limit

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

U = compound was analyzed, but not detected

TABLE 5-8 METALS, CYANIDE, OIL AND GREASE, AND GENERAL CHEMISTRY CONCENTRATIONS IN SEDIMENT CORE SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

						Southwest/Tin Mill Canal Effluent Grouping												
ANALYTE	**UNITS**	**AVG RL**	**BTAG[1]**	**PEC[2]**	**HHRA[3]**	**SD-G01-0406**	**SD-G02-0002**	**SD-G02-0406**	**SD-G03-0002**	**SD-G03-0406**	**SD-G04-0002**	**SD-G04-0406**	**SD-G04-0406-FD**	**SD-G05-0002**	**SD-G05-0406**	**SD-G05-0607**	**SD-G06-0002**	**SD-G06-0406**
ANTIMONY	MG/KG	0.51	--	--	410	**7.6 J**	**6.9 J**	**13**	**6.7 J**	**11**	**6.2 J**	**3.3 J**	**3.2 J**	**3.1 J**	**2.3 J**	**0.21 J**	**3**	**0.22**
ARSENIC	MG/KG	0.14	7.24	33	92	**50 J**	**29 J**	**57**	**29 J**	**84**	**41 J**	**71**	**69**	**22 J**	**31**	**9.8**	**120**	**10**
BERYLLIUM	MG/KG	0.25	--	--	96	**0.15 J**	**0.26 J**	**0.24**	**0.6 J**	**0.75**	**0.36 J**	**0.92**	**0.95**	**0.84 J**	**0.76**	**1.4**	**0.99**	**1.1**
CADMIUM	MG/KG	0.25	0.68	4.98	1706	**90 J**	**33 J**	**71 J**	**14 J**	**20 J**	**34 J**	**5.6 J**	**5.5 J**	**8 J**	**11 J**	**0.35 J**	**5.8 J**	**0.26 J**
CHROMIUM	MG/KG	0.67	52.3	111	133098	**7300 J**	**3900 J**	**5600**	**2600 J**	**1900**	**4200 J**	**350**	**410**	**1100 J**	**1100**	**66**	**560**	**50**
COPPER	MG/KG	0.51	18.7	149	273022	**540 J**	**400 J**	**580**	**290 J**	**500**	**440 J**	**210**	**210**	**180 J**	**240**	**35**	**230**	**38.00**
LEAD	MG/KG	0.25	30.2	128	--	**890 J**	**300 J**	**840**	**190 J**	**1200**	**560 J**	**840**	**800**	**180 J**	**300**	**45**	**1100**	**45**
MERCURY	MG/KG	0.05	0.18*	1.06	48	**1.1 J**	**0.63 J**	**1.8**	**0.53 J**	**1.7**	**1.5 J**	**1.4**	**1**	**0.49 J**	**0.74**	**0.19**	**0.95**	**0.17**
NICKEL	MG/KG	0.25	15.9	48.6	136511	**170 J**	**170 J**	**160**	**140 J**	**54**	**92 J**	**37**	**41**	**60 J**	**32**	**26**	**30**	**26**
SELENIUM	MG/KG	1.28	2*	--	34128	**1.4 J**	**1.5 J**	**2.7 J**	**2 J**	**13 J**	**3.4 J**	**30**	**30**	**2.3 J**	**4**	**0.81**	**16 J**	**0.87 J**
SILVER	MG/KG	0.25	0.73	--	1365	**10 J**	**4.8 J**	**12**	**3 J**	**7.6**	**8.1 J**	**0.64**	**0.64**	**2.2 J**	**3**	**0.14**	**1.4**	**0.12**
THALLIUM	MG/KG	0.25	--	--	68	**0.16 J**	**0.28 J**	**0.28**	**0.34 J**	**0.82**	**0.55 J**	**0.62**	**0.66**	**0.38 J**	**0.41**	**0.21**	**0.7**	**0.19**
ZINC	MG/KG	1.83	124	459	2047665	**16000 J**	**11000 J**	**12000**	**3900 J**	**3500**	**8000 J**	**1600**	**1500**	**1900 J**	**1300**	**110**	**2000**	**100**
CYANIDE, TOTAL	MG/KG	0.72	0.1*	--	4095	**4.8 J**	**8.4 J**	**15**	**4 J**	**24**	**8.2 J**	**7 J**	**9.1 J**	**12 J**	**3 J**	**7.4 J**	**18**	**0.2 J**
OIL AND GREASE	MG/KG	364.57	--	--	--	3500 J	2500 J	1700	5000 J	2000	2900 J	260	270 U	740 J	330	190 U	290 U	200 U
PERCENT MOISTURE	%	0.10	--	--	--	70	74	69	74	70	75	63	64	78	59	52	67	54
TOTAL ORGANIC CARBON	MG/KG	2873	--	--	--	220000	240000	270000	160000	120000	210000	43000	38000	130000	45000	26000	57000	20000

						Southwest/Tin Mill Canal Effluent Grouping												
ANALYTE	**UNITS**	**AVG RL**	**BTAG[1]**	**PEC[2]**	**HHRA[3]**	**SD-H07-0002-FD**	**SD-H07-0406**	**SD-I01-0001**	**SD-I01-0102**	**SD-I02-0002**	**SD-I02-0204**	**SD-I02-0406**	**SD-I03-0002**	**SD-I03-0204**	**SD-I03-0406**	**SD-J02-0002**	**SD-J02-0204**	**SD-J02-0406**
ANTIMONY	MG/KG	0.51	--	--	410	**2.6**	**0.97 J**	**1.1 J**	**0.13 J**	**3.3 J**	**1.8 J**	**0.15 J**	**3.4**	**0.69**	**0.1 J**	**2.1 J**	**1.4 J**	**0.11 J**
ARSENIC	MG/KG	0.14	7.24	33	92	**57**	**43**	**35**	**9.6**	**47 J**	**33**	**7.1**	**99**	**30**	**7.6**	**27 J**	**40**	**8.1**
BERYLLIUM	MG/KG	0.25	--	--	96	**1**	**1.1**	**0.6**	**0.32**	**0.96 J**	**0.77**	**1**	**1.1**	**1.1**	**1**	**1.5 J**	**1.7**	**1.4**
CADMIUM	MG/KG	0.25	0.68	4.98	1706	**7.5 J**	**3.5 J**	**2.9**	**0.26**	**17 J**	**7.3 J**	**0.25 J**	**8.9 J**	**1.5 J**	**0.16 J**	**4.8 J**	**3.7**	**0.2**
CHROMIUM	MG/KG	0.67	52.3	111	133098	**900**	**360**	**190**	**22**	**1900 J**	**850**	**39**	**1000**	**210**	**30**	**750 J**	**470**	**41**
COPPER	MG/KG	0.51	18.7	149	273022	**230**	**120**	**110**	**13**	**370 J**	**210**	**15**	**270**	**74**	**14**	**200 J**	**150**	**17**
LEAD	MG/KG	0.25	30.2	128	--	**570**	**360**	**450**	**27**	**430 J**	**250**	**19**	**840**	**170**	**16**	**210 J**	**210**	**17**
MERCURY	MG/KG	0.05	0.18*	1.06	48	**0.97**	**1.1**	**0.72**	**0.054**	**0.58 J**	**0.63**	**0.018 J**	**1.5**	**1.1**	**0.018 J**	**0.57 J**	**0.9**	**0.018 J**
NICKEL	MG/KG	0.25	15.9	48.6	136511	**39**	**40**	**23 J**	**9.1 J**	**61 J**	**30**	**21**	**46**	**36**	**19**	**56 J**	**40 J**	**24 J**
SELENIUM	MG/KG	1.28	2*	--	34128	**10 J**	**9.8**	**8 J**	**0.67 J**	**7.3 J**	**4.8**	**0.71**	**17 J**	**3.6 J**	**0.73 J**	**3.7 J**	**5.3 J**	**0.78 J**
SILVER	MG/KG	0.25	0.73	--	1365	**2**	**0.39**	**0.51 J**	**0.057 J**	**4.3 J**	**2**	**0.067 J**	**1.6**	**0.27**	**0.052 J**	**1.8 J**	**0.94 J**	**0.064 J**
THALLIUM	MG/KG	0.25	--	--	68	**0.64**	**0.41**	**0.36**	**0.085**	**0.86 J**	**0.43**	**0.18**	**0.81**	**0.31**	**0.16**	**0.41 J**	**0.45**	**0.16**
ZINC	MG/KG	1.83	124	459	--	**1700**	**680**	**990**	**71**	**3000 J**	**990**	**71**	**1900**	**380**	**58**	**1200 J**	**710**	**73**
CYANIDE, TOTAL	MG/KG	0.72	0.1*	--	4095	**36**	**8.1 J**	**9.6 J**	**2 J**	**13 J**	**6.5 J**	**0.23 J**	**22**	0.58 U	**0.77 J**	**2.8 J**	**11**	0.58 U
OIL AND GREASE	MG/KG	364.57	--	--	--	420	250	170 U	140 U	420 J	660	240 U	1600	220	230 U	410 UJ	500	230 U
PERCENT MOISTURE	%	0.1	--	--	--	69	53	47	31	77	68	61	66	57	58	76	64	58
TOTAL ORGANIC CARBON	MG/KG	2873	--	--	--	79000	25000	18000	6800	78000	75000	21000	53000	32000	19000	81000	62000	17000

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

This table includes data that were not considered in the risk assessments (i.e., data for subsurface sediments). Tables 8-6 through 8-10 present data used in the risk assessment for the Southwest Grouping.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater sediment benchmark

[2] Probable Effects Concentrations from MacDonald, 2000.

[3] Calculated site-specific human health screening levels, Appendix H.

Value exceeds BTAG benchmark

Value exceeds PEC

Value exceeds human health screening level

-- = no screening criterion or not analyzed

mg/kg = milligrams per kilogram

RL = reporting limit

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

U = compound was analyzed, but not detected

TABLE 5-9 POLYCYCLIC AROMATIC HYDROCARBON CONCENTRATIONS IN SEDIMENT CORE SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

						Southwest/Tin Mill Canal Effluent Grouping											
ANALYTE	UNITS	AVG RL	BTAG[1]	PEC[2]	HHRA[3]	SD-DE02-0002	SD-DE02-0406	SD-E03-0002	SD-E03-0204	SD-E03-0204-FD	SD-E03-0406	SD-F03-0002	SD-F04-0002	SD-F04-0406	SD-F06-0002	SD-F06-0406	SD-F07-0002	SD-F07-0406
ACENAPHTHENE	UG/KG	298.57	6.71	--	3.15E+07	240 J	110 J	140 J	46 J	53	35 U	770	840 U	160	670 J	160	850 J	190
ACENAPHTHYLENE	UG/KG	298.57	5.87	--	3.15E+07	610 J	250	360 J	170	190	35 U	170	1500	66 J	740 J	390	620 J	540
ANTHRACENE	UG/KG	298.57	46.9	845	1.58E+08	1100 J	350	750 J	280	350	15 J	460 J	2100	76 J	1100 J	440	1300 J	830
FLUORENE	UG/KG	298.57	21.2	536	2.10E+07	380 J	250	170 J	100	150	35 U	980	1700	290	650 J	230	1500 J	370
NAPHTHALENE	UG/KG	298.57	34.6	561	1.05E+07	1200 J	1400	950 J	580	850	41	230	1700	22 J	9100 J	2000	2900 J	2200
PHENANTHRENE	UG/KG	298.57	86.7	1170	1.58E+07	1400 J	780	930 J	370	510	29 J	3500 J	7900	1400	2800 J	870	7000 J	1300
BENZO[A]ANTHRACENE	UG/KG	298.57	74.8	1050	1.68E+04	3700 J	860	2000 J	940	760	35	660	2600	210	3800 J	1000	3600 J	2000
BENZO[A]PYRENE	UG/KG	298.57	88.8	1450	1.68E+03	3500 J	840	1500 J	900	850	42	110 U	2500	120 U	3000 J	1000	3700 J	1700
BENZO[B]FLUORANTHENE	UG/KG	298.57	27.2	--	1.68E+04	3000 J	1100	1400 J	810	1000	35	440	2600	120 U	3100 J	1200	4600 J	2100
BENZO[G,H,I]PERYLENE	UG/KG	298.57	170*	--	--	3200 J	670	1400 J	810	730	32 J	110 U	2800	120 U	2500 J	950	3500 J	1700
BENZO[K]FLUORANTHENE	UG/KG	298.57	240*	--	1.68E+05	1500 J	310	890 J	220	330	23 J	370	810 J	120 U	1600 J	620	2400 J	910
CHRYSENE	UG/KG	298.57	108	1290	1.68E+06	3600 J	890	2000 J	980	700	35	1100	2800	430	4300 J	1200	4100 J	1700
DIBENZ(A,H)ANTHRACENE	UG/KG	298.57	6.22	--	1.68E+03	600 J	200 U	330 J	160	230	35 U	110 U	840 U	120 U	610 J	250	320 UJ	400
FLUORANTHENE	UG/KG	298.57	113	2230	2.10E+07	7600 J	1800	4900 J	1000	900	64	2300 J	8600	610	6900 J	2100	7900 J	4700
INDENO[1,2,3-CD]PYRENE	UG/KG	298.57	17	--	1.68E+04	2400 J	660	1100 J	440	640	23 J	110 U	1800	120 U	1900 J	830	2600 J	1400
PYRENE	UG/KG	298.57	153	1520	1.58E+07	5700 J	1300	2800 J	2200 J	1300 J	55	1700	6600	550	4700 J	1600	5300 J	2300
TOTAL PAHs ND=0	UG/KG	--	2900	22800	--	39730	11570	21620	10006	9543	429	12680	46010	3814	47470	14840	51870	24340

						Southwest/Tin Mill Canal Effluent Grouping											
ANALYTE	UNITS	AVG RL	BTAG[1]	PEC[2]	HHRA[3]	SD-H01-0002	SD-H01-0406	SD-H03-0002	SD-H03-0406	SD-H03-0607	SD-H04-0002	SD-H04-0002-FD	SD-H04-0406	SD-H05-0002	SD-H05-0406	SD-H06-0002	SD-H06-0002-FD	SD-H06-0204
ACENAPHTHENE	UG/KG	298.57	6.71	--	--	1400	1500 J	1400 UJ	810	11 J	1400 UJ	3100 J	660	330 J	1100 J	150 J	280 J	590 J
ACENAPHTHYLENE	UG/KG	298.57	5.87	--	3.15E+07	2500	450 J	1000 UJ	440	43	2500 J	2900 J	610	920	1100 J	640 J	1000 J	850 J
ANTHRACENE	UG/KG	298.57	46.9	845	1.58E+08	4100	850 J	950 UJ	640 J	76	3200 J	3300 J	1300	1300	1600 J	520 J	930 J	880 J
FLUORENE	UG/KG	298.57	21.2	536	2.10E+07	3200	2000 J	2000 J	1200	23	4000 J	4600 J	750	850	2400 J	220 J	490 J	960 J
NAPHTHALENE	UG/KG	298.57	34.6	561	1.05E+07	3300	7000 J	6000 J	1500	130	5500 J	5900 J	6400	760	2700 J	820 J	1000 J	3100 J
PHENANTHRENE	UG/KG	298.57	86.7	1170	1.58E+07	14000	9500 J	6400 J	5500 J	100	14000 J	17000 J	3400	3900	12000 J	950 J	2000 J	3800 J
BENZO[A]ANTHRACENE	UG/KG	298.57	74.8	1050	1.68E+04	4900	1400 J	980 J	1200	190	4400 J	4100 J	2700	2400	3800 J	1600 J	2000 J	3200 J
BENZO[A]PYRENE	UG/KG	298.57	88.8	1450	1.68E+03	4300	240 UJ	300 UJ	890	160	3300 J	3500 J	2100	2200	2900 J	1700 J	1900 J	2600 J
BENZO[B]FLUORANTHENE	UG/KG	298.57	27.2	--	1.68E+04	5800	240 UJ	300 UJ	1300	220	2600 J	2100 J	2800	2100	3000 J	1600 J	1800 J	2800 J
BENZO[G,H,I]PERYLENE	UG/KG	298.57	170*	--	--	4300	240 UJ	300 UJ	200 U	130	1400 UJ	2800 J	1900	2600	2400 J	2000 J	2200 J	2700 J
BENZO[K]FLUORANTHENE	UG/KG	298.57	240*	--	1.68E+05	1100 U	240 UJ	300 UJ	480	57	2200 J	3300 J	1000	890	940 J	730 J	720 J	850 J
CHRYSENE	UG/KG	298.57	108	1290	1.68E+06	4500	2200 J	1300 UJ	1800	180	5200 J	5400 J	2900	2400	5300 J	1600 J	1900 J	3400 J
DIBENZ(A,H)ANTHRACENE	UG/KG	298.57	6.22	--	1.68E+03	1100 U	240 UJ	300 UJ	200 U	43	1400 UJ	1400 UJ	440	440 U	470 UJ	310 UJ	410 J	530 J
FLUORANTHENE	UG/KG	298.57	113	2230	2.10E+07	14000	4700 J	2800 J	3800 J	330	11000 J	12000 J	6200	7300	13000 J	4300 J	4900 J	8100 J
INDENO[1,2,3-CD]PYRENE	UG/KG	298.57	17	--	1.68E+04	3200	240 UJ	300 UJ	200 U	120	1800 J	1800 J	1700	1800	1600 J	1300 J	1500 J	1700 J
PYRENE	UG/KG	298.57	153	1520	1.58E+07	10000	3800 J	3200 J	2800	240	9500 J	11000 J	4700	3800	8400 J	2400 J	2700 J	4300 J
TOTAL PAHs ND=0	UG/KG	--	2900	22800	--	79500	33400	26030	22360	2053	69200	82800	39560	33550	62240	20530	25730	40360

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

This table includes data that were not considered in the risk assessments (i.e., data for subsurface sediments). Tables 8-6 through 8-10 present data used in the risk assessment for the Southwest Grouping.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater sediment benchmark

[2] Probable Effects Concentrations from MacDonald, 2000.

[3] Calculated site-specific human health screening levels, Appendix H.

Value exceeds BTAG benchmark

Value exceeds PEC

Value exceeds human health screening level

-- = no screening criterion

ug/kg = micrograms per kilogram

RL = reporting limit

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

U = compound was analyzed, but not detected

TABLE 5-9 POLYCYCLIC AROMATIC HYDROCARBON CONCENTRATIONS IN SEDIMENT CORE SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

						Southwest/Tin Mill Canal Effluent Grouping												
ANALYTE	UNITS	AVG RL	BTAG[1]	PEC[2]	HHRA[3]	SD-G01-0002	SD-G01-0406	SD-G02-0002	SD-G02-0406	SD-G03-0002	SD-G03-0406	SD-G04-0002	SD-G04-0406	SD-G04-0406-FD	SD-G05-0002	SD-G05-0406	SD-G05-0607	SD-G06-0002	SD-G06-0406
ACENAPHTHENE	UG/KG	298.57	6.71	--	3.15E+07	450	1700 J	890 J	1700	380 J	310	640 J	110	110	110 J	170	4.8 J	110	36 U
ACENAPHTHYLENE	UG/KG	298.57	5.87	--	3.15E+07	1800	530 J	950 J	580	710 J	470	580 J	370	440	260 J	240	5 J	400	36 U
ANTHRACENE	UG/KG	298.57	46.9	845	1.58E+08	3100	1200 J	1000 J	1600	560 J	1300	1200 J	510	690	280 J	410 J	10 J	660	15 J
FLUORENE	UG/KG	298.57	21.2	536	2.10E+07	2000	2800 J	2000 J	3200	730 J	740	1200 J	210	290	180 J	250	9.5 J	290	36 U
NAPHTHALENE	UG/KG	298.57	34.6	561	1.05E+07	1800	730 J	2100 J	1000 J	1600 J	2200	920 J	1700	2600	690 J	4400	67	3500	26 J
PHENANTHRENE	UG/KG	298.57	86.7	1170	1.58E+07	11000	11000 J	5800 J	15000	2400 J	3600	5800 J	740	980	630 J	1000 J	29	990	34 J
BENZO[A]ANTHRACENE	UG/KG	298.57	74.8	1050	1.68E+04	3500	1400 J	1200 J	1700	1100 J	2900	1300 J	1400	1500	710 J	1200	24	1500	34 J
BENZO[A]PYRENE	UG/KG	298.57	88.8	1450	1.68E+03	3300	R	260 UJ	430 U	950 J	1900	2600 J	1200	1500	800 J	850	25	1600	31 J
BENZO[B]FLUORANTHENE	UG/KG	298.57	27.2	--	1.68E+04	1300	R	800 J	860	1000 J	2100	680 J	1500	2000	660 J	720	30	1800	35 J
BENZO[G,H,I]PERYLENE	UG/KG	298.57	170*	--	--	3500	R	760 J	430 U	1500 J	1600	1000 J	1200	1400	830 J	630	22	1600	30 J
BENZO[K]FLUORANTHENE	UG/KG	298.57	240*	--	1.68E+05	3300	R	350 J	1400	260 J	710	1000 J	590	430	500 J	590	12 J	800	11 J
CHRYSENE	UG/KG	298.57	108	1290	1.68E+06	3200	2200 J	1500 J	3200	1100 J	3100	2200 J	1400	1500	710 J	1100	27	1300	35 J
DIBENZ(A,H)ANTHRACENE	UG/KG	298.57	6.22	--	1.68E+03	800	R	260 UJ	430 U	250 UJ	600	130 UJ	270	350	140 J	180	21 U	380	36 U
FLUORANTHENE	UG/KG	298.57	113	2230	2.10E+07	12000	5900 J	4000 J	6700	3100 J	7300	5300 J	3400	3900	1600 J	2200 J	52	4000	64
INDENO[1,2,3-CD]PYRENE	UG/KG	298.57	17	--	1.68E+04	2600	R	520 J	430 U	840 J	1300	630 J	1200	1300	580 J	560	21	1400	22 J
PYRENE	UG/KG	298.57	153	1520	1.58E+07	6300	4400 J	2700 J	4700	2000 J	3500	3800 J	1800	2000	1100 J	1300	41	2400	51
TOTAL PAHs ND=0	UG/KG	--	2900	22800	--	59950	31860	24570	41640	18230	33630	28850	17600	20990	9780	15800	379.3	22730	388

						Southwest/Tin Mill Canal Effluent Grouping												
ANALYTE	UNITS	AVG RL	BTAG[1]	PEC[2]	HHRA[3]	SD-H07-0002	SD-H07-0002-FD	SD-H07-0406	SD-I01-0001	SD-I01-0102	SD-I02-0002	SD-I02-0204	SD-I02-0406	SD-I03-0002	SD-I03-0204	SD-I03-0406	SD-J02-0002	SD-J02-0204	SD-J02-0406
ACENAPHTHENE	UG/KG	298.57	6.71	--	--	160 J	110	60	32	7.1 J	100 J	190	43 U	79	36 J	7.9 U	91 J	200 J	16 U
ACENAPHTHYLENE	UG/KG	298.57	5.87	--	3.15E+07	790 J	660	260	220	14 J	250 J	290	43 U	560	130	7.9 U	280 J	260	16 U
ANTHRACENE	UG/KG	298.57	46.9	845	1.58E+08	1300 J	1000	300	280	20	440 J	360	43 U	650	220	7.9 U	340 J	370	16 U
FLUORENE	UG/KG	298.57	21.2	536	2.10E+07	300 J	280	110	77	12 J	170 J	270	43 U	210	91	7.9 U	110 J	190 J	16 U
NAPHTHALENE	UG/KG	298.57	34.6	561	1.05E+07	4800 J	4200	1400	750	89	1000 J	3400	43 U	2300	530	7.9 U	1400 J	3000	6.4 J
PHENANTHRENE	UG/KG	298.57	86.7	1170	1.58E+07	1000 J	920	400	240	42	920 J	1300	43 U	660	310	7.9 U	390 J	760	16 U
BENZO[A]ANTHRACENE	UG/KG	298.57	74.8	1050	1.68E+04	6400 J	5600	860	790	52	2000 J	1800	43 U	3500	590	7.9 U	1300 J	1400	16 U
BENZO[A]PYRENE	UG/KG	298.57	88.8	1450	1.68E+03	5300 J	4600	890	930	56	1800 J	1300	43 U	3200	570	7.9 U	1700 J	1200	16 U
BENZO[B]FLUORANTHENE	UG/KG	298.57	27.2	--	1.68E+04	6100 J	5000	1100	1100	74	1700 J	1400	43 U	3300	640	7.9 U	2000 J	1400	16 U
BENZO[G,H,I]PERYLENE	UG/KG	298.57	170*	--	--	4500 J	4000	880	820	47	1900 J	1100	43 U	2700	580	7.9 U	1700 J	1100	16 U
BENZO[K]FLUORANTHENE	UG/KG	298.57	240*	--	1.68E+05	1500 J	1700	360	550	18	830 J	550	43 U	1500	240	7.9 U	550 J	580	16 U
CHRYSENE	UG/KG	298.57	108	1290	1.68E+06	5800 J	4900	700	750	49	1700 J	1600	43 U	3000	450	7.9 U	1400 J	1500	16 U
DIBENZ(A,H)ANTHRACENE	UG/KG	298.57	6.22	--	1.68E+03	1100 J	1100	250	250	14 J	320 J	250	43 U	780	140	7.9 U	390 J	260	16 U
FLUORANTHENE	UG/KG	298.57	113	2230	2.10E+07	13000 J	10000	1700	950	75	4100 J	3200	15 J	6700	1000	7.9 U	2800 J	2500	6 J
INDENO[1,2,3-CD]PYRENE	UG/KG	298.57	17	--	1.68E+04	3600 J	3300	740	750	42	1200 J	810	43 U	2400	480	7.9 U	1300 J	830	16 U
PYRENE	UG/KG	298.57	153	1520	1.58E+07	7200 J	6500	1100	940	70	2800 J	2000	11 J	4200	730	7.9 U	1800 J	1700	4.4 J
TOTAL PAHs ND=0	UG/KG	--	2900	22800	--	62850	53870	11110	9429	681.1	21230	19820	26	35739	6737	0	17551	17250	16.8

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

This table includes data that were not considered in the risk assessments (i.e., data for subsurface sediments). Tables 8-6 through 8-10 present data used in the risk assessment for the Southwest Grouping.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater sediment benchmark

[2] Probable Effects Concentrations from MacDonald, 2000.

[3] Calculated site-specific human health screening levels, Appendix H.

Value exceeds BTAG benchmark

Value exceeds PEC

Value exceeds human health screening level

-- = no screening criterion

ug/kg = micrograms per kilogram

RL = reporting limit

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

U = compound was analyzed, but not detected

TABLE 5-10 POLYCHLORINATED BIPHENYL CONCENTRATIONS IN SEDIMENT CORE SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

						Southwest/Tin Mill Canal Effluent Grouping												
ANALYTE	**UNITS**	**AVG RL**	**BTAG[1]**	**PEC[2]**	**HHRA[3]**	**SD-DE02-0002**	**SD-DE02-0406**	**SD-E03-0002**	**SD-E03-0204**	**SD-E03-0204-FD**	**SD-E03-0406**	**SD-F03-0002**	**SD-F04-0002**	**SD-F04-0406**	**SD-F06-0002**	**SD-F06-0406**	**SD-F07-0002**	**SD-F07-0406**
PCB-1016	UG/KG	26.56	--	--	3.41E+04	21 UJ	6.3 U	10 UJ	6.5 U	6.5 U	4.3 U	66 U	11 U	60 U	19 UJ	13 U	200 UJ	6.5 U
PCB-1221	UG/KG	26.56	--	--	1.48E+04	21 UJ	6.3 U	10 UJ	6.5 U	6.5 U	4.3 U	66 U	11 U	60 U	19 UJ	13 U	200 UJ	6.5 U
PCB-1232	UG/KG	26.56	--	--	1.48E+04	21 UJ	6.3 U	10 UJ	6.5 U	6.5 U	4.3 U	66 U	11 U	60 U	19 UJ	13 U	200 UJ	6.5 U
PCB-1242	UG/KG	26.56	--	--	--	21 UJ	6.3 U	10 UJ	6.5 U	6.5 U	4.3 U	66 U	11 U	60 U	19 UJ	13 U	200 UJ	6.5 U
PCB-1248	UG/KG	26.56	--	--	1.48E+04	320 J	23 J	2500 J	5.7 J	5.9 J	4.3 U	5100	220	2800	2200 J	34 J	5100 J	5.7 J
PCB-1254	UG/KG	26.56	--	--	9.75E+03	290 J	22 J	840 J	6.5 U	6.5 U	4.3 U	1800	230	1300 J	1400 J	47 J	1800 J	3.5 J
PCB-1260	UG/KG	26.56	--	--	1.48E+04	160 J	12 J	320 J	4.5 J	4.1 J	4.3 U	540	160	250	490 J	33 J	550 J	6.5 U
Total PCBs ND=0	UG/KG	--	40	676	--	**770**	**57**	**3660**	**10.2**	**10**	0	**7440**	**610**	**4350**	**4090**	**114**	**7450**	**9.2**

						Southwest/Tin Mill Canal Effluent Grouping												
ANALYTE	**UNITS**	**AVG RL**	**BTAG[1]**	**PEC[2]**	**HHRA[3]**	**SD-H01-0002**	**SD-H01-0406**	**SD-H03-0002**	**SD-H03-0406**	**SD-H03-0607**	**SD-H04-0002**	**SD-H04-0002-FD**	**SD-H04-0406**	**SD-H05-0002**	**SD-H05-0406**	**SD-H06-0002**	**SD-H06-0002-FD**	**SD-H06-0204**
PCB-1016	UG/KG	26.56	--	--	3.41E+04	13 U	150 UJ	19 UJ	12 U	0.91 U	17 UJ	17 UJ	12 U	6.8 U	150 UJ	9.7 UJ	9.9 UJ	85 UJ
PCB-1221	UG/KG	26.56	--	--	1.48E+04	13 U	150 UJ	19 UJ	12 U	0.91 U	17 UJ	17 UJ	12 U	6.8 U	150 UJ	9.7 UJ	9.9 UJ	85 UJ
PCB-1232	UG/KG	26.56	--	--	1.48E+04	13 U	150 UJ	19 UJ	12 U	0.91 U	17 UJ	17 UJ	12 U	6.8 U	150 UJ	9.7 UJ	9.9 UJ	85 UJ
PCB-1242	UG/KG	26.56	--	--	--	13 U	150 UJ	19 UJ	12 U	0.91 U	17 UJ	17 UJ	12 U	6.8 U	150 UJ	9.7 UJ	9.9 UJ	85 UJ
PCB-1248	UG/KG	26.56	--	--	1.48E+04	300 J	8100 J	1600 J	1900	7.7	530 J	510 J	44 J	120 J	6900 J	89 J	100 J	5700 J
PCB-1254	UG/KG	26.56	--	--	9.75E+03	13 U	3800 J	2400 J	620	5.7	770 J	690 J	41 J	6.8 U	3200 J	9.7 UJ	9.9 UJ	2300 J
PCB-1260	UG/KG	26.56	--	--	1.48E+04	44 J	860 J	2000 J	170	3.4	560 J	540 J	31 J	37 J	990 J	42 J	47 J	810 J
Total PCBs ND=0 [4]	UG/KG	--	40	676	--	**344**	**12760**	**6000**	**2690**	**16.8**	**1860**	**1740**	**116**	**157**	**11090**	**131**	**147**	**8810**

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

This table includes data that were not considered in the risk assessments (i.e., data for subsurface sediments). Tables 8-6 through 8-10 present data used in the risk assessment for the Southwest Grouping.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group.

[2] Probable Effects Concentrations from MacDonald, 2000.

[3] Calculated site-specific human health screening levels, Appendix H.

[4] Sum of detected Aroclors (including J-qualified). Non-detects not included.

Value exceeds BTAG benchmark

Value exceeds PEC

RL = reporting limit

P = The %RPD between the primary and confirmation column/detector is >40%. The lower value has been reported

U = compound was analyzed, but not detected

TABLE 5-10 POLYCHLORINATED BIPHENYL CONCENTRATIONS IN SEDIMENT CORE SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

						Southwest/Tin Mill Canal Effluent Grouping												
ANALYTE	UNITS	AVG RL	BTAG[1]	PEC[2]	HHRA[3]	SD-G01-0002	SD-G01-0406	SD-G02-0002	SD-G02-0406	SD-G03-0002	SD-G03-0406	SD-G04-0002	SD-G04-0406	SD-G04-0406-FD	SD-G05-0002	SD-G05-0406	SD-G05-0607	SD-G06-0002	SD-G06-0406
PCB-1016	UG/KG	26.56	--	--	3.41E+04	11 U	140 UJ	16 UJ	140 U	16 UJ	140 U	170 UJ	5.6 U	5.7 U	9.4 UJ	25 U	0.87 U	6.3 U	4.5 U
PCB-1221	UG/KG	26.56	--	--	1.48E+04	11 U	140 UJ	16 UJ	140 U	16 UJ	140 U	170 UJ	5.6 U	5.7 U	9.4 UJ	25 U	0.87 U	6.3 U	4.5 U
PCB-1232	UG/KG	26.56	--	--	1.48E+04	11 U	140 UJ	16 UJ	140 U	16 UJ	140 U	170 UJ	5.6 U	5.7 U	9.4 UJ	25 U	0.87 U	6.3 U	4.5 U
PCB-1242	UG/KG	26.56	--	--	--	11 U	140 UJ	16 UJ	140 U	16 UJ	140 U	170 UJ	5.6 U	5.7 U	9.4 UJ	25 U	0.87 U	6.3 U	4.5 U
PCB-1248	UG/KG	26.56	--	--	1.48E+04	260	6500 J	600 J	8200 J	470 J	8900 J	9000 J	5.6 U	5.7 U	290 J	1900	10	94 J	4.5 U
PCB-1254	UG/KG	26.56	--	--	9.75E+03	100	2600 J	560 J	2800	580 J	2700	3200 J	5.6 U	5.7 U	320 J	540	6.1 J	130 J	4.5 U
PCB-1260	UG/KG	26.56	--	--	1.48E+04	11 U	850 J	390 J	840	300 J	760	1000 J	2.7 J	1.7 J	170 J	25 U	2.1	50 J	4.5 U
Total PCBs ND=0	UG/KG	--	40	676	--	**360**	**9950**	**1550**	**11840**	**1350**	**12360**	**13200**	**2.7**	**1.7**	**780**	**2440**	**18.2**	**274**	0

						Southwest/Tin Mill Canal Effluent Grouping												
ANALYTE	UNITS	AVG RL	BTAG[1]	PEC[2]	HHRA[3]	SD-H07-0002	SD-H07-0002-FD	SD-H07-0406	SD-I01-0001	SD-I01-0102	SD-I02-0002	SD-I02-0204	SD-I02-0406	SD-I03-0002	SD-I03-0204	SD-I03-0406	SD-J02-0002	SD-J02-0204	SD-J02-0406
PCB-1016	UG/KG	26.56	--	--	3.41E+04	35 UJ	34 U	4.5 U	0.78 U	0.6 U	9.2 UJ	6.6 U	5.4 U	6.2 U	4.9 U	4.9 U	17 UJ	12 U	0.98 U
PCB-1221	UG/KG	26.56	--	--	1.48E+04	35 UJ	34 U	4.5 U	0.78 U	0.6 U	9.2 UJ	6.6 U	5.4 U	6.2 U	4.9 U	4.9 U	17 UJ	12 U	0.98 U
PCB-1232	UG/KG	26.56	--	--	1.48E+04	35 UJ	34 U	4.5 U	0.78 U	0.6 U	9.2 UJ	6.6 U	5.4 U	6.2 U	4.9 U	4.9 U	17 UJ	12 U	0.98 U
PCB-1242	UG/KG	26.56	--	--	--	35 UJ	34 U	4.5 U	0.78 U	0.6 U	9.2 UJ	6.6 U	5.4 U	6.2 U	4.9 U	4.9 U	17 UJ	12 U	0.98 U
PCB-1248	UG/KG	26.56	--	--	1.48E+04	520 J	420 J	4.5 U	4.4 J	0.33 J	650 J	1300 J	5.7 J	260 J	4.9 U	4.9 U	200 J	620	1.1
PCB-1254	UG/KG	26.56	--	--	9.75E+03	310 J	260 J	4.5 U	9.2	0.55 J	470 J	450	5.4 U	120 J	4.9 U	4.9 U	190 J	420	0.83 J
PCB-1260	UG/KG	26.56	--	--	1.48E+04	100 J	81 J	4.5 U	5.3 J	0.35 J	160 J	160	5.4 U	40 J	4.9 U	4.9 U	100 J	150	0.37 J
Total PCBs ND=0 [4]	UG/KG	--	40	676	--	**930**	**761**	0	**18.9**	**1.23**	**1280**	**1910**	**5.7**	**420**	0	0	**490**	**1190**	**2.3**

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

This table includes data that were not considered in the risk assessments (i.e., data for subsurface sediments). Tables 8-6 through 8-10 present data used in the risk assessment for the Southwest Grouping.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group.

[2] Probable Effects Concentrations from MacDonald, 2000.

[3] Calculated site-specific human health screening levels, Appendix H.

[4] Sum of detected Aroclors (including J-qualified). Non-detects not included.

Value exceeds BTAG benchmark

Value exceeds PEC

RL = reporting limit

P = The %RPD between the primary and confirmation column/detector is

U = compound was analyzed, but not detected

TABLE 5-11 VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN SEDIMENT CORE SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

					Southwest/Tin Mill Canal Effluent Grouping													
ANALYTE	**UNITS**	**AVG RL**	**BTAG[1]**	**HHRA[2]**	**SD-DE02-0002**	**SD-DE02-0406**	**SD-E03-0002**	**SD-E03-0204**	**SD-E03-0204-FD**	**SD-E03-0406**	**SD-F03-0002**	**SD-F04-0002**	**SD-F04-0406**	**SD-F06-0002**	**SD-F06-0406**	**SD-F07-0002**	**SD-F07-0406**	**SD-G01-0002**	**SD-G01-0406**
1,1,1-TRICHLOROETHANE	UG/KG	15.11	856	--	26 UJ	15 U	25 UJ	16 UJ	16 UJ	10 UJ	7.9 U	13 U	7.2 UJ	22 UJ	15 U	24 UJ	16 U	14 UJ	17 UJ
1,1,2,2-TETRACHLOROETHANE	UG/KG	15.11	202	--	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ
1,1,2-TRICHLOROETHANE	UG/KG	15.11	570	--	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ
1,1-DICHLOROETHANE	UG/KG	15.11	--	--	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ
1,1-DICHLOROETHENE	UG/KG	15.11	2780	--	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ
1,2-DICHLOROBENZENE	UG/KG	15.11	989	6.14E+07	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ
1,2-DICHLOROETHANE	UG/KG	15.11	--	--	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ
1,2-DICHLOROPROPANE	UG/KG	15.11	--	--	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ
1,3-DICHLOROBENZENE	UG/KG	15.11	842	6.14E+07	26 UJ	15 U	25 UJ	16 U	16 U	10 U	**2.4 J**	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ
1,4-DICHLOROBENZENE	UG/KG	15.11	460	7.67E+06	26 UJ	15 U	25 UJ	16 U	16 U	10 U	**3.5 J**	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	**2.8 J**	17 UJ
2-CHLOROETHYL VINYL ETHER	UG/KG	30.27	--	--	52 UJ	31 U	50 UJ	31 U	31 U	21 U	16 U	25 U	14 U	45 UJ	31 U	48 UJ	31 U	28 U	34 UJ
ACROLEIN	UG/KG	302.72	--	--	520 UJ	310 U	500 UJ	310 UJ	310 UJ	210 UJ	160 U	250 U	140 U	450 UJ	310 U	480 UJ	310 U	280 UJ	340 UJ
ACRYLONITRILE	UG/KG	302.72	--	--	520 UJ	310 U	500 UJ	310 U	310 U	210 U	160 U	250 U	140 U	450 UJ	310 U	480 UJ	310 U	280 U	340 UJ
BENZENE	UG/KG	15.11	137	1.51E+08	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	**2.6 J**	**2.6 J**	22 UJ	15 U	24 UJ	16 U	**2.7 J**	**17 J**
BROMOFORM	UG/KG	15.11	1310	--	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ
BROMOMETHANE	UG/KG	15.11	--	--	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ
CARBON TETRACHLORIDE	UG/KG	15.11	7240	--	26 UJ	15 U	25 UJ	16 UJ	16 UJ	10 UJ	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 UJ	17 UJ
CHLOROBENZENE	UG/KG	15.11	162	1.37E+07	26 UJ	15 U	25 UJ	16 U	16 U	10 U	**32**	**4.6 J**	7.2 U	22 UJ	15 U	24 UJ	16 U	**9.7 J**	**2.8 J**
CHLORODIBROMOMETHANE	UG/KG	15.11	--	--	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ
CHLOROETHANE	UG/KG	15.11	--	--	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ
CHLOROFORM	UG/KG	15.11	--	--	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ
CHLOROMETHANE	UG/KG	15.11	--	--	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ
CIS-1,3-DICHLOROPROPENE	UG/KG	15.11	--	--	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ
DICHLOROBROMOMETHANE	UG/KG	15.11	--	--	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ
ETHYLBENZENE	UG/KG	15.11	305	1.26E+07	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	**4.7 J**	**2.5 J**	22 UJ	15 U	24 UJ	16 U	**8.6 J**	**19 J**
METHYLENE CHLORIDE	UG/KG	15.11	--	--	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ
TETRACHLOROETHENE	UG/KG	15.11	190	--	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ
TOLUENE	UG/KG	15.11	1090	1.82E+08	26 UJ	15 U	25 UJ	16 U	16 U	10 U	**1.3 J**	**12 J**	**30**	22 UJ	15 U	24 UJ	16 U	**34**	**220 J**
TRANS-1,2-DICHLOROETHENE	UG/KG	15.11	1050*	--	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ
TRANS-1,3-DICHLOROPROPENE	UG/KG	15.11	--	--	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ
TRICHLOROETHENE	UG/KG	15.11	8950	--	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ
VINYL CHLORIDE	UG/KG	15.11	--	--	26 UJ	15 U	25 UJ	16 U	16 U	10 U	7.9 U	13 U	7.2 U	22 UJ	15 U	24 UJ	16 U	14 U	17 UJ

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

This table includes data that were not considered in the risk assessments (i.e., data for subsurface sediments). Tables 8-6 through 8-10 present data used in the risk assessment for the Southwest Grouping.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater sediment benchmark

[2] Calculated site-specific human health screening levels, Appendix H.

RL = reporting limit

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

U = compound was analyzed, but not detected

*BTAG value from freshwater sediment screening values

TABLE 5-11 VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN SEDIMENT CORE SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

					Southwest/Tin Mill Canal Effluent Grouping																
ANALYTE	**UNITS**	**AVG RL**	**BTAG[1]**	**HHRA[2]**	**SD-G02-0002**	**SD-G02-0406**	**SD-G03-0002**	**SD-G03-0406**	**SD-G04-0002**	**SD-G04-0406**	**SD-G04-0406-FD**	**SD-G05-0002**	**SD-G05-0406**	**SD-G05-0607**	**SD-G06-0002**	**SD-G06-0406**	**SD-H01-0002**	**SD-H01-0406**	**SD-H03-0002**	**SD-H03-0406**	**SD-H03-0607**	**SD-H04-0002**
1,1,1-TRICHLOROETHANE	UG/KG	15.11	856	--	19 UJ	16 U	19 UJ	17 U	20 UJ	13 UJ	14 UJ	23 UJ	12 UJ	10 UJ	15 U	11 U	16 UJ	18 UJ	22 UJ	15 U	11 U	20 UJ
1,1,2,2-TETRACHLOROETHANE	UG/KG	15.11	202	--	19 UJ	16 U	19 UJ	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	22 UJ	15 U	11 U	20 UJ
1,1,2-TRICHLOROETHANE	UG/KG	15.11	570	--	19 UJ	**15 J**	19 UJ	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	22 UJ	15 U	11 U	20 UJ
1,1-DICHLOROETHANE	UG/KG	15.11	--	--	19 UJ	16 U	19 UJ	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	22 UJ	15 U	11 U	20 UJ
1,1-DICHLOROETHENE	UG/KG	15.11	2780	--	19 UJ	16 U	19 UJ	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	22 UJ	15 U	11 U	20 UJ
1,2-DICHLOROBENZENE	UG/KG	15.11	989	6.14E+07	**180 J**	**11 J**	**16 J**	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	**92 J**	15 U	11 U	**5.1 J**
1,2-DICHLOROETHANE	UG/KG	15.11	--	--	19 UJ	16 U	19 UJ	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	22 UJ	15 U	11 U	20 UJ
1,2-DICHLOROPROPANE	UG/KG	15.11	--	--	19 UJ	16 U	19 UJ	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	22 UJ	15 U	11 U	20 UJ
1,3-DICHLOROBENZENE	UG/KG	15.11	842	6.14E+07	19 UJ	16 U	**6.7 J**	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	**13 J**	15 U	11 U	**4.8 J**
1,4-DICHLOROBENZENE	UG/KG	15.11	460	7.67E+06	**28 J**	16 U	**10 J**	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	**4.4 J**	18 UJ	**19 J**	15 U	11 U	**6.7 J**
2-CHLOROETHYL VINYL ETHER	UG/KG	30.27	--	--	39 UJ	32 U	38 UJ	33 U	40 UJ	27 U	28 U	46 UJ	24 U	21 U	30 U	22 U	32 U	37 UJ	45 UJ	30 U	22 U	41 UJ
ACROLEIN	UG/KG	302.72	--	--	390 UJ	320 U	380 UJ	330 U	400 UJ	270 UJ	280 UJ	460 UJ	240 U	210 UJ	300 U	220 U	320 UJ	370 UJ	450 UJ	300 U	220 U	410 UJ
ACRYLONITRILE	UG/KG	302.72	--	--	390 UJ	320 U	380 UJ	330 U	400 UJ	270 U	280 U	460 UJ	240 U	210 U	300 U	220 U	320 U	370 UJ	450 UJ	300 U	220 U	410 UJ
BENZENE	UG/KG	15.11	137	1.51E+08	**12 J**	**16**	**4.5 J**	**2.4 J**	**8 J**	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	**4.5 J**	**15 J**	**9.6 J**	**8.3 J**	11 U	**3.6 J**
BROMOFORM	UG/KG	15.11	1310	--	19 UJ	16 U	19 UJ	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	22 UJ	15 U	11 U	20 UJ
BROMOMETHANE	UG/KG	15.11	--	--	19 UJ	16 U	19 UJ	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	22 UJ	15 U	11 U	20 UJ
CARBON TETRACHLORIDE	UG/KG	15.11	7240	--	19 UJ	16 U	19 UJ	17 U	20 UJ	13 UJ	14 UJ	23 UJ	12 U	10 UJ	15 U	11 U	16 UJ	18 UJ	22 UJ	15 U	11 U	20 UJ
CHLOROBENZENE	UG/KG	15.11	162	1.37E+07	**45 J**	16 U	**84 J**	**3.9 J**	**14 J**	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	**11 J**	18 UJ	**50 J**	15 U	11 U	**67 J**
CHLORODIBROMOMETHANE	UG/KG	15.11	--	--	19 UJ	16 U	19 UJ	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	22 UJ	15 U	11 U	20 UJ
CHLOROETHANE	UG/KG	15.11	--	--	19 UJ	16 U	19 UJ	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	22 UJ	15 U	11 U	20 UJ
CHLOROFORM	UG/KG	15.11	--	--	19 UJ	16 U	19 UJ	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	22 UJ	15 U	11 U	20 UJ
CHLOROMETHANE	UG/KG	15.11	--	--	19 UJ	16 U	19 UJ	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	22 UJ	15 U	11 U	20 UJ
CIS-1,3-DICHLOROPROPENE	UG/KG	15.11	--	--	19 UJ	16 U	19 UJ	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	22 UJ	15 U	11 U	20 UJ
DICHLOROBROMOMETHANE	UG/KG	15.11	--	--	19 UJ	16 U	19 UJ	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	22 UJ	15 U	11 U	20 UJ
ETHYLBENZENE	UG/KG	15.11	305	1.26E+07	**89 J**	**14 J**	**33 J**	**3.3 J**	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	**4.8 J**	**8.9 J**	**80 J**	**4.6 J**	11 U	20 UJ
METHYLENE CHLORIDE	UG/KG	15.11	--	--	19 UJ	16 U	19 UJ	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	22 UJ	15 U	11 U	20 UJ
TETRACHLOROETHENE	UG/KG	15.11	190	--	19 UJ	16 U	19 UJ	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	22 UJ	15 U	11 U	20 UJ
TOLUENE	UG/KG	15.11	1090	1.82E+08	**66 J**	**190**	**21 J**	**4.3 J**	**6.3 J**	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	**24**	**120 J**	**71 J**	**83 J**	11 U	**11 J**
TRANS-1,2-DICHLOROETHENE	UG/KG	15.11	1050*	--	19 UJ	16 U	19 UJ	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	22 UJ	15 U	11 U	20 UJ
TRANS-1,3-DICHLOROPROPENE	UG/KG	15.11	--	--	19 UJ	16 U	19 UJ	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	22 UJ	15 U	11 U	20 UJ
TRICHLOROETHENE	UG/KG	15.11	8950	--	19 UJ	16 U	19 UJ	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	22 UJ	15 U	11 U	20 UJ
VINYL CHLORIDE	UG/KG	15.11	--	--	19 UJ	16 U	19 UJ	17 U	20 UJ	13 U	14 U	23 UJ	12 U	10 U	15 U	11 U	16 U	18 UJ	22 UJ	15 U	11 U	20 UJ

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

This table includes data that were not considered in the risk assessments (i.e., data for subsurface sediments). Tables 8-6 through 8-10 present data used in the risk assessment for the Southwest Grouping.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assista unless marked with asterisk.

*BTAG freshwater sediment benchmark

[2] Calculated site-specific human health screening levels, Appendix H.

RL = reporting limit

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

U = compound was analyzed, but not detected

*BTAG value from freshwater sediment screening values

TABLE 5-11 VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN SEDIMENT CORE SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

					Southwest/Tin Mill Canal Effluent Grouping																		
ANALYTE	UNITS	AVG RL	BTAG[1]	HHRA[2]	SD-H04-0002-FD	SD-H04-0406	SD-H05-0002	SD-H05-0406	SD-H06-0002	SD-H06-0002-FD	SD-H06-0204	SD-H07-0002	SD-H07-0002-FD	SD-H07-0406	SD-I01-0001	SD-I01-0102	SD-I02-0002	SD-I02-0204	SD-I02-0406	SD-I03-0002	SD-I03-0204	SD-I03-0406	SD-J02-0002	SD-J02-0204	SD-J02-0406
1,1,1-TRICHLOROETHANE	UG/KG	15.11	856	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 UJ	9.4 U	7.3 UJ	22 UJ	16 UJ	13 UJ	15 U	12 UJ	12 UJ	21 UJ	14 U	12 U
1,1,2,2-TETRACHLOROETHANE	UG/KG	15.11	202	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
1,1,2-TRICHLOROETHANE	UG/KG	15.11	570	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
1,1-DICHLOROETHANE	UG/KG	15.11	--	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
1,1-DICHLOROETHENE	UG/KG	15.11	2780	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
1,2-DICHLOROBENZENE	UG/KG	15.11	989	6.14E+07	**3.4 J**	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
1,2-DICHLOROETHANE	UG/KG	15.11	--	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
1,2-DICHLOROPROPANE	UG/KG	15.11	--	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
1,3-DICHLOROBENZENE	UG/KG	15.11	842	6.14E+07	**6.1 J**	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
1,4-DICHLOROBENZENE	UG/KG	15.11	460	7.67E+06	**7.9 J**	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
2-CHLOROETHYL VINYL ETHER	UG/KG	30.27	--	--	41 UJ	28 U	32 U	35 UJ	46 UJ	48 UJ	41 UJ	34 UJ	33 U	21 U	19 U	15 U	44 UJ	32 U	26 U	30 U	23 U	24 U	41 UJ	28 U	24 U
ACROLEIN	UG/KG	302.72	--	--	410 UJ	280 U	320 U	350 UJ	460 UJ	480 UJ	410 UJ	340 UJ	330 U	210 U	190 U	150 U	440 UJ	320 UJ	260 UJ	300 U	230 UJ	240 UJ	410 UJ	280 U	240 U
ACRYLONITRILE	UG/KG	302.72	--	--	410 UJ	280 U	320 U	350 UJ	460 UJ	480 UJ	410 UJ	340 UJ	330 U	210 U	190 U	150 U	440 UJ	320 U	260 U	300 U	230 U	240 U	410 UJ	280 U	240 U
BENZENE	UG/KG	15.11	137	1.51E+08	**3.8 J**	14 U	16 U	**10 J**	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
BROMOFORM	UG/KG	15.11	1310	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
BROMOMETHANE	UG/KG	15.11	--	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
CARBON TETRACHLORIDE	UG/KG	15.11	7240	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 UJ	13 UJ	15 U	12 UJ	12 UJ	21 UJ	14 U	12 U
CHLOROBENZENE	UG/KG	15.11	162	1.37E+07	**72 J**	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
CHLORODIBROMOMETHANE	UG/KG	15.11	--	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
CHLOROETHANE	UG/KG	15.11	--	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
CHLOROFORM	UG/KG	15.11	--	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
CHLOROMETHANE	UG/KG	15.11	--	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
CIS-1,3-DICHLOROPROPENE	UG/KG	15.11	--	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
DICHLOROBROMOMETHANE	UG/KG	15.11	--	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
ETHYLBENZENE	UG/KG	15.11	305	1.26E+07	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
METHYLENE CHLORIDE	UG/KG	15.11	--	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
TETRACHLOROETHENE	UG/KG	15.11	190	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
TOLUENE	UG/KG	15.11	1090	1.82E+08	**12 J**	14 U	16 U	**2.7 J**	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
TRANS-1,2-DICHLOROETHENE	UG/KG	15.11	1050*	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
TRANS-1,3-DICHLOROPROPENE	UG/KG	15.11	--	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
TRICHLOROETHENE	UG/KG	15.11	8950	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U
VINYL CHLORIDE	UG/KG	15.11	--	--	20 UJ	14 U	16 U	18 UJ	23 UJ	24 UJ	20 UJ	17 UJ	16 U	11 U	9.4 U	7.3 U	22 UJ	16 U	13 U	15 U	12 U	12 U	21 UJ	14 U	12 U

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

This table includes data that were not considered in the risk assessments (i.e., data for subsurface sediments). Tables 8-6 through 8-10 present data used in the risk assessment for the Southwest Grouping.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assista unless marked with asterisk.

*BTAG freshwater sediment benchmark

[2] Calculated site-specific human health screening levels, Appendix H.

RL = reporting limit

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

U = compound was analyzed, but not detected

*BTAG value from freshwater sediment screening values

TABLE 5-12 SEMIVOLATILE ORGANIC COMPOUND CONCENTRATIONS IN SEDIMENT CORE SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

						Southwest/Tin Mill Canal Effluent Grouping													
ANALYTE	UNITS	AVG RL	BTAG[1]	PEC[2]	HHRA[3]	SD-DE02-0002	SD-DE02-0406	SD-E03-0002	SD-E03-0204	SD-E03-0204-FD	SD-E03-0406	SD-F03-0002	SD-F04-0002	SD-F04-0406	SD-F06-0002	SD-F06-0406	SD-F07-0002	SD-F07-0406	SD-G01-0002	SD-G01-0406	SD-G02-0002	SD-G02-0406
1,2,4-TRICHLOROBENZENE	UG/KG	1419.15	473	--	--	1700 UJ	1000 U	410 UJ	260 U	260 U	170 U	520 U	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 U	1100 UJ	1300 UJ	2100 U
1,2-DIPHENYLHYDRAZINE(AS AZOBENZENE)	UG/KG	1419.15	--	--	--	1700 UJ	1000 U	410 UJ	260 U	260 U	170 U	520 UJ	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 U	1100 UJ	1300 UJ	2100 U
2,2'-OXYBIS[1-CHLOROPROPANE]	UG/KG	289.25	--	--	--	340 UJ	200 U	83 UJ	52 U	52 U	35 U	110 U	840 U	120 U	300 UJ	100 U	320 UJ	100 U	180 U	230 UJ	260 UJ	430 U
2,4,6-TRICHLOROPHENOL	UG/KG	1419.15	2650	--	--	1700 UJ	1000 U	410 UJ	260 U	260 U	170 U	520 U	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 U	1100 UJ	1300 UJ	2100 U
2,4-DICHLOROPHENOL	UG/KG	289.25	117*	--	--	340 UJ	200 U	83 UJ	52 U	52 U	35 U	110 U	840 U	120 U	300 UJ	100 U	320 UJ	100 U	180 U	230 UJ	260 UJ	430 U
2,4-DIMETHYLPHENOL	UG/KG	1419.15	29*	--	1.37E+07	1700 UJ	1000 U	410 UJ	260 U	260 U	170 U	520 U	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 U	**2400 J**	1300 UJ	**5100 J**
2,4-DINITROPHENOL	UG/KG	7311.47	41.6*	--	--	8700 UJ	5200 U	2100 UJ	1300 U	1300 U	880 U	2700 U	21000 U	3100 U	7600 UJ	2600 U	8200 UJ	2700 U	4700 U	5700 UJ	6600 UJ	11000 U
2,4-DINITROTOLUENE	UG/KG	1419.15	41.6	--	--	1700 UJ	1000 U	410 UJ	260 U	260 U	170 U	520 U	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 U	1100 UJ	1300 UJ	2100 U
2,6-DINITROTOLUENE	UG/KG	1419.15	--	--	--	1700 UJ	1000 U	410 UJ	260 U	260 U	170 U	520 U	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 U	1100 UJ	1300 UJ	2100 U
2-CHLORONAPHTHALENE	UG/KG	289.25	--	--	--	340 UJ	200 U	83 UJ	52 U	52 U	35 U	110 U	840 U	120 U	300 UJ	100 U	320 UJ	100 U	180 U	230 UJ	260 UJ	430 U
2-CHLOROPHENOL	UG/KG	1419.15	344	--	--	1700 UJ	1000 U	410 UJ	260 U	260 U	170 U	520 U	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 U	1100 UJ	1300 UJ	2100 U
2-NITROPHENOL	UG/KG	1419.15	--	--	--	1700 UJ	1000 U	410 UJ	260 U	260 U	170 U	520 U	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 U	1100 UJ	1300 UJ	2100 U
3,3'-DICHLOROBENZIDINE	UG/KG	1419.15	2060	--	--	1700 UJ	1000 U	410 UJ	260 U	260 U	170 U	520 U	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 U	1100 UJ	1300 UJ	2100 U
4,6-DINITRO-2-METHYLPHENOL	UG/KG	7311.47	--	--	--	8700 UJ	5200 U	2100 UJ	1300 U	1300 U	880 U	2700 UJ	21000 U	3100 U	7600 UJ	2600 U	8200 UJ	2700 U	4700 U	5700 UJ	6600 UJ	11000 U
4-BROMOPHENYL PHENYL ETHER	UG/KG	1419.15	1230*	--	--	1700 UJ	1000 U	410 UJ	260 U	260 U	170 U	520 UJ	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 U	1100 UJ	1300 UJ	2100 U
4-CHLORO-3-METHYLPHENOL	UG/KG	1419.15	--	--	--	1700 UJ	1000 U	410 UJ	260 U	260 U	170 U	520 U	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 U	1100 UJ	1300 UJ	2100 U
4-CHLOROPHENYL PHENYL ETHER	UG/KG	1419.15	--	--	--	1700 UJ	1000 U	410 UJ	260 U	260 U	170 U	520 U	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 U	1100 UJ	1300 UJ	2100 U
4-NITROPHENOL	UG/KG	7311.47	--	--	--	8700 UJ	5200 U	2100 UJ	1300 U	1300 U	880 U	2700 U	21000 UJ	3100 UJ	7600 UJ	2600 U	**3600 J**	2700 U	4700 U	5700 UJ	6600 UJ	11000 U
BENZIDINE	UG/KG	28924.85	--	--	--	34000 UJ	20000 UJ	8300 UJ	5200 U	5200 U	3500 U	11000 U	84000 U	12000 U	30000 UJ	10000 U	32000 UJ	10000 U	18000 U	23000 UJ	26000 UJ	43000 UJ
BENZOIC ACID	UG/KG	7311.47	650*	--	2.73E+09	8700 UJ	5200 U	**1400 J**	**810 J**	1300 U	880 U	2700 U	21000 UJ	3100 UJ	7600 UJ	2600 U	8200 UJ	**1600 J**	4700 U	5700 UJ	6600 UJ	11000 U
BIS(2-CHLOROETHOXY)METHANE	UG/KG	1419.15	--	--	--	1700 UJ	1000 U	410 UJ	260 U	260 U	170 U	520 U	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 U	1100 UJ	1300 UJ	2100 U
BIS(2-CHLOROETHYL)ETHER	UG/KG	289.25	--	--	--	340 UJ	200 U	83 UJ	52 U	52 U	35 U	110 U	840 U	120 U	300 UJ	100 U	320 UJ	100 U	180 U	230 UJ	260 UJ	430 U
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	2689.99	182.16	2647	2.96E+06	**12000 J**	2000 U	**3600 J**	520 U	520 U	350 U	**6500**	**7600 J**	**2400**	**16000 J**	1000 U	**14000 J**	1000 U	**6600**	**27000 J**	**18000 J**	**29000**
BUTYL BENZYL PHTHALATE	UG/KG	1419.15	16800	--	--	1700 UJ	1000 U	410 UJ	260 U	260 U	**36 J**	520 U	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 U	1100 UJ	1300 UJ	2100 U
DIETHYL PHTHALATE	UG/KG	1419.15	218	--	--	1700 UJ	1000 U	410 UJ	260 U	260 U	170 U	520 U	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 U	1100 UJ	1300 UJ	2100 U
DIMETHYL PHTHALATE	UG/KG	1419.15	--	--	--	1700 UJ	1000 U	410 UJ	260 U	260 U	170 U	520 U	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 U	1100 UJ	1300 UJ	2100 U
DI-N-BUTYL PHTHALATE	UG/KG	1419.15	1160	--	6.83E+07	1700 UJ	1000 U	410 UJ	260 U	260 U	170 U	520 UJ	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 U	1100 UJ	1300 UJ	2100 U
DI-N-OCTYL PHTHALATE	UG/KG	1419.15	--	--	--	1700 UJ	1000 U	410 UJ	260 U	260 U	170 U	520 U	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 U	**R**	1300 UJ	2100 U
HEXACHLOROBENZENE	UG/KG	289.25	20*	--	--	340 UJ	200 U	83 UJ	52 U	52 U	35 U	110 UJ	840 U	120 U	300 UJ	100 U	320 UJ	100 U	180 U	230 UJ	260 UJ	430 U
HEXACHLOROBUTADIENE	UG/KG	289.25	--	--	--	340 UJ	200 U	83 UJ	52 U	52 U	35 U	110 U	840 U	120 U	300 UJ	100 U	320 UJ	100 U	180 U	230 UJ	260 UJ	430 U
HEXACHLOROCYCLOPENTADIENE	UG/KG	1419.15	139	--	--	1700 UJ	1000 UJ	410 UJ	260 UJ	260 UJ	170 UJ	520 U	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 UJ	910 UJ	1100 UJ	1300 UJ	2100 UJ
HEXACHLOROETHANE	UG/KG	1419.15	804	--	--	1700 UJ	1000 U	410 UJ	260 U	260 U	170 U	520 U	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 U	1100 UJ	1300 UJ	2100 U
ISOPHORONE	UG/KG	1419.15	--	--	--	1700 UJ	1000 U	410 UJ	260 U	260 U	170 U	520 U	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 U	1100 UJ	1300 UJ	2100 U
NITROBENZENE	UG/KG	2869.99	--	--	--	3400 UJ	2000 U	830 UJ	520 U	520 U	350 U	1100 U	8400 U	1200 U	3000 UJ	1000 U	3200 UJ	1000 U	1800 U	2200 UJ	2600 UJ	4300 U
N-NITROSODIMETHYLAMINE	UG/KG	1419.15	--	--	--	1700 UJ	1000 UJ	410 UJ	260 UJ	260 UJ	170 UJ	520 U	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 UJ	1100 UJ	1300 UJ	2100 UJ
N-NITROSODI-N-PROPYLAMINE	UG/KG	289.25	--	--	--	340 UJ	200 U	83 UJ	52 U	52 U	35 U	110 U	840 U	120 U	300 UJ	100 U	320 UJ	100 U	180 U	230 UJ	260 UJ	430 U
N-NITROSODIPHENYLAMINE	UG/KG	1419.15	422000	--	--	1700 UJ	1000 U	410 UJ	260 U	260 U	170 U	520 UJ	4200 U	600 U	1500 UJ	510 U	1600 UJ	520 U	910 U	1100 UJ	1300 UJ	2100 U
PENTACHLOROPHENOL	UG/KG	1419.15	7970	--	--	1700 UJ	1000 UJ	410 UJ	260 UJ	260 UJ	170 UJ	520 UJ	4200 UJ	600 UJ	1500 UJ	510 U	1600 UJ	520 U	910 UJ	1100 UJ	1300 UJ	2100 UJ
PHENOL	UG/KG	289.25	420*	--	2.05E+08	**180 J**	**210 J**	**250 J**	**290**	**210**	**96**	110 U	840 U	**160**	**330 J**	**370**	**390 J**	**300**	180 U	**370 J**	260 UJ	**700**

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

This table includes data that were not considered in the risk assessments (i.e., data for subsurface sediments). Tables 8-6 through 8-10 present data used in the risk assessment for the Southwest Grouping.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater sediment benchmark

[2] Probable Effects Concentrations from MacDonald, 1996.

[3] Calculated site-specific human health screening levels, Appendix H.

Value exceeds BTAG benchmark

Value exceeds PEC

R = data point rejected during validation (see Appendix E)

RL = reporting limit

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

U = compound was analyzed, but not detected

TABLE 5-12 SEMIVOLATILE ORGANIC COMPOUND CONCENTRATIONS IN SEDIMENT CORE SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

ANALYTE	UNITS	AVG RL	BTAG[1]	PEC[2]	HHRA[3]	Southwest/Tin Mill Canal Effluent Grouping																
						SD-G03-0002	SD-G03-0406	SD-G04-0002	SD-G04-0406	SD-G04-0406-FD	SD-G05-0002	SD-G05-0406	SD-G05-0607	SD-G06-0002	SD-G06-0406	SD-H01-0002	SD-H01-0406	SD-H03-0002	SD-H03-0406	SD-H03-0607	SD-H04-0002	SD-H04-0002-FD	SD-H04-0406	SD-H05-0002	SD-H05-0406
1,2,4-TRICHLOROBENZENE	UG/KG	1419.15	473	--	--	1300 UJ	1100 U	650 UJ	220 U	230 U	380 UJ	200 U	100 U	250 U	180 U	5300 U	1200 UJ	1500 UJ	980 U	110 U	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
1,2-DIPHENYLHYDRAZINE(AS AZOBENZENE)	UG/KG	1419.15	--	--	--	1300 UJ	1100 U	650 UJ	220 U	230 U	380 UJ	200 UJ	100 U	250 U	180 U	5300 U	1200 UJ	1500 UJ	980 UJ	110 U	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
2,2'-OXYBIS[1-CHLOROPROPANE]	UG/KG	289.25	--	--	--	250 UJ	220 U	130 UJ	45 U	46 U	76 UJ	41 U	21 U	50 U	36 U	1100 U	240 UJ	300 UJ	200 U	22 U	1400 UJ	1400 UJ	140 U	440 U	470 UJ
2,4,6-TRICHLOROPHENOL	UG/KG	1419.15	2650	--	--	1300 UJ	1100 U	650 UJ	220 U	230 U	380 UJ	200 U	100 U	250 U	180 U	5300 U	1200 UJ	1500 UJ	980 U	110 U	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
2,4-DICHLOROPHENOL	UG/KG	289.25	117*	--	--	250 UJ	220 U	130 UJ	45 U	46 U	76 UJ	41 U	21 U	50 U	36 U	1100 U	240 UJ	300 UJ	200 U	22 U	1400 UJ	1400 UJ	140 U	440 U	470 UJ
2,4-DIMETHYLPHENOL	UG/KG	1419.15	29*	--	1.37E+07	1300 UJ	1100 U	650 UJ	220 U	230 U	380 UJ	200 U	100 U	250 U	180 U	5300 U	**7300 J**	1500 UJ	**5300**	**290**	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
2,4-DINITROPHENOL	UG/KG	7311.47	41.6*	--	--	6500 UJ	5600 U	3400 UJ	1100 U	1200 U	1900 UJ	1000 U	530 U	1300 U	930 U	27000 U	6200 UJ	7600 UJ	5100 U	550 U	35000 UJ	34000 UJ	3600 U	11000 U	12000 UJ
2,4-DINITROTOLUENE	UG/KG	1419.15	41.6	--	--	1300 UJ	1100 U	650 UJ	220 U	230 U	380 UJ	200 U	100 U	250 U	180 U	5300 U	1200 UJ	1500 UJ	980 U	110 U	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
2,6-DINITROTOLUENE	UG/KG	1419.15	--	--	--	1300 UJ	1100 U	650 UJ	220 U	230 U	380 UJ	200 U	100 U	250 U	180 U	5300 U	1200 UJ	1500 UJ	980 U	110 U	6700 UJ	6700 UJ	**150 J**	2100 U	2300 UJ
2-CHLORONAPHTHALENE	UG/KG	289.25	--	--	--	250 UJ	220 U	130 UJ	45 U	46 U	76 UJ	41 U	21 U	50 U	36 U	1100 U	240 UJ	300 UJ	200 U	22 U	1400 UJ	1400 UJ	140 U	440 U	470 UJ
2-CHLOROPHENOL	UG/KG	1419.15	344	--	--	1300 UJ	1100 U	650 UJ	220 U	230 U	380 UJ	200 U	100 U	250 U	180 U	5300 U	1200 UJ	1500 UJ	980 U	110 U	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
2-NITROPHENOL	UG/KG	1419.15	--	--	--	1300 UJ	1100 U	650 UJ	220 U	230 U	380 UJ	200 U	100 U	250 U	180 U	5300 U	1200 UJ	1500 UJ	980 U	110 U	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
3,3'-DICHLOROBENZIDINE	UG/KG	1419.15	2060	--	--	1300 UJ	1100 U	650 UJ	220 U	230 U	380 UJ	200 U	100 U	250 U	180 U	5300 U	1200 UJ	1500 UJ	980 U	110 U	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
4,6-DINITRO-2-METHYLPHENOL	UG/KG	7311.47	--	--	--	6500 UJ	5600 U	3400 UJ	1100 U	1200 U	1900 UJ	1000 UJ	530 U	1300 U	930 U	27000 U	6200 UJ	7600 UJ	5100 UJ	550 U	35000 UJ	34000 UJ	3600 U	11000 U	12000 UJ
4-BROMOPHENYL PHENYL ETHER	UG/KG	1419.15	1230*	--	--	1300 UJ	1100 U	650 UJ	220 U	230 U	380 UJ	200 UJ	100 U	250 U	180 U	5300 U	1200 UJ	1500 UJ	980 UJ	110 U	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
4-CHLORO-3-METHYLPHENOL	UG/KG	1419.15	--	--	--	1300 UJ	1100 U	650 UJ	220 U	230 U	380 UJ	200 U	100 U	250 U	180 U	5300 U	1200 UJ	1500 UJ	980 U	110 U	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
4-CHLOROPHENYL PHENYL ETHER	UG/KG	1419.15	--	--	--	1300 UJ	1100 U	650 UJ	220 U	230 U	380 UJ	200 U	100 U	250 U	180 U	5300 U	1200 UJ	1500 UJ	980 U	110 U	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
4-NITROPHENOL	UG/KG	7311.47	--	--	--	6500 UJ	5600 U	3400 UJ	1100 U	1200 U	1900 UJ	1000 U	530 U	1300 U	930 U	27000 U	6200 UJ	7600 UJ	5100 U	550 U	35000 UJ	34000 UJ	3600 U	11000 U	12000 UJ
BENZIDINE	UG/KG	28924.85	--	--	--	25000 UJ	22000 U	13000 UJ	4500 U	4600 U	7600 UJ	4100 U	2100 U	5000 UJ	3600 UJ	110000 U	24000 UJ	30000 UJ	20000 U	2200 U	140000 UJ	140000 UJ	14000 U	44000 U	47000 UJ
BENZOIC ACID	UG/KG	7311.47	650*	--	2.73E+09	6500 UJ	**3700 J**	3400 UJ	**630 J**	**700 J**	1900 UJ	1000 U	530 U	**790 J**	930 U	27000 U	6200 UJ	7600 UJ	5100 U	550 U	35000 UJ	34000 UJ	3600 U	11000 UJ	12000 UJ
BIS(2-CHLOROETHOXY)METHANE	UG/KG	1419.15	--	--	--	1300 UJ	1100 U	650 UJ	220 U	230 U	380 UJ	200 U	100 U	250 U	180 U	5300 U	1200 UJ	1500 UJ	980 U	110 U	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
BIS(2-CHLOROETHYL)ETHER	UG/KG	289.25	--	--	--	250 UJ	220 U	130 UJ	45 U	46 U	76 UJ	41 U	21 U	50 U	36 U	1100 U	240 UJ	300 UJ	200 U	22 U	1400 UJ	1400 UJ	140 U	440 U	470 UJ
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	2689.99	182.16	2647	2.96E+06	**11000 J**	**4600**	**17000 J**	450 U	460 U	**3900 J**	**2200**	**50 J**	**180 J**	360 U	**23000**	**17000 J**	19000 UJ	**9700**	**49 J**	**48000 J**	**54000 J**	1400 U	**8700**	**29000 J**
BUTYL BENZYL PHTHALATE	UG/KG	1419.15	16800	--	--	1300 UJ	1100 U	650 UJ	220 U	230 U	380 UJ	200 U	**16 J**	250 U	180 U	5300 U	1200 UJ	1500 UJ	980 U	110 U	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
DIETHYL PHTHALATE	UG/KG	1419.15	218	--	--	1300 UJ	1100 U	650 UJ	220 U	230 U	380 UJ	200 U	100 U	250 U	180 U	5300 U	1200 UJ	1500 UJ	980 U	110 U	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
DIMETHYL PHTHALATE	UG/KG	1419.15	--	--	--	1300 UJ	1100 U	650 UJ	220 U	230 U	380 UJ	200 U	100 U	250 U	180 U	5300 U	1200 UJ	1500 UJ	980 U	110 U	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
DI-N-BUTYL PHTHALATE	UG/KG	1419.15	1160	--	6.83E+07	1300 UJ	1100 U	650 UJ	220 U	230 U	**180 J**	200 UJ	100 U	250 U	180 U	5300 U	1200 UJ	1500 UJ	980 UJ	110 U	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
DI-N-OCTYL PHTHALATE	UG/KG	1419.15	--	--	--	1300 UJ	1100 U	650 UJ	220 U	230 U	380 UJ	200 U	100 U	250 U	180 U	5300 U	1200 UJ	1500 UJ	980 U	110 U	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
HEXACHLOROBENZENE	UG/KG	289.25	20*	--	--	250 UJ	220 U	130 UJ	45 U	46 U	76 UJ	41 UJ	21 U	50 U	36 U	1100 U	240 UJ	300 UJ	200 UJ	22 U	1400 UJ	1400 UJ	140 U	440 U	470 UJ
HEXACHLOROBUTADIENE	UG/KG	289.25	--	--	--	250 UJ	220 U	130 UJ	45 U	46 U	76 UJ	41 U	21 U	50 U	36 U	1100 U	240 UJ	300 UJ	200 U	22 U	1400 UJ	1400 UJ	140 U	440 U	470 UJ
HEXACHLOROCYCLOPENTADIENE	UG/KG	1419.15	139	--	--	1300 UJ	1100 UJ	650 UJ	220 UJ	230 UJ	380 UJ	200 UJ	100 U	250 UJ	180 UJ	5300 U	1200 UJ	1500 UJ	980 U	110 U	6700 UJ	6700 UJ	690 U	2100 UJ	2300 UJ
HEXACHLOROETHANE	UG/KG	1419.15	804	--	--	1300 UJ	1100 U	650 UJ	220 U	230 U	380 UJ	200 U	100 U	250 U	180 U	5300 U	1200 UJ	1500 UJ	980 U	110 U	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
ISOPHORONE	UG/KG	1419.15	--	--	--	1300 UJ	1100 U	650 UJ	220 U	230 U	380 UJ	200 U	100 U	250 U	180 U	5300 U	1200 UJ	1500 UJ	980 U	110 U	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
NITROBENZENE	UG/KG	2869.99	--	--	--	2500 UJ	2200 U	1300 UJ	450 U	460 U	760 UJ	400 U	210 U	500 U	360 U	11000 U	2400 UJ	3000 UJ	2000 U	220 U	14000 UJ	13000 UJ	1400 U	4300 U	4700 UJ
N-NITROSODIMETHYLAMINE	UG/KG	1419.15	--	--	--	1300 UJ	1100 U	650 UJ	220 UJ	230 UJ	380 UJ	200 UJ	100 U	250 UJ	180 UJ	5300 U	1200 UJ	1500 UJ	980 UJ	110 U	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
N-NITROSODI-N-PROPYLAMINE	UG/KG	289.25	--	--	--	250 UJ	220 U	130 UJ	45 U	46 U	76 UJ	41 U	21 U	50 U	36 U	1100 U	240 UJ	300 UJ	200 U	22 U	1400 UJ	1400 UJ	140 U	440 U	470 UJ
N-NITROSODIPHENYLAMINE	UG/KG	1419.15	422000	--	--	1300 UJ	1100 U	650 UJ	220 U	230 U	380 UJ	200 UJ	100 U	250 U	180 U	5300 U	1200 UJ	1500 UJ	980 U	110 U	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
PENTACHLOROPHENOL	UG/KG	1419.15	7970	--	--	1300 UJ	1100 U	650 UJ	220 UJ	230 UJ	380 UJ	200 UJ	100 U	250 UJ	180 UJ	5300 U	1200 UJ	1500 UJ	980 UJ	110 U	6700 UJ	6700 UJ	690 U	2100 U	2300 UJ
PHENOL	UG/KG	289.25	420*	--	2.05E+08	250 UJ	220 U	**110 J**	**30 J**	46 U	76 UJ	**55**	**47**	**170**	**120**	1100 U	**290 J**	300 UJ	200 U	22 U	1400 UJ	1400 UJ	140 U	440 U	470 UJ

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

This table includes data that were not considered in the risk assessments (i.e., data for subsurface sediments). Tables 8-6 through 8-10 present data used in the risk assessment for the Southwest Grouping.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater sediment benchmark

[2] Probable Effects Concentrations from MacDonald, 1996.

[3] Calculated site-specific human health screening levels, Appendix H.

Value exceeds BTAG benchmark

Value exceeds PEC

R = data point rejected during validation (see Appendix E)

RL = reporting limit

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

U = compound was analyzed, but not detected

TABLE 5-12 SEMIVOLATILE ORGANIC COMPOUND CONCENTRATIONS IN SEDIMENT CORE SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

ANALYTE	UNITS	AVG RL	BTAG[1]	PEC[2]	HHRA[3]	Southwest/Tin Mill Canal Effluent Grouping														
						SD-H06-0002	SD-H06-0002-FD	SD-H06-0204	SD-H07-0002	SD-H07-0002-FD	SD-H07-0406	SD-I01-0001	SD-I01-0102	SD-I02-0002	SD-I02-0204	SD-I02-0406	SD-I03-0002	SD-I03-0204	SD-I03-0406	SD-J02-0002	SD-J02-0204	SD-J02-0406
1,2,4-TRICHLOROBENZENE	UG/KG	1419.15	473	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 U	180 U	120 U	72 U	360 UJ	260 U	210 U	240 U	190 U	39 U	1700 UJ	1200 U	78 U
1,2-DIPHENYLHYDRAZINE(AS AZOBENZENE)	UG/KG	1419.15	--	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 U	180 U	120 U	72 U	360 UJ	260 U	210 U	240 U	190 U	39 U	1700 UJ	1200 U	78 U
2,2'-OXYBIS[1-CHLOROPROPANE]	UG/KG	289.25	--	--	--	310 UJ	320 UJ	270 UJ	110 UJ	110 U	36 U	25 U	15 U	74 UJ	53 U	43 U	50 U	39 U	7.9 U	350 UJ	240 U	16 U
2,4,6-TRICHLOROPHENOL	UG/KG	1419.15	2650	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 U	180 U	120 U	72 U	360 UJ	260 U	210 U	240 U	190 U	39 U	1700 UJ	1200 U	78 U
2,4-DICHLOROPHENOL	UG/KG	289.25	117*	--	--	310 UJ	320 UJ	270 UJ	110 UJ	110 U	36 U	25 U	15 U	74 UJ	53 U	43 U	50 U	39 U	7.9 U	350 UJ	240 U	16 U
2,4-DIMETHYLPHENOL	UG/KG	1419.15	29*	--	1.37E+07	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 U	180 U	120 U	72 U	360 UJ	260 U	210 U	**59 J**	190 U	39 U	1700 UJ	1200 U	78 U
2,4-DINITROPHENOL	UG/KG	7311.47	41.6*	--	--	7900 UJ	8100 UJ	6900 UJ	2800 UJ	2800 U	910 U	640 U	370 U	1900 UJ	1300 U	1100 U	1300 U	990 U	200 U	8800 UJ	6000 U	400 U
2,4-DINITROTOLUENE	UG/KG	1419.15	41.6	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 U	180 U	120 U	72 U	360 UJ	260 U	210 U	240 U	190 U	39 U	1700 UJ	1200 U	78 U
2,6-DINITROTOLUENE	UG/KG	1419.15	--	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 U	180 U	120 U	72 U	360 UJ	260 U	210 U	240 U	190 U	39 U	1700 UJ	1200 U	78 U
2-CHLORONAPHTHALENE	UG/KG	289.25	--	--	--	310 UJ	320 UJ	270 UJ	110 UJ	110 U	36 U	25 U	15 U	74 UJ	53 U	43 U	50 U	39 U	7.9 U	350 UJ	240 U	16 U
2-CHLOROPHENOL	UG/KG	1419.15	344	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 U	180 U	120 U	72 U	360 UJ	260 U	210 U	240 U	190 U	39 U	1700 UJ	1200 U	78 U
2-NITROPHENOL	UG/KG	1419.15	--	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 U	180 U	120 U	72 U	360 UJ	260 U	210 U	240 U	190 U	39 U	1700 UJ	1200 U	78 U
3,3'-DICHLOROBENZIDINE	UG/KG	1419.15	2060	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 U	180 U	120 U	72 U	360 UJ	260 U	210 U	240 U	190 U	39 U	1700 UJ	1200 U	78 U
4,6-DINITRO-2-METHYLPHENOL	UG/KG	7311.47	--	--	--	7900 UJ	8100 UJ	6900 UJ	2800 UJ	2800 U	910 U	640 U	370 U	1900 UJ	1300 U	1100 U	1300 U	990 U	200 U	8800 UJ	6000 U	400 U
4-BROMOPHENYL PHENYL ETHER	UG/KG	1419.15	1230*	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 U	180 U	120 U	72 U	360 UJ	260 U	210 U	240 U	190 U	39 U	1700 UJ	1200 U	78 U
4-CHLORO-3-METHYLPHENOL	UG/KG	1419.15	--	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 U	180 U	120 U	72 U	360 UJ	260 U	210 U	240 U	190 U	39 U	1700 UJ	1200 U	78 U
4-CHLOROPHENYL PHENYL ETHER	UG/KG	1419.15	--	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 U	180 U	120 U	72 U	360 UJ	260 U	210 U	240 U	190 U	39 U	1700 UJ	1200 U	78 U
4-NITROPHENOL	UG/KG	7311.47	--	--	--	7900 UJ	8100 UJ	6900 UJ	2800 UJ	2800 U	910 U	640 U	370 U	1900 UJ	1300 U	1100 U	1300 U	990 U	200 U	8800 UJ	6000 UJ	400 UJ
BENZIDINE	UG/KG	28924.85	--	--	--	31000 UJ	32000 UJ	27000 UJ	11000 UJ	11000 UJ	3600 UJ	2500 U	1500 U	7400 UJ	5300 U	4300 U	5000 UJ	3900 UJ	790 UJ	35000 UJ	24000 U	1600 U
BENZOIC ACID	UG/KG	7311.47	650*	--	2.73E+09	7900 UJ	8100 UJ	**4400 J**	2800 UJ	2800 U	910 U	640 U	370 U	1900 UJ	1300 U	1100 U	**960 J**	990 U	200 U	8800 UJ	6000 UJ	400 UJ
BIS(2-CHLOROETHOXY)METHANE	UG/KG	1419.15	--	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 U	180 U	120 U	72 U	360 UJ	260 U	210 U	240 U	190 U	39 U	1700 UJ	1200 U	78 U
BIS(2-CHLOROETHYL)ETHER	UG/KG	289.25	--	--	--	310 UJ	320 UJ	270 UJ	110 UJ	110 U	36 U	25 U	15 U	74 UJ	53 U	43 U	50 U	39 U	7.9 U	350 UJ	240 U	16 U
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	2689.99	182.16	2647	2.96E+06	**5200 J**	**7600 J**	**16000 J**	**3300 J**	**2800**	360 U	250 U	150 U	**2800 J**	**5100**	430 U	**220 J**	390 U	**13 J**	**2000 J**	**3900**	160 U
BUTYL BENZYL PHTHALATE	UG/KG	1419.15	16800	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 U	180 U	120 U	72 U	360 UJ	260 U	210 U	240 U	190 U	**19 J**	1700 UJ	1200 U	78 U
DIETHYL PHTHALATE	UG/KG	1419.15	218	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 U	180 U	120 U	72 U	360 UJ	260 U	210 U	240 U	190 U	39 U	1700 UJ	1200 U	78 U
DIMETHYL PHTHALATE	UG/KG	1419.15	--	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 U	180 U	120 U	72 U	360 UJ	260 U	210 U	240 U	190 U	39 U	1700 UJ	1200 U	78 U
DI-N-BUTYL PHTHALATE	UG/KG	1419.15	1160	--	6.83E+07	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 U	180 U	120 U	72 U	**77 J**	**120 J**	**48 J**	240 U	190 U	39 U	1700 UJ	1200 U	78 U
DI-N-OCTYL PHTHALATE	UG/KG	1419.15	--	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 U	180 U	120 U	72 U	360 UJ	260 U	210 U	240 U	190 U	39 U	1700 UJ	1200 U	78 U
HEXACHLOROBENZENE	UG/KG	289.25	20*	--	--	310 UJ	320 UJ	270 UJ	110 UJ	110 U	36 U	25 U	15 U	74 UJ	53 U	43 U	50 U	39 U	7.9 U	350 UJ	240 U	16 U
HEXACHLOROBUTADIENE	UG/KG	289.25	--	--	--	310 UJ	320 UJ	270 UJ	110 UJ	110 U	36 U	25 U	15 U	74 UJ	53 U	43 U	50 U	39 U	7.9 U	350 UJ	240 U	16 U
HEXACHLOROCYCLOPENTADIENE	UG/KG	1419.15	139	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 UJ	180 UJ	120 U	72 U	360 UJ	260 UJ	210 UJ	240 UJ	190 UJ	39 UJ	1700 UJ	1200 U	78 U
HEXACHLOROETHANE	UG/KG	1419.15	804	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 U	180 U	120 U	72 U	360 UJ	260 U	210 U	240 U	190 U	39 U	1700 UJ	1200 U	78 U
ISOPHORONE	UG/KG	1419.15	--	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 U	180 U	120 U	72 U	360 UJ	260 U	210 U	240 U	190 U	39 U	1700 UJ	1200 U	78 U
NITROBENZENE	UG/KG	2869.99	--	--	--	3100 UJ	3200 UJ	2700 UJ	1100 UJ	1100 U	360 U	250 U	150 U	730 UJ	530 U	430 U	490 U	390 U	79 U	3400 UJ	2300 U	160 U
N-NITROSODIMETHYLAMINE	UG/KG	1419.15	--	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 UJ	180 UJ	120 U	72 U	360 UJ	260 UJ	210 UJ	240 UJ	190 UJ	39 UJ	1700 UJ	1200 U	78 U
N-NITROSODI-N-PROPYLAMINE	UG/KG	289.25	--	--	--	310 UJ	320 UJ	270 UJ	110 UJ	110 U	36 U	25 U	15 U	74 UJ	53 U	43 U	50 U	39 U	7.9 U	350 UJ	240 U	16 U
N-NITROSODIPHENYLAMINE	UG/KG	1419.15	422000	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 U	180 U	120 U	72 U	360 UJ	260 U	210 U	240 U	190 U	39 U	1700 UJ	1200 U	78 U
PENTACHLOROPHENOL	UG/KG	1419.15	7970	--	--	1500 UJ	1600 UJ	1300 UJ	550 UJ	540 UJ	180 UJ	120 U	72 U	360 UJ	260 UJ	210 UJ	240 UJ	190 UJ	39 UJ	1700 UJ	1200 UJ	78 UJ
PHENOL	UG/KG	289.25	420*	--	2.05E+08	310 UJ	320 UJ	270 UJ	110 UJ	110 U	36 U	**58**	15 U	74 UJ	53 U	**28 J**	**79**	**57**	7.9 U	**170 J**	**160 J**	**110**

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

This table includes data that were not considered in the risk assessments (i.e., data for subsurface sediments). Tables 8-6 through 8-10 present data used in the risk assessment for the Southwest Grouping.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater sediment benchmark

[2] Probable Effects Concentrations from MacDonald, 1996.

[3] Calculated site-specific human health screening levels, Appendix H.

Value exceeds BTAG benchmark

Value exceeds PEC

R = data point rejected during validation (see Appendix E)

RL = reporting limit

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

U = compound was analyzed, but not detected

TABLE 5-13 SIMULTANEOUSLY EXTRACTED METALS AND ACID VOLATILE SULFIDE CONCENTRATIONS IN SEDIMENT CORE SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

			Southwest/Tin Mill Canal Effluent Grouping											
ANALYTE	**UNITS**	**AVG RL**	**SD-DE02-0002**	**SD-E03-0002**	**SD-F03-0002**	**SD-F04-0002**	**SD-F06-0002**	**SD-F07-0002**	**SD-G01-0002**	**SD-G02-0002**	**SD-G03-0002**	**SD-G04-0002**	**SD-G05-0002**	**SD-G06-0002**
CADMIUM SEM	UMOL/G	0.00	**0.19 J**	**0.12 J**	**0.065**	**0.049**	**0.22 J**	**0.27 J**	**0.031**	**0.27 J**	**0.17 J**	**0.37 J**	**0.077 J**	**0.057**
COPPER SEM	UMOL/G	0.04	**2.4 J**	**0.095 J**	**0.39 J**	**2.3 J**	**6.1 J**	**1.7 J**	**2 J**	**4 J**	**3 J**	**2.6 J**	**2.4 J**	**2.4 J**
LEAD SEM	UMOL/G	0.02	**1.3 J**	**3.9 J**	**1.4**	**0.62**	**2.5 J**	**3.2 J**	**0.38**	**1.2 J**	**0.89 J**	**2.8 J**	**0.86 J**	**3.6**
NICKEL SEM	UMOL/G	0.26	**0.84 J**	**0.77 J**	**0.58**	**1.7**	**0.85 J**	**0.85 J**	**2.2**	**2.3 J**	**1.8 J**	**1.5 J**	**1.1 J**	**0.34**
ZINC SEM	UMOL/G	0.30	**49 J**	**57 J**	**35**	**24**	**57 J**	**78 J**	**16 J**	**120 J**	**67 J**	**130 J**	**31 J**	**25 J**
ACID VOLATILE SULFIDES	UMOL/G	2.03	**650 J**	**750 J**	**150**	**160**	**520 J**	**560 J**	**150**	**270 J**	**500 J**	**500 J**	**550 J**	**240**
SEM/AVS RATIO	NONE	0.001	**0.082**	**0.083**	**0.25**	**0.18**	**0.13**	**0.15**	**0.14**	**0.46**	**0.15**	**0.27**	**0.065**	**0.13**

			Southwest/Tin Mill Canal Effluent Grouping											
ANALYTE	**UNITS**	**AVG RL**	**SD-H01-0002**	**SD-H03-0002**	**SD-H04-0002**	**SD-H04-0002-FD**	**SD-H05-0002**	**SD-H06-0002**	**SD-H06-0002-FD**	**SD-H07-0002**	**SD-H07-0002-FD**	**SD-I01-0001**	**SD-I02-0002**	**SD-I03-0002**	**SD-J02-0002**
CADMIUM SEM	UMOL/G	0.00	**0.033**	**1.1 J**	**0.16 J**	**0.22 J**	**0.044**	**0.043 J**	**0.044 J**	**0.078 J**	**0.071**	**0.028**	**0.08 J**	**0.08**	**0.073 J**
COPPER SEM	UMOL/G	0.04	**2**	**7.3 J**	**4.5 J**	**5.5 J**	**2.2 J**	**1.9 J**	**2.1 J**	**2.6 J**	**0.81 J**	**1.2 J**	**2.4 J**	**2.7 J**	**3 J**
LEAD SEM	UMOL/G	0.02	**0.36**	**2.1 J**	**1.1 J**	**1.7 J**	**0.53**	**0.67 J**	**0.71 J**	**2 J**	**2**	**1.9**	**1.2 J**	**3.5**	**1.2 J**
NICKEL SEM	UMOL/G	0.26	**1.8**	**3.2 J**	**2.4 J**	**2.6 J**	**1.4**	**0.87 J**	**0.84 J**	**0.5 J**	**0.49**	**0.2**	**0.61 J**	**0.51**	**0.66 J**
ZINC SEM	UMOL/G	0.30	**18**	**280 J**	**68 J**	**130 J**	**19 J**	**19 J**	**20 J**	**26 J**	**24 J**	**13**	**25 J**	**23 J**	**24 J**
ACID VOLATILE SULFIDES	UMOL/G	2.03	**260**	**120 J**	**550 J**	**490 J**	**260**	**590 J**	**500 J**	**270 J**	**210**	**60**	**320 J**	**170**	**340 J**
SEM/AVS RATIO	NONE	0.001	**0.083**	**2.6**	**0.14**	**0.29**	**0.091**	**0.038**	**0.047**	**0.12**	**0.13**	**0.28**	**0.093**	**0.18**	**0.085**

NOTES: Bold values represent detected concentrations. RL is reported for non-detected constituents.
AVS = Acid volatile sulfide
J = compound was detected, but below the reporting limit (value is estimated)
RL = reporting limit
SEM = simultaneously extracted metal
umol/g = micromoles per gram

TABLE 5-14 DEPTH RANGES OF MAXIMUM CONSTITUENT CONCENTRATIONS IN SILTY SEDIMENT SAMPLES FROM CORES

Coring Location	Metals[1]	Total PAHs	Total PCBs	Oil & Grease	Cyanide	Bis(2-ethylhexyl)phthalate
DE02	Surface	Surface	Surface	Surface	Subsurface	Surface
E03	Surface	Surface	Surface	Surface	Surface	Surface
F04	Surface	Surface	Subsurface	Surface	Surface	Surface
F06	Surface	Surface	Surface	No Trend	Subsurface	Surface
F07	Surface	Surface	Surface	Surface	No Trend	Surface
G01	Subsurface	Surface	Subsurface	Surface	Surface	Subsurface
G02	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface
G03	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Surface
G04	Surface	Surface	Surface	Surface	No Trend	Surface
G05	Subsurface	Subsurface	Subsurface	Surface	Surface	Surface
G06	Surface	Surface	Surface	No Trend	Surface	No Trend
H01	Subsurface	Surface	Subsurface	No Trend	Subsurface	Surface
H03	Surface	Surface	Surface	Surface	Surface	Subsurface
H04	Subsurface	Surface	Surface	Surface	No Trend	No Trend
H05	Subsurface	Subsurface	Subsurface	Surface	Subsurface	Subsurface
H06	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
H07	Surface	Surface	Surface	Surface	Surface	Surface
I01	Surface	Surface	Surface	No Trend	Surface	No Trend
I02	Surface	Surface	Subsurface	Subsurface	Surface	Subsurface
I03	Surface	Surface	Surface	Surface	Surface	No Trend
J02	Surface	No Trend	Subsurface	Subsurface	Subsurface	Subsurface

Notes:

(1) Refers to the following metals, which exhibited similar trends, as discussed in the text: cadmium, chromium, copper, nickel, silver, and zinc.

TABLE 5-15 METALS, CYANIDE, OIL AND GREASE, AND SOLIDS CONCENTRATIONS IN STORMWATER SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

						Storm Event 1				Storm Event 2			
ANALYTE	**UNITS**	**AVG RL**	**BTAG[1]**	**Aquatic Life NRWQC[2]**	**Human Health NRWQC[3]**	**ST-014-111614**	**ST-018-111614**	**ST-DUP1-111614**	**ST-UNNAMED-111614**	**ST-014-120114**	**ST-018-120114**	**ST-071-120114**	**ST-UNNAMED-120114**
ANTIMONY	UG/L	2	500	---	640	2 U	2 U	2 U	2 U	**1.1 J**	**0.88 J**	**0.63 J**	**1.2 J**
ARSENIC	UG/L	1	12.5	36	0.14 [4]	1 U	**3.4**	**0.67 J**	1 U	**1.1**	**2.2**	**2.4**	1 U
BERYLLIUM	UG/L	1	0.66*	---	---	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
CADMIUM	UG/L	1	0.12	8.8	---	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
CHROMIUM	UG/L	2	57.5**	50	---	**1.2 J**	**3.7**	**1 J**	**0.96 J**	**1.4 J**	**6.8**	**1.7 J**	**0.89 J**
COPPER	UG/L	2	3.1	3.1	---	**0.69 J**	**1.3 J**	**1.1 J**	**1.1 J**	2 U	2 U	**3**	**3.1**
LEAD	UG/L	1	8.1	8.1	---	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
MERCURY	UG/L	0.2	0.02	0.94	---	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**0.051 J**	**0.083 J**
NICKEL	UG/L	1	8.2	8.2	4600	**4.1**	**0.3 J**	**1.9**	**1.5**	**6.3**	**1.2**	**4.1**	**2.8**
SELENIUM	UG/L	5	71	71	4200	5 U	**2.3 J**	**0.45 J**	5 U	5 U	**0.9 J**	**0.42 J**	5 U
SILVER	UG/L	1	0.23	---	---	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
THALLIUM	UG/L	1	21.3	---	0.47	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
ZINC	UG/L	5	81	81	26000	**10**	**1.6 J**	**14**	**10**	**20**	**9.40**	**75**	**12**
CYANIDE, TOTAL	UG/L	10	1	1	140	**4.3 J**	**40**	10 U	10 U	10 U	**14**	10 U	10 U
HEM	MG/L	5.2	---	---	---	5.2 U	**2 J**	**2 J**	**2 J**	**3 J**	**2.7 J**	**3.4 J**	**2.7 J**
TOTAL SUSPENDED SOLIDS	MG/L	2	---	---	---	**2.4**	**3.6**	**3.2**	**2**	**6.4**	**30**	**20**	2 U

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

ST-DUP1 was collected at site ST-UNNAMED

[1] Surface Water Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater surface water benchmark

[2] National Recommended Water Quality Criteria for Saltwater Aquatic Life, Chronic

[3] National Recommended Water Quality Criteria for Human Health, Consumption of Organism Only

[4] EPA is currently reassessing the human health criteria for arsenic; therefore, the current value is not used for screening.

** total chromium screening level

Value exceeds BTAG criteria

Value exceeds NRWQC criteria

RL = reporting limit

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

U = compound was analyzed, but not detected

TABLE 5-16 POLYCYCLIC AROMATIC HYDROCARBON CONCENTRATIONS IN STORMWATER SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

						Storm Event 1				Storm Event 2			
ANALYTE	**UNITS**	**AVG RL**	**BTAG[1]**	**Aquatic Life NRWQC[2]**	**Human Health NRWQC[3]**	**ST-014-111614**	**ST-018-111614**	**ST-DUP1-111614**	**ST-UNNAMED-111614**	**ST-014-120114**	**ST-018-120114**	**ST-071-120114**	**ST-UNNAMED-120114**
ACENAPHTHENE	UG/L	0.19	6.6	---	990	0.19 U	**0.029 J**	0.19 UJ	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
ACENAPHTHYLENE	UG/L	0.19	---	---	--	0.19 U	0.19 UJ	0.19 UJ	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
ANTHRACENE	UG/L	0.19	0.18	---	40000	**0.05 J**	**0.024 J**	**0.019 J**	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
FLUORENE	UG/L	0.19	2.5	---	5300	**0.14 J**	**0.025 J**	0.19 UJ	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
NAPHTHALENE	UG/L	0.19	1.4	---	---	0.19 U	**0.05 J**	0.19 UJ	0.19 U	0.19 U	**0.13 J**	0.19 U	0.19 U
PHENANTHRENE	UG/L	0.19	1.5	---	---	**0.19**	**0.061 J**	0.19 UJ	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
BENZO[A]ANTHRACENE	UG/L	0.19	0.018*	---	0.018	0.19 U	0.19 UJ	0.19 UJ	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
BENZO[A]PYRENE	UG/L	0.19	0.015*	---	0.018	0.19 U	0.19 UJ	0.19 UJ	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
BENZO[B]FLUORANTHENE	UG/L	0.19	---	---	0.018	0.19 U	0.19 UJ	0.19 UJ	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
BENZO[G,H,I]PERYLENE	UG/L	0.19	---	---	---	0.19 U	0.19 UJ	0.19 UJ	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
BENZO[K]FLUORANTHENE	UG/L	0.19	---	---	0.018	0.19 U	0.19 UJ	0.19 UJ	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
CHRYSENE	UG/L	0.19	---	---	0.018	0.19 U	0.19 UJ	0.19 UJ	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
DIBENZ(A,H)ANTHRACENE	UG/L	0.19	---	---	0.018	0.19 U	0.19 UJ	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
FLUORANTHENE	UG/L	0.19	1.6	---	140	**0.11 J**	**0.028 J**	0.19 UJ	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
INDENO[1,2,3-CD]PYRENE	UG/L	0.19	---	---	--	0.19 U	0.19 UJ	0.19 UJ	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
PYRENE	UG/L	0.19	0.24	---	4000	**0.078 J**	0.19 UJ	0.19 UJ	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
TOTAL PAHs (ND=0)	UG/L	---	---	---	---	0.568	0.452	0.019	0	0	0.13	0	0

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

ST-DUP1 was collected at site ST-UNNAMED

[1] Surface Water Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater surface water benchmark

[2] National Recommended Water Quality Criteria for Saltwater Aquatic Life, Chronic

[3] National Recommended Water Quality Criteria for Human Health, Consumption of Organism Only, prior to June 2015 update. Pre-2015 values were used in identification of Site-Related COPCs, due to project timing and consistent with the Work Plan.

RL = reporting limit

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

U = compound was analyzed, but not detected

TABLE 5-17 POLYCHLORINATED BIPHENYL CONCENTRATIONS IN STORMWATER SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

				Storm Event 1				Storm Event 2			
ANALYTE	**UNITS**	**BTAG[1]**	**AVG RL**	**ST-014-111614**	**ST-018-111614**	**ST-DUP1-111614**	**ST-UNNAMED-111614**	**ST-014-120114**	**ST-018-120114**	**ST-071-120114**	**ST-UNNAMED-120114**
PCB-1016	UG/L	0.000074*	0.0094	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U
PCB-1221	UG/L	0.000074*	0.0094	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U
PCB-1232	UG/L	0.000074*	0.0094	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U
PCB-1242	UG/L	0.000074*	0.0094	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U
PCB-1248	UG/L	0.000074*	0.0094	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U
PCB-1254	UG/L	0.000074*	0.0094	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U
PCB-1260	UG/L	0.000074*	0.0094	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U	0.0094 U

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

ST-DUP1 was collected at site ST-UNNAMED

[1] Surface Water Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater surface water benchmark

RL = reporting limit

U = compound was analyzed, but not detected

TABLE 5-18 VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN STORMWATER SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

						Storm Event 1				Storm Event 2			
ANALYTE	**UNITS**	**AVG RL**	**BTAG[1]**	**Aquatic Life NRWQC[2]**	**Human Health NRWQC[3]**	**ST-014-111614**	**ST-018-111614**	**ST-DUP1-111614**	**ST-UNNAMED-111614**	**ST-014-120114**	**ST-018-120114**	**ST-071-120114**	**ST-UNNAMED-120114**
1,1,1-TRICHLOROETHANE	UG/L	5	312	---	--	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
1,1,2,2-TETRACHLOROETHANE	UG/L	5	90.2	---	4.0	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
1,1,2-TRICHLOROETHANE	UG/L	5	550	---	16	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
1,1-DICHLOROETHANE	UG/L	5	47*	---	--	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
1,1-DICHLOROETHENE	UG/L	5	2240	---	7100	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
1,2-DICHLOROBENZENE	UG/L	5	42	---	1300	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
1,2-DICHLOROETHANE	UG/L	5	1130	---	37	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
1,2-DICHLOROPROPANE	UG/L	5	2400	---	15	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
1,3-DICHLOROBENZENE	UG/L	5	28.5	---	960	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
1,4-DICHLOROBENZENE	UG/L	5	19.9	---	190	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
2-CHLOROETHYL VINYL ETHER	UG/L	10	---	---	--	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U
ACROLEIN	UG/L	100	0.55	3*	9.00	100 U	100 U	100 U	100 U	100 U	100 UJ	100 U	100 U
ACRYLONITRILE	UG/L	50	581	---	0.25	50 U	50 U	50 U	50 U	50 U	50 UJ	50 U	50 U
BENZENE	UG/L	5	110	---	51	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
BROMOFORM	UG/L	5	640	---	140	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
BROMOMETHANE	UG/L	5	120	---	--	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
CARBON TETRACHLORIDE	UG/L	5	1500	---	1.6	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
CHLOROBENZENE	UG/L	5	25	---	1600	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
CHLORODIBROMOMETHANE	UG/L	5	---	---	--	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
CHLOROETHANE	UG/L	5	---	---	--	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
CHLOROFORM	UG/L	5	815	---	470	**1 J**	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
CHLOROMETHANE	UG/L	5	2700	---	--	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
CIS-1,3-DICHLOROPROPENE	UG/L	5	---	---	21	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
DICHLOROBROMOMETHANE	UG/L	5	---	---	13	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
ETHYLBENZENE	UG/L	5	25	---	2100	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
METHYLENE CHLORIDE	UG/L	5	2560	---	590	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
TETRACHLOROETHENE	UG/L	5	45	---	3.3	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
TOLUENE	UG/L	5	215	---	15000	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
TRANS-1,2-DICHLOROETHENE	UG/L	5	---	---	10000	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
TRANS-1,3-DICHLOROPROPENE	UG/L	5	---	---	21	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
TRICHLOROETHENE	UG/L	5	1940	---	30	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
VINYL CHLORIDE	UG/L	5	930*	---	2.4	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U

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

ST-DUP1 was collected at site ST-UNNAMED

[1] Surface Water Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

[2] National Recommended Water Quality Criteria for Aquatic Life, Chronic. Saltwater value unless marked with an asterisk

*BTAG freshwater surface water benchmark or freshwater NRWQC

[3] National Recommended Water Quality Criteria for Human Health, Consumption of Organism Only, prior to June 2015 update. Pre-2015 values were used in identification of Site-Related COPCs, due to project timing and consistent with the Work Plan.

RL = reporting limit

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

U = compound was analyzed, but not detected

TABLE 5-19 SEMIVOLATILE ORGANIC COMPOUND CONCENTRATIONS IN STORMWATER SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

						Storm Event 1				Storm Event 2			
ANALYTE	**UNITS**	**AVG RL**	**BTAG[1]**	**Aquatic Life NRWQC[2]**	**Human Health NRWQC[3]**	**ST-014-111614**	**ST-018-111614**	**ST-DUP1-111614**	**ST-UNNAMED-111614**	**ST-014-120114**	**ST-018-120114**	**ST-071-120114**	**ST-UNNAMED-120114**
1,2,4-TRICHLOROBENZENE	UG/L	0.96	5.4	---	70	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
1,2-DIPHENYLHYDRAZINE(AS AZOBENZENE)	UG/L	0.96	---	---	--	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
2,2'-OXYBIS[1-CHLOROPROPANE]	UG/L	0.96	---	---	--	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
2,4,6-TRICHLOROPHENOL	UG/L	0.96	61	---	2	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
2,4-DICHLOROPHENOL	UG/L	0.96	48.5	---	290	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
2,4-DIMETHYLPHENOL	UG/L	0.96	---	---	850	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	**1.80**	0.96 U	0.96 U
2,4-DINITROPHENOL	UG/L	4.8	48.5	---	5300	4.8 U	4.8 UJ	4.8 UJ	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U
2,4-DINITROTOLUENE	UG/L	0.96	44*	---	3.4	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
2,6-DINITROTOLUENE	UG/L	0.96	81*	---	--	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
2-CHLORONAPHTHALENE	UG/L	0.19	---	---	1600	0.19 U	0.19 UJ	0.19 UJ	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
2-CHLOROPHENOL	UG/L	0.96	265	---	150	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
2-NITROPHENOL	UG/L	0.96	2940	---	--	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
3,3'-DICHLOROBENZIDINE	UG/L	0.96	73	---	0	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
4,6-DINITRO-2-METHYLPHENOL	UG/L	4.8	---	---	280	4.8 U	4.8 UJ	4.8 UJ	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U
4-BROMOPHENYL PHENYL ETHER	UG/L	0.96	1.5*	---	--	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
4-CHLORO-3-METHYLPHENOL	UG/L	0.96	---	---	--	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
4-CHLOROPHENYL PHENYL ETHER	UG/L	0.96	---	---	--	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
4-NITROPHENOL	UG/L	4.8	71.7	---	--	4.8 U	4.8 UJ	4.8 UJ	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U
BENZIDINE	UG/L	19	3.9*	---	0.00002	19 U	19 UJ	19 UJ	19 U	19 U	19 U	19 U	19 U
BENZOIC ACID	UG/L	4.8	42*	---		4.8 U	4.8 UJ	4.8 UJ	4.8 U	4.8 U	4.8 U	4.8 U	4.8 U
BIS(2-CHLOROETHOXY)METHANE	UG/L	0.96	---	---	--	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
BIS(2-CHLOROETHYL)ETHER	UG/L	0.96	---	---	0.53	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	1.9	16*	---	2.2	1.9 U	**1.5 J**	**0.42 J**	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U
BUTYL BENZYL PHTHALATE	UG/L	0.96	29.4	---	1900	**0.35 J**	**0.41 J**	**0.47 J**	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
DIETHYL PHTHALATE	UG/L	0.96	75.9	---	44000	0.96 U	0.96 UJ	**0.53 J**	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
DIMETHYL PHTHALATE	UG/L	0.96	580	---	1100000	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
DI-N-BUTYL PHTHALATE	UG/L	0.96	3.4	---	4500	0.96 U	0.96 UJ	0.96 UJ	0.96 U	**0.49 J**	0.96 U	0.96 U	0.96 U
DI-N-OCTYL PHTHALATE	UG/L	0.96	22*	---	--	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
HEXACHLOROBENZENE	UG/L	0.96	0.0003	---	0.00029	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
HEXACHLOROBUTADIENE	UG/L	0.96	0.3	---	18	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
HEXACHLOROCYCLOPENTADIENE	UG/L	0.96	0.07	---	1100	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
HEXACHLOROETHANE	UG/L	0.96	9.4	---	3.3	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
ISOPHORONE	UG/L	0.96	129	---	960	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
NITROBENZENE	UG/L	1.9	66.8	---	690	1.9 U	1.9 UJ	1.9 UJ	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U
N-NITROSODIMETHYLAMINE	UG/L	0.96	330000	---	3	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
N-NITROSODI-N-PROPYLAMINE	UG/L	0.96	120	---	0.51	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
N-NITROSODIPHENYLAMINE	UG/L	0.96	33000	---	6	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
PENTACHLOROPHENOL	UG/L	0.96	7.9	7.90	3	0.96 U	0.96 UJ	0.96 UJ	0.96 U	0.96 U	0.96 U	0.96 U	0.96 U
PHENOL	UG/L	0.96	58	---	860000	0.96 U	**0.14 J**	0.96 UJ	0.96 U	0.96 U	**3.3**	0.96 U	0.96 U

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

ST-DUP1 was collected at site ST-UNNAMED

[1] Surface Water Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater surface water benchmark

[2] National Recommended Water Quality Criteria for Saltwater Aquatic Life, Chronic

[3] National Recommended Water Quality Criteria for Human Health, Consumption of Organism Only, prior to June 2015 update. Pre-2015 values were used in identification of Site-Related COPCs, due to project timing and consistent with the Work Plan.

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

U = compound was analyzed, but not detected

RL = reporting limit

TABLE 5-20 METALS, CYANIDE, ORGANIC CARBON, POLYCYCLIC AROMATIC HYDROCARBON, AND PHTHALATE CONCENTRATIONS IN PORE WATER SAMPLES.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

ANALYTE	Units	AVG RL	BTAG[1]	Aquatic Life NRWQC[2]	Human Health NRWQC[3]	PW-A01	PW-B01	PW-C01	PW-C02	PW-D02	PW-DE01	PW-E01	PW-F05
METALS													
CADMIUM	UG/L	7.75	0.12	8.8	---	--	--	--	--	10 U	10 U	10 U	--
CHROMIUM	UG/L	14.9	57.5**	50	---	--	20 U	--	--	--	--	--	--
COPPER	UG/L	16.4	3.1	3.1	---	20 U	20 U	--	--	**2.6 J**	20 U	20 U	20 U
LEAD	UG/L	8.20	8.1	8.1	---	--	--	--	--	**0.74 J**	**10**	10 U	10 U
MERCURY	UG/L	0.20	0.016	0.94	---	--	--	0.2 U	**0.095 J**	--	--	--	--
NICKEL	UG/L	8.20	8.2	8.2	4600	**2.9 J**	**2 J**	**2.1 J**	**3.5 J**	10 U	**20**	10 U	--
SILVER	UG/L	6.40	0.23	---	---	--	10 U	10 U	--	--	--	--	--
ZINC	UG/L	41	81	81	26000	50 U	50 U	**12 J**	**210**	**22 J**	**160**	50 U	--
GENERAL CHEMISTRY													
CYANIDE, TOTAL	UG/L	10	1	1	140	--	--	--	--	**4.4 J**	**2.5 J**	**3.5 J**	**24**
HARDNESS AS CALCIUM CARBONATE	MG/L	56.9	---	---	---	**1700**	**2100**	**1300**	**920**	**1400**	**1800**	**1700**	**1400**
TOTAL ORGANIC CARBON	MG/L	1	---	---	---	**0.96 J**	**1**	**1.2**	**1.7**	**1.8**	**2.8**	**2.1**	**6.7**
POLYCYCLIC AROMATIC HYDROCARBONS													
ACENAPHTHENE	UG/L	0.19	6.6	---	990	--	--	--	--	0.19 U	0.19 U	0.19 U	0.19 U
ACENAPHTHYLENE	UG/L	0.19	---	---	---	--	--	--	--	0.19 U	0.19 U	0.19 U	0.19 U
ANTHRACENE	UG/L	0.19	0.18	---	40000	--	--	--	--	0.19 U	0.19 U	0.19 U	0.19 U
BENZO[A]ANTHRACENE	UG/L	0.19	0.018*	---	0.018	--	--	--	--	0.19 U	0.19 U	0.19 U	0.19 U
BENZO[A]PYRENE	UG/L	0.19	0.015*	---	0.018	--	--	--	--	0.19 U	0.19 U	0.19 U	0.19 U
BENZO[B]FLUORANTHENE	UG/L	0.19	---	---	0.018	--	--	--	--	0.19 U	0.19 U	0.19 U	0.19 U
BENZO[G,H,I]PERYLENE	UG/L	0.19	---	---	---	--	--	--	--	0.19 U	0.19 U	0.19 U	0.19 U
BENZO[K]FLUORANTHENE	UG/L	0.19	---	---	0.018	--	--	--	--	0.19 U	0.19 U	0.19 U	0.19 U
CHRYSENE	UG/L	0.19	---	---	0.018	--	--	--	--	0.19 U	0.19 U	0.19 U	0.19 U
DIBENZ(A,H)ANTHRACENE	UG/L	0.19	---	---	0.018	--	--	--	--	0.19 U	0.19 U	0.19 U	0.19 U
FLUORANTHENE	UG/L	0.19	1.6	---	140	--	--	--	--	0.19 U	0.19 U	0.19 U	0.19 U
FLUORENE	UG/L	0.19	2.5	---	5300	--	--	--	--	0.19 U	0.19 U	0.19 U	0.19 U
INDENO[1,2,3-CD]PYRENE	UG/L	0.19	---	---	---	--	--	--	--	0.19 U	0.19 U	0.19 U	0.19 U
NAPHTHALENE	UG/L	0.19	1.4	---	---	--	--	--	--	0.19 U	**0.15 J**	0.19 U	0.19 U
PHENANTHRENE	UG/L	0.19	1.5	---	---	--	--	--	--	0.19 U	0.19 U	0.19 U	0.19 U
PYRENE	UG/L	0.19	0.24	---	4000	--	--	--	--	0.19 U	0.19 U	0.19 U	0.19 U
TOTAL PAHs (ND=0)	UG/L	---	---	---	---	--	--	--	--	0	0.15	0	0
SEMIVOLATILE ORGANIC COMPOUNDS													
BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	1.92	16*	---	2.2	2 U	1.9 U	**0.73 J**	--	1.9 U	**0.24 J**	1.9 U	**1.1 J**

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

[1] Surface Water Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater surface water benchmark

[2] National Recommended Water Quality Criteria for Saltwater Aquatic Life, Chronic

[3] National Recommended Water Quality Criteria for Human Health, Consumption of Organism Only, prior to June 2015 update. Pre-2015 values were used in identification of Site-Related COPCs and screening pore water, due to project timing and consistent with the Work Plan.

** total chromium screening level

Value exceeds BTAG criteria

Value exceeds NRWQC criteria

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

U = compound was analyzed, but not detected

NA = not analyzed

RL = reporting limit

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6. CONCEPTUAL SITE MODEL

The CSMs for ecological and human health risk, presented in the following sections, identify exposure pathways that link receptors (e.g., wildlife and humans) to elevated chemical constituent concentrations observed in the offshore environment and that therefore require assessment.

The CSMs identify:

- the potential sources and release mechanisms for chemicals with elevated concentrations
- the fate and transport of these chemicals
- the media of concern
- potential pathways for ecological and human receptors
- potential wildlife receptors and human populations that could be exposed.

Exposure pathways that are complete and significant for the area are included in the risk characterization. An exposure pathway describes the mechanism by which a potential receptor contacts chemicals present in the area. A complete exposure pathway requires the following four components:

- a source and mechanism of chemical release to the environment
- an environmental transport medium for the released chemical
- a point of potential contact with medium containing chemicals
- an exposure route (e.g., ingestion or dermal absorption) at the point of exposure.

All four components must exist for an exposure pathway to be complete and for exposure to occur. Incomplete exposure pathways do not result in actual exposure of receptors (wildlife or human) and are not evaluated in the risk assessment. The exposure pathways for the ecological and human health components of the risk assessment are summarized in **Figures 6-1** and **6-2**, respectively.

6.1 DIVISION OF THE PHASE I AREA INTO TWO INVESTIGATION AREAS/ DATA GROUPINGS

As described in previous sections of this report, the results of the offshore investigation led to the division of the Phase I area into two areas, with distinct conceptual site models and investigation objectives. The data from these two areas were divided into separate groupings, which are described below, and risk was assessed for each grouping. However, it should be noted that these groupings do not represent clearly defined exposure areas. Rather, the groupings were selected to reflect the differentiation in risk assessment objectives and nature and extent of contamination, as described below.

The Southwest/Tin Mill Canal Effluent (SWTM) Grouping includes all of transects G, H, I, and J, as well as the following locations in Transects DE, E, and F: DE02, E03, F03, F04, F06, and F07 (**Figure 6-3**). Sediments from locations in this grouping are generally silty-to-clayey and show preliminary evidence of impacts from the Tin Mill Canal effluent. In this grouping, all constituents analyzed are potentially related to historical discharges from the Tin Mill Canal, which are the focus of the risk assessment in this area. Therefore, all available data from the offshore investigation are used in calculating exposure point concentrations (EPCs) for use in the risk assessment for this grouping. The primary use of the investigation and risk assessment results for this grouping is delineation of areas requiring cleanup in the southern area that has been impacted by the Tin Mill Canal effluent.

The Northeast/Near-Shore (NNS) Grouping includes all samples from Transects A, B, C, and D, as well as the following locations in Transects DE, E, and F: DE01, E01, E02, F01, F02, and F05 (**Figure 6-3**). Sediments from locations in this grouping are coarser and/or have less observable impacts (e.g., odor, sheen). In this grouping, since there is no clear evidence of historical impacts in the sample results, current inputs to the offshore area via groundwater/pore water and stormwater remain the focus of this investigation, including the risk assessment. The primary use anticipated for the investigation and risk assessment results for this grouping is evaluation of whether current impacts are associated with unacceptable risk in this area.

6.2 CHEMICAL SOURCES AND TRANSPORT MECHANISMS

Potential sources of chemicals from the Site that have affected the Phase I area, and the mechanisms by which these chemicals are transported from the Site to Bear Creek, are described in Section 3.1, and summarized on **Figures 6-1 and 6-2**. Sources of interest for the SWTM grouping include historical wastewater from the Tin Mill Canal, as well as current stormwater and groundwater inputs. Sources of interest for the NNS grouping include current stormwater and groundwater (pore water) inputs, since there is no clear evidence of historical impacts in the sample results.

6.3 MEDIA OF CONCERN

Based upon chemical sources and release mechanisms, potential media of concern for this risk assessment are sediment, sediment pore water, and surface water within the Phase I Offshore Investigation Area. As discussed in Section 3.1, chemicals in groundwater may be transported to sediment pore water and surface water via groundwater seepage into Bear Creek, and active stormwater outfalls may also transport chemicals to offshore sediment and surface water. Pore water sampling was conducted in the NNS to evaluate inputs via groundwater seepage. Surface sediments are the primary concern because these are the media fish, wildlife, and other receptors are most likely to contact. Subsurface sediments (sediments deeper than 1 ft in depth) are unlikely to provide a significant route of exposure to ecological or human receptors; therefore, exposure pathways for subsurface sediments are not considered complete. However, the data for the uppermost interval analyzed (0–1 ft or 0–2 ft) from sediment cores, as well as the grab

sample results collected to approximately 6 inches below the sediment surface, are included in the risk assessment for the SWTM. The purpose of collection of pore water was to identify linkages between groundwater and surface water, as identified in planning documents. Based on the methods used in the Coke Point risk assessment, the exposure assessment focused on bulk sediment and surface water. Exposures to pore water were not directly assessed, in favor of a conservative evaluation of bulk sediment chemistry.

The risk assessment does not evaluate future hypothetical risks that could occur if conditions in the Phase I area change; such changes would include redistribution of constituent concentrations in the sediment profile due to erosion or mixing.

6.4 ECOLOGICAL RISK − EXPOSURE PATHWAYS AND RECEPTORS

The conceptual site model for the ecological risk assessment (ERA) is based on an examination of site ecology. Based on the habitats and species expected offshore, complete pathways, assessment endpoints, and representative receptor species are selected for evaluation in the risk assessment.

6.4.1 Site Ecology

The Phase I area is located along the eastern side of Bear Creek, which flows into the Patapsco River. This is a moderately well mixed mesohaline aquatic environment, in which chemical transport is affected by tidal flow and surface water input from storm events. As defined by the Subaqueous Survey (see Section 2.1), water depths in the Phase I area of Bear Creek vary from less than 1 ft along the shoreline to 13 ft near the centerline of Bear Creek, and the water is generally deeper in the northern portion of the area. Substrate is generally sandy near the shoreline, with silt and clay farther offshore and at the outflow of the Tin Mill Canal. Water quality in the Patapsco River is often poor because of eutrophication (EA 2003), a condition that is also expected to affect Bear Creek.

The Visual Shoreline Survey (see Section 2.1.2) included documentation of shoreline habitats. The survey found that the intertidal zone in the Phase I area was largely covered by slag and rock, with a very low diversity of plant species as well as wildlife. The second most abundant habitat type in the intertidal zone was sandy shoreline dominated by *Phragmites*, an invasive plant. These areas have low plant diversity but provide habitat for a variety of wildlife, including birds and frogs. Debris and trash were commonly found along the shoreline, particularly in the areas dominated by *Phragmites*, where floating debris can become trapped.

The offshore environment adjacent to the Coke Point Peninsula on Sparrows Point was characterized in a reconnaissance study through fisheries studies, benthic community surveys, and review of submerged aquatic vegetation (SAV) maps (EA 2003). White perch and Atlantic silversides dominated fish surveys, although other fish species and blue crabs were collected. The study also found that birds, including herons, cormorants, terns, gulls, and ospreys utilize offshore areas, including the shoreline and/or open water. Herons and cormorants were observed

perching on a deteriorating wooden structure in the southern portion of the Phase I area during the Visual Shoreline Survey. Polychaetes and amphipods were dominant in the benthic community surveys, which indicated somewhat degraded conditions at two stations south and southwest of Coke Point and generally good benthic community health at the other three survey stations. No evidence of mammals or rare, threatened, or endangered species was observed during the reconnaissance study (EA 2003).

6.4.2 Assessment Endpoints

Assessment endpoints are clear statements of an environmental value to be protected from impacts (USEPA 1997a). The selection of assessment endpoints is based on the fundamental knowledge of site ecology, and incorporates consideration of the COPCs, exposure pathways, toxic mechanisms, and potentially important exposure groups. Per USEPA guidance (USEPA 1997a), the focus of the ecological risk assessment is to protect the ecological values at the site-wide population or community level except where threatened or endangered species are concerned.

The following preliminary assessment endpoints were defined to reflect the potential impacts of complete and significant exposure pathways and to aid in selecting representative receptor species:

- Viability of aquatic and benthic organism communities
- Viability of wildlife communities including piscivorous (fish-eating) birds and mammals.

Given the poor shoreline habitat, water depth, and poor water quality, the current offshore environment of the Phase I area is considered unlikely to support SAV or wetland plants (Maryland Department of Natural Resources 2013). Therefore, viability of wetland plants/SAV was not considered as an assessment endpoint. Phytoplankton that are present in the surface waters of the Phase I area are considered part of the aquatic and benthic community in the assessment.

The assessment endpoint for wildlife includes feeding guilds or taxa likely to use offshore area habitats. Previous studies have identified several species of fish as utilizing the offshore area. Therefore, piscivorous species which may consume benthos, crabs, or fish are appropriate as potential wildlife receptors for wildlife. Because the Phase I area is not expected to support SAV or wetland plants, herbivorous wildlife are not considered potential receptors.

Birds have been observed using the offshore area around Sparrows Point (EA 2003), and mammals, while they were not observed during habitat surveys (EA 2003), could be expected in near-shore environments of Bear Creek. Therefore, birds and mammals are considered potential receptors. There are limited methods to assess risks to reptiles and amphibians quantitatively. Therefore, reptiles and amphibians are not included in the selection of representative receptors.

6.4.3 Exposure Pathway Analysis

Ecological receptors of concern that are potentially present in the Phase I area include wildlife (birds and mammals) and aquatic/benthic organisms (fish, crab, invertebrates, and plankton). The major routes of exposure and their applicability to each of these receptor groups are presented in **Figure 6-1** and discussed below. The major routes of exposure for the identified receptor species are direct/dermal contact, ingestion, and inhalation.

Ingestion

The most significant exposure route for wildlife is ingestion of chemicals in impacted media (USEPA 2003a). Wildlife may ingest chemicals in environmental media by incidentally drinking brackish surface water or by incidentally ingesting soil and sediment while grooming or foraging. Chemicals may bioaccumulate in the tissue of plants and animals. Wildlife may also ingest chemicals accumulated in plants and animals that they consume as food. The Phase I area is expected to support a range of wildlife, including species that consume invertebrates, small birds and mammals, and fish or aquatic organisms. Ingestion of chemicals in sediment, surface water, and/or food is considered a complete and potentially significant exposure pathway for aquatic and benthic organisms and wildlife. Because surface water is brackish, consumption would be primarily through incidental ingestion.

Exposure through ingestion varies based on the feeding habits and foraging range of the species evaluated. Some aquatic organisms such as clams and worms have small home ranges and may live and feed within the same several hundred foot wide area their entire lives. Other organisms such as fish, crabs, and wildlife may feed in a specific area for days or months, but may leave the area to forage elsewhere.

Direct Contact/Dermal Contact

Aquatic and benthic organisms may be exposed to chemicals in sediment and surface water through direct contact and absorption through the skin and gills. Based on this information, direct exposure to sediment and surface water is considered a complete and significant pathway for aquatic and benthic organisms. Organisms such as clams and worms that live in the sediment and have small home ranges are likely to receive the greatest direct contact exposures, while more mobile organisms that also inhabit the water column are likely to have lower exposures.

Wildlife may be exposed to chemicals in air, soil (both surface and subsurface), sediment, or water via direct contact during foraging or burrowing. USEPA guidance identifies that, in most cases, dermal exposures are likely to be less significant than exposures through ingestion and their evaluation involves considerable uncertainty (USEPA 2003a). Given that fur and feathers are likely to limit dermal absorption of many chemicals, this exposure route is considered complete but relatively insignificant for wildlife. Therefore, dermal exposure for wildlife is not quantitatively evaluated in the ERA.

Inhalation

Inhalation is a potentially complete pathway for wildlife. Animals may inhale chemicals which have volatilized or which are adsorbed to airborne particulates. USEPA guidance indicates that, in general, inhalation pathways are likely to be insignificant compared to ingestion pathways (USEPA 2003a). Given the low importance set for both airborne fate and exposure, inhalation exposures are not quantitatively evaluated in the ERA.

6.4.4 Selection of Representative Receptor Species

Ecological receptors potentially present in the Phase I area include piscivorous wildlife (birds and mammals) and aquatic and benthic organisms. Because the Phase I area is not expected to support SAV or wetland plants other than *Phragmites*, herbivorous wildlife are not considered potential receptors. Because the ERA cannot quantitatively evaluate all of the species/receptors potentially present at a site, representative receptor species are selected. These species act as surrogates for other species that have similar diets/feeding habitats.

Selection of representative receptor species is based on several factors:

1) the likelihood of a species to use the Phase I area and the area immediately surrounding the area

2) the potential for exposure to site-related chemicals based on the feeding habits and life history of the organisms/guild represented by the receptor species

3) the availability of life history and exposure information for the selected receptor species

4) the availability of toxicity information for the representative receptor species.

To identify potentially affected species, groups, or guilds, the feeding guilds of the organisms known to occur in the area were reviewed. Previous studies indicated that fish and crustaceans are present in the offshore area adjacent to the Sparrows Point Peninsula (EA 2003); therefore, aquatic and benthic organisms as well as crab- or fish-eating (piscivorous) wildlife are potential receptors. Based on this information and the determination of the assessment endpoints, the receptors evaluated in this ERA are:

- aquatic organisms including crustaceans, fish, and algae
- benthic organisms including crustaceans, bivalves, worms, and algae
- piscivorous birds
- piscivorous mammals.

Aquatic and Benthic Organisms

Toxicological benchmarks for the evaluation of risk to aquatic and benthic organisms are based on a wide variety of species and taxa, including crustaceans, fish, bivalves, worms, and algae. Therefore, the overall aquatic community or benthic community is identified as the representative receptor. The benchmarks used in the evaluation are highly precautionary and are typically based on organism exposures to environmental media through a variety of pathways, including direct exposure and ingestion. Therefore, both of these pathways are examined in the assessment.

Piscivorous Wildlife

The great blue heron (*Ardea herodias*) was selected as a representative receptor for piscivorous avian species, to evaluate potential adverse effects to birds from the ingestion of aquatic and benthic prey in the Phase I area. Great blue heron are known to eat fish, invertebrates, and amphibians among other things. The heron is chosen as a receptor because it is likely to hunt in the shallower waters along the shoreline of the Phase I area, where it can walk through the water and capture prey with its bill. Exposure data are available for quantitative evaluation of great blue heron food chain exposures. As a representative receptor, herons act as surrogates for other piscivorous birds including gulls, cormorants, and terns.

The raccoon (*Procyon lotor*) was selected as a representative receptor for piscivorous mammal species, to evaluate potential adverse effects to mammals from the ingestion of fish and aquatic invertebrates. The raccoon's diet is very diverse but includes the consumption of fish and other aquatic animals. Although the raccoon is unlikely to feed in deeper water, they may feed in the shallows along the shore. Exposure data are available for quantitative evaluation of raccoon food chain exposures. As a representative receptor, raccoons act as surrogates for other piscivorous mammals. While piscivorous mammals have not been directly observed utilizing the Phase I area, raccoon are evaluated as a precautionary measure.

In addition to the ingestion of chemicals in food items (prey), the inadvertent ingestion of chemicals in sediment and direct exposure to chemicals in surface water is evaluated for the above species. Wildlife may consume prey from different levels within the food chain. Prey may include lower trophic level organisms such as worms, mussels, small crustaceans, or other bivalves. Prey may also include fish or mature crabs higher in the food chain. Prey lower on the food chain are often less mobile and would experience more prolonged direct exposure to chemicals in sediments of the Phase I area. Prey higher on the food chain are often very mobile, and may spend less time in the Phase I area; however, they may bioaccumulate high concentrations of chemicals such as PCBs which tend to biomagnify up the food chain. Therefore, separate evaluation of different types of prey is warranted.

It is important to note that, while the risk assessment typically quantifies the potential for adverse effects to individual organisms, the objective is to be protective of the populations that use the Phase I area (given the absence of threatened and endangered species). Because few methods are

available to extrapolate the potential for adverse effects from the individual level to the population level, it is assumed that if there is no potential for direct adverse effects to individual organisms, then it is also unlikely for there to be the potential for direct adverse effects to populations. Similarly, it is assumed that if there is the potential for adverse effects to individual organisms, then there is also the potential for adverse effects to populations. The methodology used to evaluate exposure scenarios for these receptors is discussed further in Chapters 8 and 9.

6.5 HUMAN HEALTH RISK – EXPOSURE PATHWAYS AND RECEPTORS

The CSM for the human health risk assessment (HHRA) is based on a determination of expected activities within the Phase I area. Based on the types of activities expected in this area, representative receptor populations and their activities are selected for evaluation in the HHRA.

6.5.1 Site Conditions

The Phase I area, in Bear Creek adjacent to the Sparrows Point facility, is a low frequency use recreational area overall. Other areas that present a more attractive area for recreational use are present in close proximity but not adjacent to the Sparrows Point Peninsula. As described in Section 6.4.1, the shoreline of the Phase I area is largely covered by slag, rock, and *Phragmites*, making the shoreline generally unattractive for use and difficult to access on foot. Access by boat is also made more difficult by shallow water and a lack of boat ramps or docking facilities. It is therefore expected that people will visit the shoreline of the Phase I area infrequently and for short periods of time. However, during the field sampling for the offshore investigation, fishing from shore was observed in the far northern portion of the Phase I shoreline, where nearby road access and near-shore deep water are present. Additionally, the offshore environments of the Phase I area are not controlled, and access to these areas is not limited. The land across Bear Creek from the Phase I area consists of residential properties, most with private boat piers, and with a number of attractive shoreline parks. People clearly use this shoreline opposite, but outside of, the Phase I area for boating, swimming, and fishing. Recreational boat traffic in the channel that runs through the offshore portion of Phase I area is also common. During the field sampling, bottom trawling from vessels was observed in the channel in the southern portion of the Phase I area. Based on the observed and potential human uses of the Phase I area, two populations were identified as potential receptors: recreational users and commercial watermen. White perch, Atlantic silversides, blue crabs, and other fish species were found in fish surveys completed adjacent to the Sparrows Point Peninsula (EA 2003).

6.5.2 Potential Receptors and Exposure Pathways

Based on the observed and potential uses of the Phase I area, two populations are identified as potential receptors: recreational users and commercial watermen. Complete exposure pathways for these receptors are presented on **Figure 6-2**.

Recreational Users

Recreational users can access the Phase I area by boat. Recreational users could use the Phase I area of Bear Creek for swimming or fishing. This results in a complete contact point with chemicals modeled in surface water. Because of the brackish nature of the surface water, only incidental ingestion of surface water while swimming is expected to occur. Incidental ingestion of surface water is not included as a complete exposure pathway because the previous risk assessment for the Coke Point portion of the Sparrows Point Site (EA 2011a) indicated that risks associated with this pathway were insignificant. The primary contact with surface water is expected to be through dermal contact while swimming. Surface water depths in the Phase I area, as characterized during the Subaqueous Survey (Section 2.1), range from 1 ft along the shoreline to 13 ft near the centerline of Bear Creek. As a result, there is a possibility that recreational users may contact sediment while swimming within shallow portions of the Phase I area. Therefore, dermal contact with sediment is also considered a complete exposure pathway for recreational users except for the age range for the child (3-6 years old), as a conservative measure. The dermal area of the recreational user exposed to sediment is the foot and lower leg. It is also expected that recreational users engage in fishing and crabbing in the area and consume their catch. Therefore, recreational users are evaluated for both fish and crab ingestion. Recreational users are evaluated for three age ranges: a child (3 to 6), an adolescent (age 6 to 16), and an adult (>16 years). Although regulatory guidance suggests the use of the age range of 0 to 6 years for a child exposure, it is assumed that a child aged 0 to 3 years would not swim or consume fish/crabs from the Phase I area.

The following exposure routes are considered complete for recreational users:

- Dermal contact with surface water
- Dermal contact with sediment
- Ingestion of fish and crabs.

Commercial Watermen

Commercial watermen are also potential users of the Phase I area. Based upon local fishing methods, it is assumed that the fishermen come in contact with surface water and sediment during fishing activities. Therefore, surface water and sediment dermal contact with the skin is considered a complete exposure pathway. The dermal area of the watermen exposed to surface water and sediment is the hands and forearms only. Incidental ingestion of surface water and sediment while fishing is likely to be non-existent to minimal and is not considered a complete exposure route. It is expected that the watermen ingest the fish and crabs collected from the Phase I area. Commercial watermen are assumed to be adults (>16 years).

The following exposure routes are considered complete for the commercial watermen:

- Dermal contact with surface water
- Dermal contact with sediment
- Ingestion of fish and crabs.

The methodology used to evaluate exposure scenarios for these receptors is discussed further in Chapters 8 and 10.

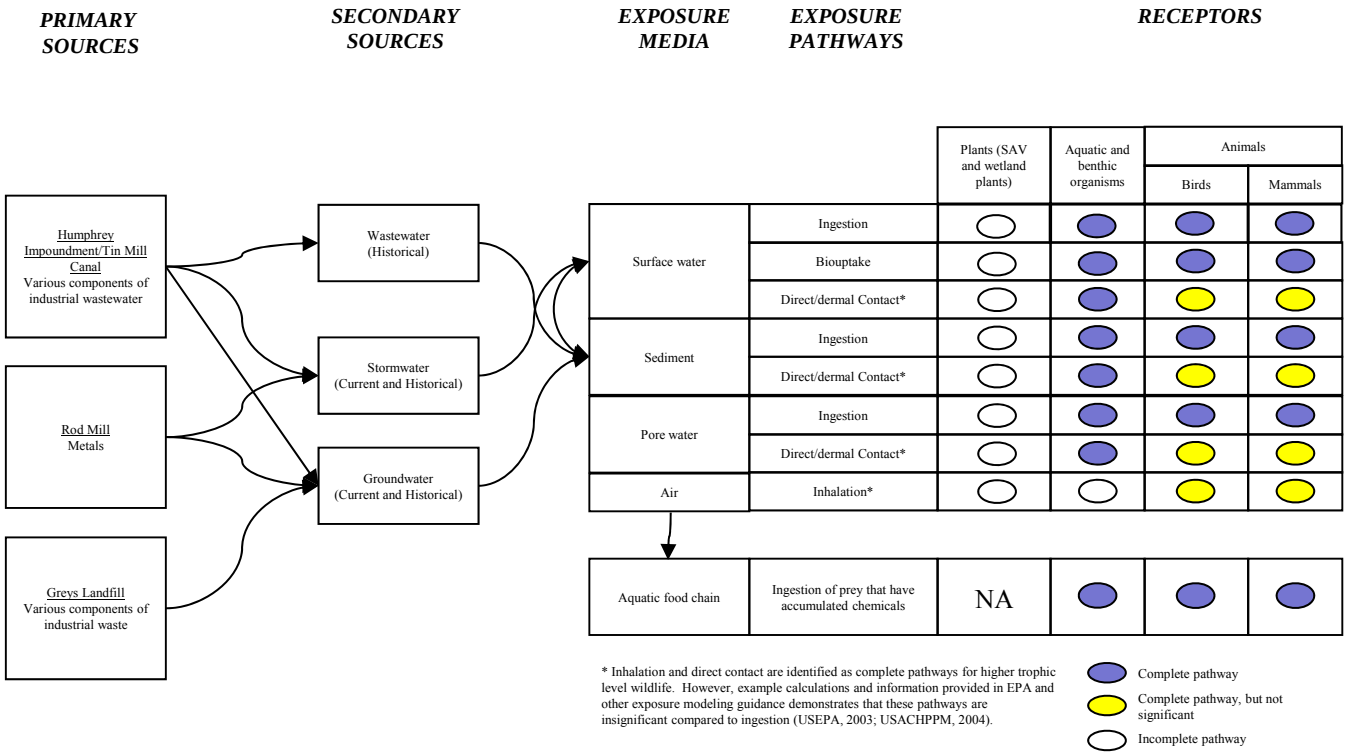


Figure 6-1. Ecological Components of the Conceptual Site Model for the Phase I Area, Sparrows Point

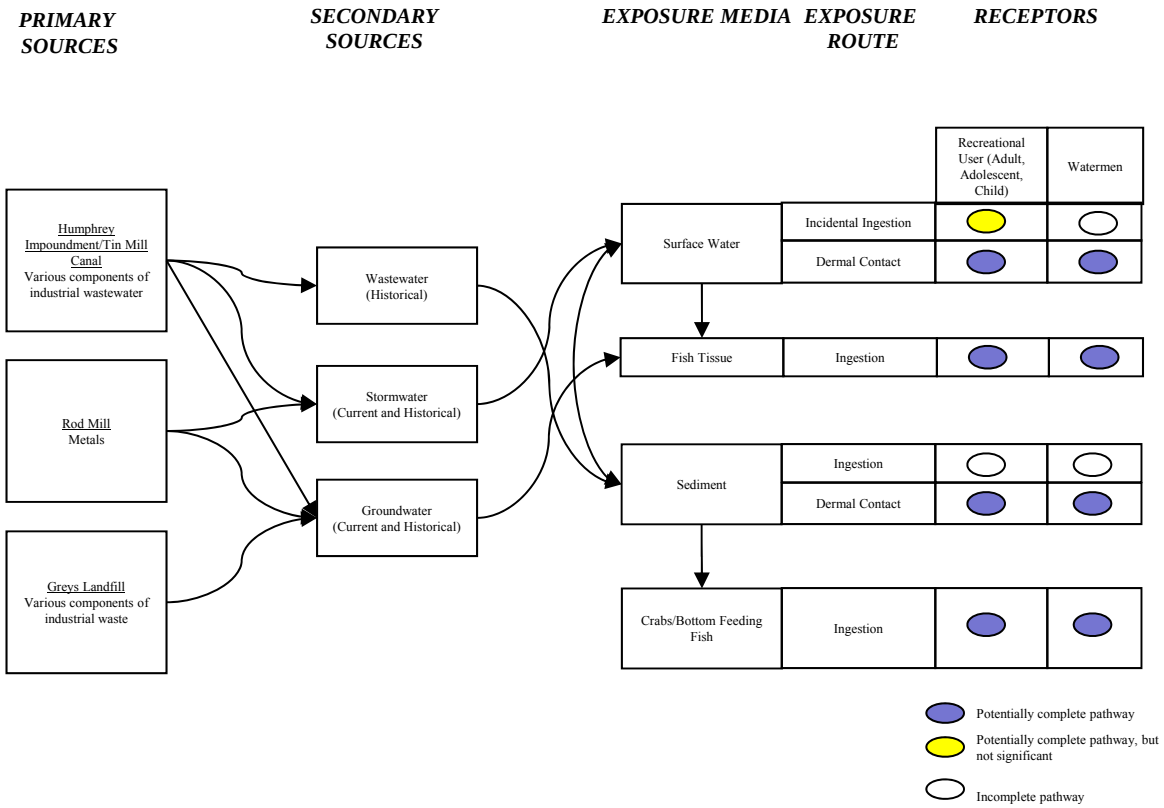
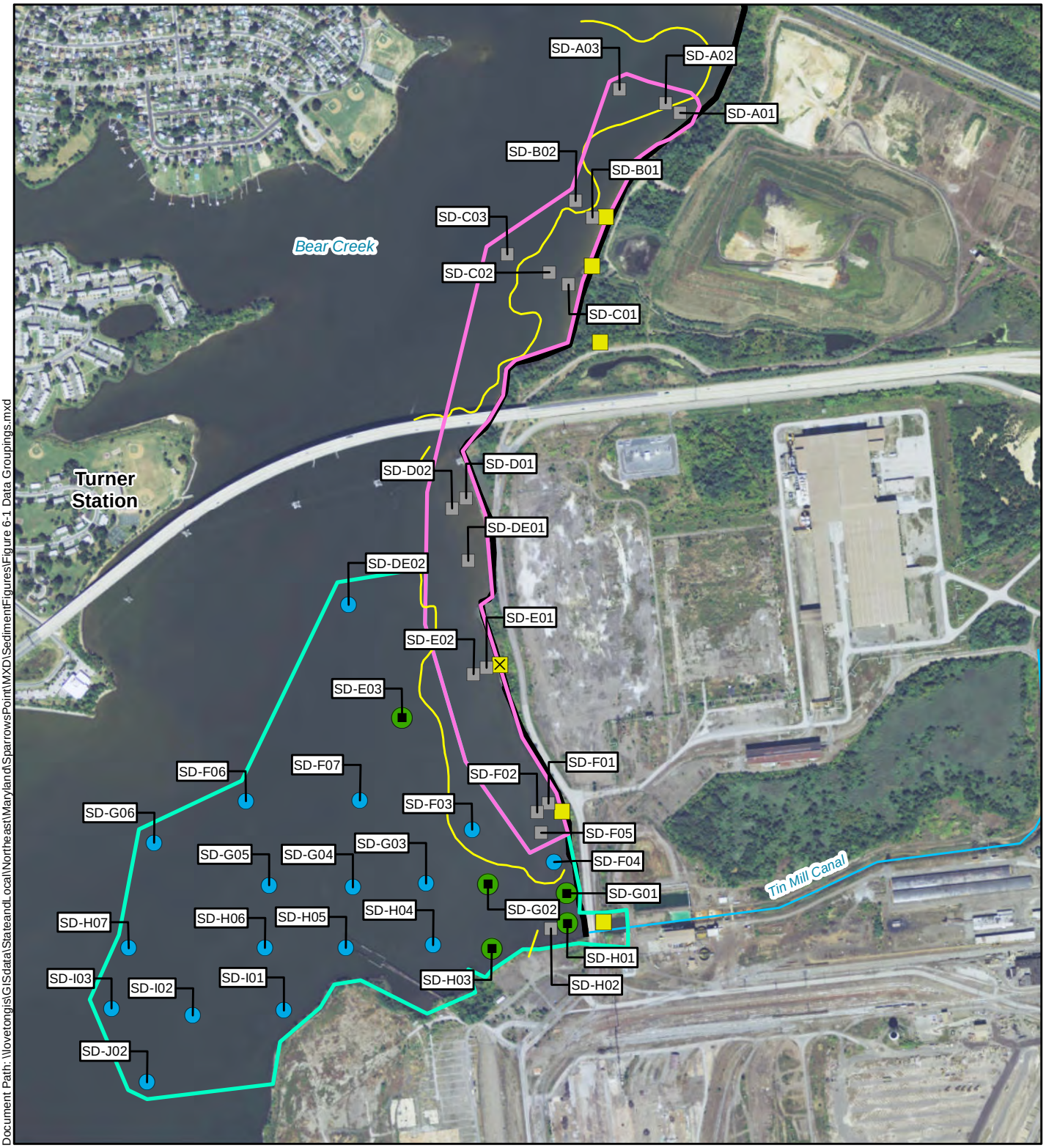


Figure 6-2. Human Health Components of the Conceptual Site Model for the Phase I Area, Sparrows Point



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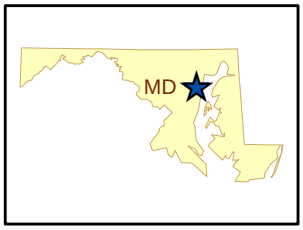

0 250 500 1,000
Feet

1 inch = 1,000 feet

N

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

Sample Location

- Coring Location
- Surface Grab and Coring Location
- Surface Grab
- Northeast/Near-Shore Grouping
- Southwest/Tin Mill Canal Effluent Grouping

Figure 6-3
Data Groupings
Phase I Northwest Shoreline
Baltimore, Maryland

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

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7. SURFACE WATER MODELING

As stated in Section 1.5, identification of Site-related impacts to the offshore environment was a key objective of the offshore investigation. To this end, it was important to understand how the measured concentrations of constituents in stormwater and pore water would be expected to impact the quality of surface water in Bear Creek. A hydrodynamic model was used to model these surface water concentrations. This section describes the inputs and methods used in modeling, as well as the results of the model.

7.1 MODEL INPUTS

7.1.1 Estimation of Stormwater Flows

As described in Section 4.3, two unmonitored stormwater outfalls (018 and UNNAMED), one stormwater pond (representing outfall 070), and one monitored outfall (014) were sampled in November and December 2014 to support the offshore investigation. In order to estimate the contaminant loading into Bear Creek from Outfalls 018, UNNAMED, and 070 during a storm event, it was necessary to generate storm event hydrographs. A constant flow of 38.68 cubic feet per second was modeled for Outfall 014, which was previously fed by a water treatment system. Currently, the Outfall 014 base flow is primarily groundwater and stormwater. The flow used represents an above average flow from the outfall, based on available data.

The USEPA Stormwater Management Modeling (SWMM) software was used to generate storm event hydrographs for Outfalls 018, UNNAMED, and 070. SWMM is a dynamic rainfall-runoff-routing simulation model used for single event or continuous simulation of runoff quantity and quality from urban areas. The runoff component of SWMM simulates runoff and pollutant loads from subcatchment areas receiving precipitation. SWMM enables the user to design the routing component to transport this runoff through a variety of transport/treatment devices including pipes, channels, storage/treatment devices, pumps, and regulators. Throughout a model simulation, SWMM tracks the quantity and quality of the water in both the runoff and routing components.

SWMM relies on information about the subcatchments or drainage areas to be modeled. The portion of the Site adjacent to the Phase I area is generally flat, with minimal slope, except in areas adjacent to roads, on Greys Landfill, or along the shoreline. Consequently, delineation of drainage areas for each of the outfalls was not straightforward. Combining the physical data from the contour map, and field observations of site drainage recorded during the storm sampling events and other site reconnaissance visits, EA developed three conservative drainage areas, which collect and transport water to outfalls 018, UNNAMED, and 070 (**Figure 7-1**).

After delineating the drainage areas, the SWMM requires inputs describing the areas and their permeability. The runoff component of SWMM is highly sensitive to the percent impervious area and the subcatchment width. Conservative estimates of the these parameters were used for

each drainage area, to support a conservative estimate of the pollutant load into Bear Creek. The percent impervious area was determined by delineating the impervious areas within each of the areas as depicted on the most up-to-date aerial imagery available, as well as from photos taken during field reconnaissance visits and storm sampling events. The subcatchment width was calculated by dividing the drainage area by the average maximum overland flow length. The maximum overland flow length was defined in SWMM as the length of the flow path from the drainage area outlet to the furthest drainage point of the drainage area. The maximum overland flow lengths for each of the drainage areas were estimated using aerial imagery and field observations. **Table 7-1** summarizes the results of the impervious area and subcatchment width analyses. All other drainage area characteristics were left as their default value in the SWMM model.

No information was available regarding the underground piping, conduits, and other transport devices within the Phase I area. Therefore, for conservative purposes, the model was constructed under the assumption that no matter the routing mechanism, all flow within each drainage area is routed to the designated outfall. This assumption produced conservative estimates of flow from each outfall, which in turn generated the most conservative pollutant load estimates.

The last component of the SWMM model that is necessary to generate stormwater hydrographs for each outfall is the rainfall data. Within the SWMM model, rainfall data were input as a rain gauge, which can contain a single rainfall amount or time series data for storm events. This modeling effort used different storm events, including the 24-hour rainfall data for the 16 November 2014 and 1 December 2014 sampling events, and the Soil Conservation Service type II rainfall distribution for the 1-year design storm as described in the Maryland Stormwater Design Manual. **Table 7-2** summarizes the hydrologic modeling results for the peak runoff from each drainage area, and the peak flow and average flow from each outfall.

7.1.2 Estimation of Pore Water Flow Rates

The rate flux of COPCs from groundwater to pore water and ultimately to surface water in Bear Creek was estimated using pore water concentrations of constituents of interest, along with the approximate rate of flow of upland groundwater into surface water. Generally, flow velocity in the subsurface is a function of the porosity and permeability of the aquifer, as well as its hydraulic gradient (slope). As described below, the rate of groundwater upwelling was estimated using the hydraulic gradient, porosity, and hydraulic conductivity of the upper zone of the aquifer onshore. The flow from onshore to offshore was then distributed across the sandy portion of the offshore (see below).

The upper zone of the aquifer that is of interest for potential upwelling into Bear Creek consists of steel-making slag fill material, which typically has permeability similar to that of sand, and an underlying sandy aquifer. As described in the Subaqueous Survey of the Phase I area, the sandy portion of the offshore extends from the shoreline to approximately 500 ft into Bear Creek.

Hydraulic gradient – The hydraulic gradient dh/dl was calculated from groundwater flow contours for Greys Landfill, the Rod & Wire Mill, and the southern portion of the Phase I area, as the change in water table height (dh) in feet divided by the surface distance in feet between two points (dl). Calculations were performed for multiple timepoints in each area (**Table 7-3**). Based on these calculations, a hydraulic gradient of 0.01 was estimated for the Phase I shoreline overall.

Note that the drawdown associated with groundwater extraction in the southern portion of the Rod & Wire Mill Area, particularly in the vicinity of the RW20 well cluster, was not taken into account. Well RW20PZM020 is an active pumping well screened in the intermediate groundwater zone, pumping at approximately 2 gallons per minute, and also causes a cone of depression in the shallow groundwater zone in this area. However, as a conservative measure and taking into account the possible cessation of pumping, the flow rate calculations from the Rod & Wire Mill area are based on the gradient farther north, between wells RW18 and RW19.

Porosity – A soil porosity value of n = 0.3 was assumed for both the shallow zone of the aquifer and the sandy sediments, based on Site records and literature values for similar geologic materials (Domenico and Schwartz 1990).

Hydraulic conductivity – The average hydraulic conductivity (K) of the shallow zone of the aquifer in the Phase I area was estimated to be 10 ft/day, based on the average K modeled for this area in the *Site Wide Investigation Groundwater Study Report* (CH2M Hill 2001).

Groundwater velocity – The groundwater velocity v flowing from the onshore to the offshore environment was calculated using Darcy's Law (v = K/n*dh/dl), based on the parameter values described above. This yielded a velocity of 0.33 ft/day.

Groundwater flux – Based on the velocity above, the flux of groundwater through each 1-ft-wide, 30-ft-deep cross section of the interface between the onshore and offshore environments was calculated at 10 cubic feet per day (0.33 ft/day*30 square feet). This flux was then distributed across a 500-ft-long strip of sandy offshore environment, yielding an upwelling velocity of 0.02 ft/day through the pore water into the surface water. This upwelling velocity was applied across the sandy zone of the offshore in the surface water model, and used in estimating the flux of contaminants from pore water into surface water (**Table 7-4**).

7.1.3 Selection of Constituents to be Modeled and Calculation of Input Concentrations

Constituents modeled in surface water met the following criteria:

- Constituents that were detected in pore water and/or stormwater

- Constituents that were reported in at least one pore water, stormwater, or surface sediment sample at a concentration exceeding the BTAG screening criteria, or which had no available BTAG screening criteria.

However, oil and grease was not modeled because it is not quantitatively considered in the risk assessment process, although it did meet the above criteria. The decision not to model oil and grease in surface water was also justified by the fact that concentrations in sediment were substantially higher than those in stormwater samples.

The following constituents were modeled:

- Antimony
- Arsenic
- Chromium
- Copper
- Lead
- Mercury
- Nickel
- Selenium
- Zinc
- Cyanide
- Bis(2-ethylhexyl) phthalate
- Low molecular weight (LMW) PAHs
- High molecular weight (HMW) PAHs
- 2,4-Dimethylphenol.

For each constituent selected to be modeled, all detected pore water concentrations were used as inputs. For stormwater, the highest detection from the two sampling events was used as the input concentration. For LMW and HMW PAHs, the sums of concentrations of PAHs in each group (see Section 8.2) were used as input concentrations in the models for LMW and HMW PAHs.

The calculated fluxes of modeled constituents entering Bear Creek surface water via pore water transport are presented in **Table 7-4**. These fluxes were used as inputs to the hydrodynamic model.

7.1.4 Tide Conditions

Monthly tide elevations at Fort McHenry in Baltimore Harbor, available from the National Oceanic and Atmospheric Administration (NOAA), were used to assess tide conditions in Bear Creek. The mean high water tide elevation in Baltimore Harbor is 1.11 ft relative to mean low water and the hydrodynamic model was driven with average tidal range of this magnitude as a downstream boundary condition. Tidal datums at Baltimore (Fort McHenry), Patapsco River are presented in **Table 7-5**, and the tidal input to the model is presented on **Figure 7-2**.

7.2 HYDRODYNAMICS AND CONTAMINANT FATE

7.2.1 Model Setup

A tidally dynamic model was developed to examine the fate and transport of COPCs in stormwater and pore water from the shoreline surrounding Sparrows Point into Bear Creek and the adjoining Baltimore Harbor. The United States Army Corps of Engineers models RMA2 (hydrodynamics) and RMA4 (water quality) were used. Both are finite element numerical models. RMA2 calculates fluid flow velocities within a two-dimensional grid system, and RMA4 uses the solutions to calculate movement of mass through the grid, based on advection and diffusion processes. These models were executed within the framework provided by the Surface-water Modeling System. The downstream end of the model domain had a tidal boundary at a transect between the middle of Key Bridge on the west to the Dundalk Marine Terminal area on the east. The model included Bear Creek and adjoinng Baltimore Harbor (**Figure 7-3**), with 951 cells and 2,706 nodes. The maximum nodal water depth in Bear Creek is 29 ft.

An average flow of 7.6 cubic feet per second (Stammerjohn et al. 1991) was applied at the northern end of Bear Creek that represents the total Bear Creek watershed flow as an upstream boundary condition. A 1.1-ft sinusoidal tide curve with a 12.4-hour period was applied at the downstream model boundary. The model was executed with a 0.5-hour time step and output saved every hour. The hydrodynamic output file from RMA2 is used as an input file to RMA4.

The simulation for each modeled constituent was run for a period of 1,200 hours (50 days). For the first 1,000 hours of the simulation, only the continuous fluxes of constituents (pore water and Outfall 014) (**Table 7-4**) were included, to allow the modeled constituent concentrations to approach an equilibrium concentration at nodes in the north and south boundaries Bear Creek model. At 1,000 hours, stormwater flows representing the 1-year design storm, with associated constituent concentrations (**Table 7-4**), were added to the model.

Model cells where pore water and stormwater loading was included in the model are shown on **Figure 7-4**. Stormwater inputs were placed in the cell closest to the corresponding sampled outfall (**Figure 4-1**). Pore water constituent inputs were included in each cell corresponding to a pore water sampling location (**Figure 4-1**), and also to the cells extending to the west, up to approximately 500–600 ft offshore from that location. Additionally, pore water concentrations were extrapolated between sampling locations, so that pore water inputs were applied to all cells within 500–600 ft of the shoreline (**Figure 7-4**). This extrapolation was based on the conservative assumption that pore water fluxes are continuous in the near-shore area.

All constituents were modeled as conservative tracers. Thus, the model only represents physical processes affecting chemical transport and mixing, and does not include any chemical effects. A zero background concentration was used for all constituents, such that the model only represents constituent concentrations derived from Sparrows Point stormwater and pore water inputs.

7.2.2 Model Assumptions

A number of assumptions were made in constructing the surface water model. Generally, as noted above, conservative assumptions were employed to avoid underestimating the surface water concentrations resulting from inputs from the Site:

- All groundwater from a 30-ft-thick vertical section of the aquifer was assumed to flow upward into the surface water of Bear Creek. This is a conservative assumption, consistent with the analysis presented in the *Site Assessment for the Proposed Coke Point Dredged Material Containment Facility at Sparrows Poin*t (EA 2009).

- Groundwater upwelling velocity and the mass flux of each COPC were assumed to be constant from the shoreline to approximately 500 ft offshore. This is also a likely a conservative assumption, as the mass flux likely decreases somewhat with distance traveled through the aquifer, away from the source area.

- Because pore water data were only available from one location per transect, pore water concentrations were also assumed to be constant from the shoreline to approximately 500–600 ft offshore. This is also likely to be a conservative assumption, as dilution and absorption processes could decrease groundwater constituent concentrations in pore water farther away from the shoreline.

- The maximum reported COPC concentration from each stormwater outfall was used in calculating the flux to be modeled. Outfall 014, the water treatment plant outfall, was sampled with the other outfalls during storm events. The maximum concentration of each constituent measured during these events was used as continuous inputs to the model (with pore water, as part of the non-storm condition). Thus, it was assumed that concentrations measured from samples collected during storm events represent the typical discharge from Outfall 014. The stormwater pond adjacent to Greys Landfill was sampled at the beginning of the 1 December 2014 storm. The results for this sample were used to model the constituent flux from Outfall 070, although it is unknown how often water overflows through this outfall or adjacent Outfall 071. Thus, use of the stormwater pond water to model flux from this outfall to the offshore represents a conservative assumption.

- The model runs were carried out in a screening-level mode. Neither hydrodynamic nor constituent concentration models were calibrated or validated with independent surface water data from field samples, as the objective was to determine only the impacts to surface water resulting from Site-related inputs.

7.3 MODEL RESULTS

The model results indicate that, as expected, flow velocities during both ebb and flood tides are relatively high in the center of Bear Creek, and are diminished near the mouth of the Tin Mill canal, thus reducing the flushing rates of this area (**Figures 7-5 and 7-6)**.

Isocontour plots showing the modeled concentrations of select constituents (LMW PAHs, HMW PAHs, cyanide, and nickel) in Bear Creek surface water are provided in **Figures 7-7 through 7-12**. For LMW PAHs, cyanide, and nickel, two figures are provided: one illustrating the modeled surface water concentrations after equilibration of the non-storm (pore water and Outfall 014) simulation, and the other illustrating concentrations at the peak of the modeled 1-year storm. Note that HMW PAHs were only detected in Outfall 014 (not in any of the active stormwater outfalls); therefore, only the non-storm simulation applies.

Output from the model was used to compute screening (maximum) EPCs and reasonable maximum EPCs for surface water within the NNS and SWTM Phase I data groupings, for use in the risk assessments (Chapters 9 and 10). EPCs were computed for both the non-storm condition (including pore water and Outfall 014) and the 1-year storm condition (**Table 7-6**). Maximum concentrations for the non-storm and storm conditions were calculated as the highest concentration modeled in any single model cell under the given scenario. The reasonable maximum EPCs for the non-storm condition were calculated as the highest volume-weighted average within the grouping of interest (NNS or SWTM) for a single timepoint during one tide cycle. The reasonable maximum EPCs for the storm condition represent the highest volume-weighted average concentration within the grouping of interest for a single timepoint during the course of the 24-hour design storm. Application of these EPCs to the risk assessments is discussed in Section 8.4.

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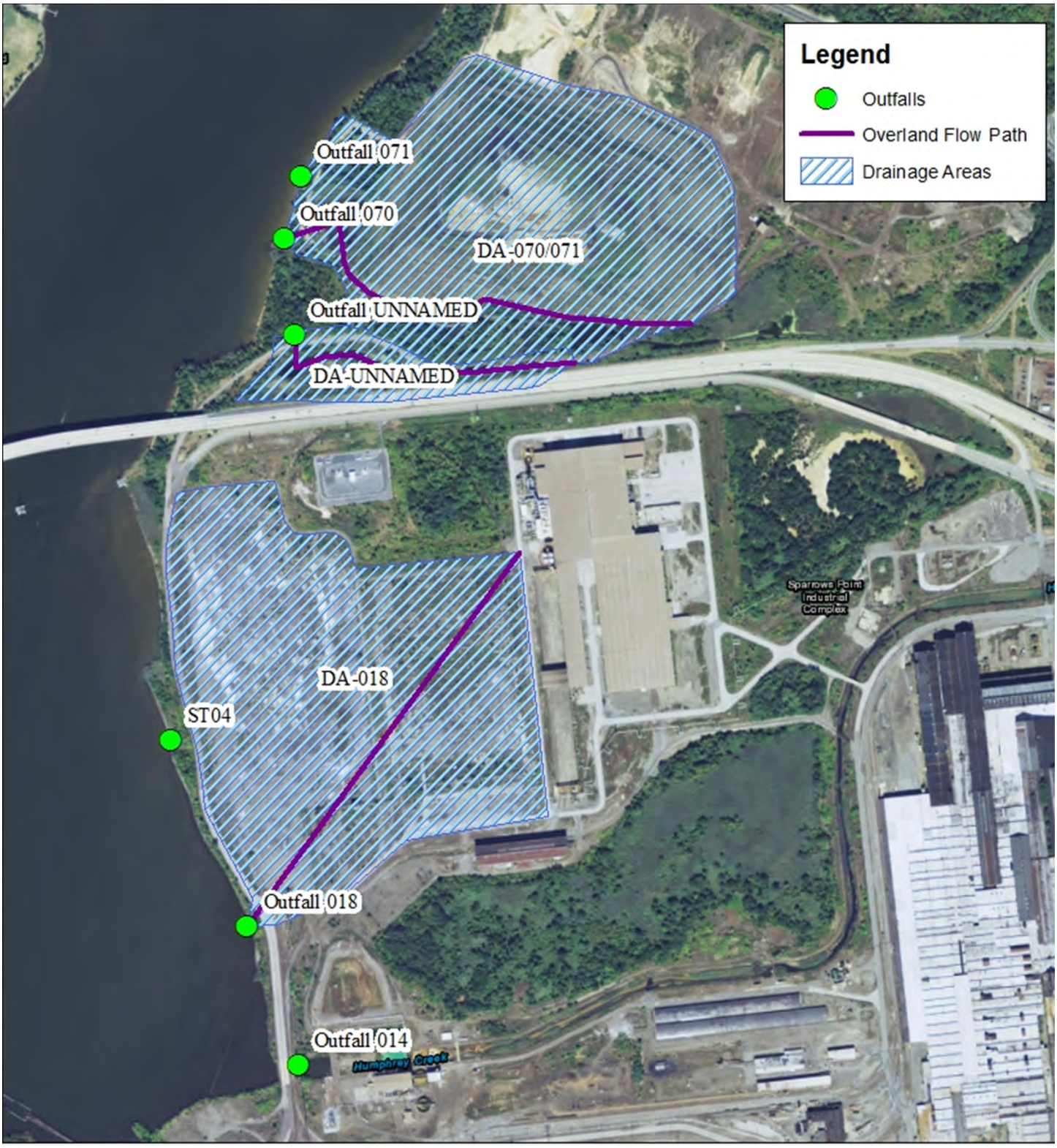
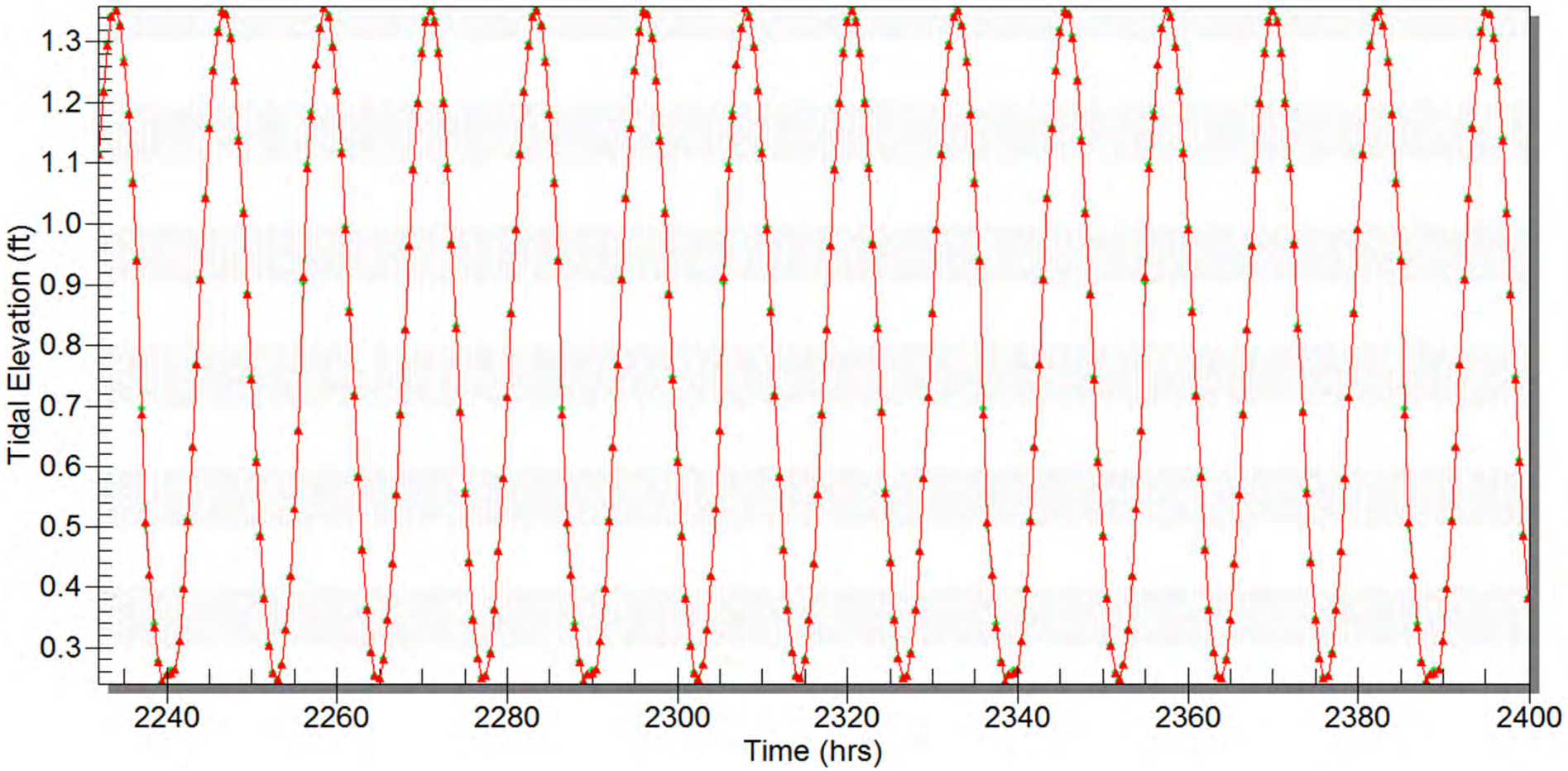


EA Engineering, Science, and Technology, Inc., PBC

N
W E
S

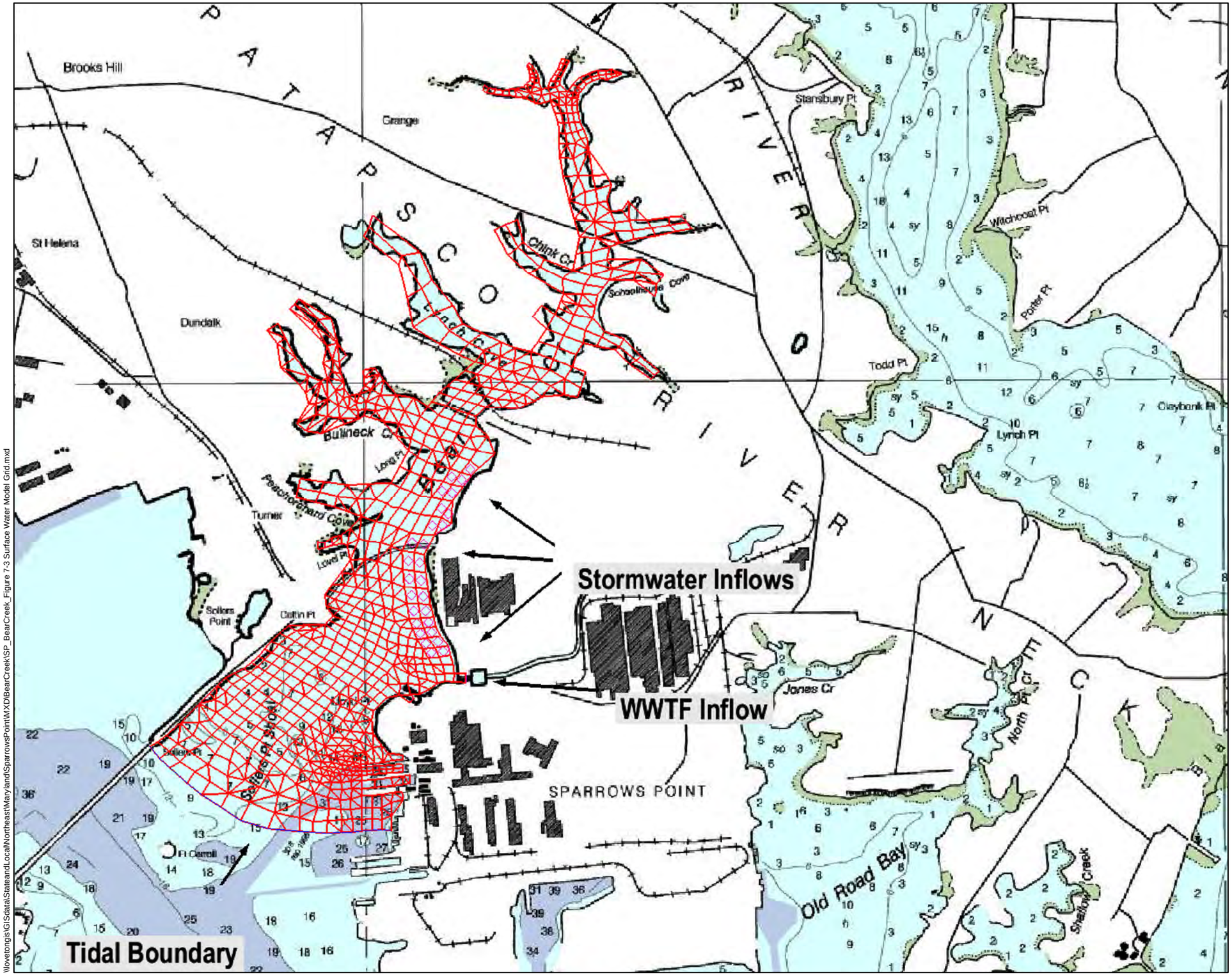
0 650 1,300 Feet

Figure 7-1 Drainage Areas for Outfalls

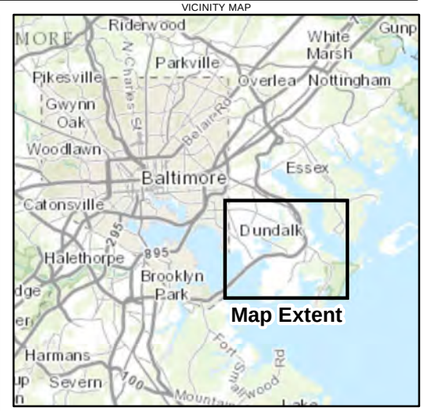


Source: National Oceanic and Atmospheric Administration, tidal data for Baltimore (Fort McHenry), Patapsco River

Figure 7-2 Tidal elevation input to model (7 days)



VICINITY MAP



Legend

Surface Water Model Grid Cell

N

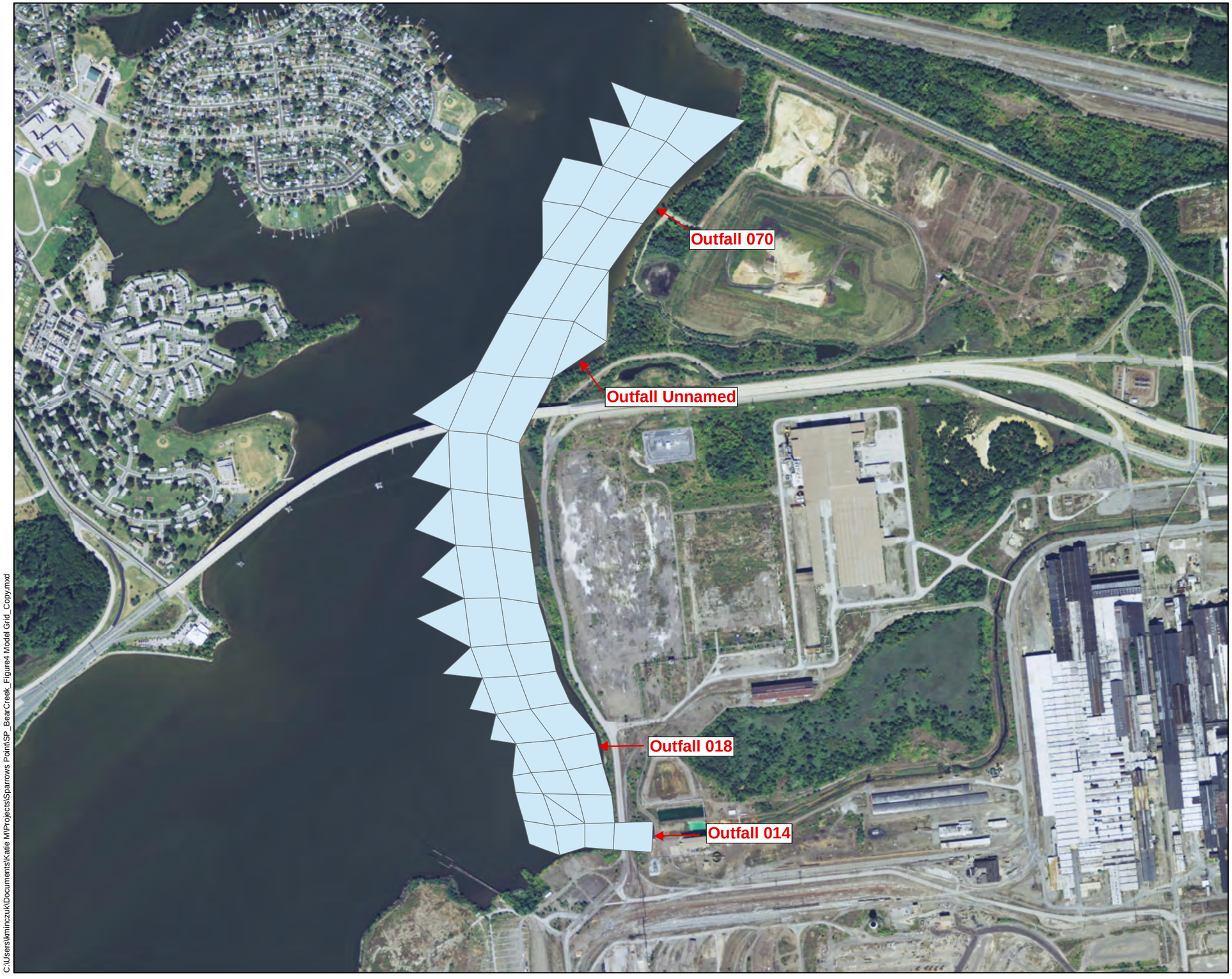
0 2,000 4,000

Feet

EA Engineering, Science, and Technology, Inc., PBC

Figure 7-3
Surface Water Model Grid
Bear Creek
Sparrows Point, Maryland

\\lovetongis\GIS\data\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\BearCreek\SP_BearCreek_Figure 7-3 Surface Water Model Grid.mxd



Legend

- Cells with Pore Water Inputs
- Locations of Stormwater Inputs

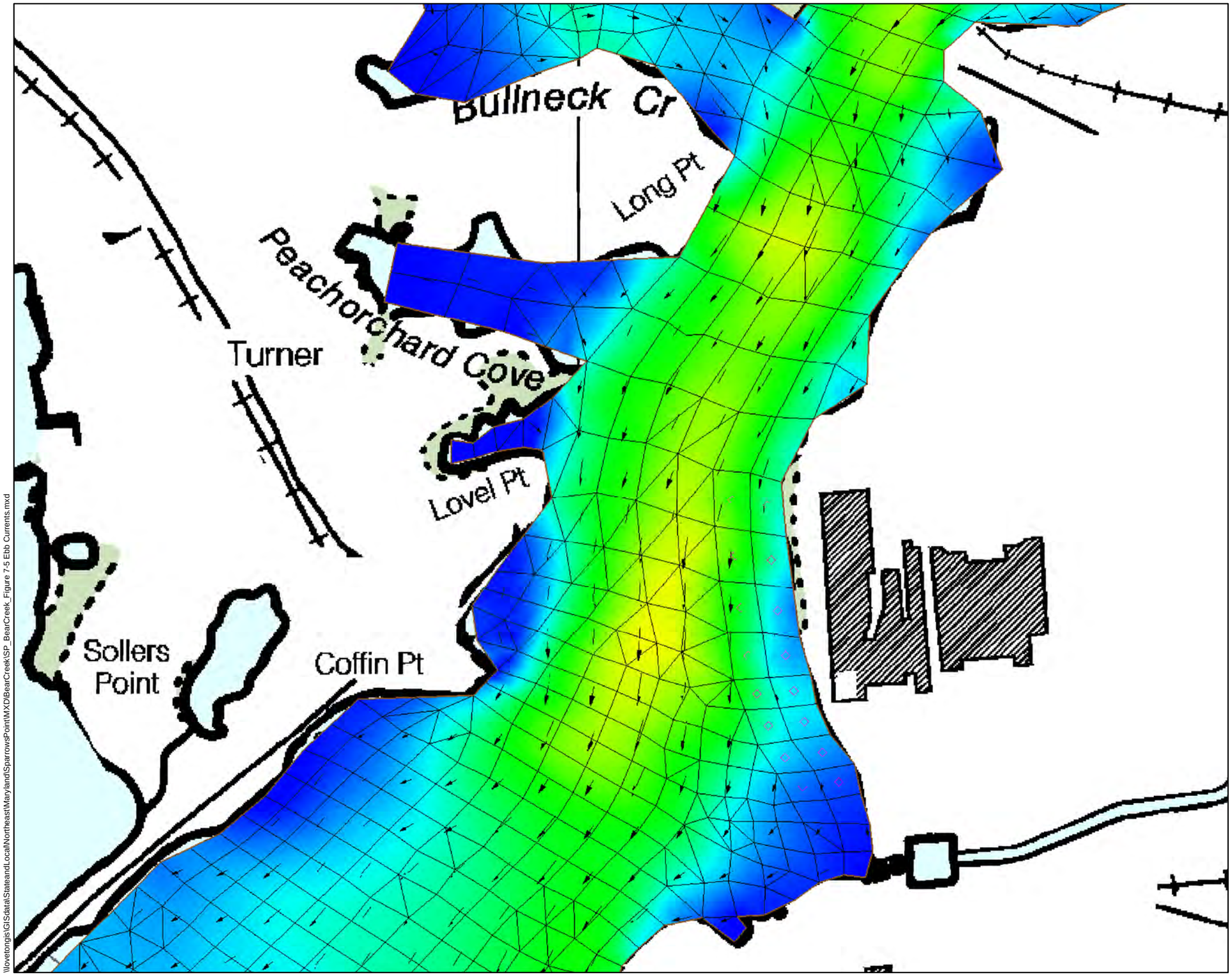
N

0 800 1,600

Feet

Figure 7-4
Locations of Stormwater and Pore Water Inputs to Model Loading
Bear Creek
Sparrows Point, Maryland

C:\Users\kminczuk\Documents\Katie M\Projects\Sparrows Point\SP_BearCreek_Figure4 Model Grid_Copy.mxd



VICINITY MAP

Mess Module Velocity (ft/s)

- 0.38 ft/s
- 0.3 ft/s
- 0.2 ft/s
- 0.1 ft/s
- 0.0 ft/s

N

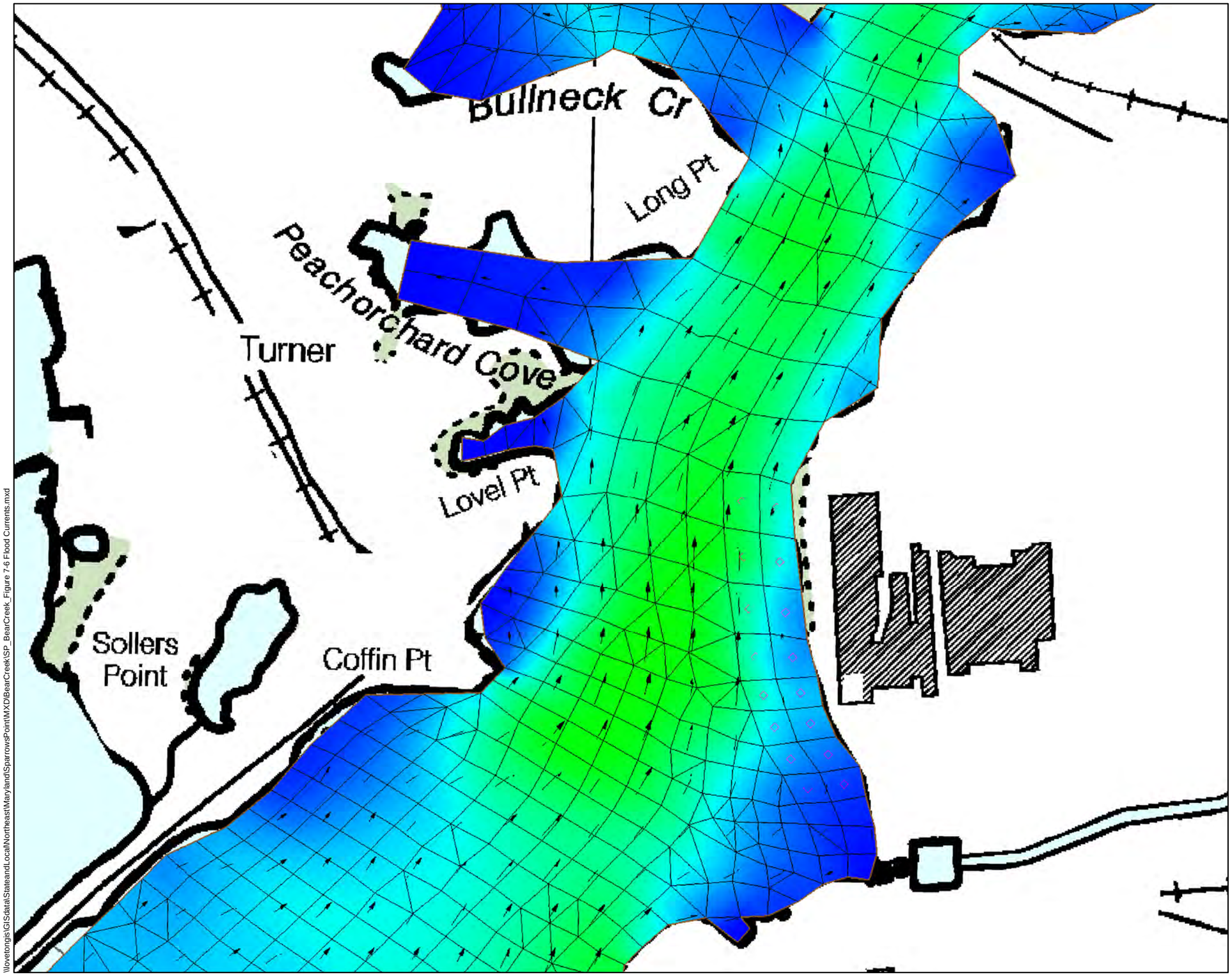
0 800 1,600

Feet

EA Engineering, Science, and Technology, Inc., PBC

Figure 7-5
Ebb Currents in Bear Creek
Bear Creek
Sparrows Point, Maryland

\\lovetongis\GIS\data\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\BearCreek\SP_BearCreek_Figure 7-5 Ebb Currents.mxd



Mess Module Velocity (ft/s)

- 0.38 ft/s
- 0.3 ft/s
- 0.2 ft/s
- 0.1 ft/s
- 0.0 ft/s

N

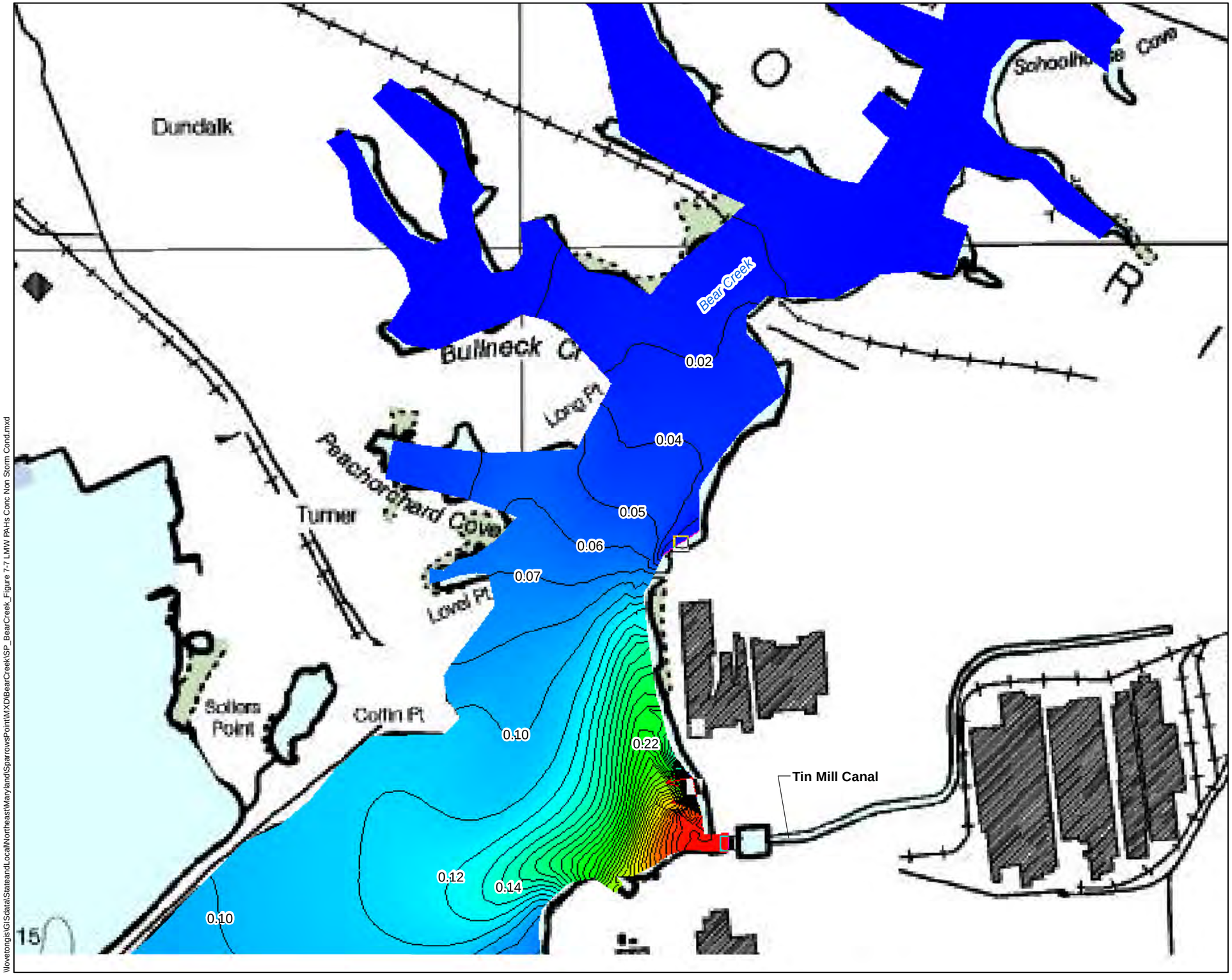
0 800 1,600

Feet

EA Engineering, Science, and Technology, Inc., PBC

Figure 7-6
Flood Currents in Bear Creek
Bear Creek
Sparrows Point, Maryland

\\lovetongis\GIS\data\State and Local\Northeast\Maryland\SparrowsPoint\MXD\BearCreek\SP_BearCreek_Figure 7-6 Flood Currents.mxd



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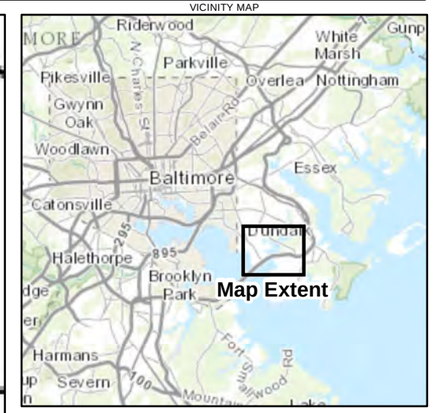


Bear Creek Low Molecular Weight PAHs (ug/l) Storm Event

- 0.44 ug/l
- 0.37 ug/l
- 0.29 ug/l
- 0.22 ug/l
- 0.15 ug/l
- 0.07 ug/l
- 0.00 ug/l

N

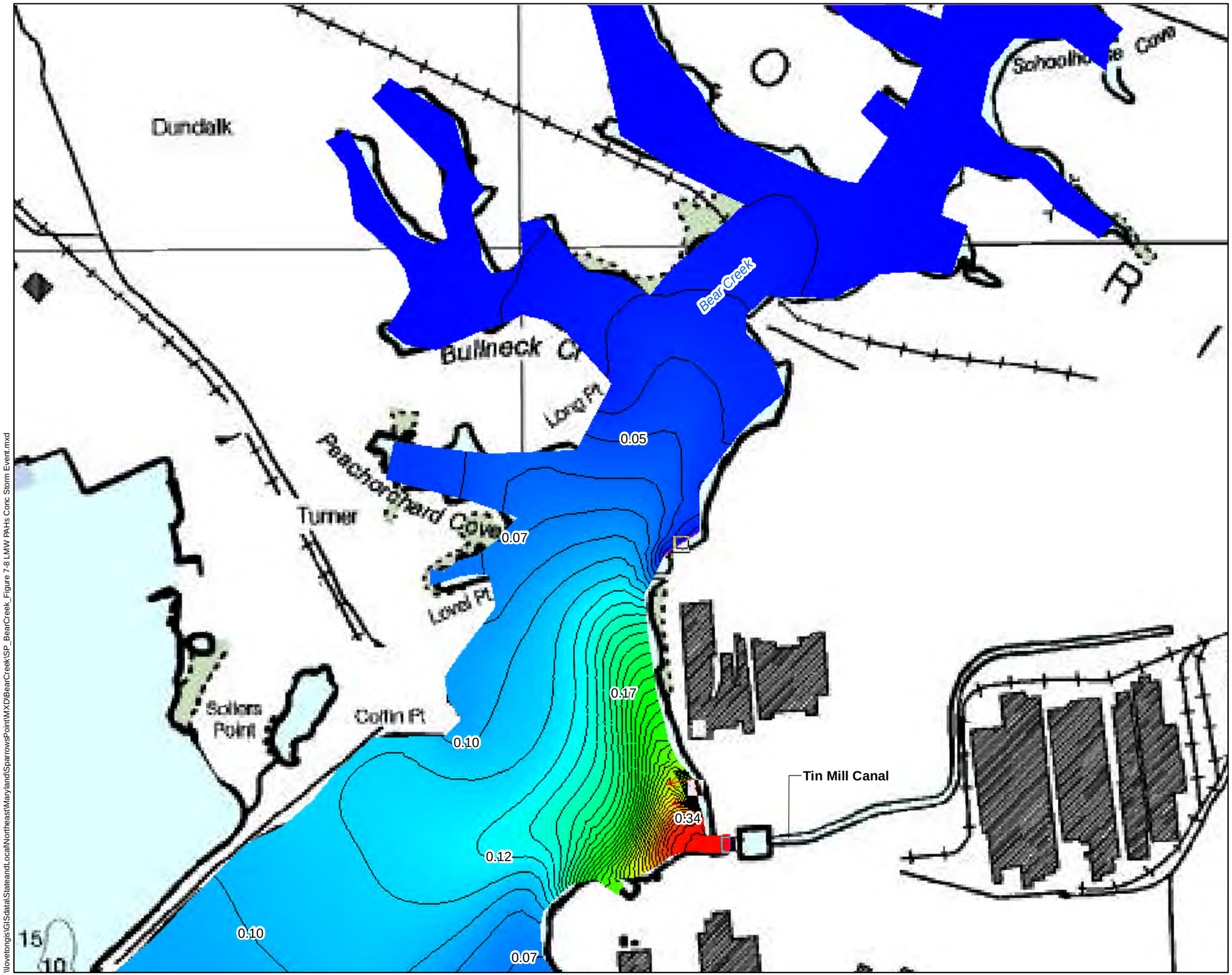
0 1,500 3,000

Feet

EA Engineering, Science, and Technology, Inc., PBC

Figure 7-7
Modeled Concentrations of Low Molecular Weight PAHs (ug/l) under Non-Storm Condition
Bear Creek
Sparrows Point, Maryland

\\lovetongis\GIS\data\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\BearCreek\SP_BearCreek_Figure 7-7 LMW PAHs Conc Non Storm Cond.mxd



Bear Creek Low Molecular Weight PAHs (ug/l) Storm Event

- 0.44 ug/l
- 0.37 ug/l
- 0.29 ug/l
- 0.22 ug/l
- 0.15 ug/l
- 0.07 ug/l
- 0.00 ug/l

N

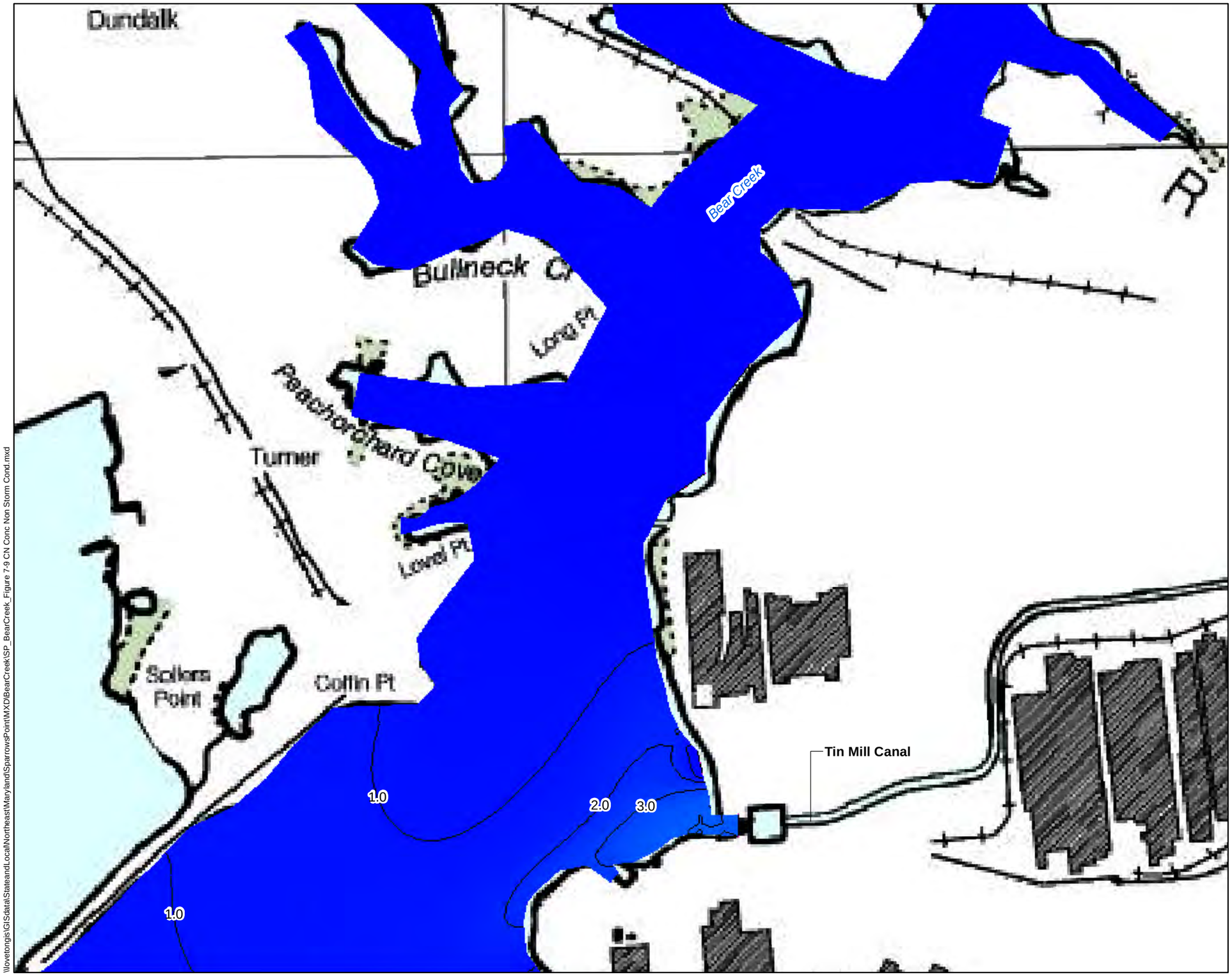
0 1,500 3,000

Feet

EA Engineering, Science, and Technology, Inc., PBC

Figure 7-8
Modeled Concentrations of Low Molecular Weight PAHs (ug/l) during Storm Event
Bear Creek
Sparrows Point, Maryland

\\lovetongis\GIS\data\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\BearCreek\SP_BearCreek_Figure 7-8 LMW PAHs Conc Storm Event.mxd



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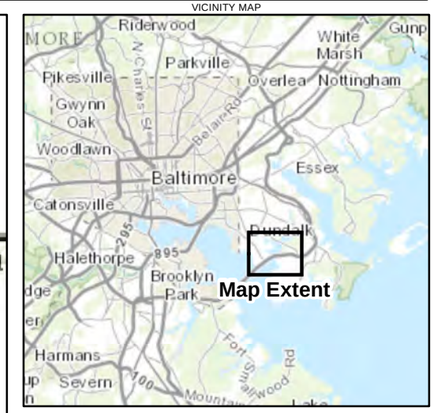


Bear Creek Cyanide (ug/l) Non-Storm

30.0 ug/l
24.0 ug/l
18.0 ug/l
12.0 ug/l
6.0 ug/l
0 ug/l

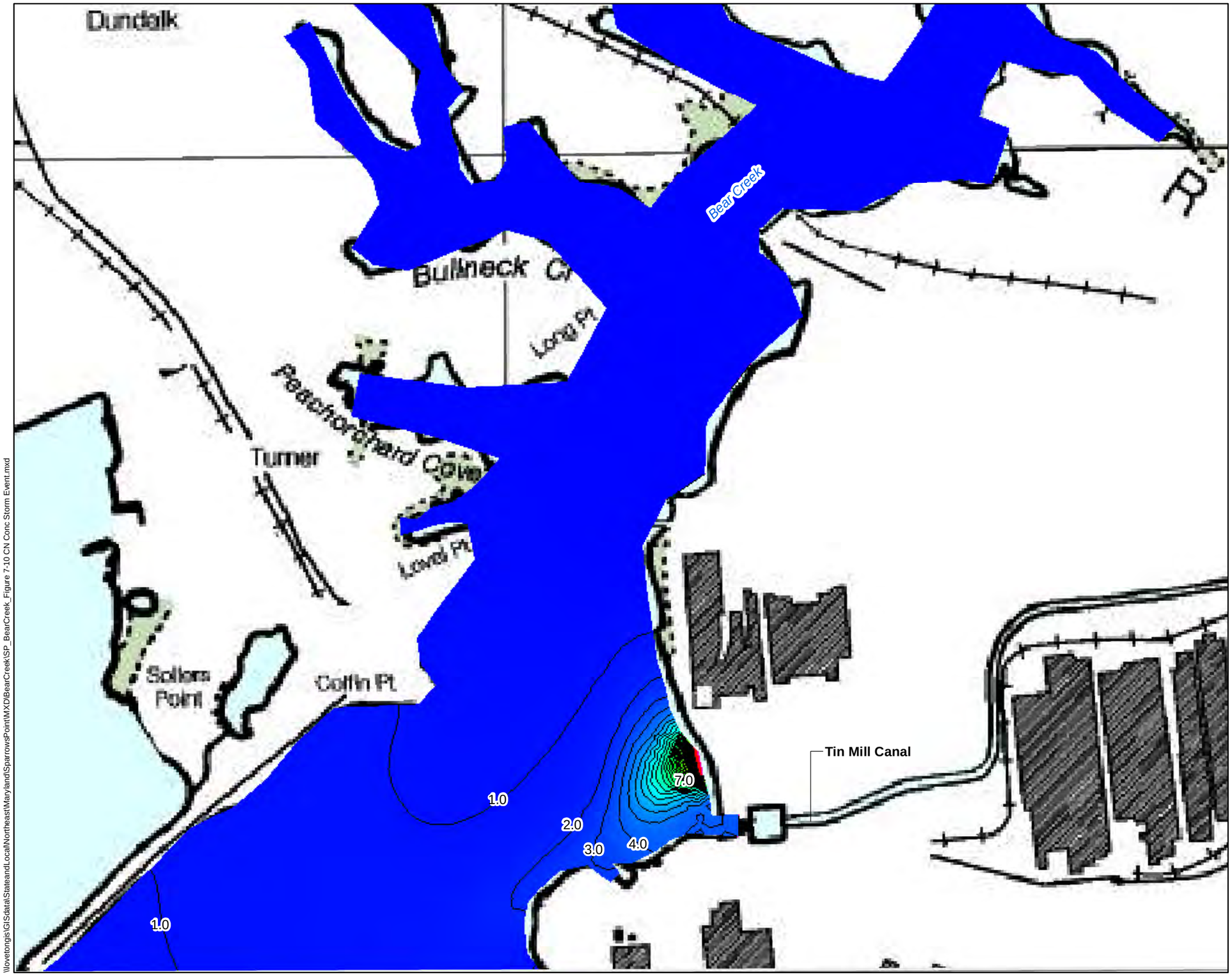
N

0 1,000 2,000
Feet

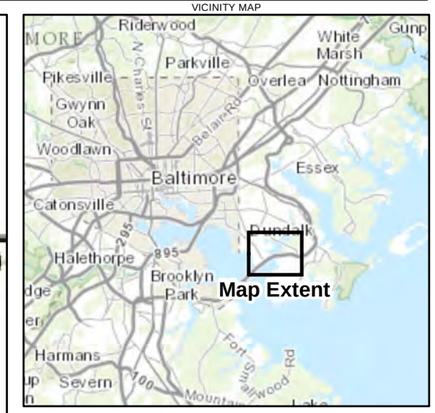
EA Engineering, Science, and Technology, Inc., PBC

Figure 7-9
Modeled Concentrations of Cyanide (ug/l) under Non-Storm Condition
Bear Creek
Sparrows Point, Maryland

\\lovetongis\GIS\data\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\BearCreek\SP_BearCreek_Figure 7-9 CN Conc Non Storm Cond.mxd



VICINITY MAP



Bear Creek Cyanide (ug/l) Storm Event

30.0 ug/l
24.0 ug/l
18.0 ug/l
12.0 ug/l
6.0 ug/l
0 ug/l

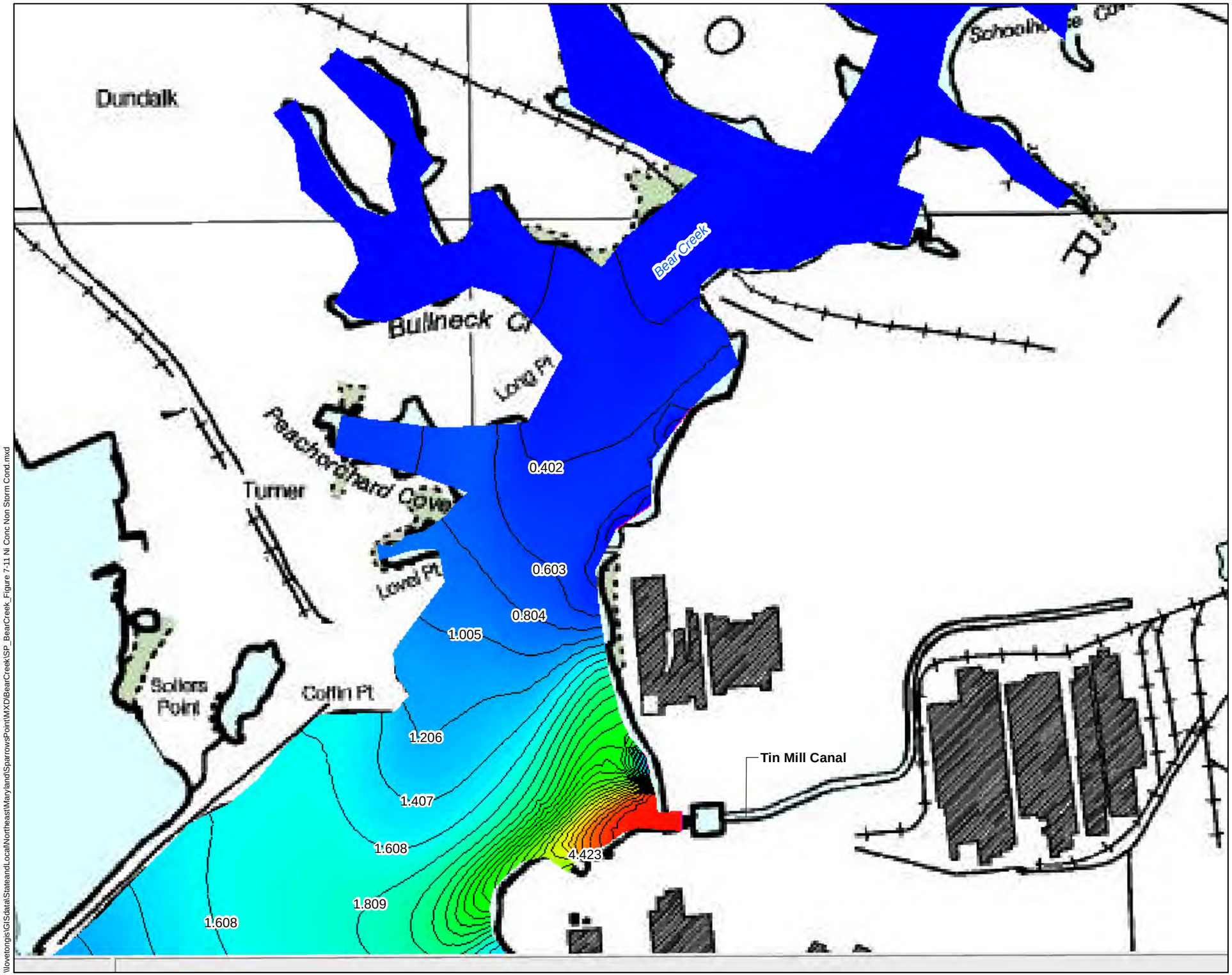
N

0 1,000 2,000
Feet

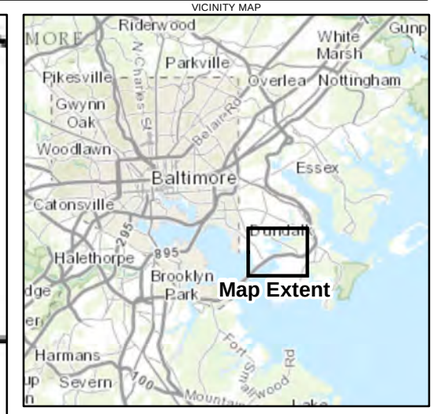
EA Engineering, Science, and Technology, Inc., PBC

Figure 7-10
Modeled Concentrations of Cyanide (ug/l) during Storm Event
Bear Creek
Sparrows Point, Maryland

\\lovetongis\GISdata\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\BearCreek\SP_BearCreek_Figure 7-10 CN Conc Storm Event.mxd



VICINITY MAP



Bear Creek Nickel (ug/l) Non-Storm

- 6.032 ug/l
- 5.026 ug/l
- 4.021 ug/l
- 3.016 ug/l
- 2.011 ug/l
- 1.005 ug/l
- 0.00 ug/l

N

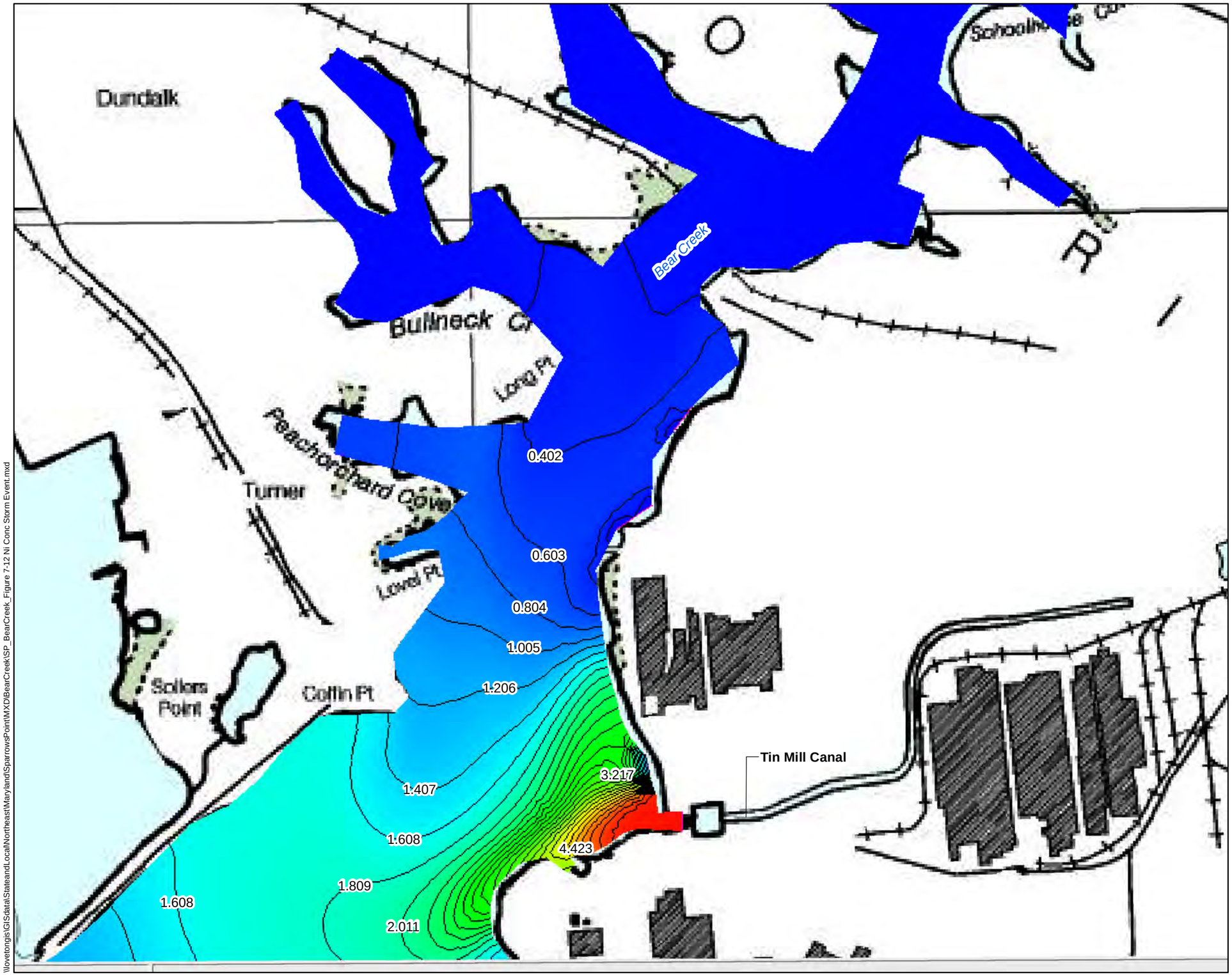
0 1,500 3,000

Feet

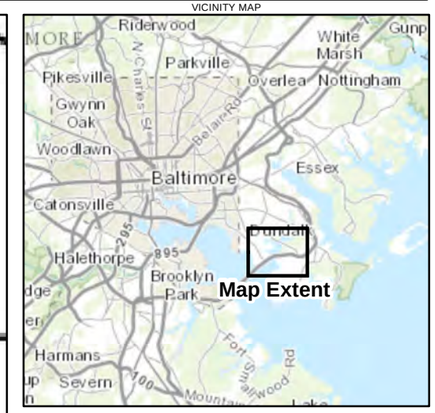
EA Engineering, Science, and Technology, Inc., PBC

Figure 7-11
Modeled Concentrations of Nickel (ug/l) under Non-Storm Conditions
Bear Creek
Sparrows Point, Maryland

\\lovetongis\GIS\data\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\BearCreek\SP_BearCreek_Figure 7-11 Ni Conc Non Storm Cond.mxd



VICINITY MAP



Bear Creek Nickel (ug/l) Storm Event

- 6.032 ug/l
- 5.026 ug/l
- 4.021 ug/l
- 3.016 ug/l
- 2.011 ug/l
- 1.005 ug/l
- 0.00 ug/l

N

0 1,500 3,000

Feet

EA Engineering, Science, and Technology, Inc., PBC

Figure 7-12
Modeled Concentrations
of Nickel (ug/l) during Storm Event
Bear Creek
Sparrows Point, Maryland

\\lovetongis\GIS\data\StateandLocal\Northeast\Maryland\SparrowsPoint\MXD\BearCreek\SP_BearCreek_Figure 7-12 Ni Conc Storm Event.mxd

TABLE 7-1 SUMMARY OF THE DRAINAGE AREA CHARACTERISTICS INPUT INTO SWMM

Outfall ID	Outfall Location	Drainage Area	Percent Impervious	Overland Flow Length	Subcatchment Width
18	Parking Area	86.2	100	2,622.50	1,432.10
UNNAMED	I-695 & Highway	11.4	31	1,829.90	271.3
70	Landfill	75.2	30	2,705.00	1,211.60

TABLE 7-2 SUMMARY OF HYDROLOGIC MODELING RESULTS FOR OUTFALLS 018, UNNAMED, AND 070

Model Scenario	Total Rainfall	Runoff (CFS)			Peak Flow (CFS)			Average Flow (CFS)		
	(in)	18	UNNAMED	70	18	UNNAMED	70	18	UNNAMED	70
11/16/2014	0.03	0.15	0.02	0.09	0.14	0.02	0.09	0.01	0	0
12/1/2014	0.16	3.58	0.35	1.95	3.47	0.35	1.91	0.15	0.01	0.04
1-year flood	2.4	121.4	9.96	53.25	111.67	9.29	49.66	2.87	0.13	0.76
10-year flood	4.5	280.07	23.34	126.01	258.65	21.85	117.55	5.43	0.32	1.67
100-year flood	6.2	424.37	35.61	191.9	393.07	33.42	179.42	7.51	0.5	2.58

Notes:
CFS = Cubic feet per second
in. = inches

TABLE 7-3 CALCULATIONS OF GROUNDWATER HYDRAULIC GRADIENT

Date	*December 2003*			*June 2004*			*July 2009*			*March-April 2011*			*October-November 2011*		
Area	*Tin Mill Canal Vicinity*			*Tin Mill Canal Vicinity*			*Greys Landfill*			*Greys Landfill*			*Rod&Wire Mill*		
	Water table height (ft)	**Distance (ft)**	**Hydraulic gradient**	**Water table height (ft)**	**Distance (ft)**	**Hydraulic gradient**	**Water table height (ft)**	**Distance (ft)**	**Hydraulic gradient**	**Water table height (ft)**	**Distance (ft)**	**Hydraulic gradient**	**Water table height (ft)**	**Distance (ft)**	**Hydraulic gradient**
	dh	***dl***	***dh/dl***	***dh***	***dl***	***dh/dl***	***dh***	***dl***	***dh/dl***	***dh***	***dl***	***dh/dl***	***dh***	***dl***	***dh/dl***
	6	900	0.0067	6	600	0.0100	5	456	0.0110	5	468	0.0107	4	300	0.0133
Source	Site-Wide Investigation: Report of Nature & Extent of Releases to Groundwater from the Special Study Area, January 2005						Grey's Landfill 2009 Groundwater Monitoring Report, January 2010			Grey's Landfill June 2011 Groundwater Monitoring Report, June 2011			Interim Measures 2011 Annual Report, Former Sludge Bin Storage Area, Rod&Wire Mill, January 2012		

Date	*October 2012*			*March 2013*			*April-May 2013*			*September 2013*		
Area	*Rod&Wire Mill*			*Greys Landfill*			*Rod&Wire Mill*			*Greys Landfill*		
	Water table height (ft)	**Distance (ft)**	**Hydraulic gradient**	**Water table height (ft)**	**Distance (ft)**	**Hydraulic gradient**	**Water table height (ft)**	**Distance (ft)**	**Hydraulic gradient**	**Water table height (ft)**	**Distance (ft)**	**Hydraulic gradient**
	dh	***dl***	***dh/dl***	***dh***	***dl***	***dh/dl***	***dh***	***dl***	***dh/dl***	***dh***	***dl***	***dh/dl***
	4	380	0.0105	8	380	0.0211	2	125	0.0160	8	560	0.0143
Source	Interim Measures 2012 Annual Report, Former Sludge Bin Storage Area, Rod and Wire Mill Area, January 2013			Coke Point and Greys Landfills Semi-Annual Groundwater Monitoring Report, 1st Half 2013, June 2013			Interim Measures 2013 Annual Report, Former Sludge Bin Storage Area, Rod and Wire Mill Area, January 2014			Coke Point and Greys Landfills Semi-Annual Groundwater Monitoring Report, 2nd Half 2013, February 2014		

Notes:

ft = feet

dl = change in distance

dh = change in height/elevation

TABLE 7-4 INPUT CONCENTRATIONS FOR SURFACE WATER MODEL

Analyte	Pore Water Location	Groundwater Velocity (ft/day)	Porosity	Concentration[1] (µg/L)	Mass Flux (g/s/ft^2)	Stormwater Location	Reported Concentrations[2] (µg/L)		Modeled Concentration (µg/L)
		v	n	C	J		111614	120114	
Antimony	Not Site-Related COPC					ST-071	--	0.63	0.63
						ST-UNNAMED	2 U	1.2	1.2
						ST-018	2 U	0.88	0.9
						ST-014	2 U	1.1	1.1
Arsenic	Not Site-Related COPC					ST-071	--	2.4	2.4
						ST-UNNAMED	0.67	1 U	0.67
						ST-018	3.4	2.2	3.4
						ST-014	1 U	1.1	1.1
Chromium	Not Detected at location PW-B01, where a Site-Related COPC					ST-071	--	1.7	1.7
						ST-UNNAMED	1	0.89	1.0
						ST-018	3.7	6.8	6.8
						ST-014	1.2	1.4	1.4
Copper	PW-D02	0.02	0.3	2.6	5.10972E-12	ST-071	--	3	3
	Not Detected in Other Pore Water Samples					ST-UNNAMED	1.1	3.1	3.1
						ST-018	1.3	2 U	1.3
						ST-014	0.69	2U	0.69
Lead	PW-D02	0.02	0.3	0.74	1.45431E-12	Not Detected in Stormwater			
	PW-DE01	0.02	0.3	10	1.96528E-11				
Mercury	PW-C02	0.02	0.3	0.095	1.86701E-13	ST-071	--	0.051	0.051
	Not Detected in Other Pore Water Samples					ST-UNNAMED	0.2 U	0.083	0.083
Nickel	PW-A01	0.02	0.3	2.9	5.69931E-12	ST-071	--	4.1	4.1
	PW-B01	0.02	0.3	2	3.93056E-12	ST-UNNAMED	1.9	2.8	2.8
	PW-C01	0.02	0.3	2.1	4.12708E-12	ST-018	0.3	1.2	1.2
	PW-C02	0.02	0.3	3.5	6.87847E-12	ST-014	4.1	6.3	6.3
	PW-DE01	0.02	0.4	20	5.24074E-11				
Selenium	Not Site-Related COPC					ST-071	--	0.42	0.42
						ST-UNNAMED	0.45	5 U	0.45
						ST-018	2.3	0.9	2.3
Zinc	PW-C01	0.02	0.3	12	2.35833E-11	ST-071	--	75	75
	PW-C02	0.02	0.3	210	4.12708E-10	ST-UNNAMED	14	12	14
	PW-D02	0.02	0.3	22	4.32361E-11	ST-018	1.6	9.4	9.4
	PW-DE01	0.02	0.4	160	4.19259E-10	ST-014	10	20	20
Cyanide	PW-D02	0.02	0.3	4.4	8.64722E-12	ST-018	40	14	40
	PW-DE01	0.02	0.3	2.5	4.91319E-12	ST-014	4.3	10 U	4.3
	PW-E01	0.02	0.3	3.5	6.87847E-12	Not Detected in Outfalls 071 or UNNAMED			
	PW-F05	0.02	0.4	24	6.28889E-11				
Bis(2-ethylhexyl) phthalate	PW-C01	0.02	0.3	0.73	1.43465E-12	ST-018	1.5	1.9 U	1.5
	PW-DE01	0.02	0.3	0.24	4.71667E-13	ST-UNNAMED	0.42	1.9 U	0.42
	PW-F05	0.02	0.4	1.1	2.88241E-12				
LMW PAHs[3]	PW-DE01	0.02	0.3	0.15	2.94792E-13	ST-018	0.217	0.13	0.217
	Not Detected in Other Pore Water Samples					ST-UNNAMED	0.019	0.19 U	0.019
						ST-014	0.49	0.19 U	0.49
HMW PAHs[4]	Not Detected in Pore Water					ST-014	0.078	0.19 U	0.078
2,4-Dimethylphenol	Not Site-Related COPC					ST-018	0.96 UJ	1.8	1.8

Notes:

(1) As reported in Table 5-20

(2) As reported in Tables 5-15, 5-16, and 5-19

(3) Low Molecular Weight Polycyclic Aromatic Hydrocarbons: acenaphthene, acenaphthylene, anthracene, fluorene, fluoranthene, naphthalene, and phenanthrene

(4) High Molecular Weight Polycyclic Aromatic Hydrocarbons: Sum of concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and pyrene

COPC = constituent of potential concern

ft/day = feet per day

µg/L = micrograms per liter

g/s/ft^2 = grams per second per square foot of river bottom

TABLE 7-5 TIDAL DATUMS AT BALTIMORE (FORT MCHENRY), PATAPSCO RIVER

Tidal Datum (ft)	Elevations referred to MLLW	Tidal range between MHW and MLW (feet)
HIGHEST OBSERVED WATER LEVEL (08/23/1933)	7.9	
MEAN HIGHER HIGH WATER	1.66	
MEAN HIGH WATER	**1.35**	
MEAN TIDE LEVEL	0.8	**1.11**
NATIONAL MEAN LOW WATER GEODETIC VERTICAL DATUM (NGVD29)	0.28	
MEAN LOW WATER	**0.24**	
MEAN LOWER LOW WATER	0	

Notes:
Tidal datums are based on a 19-year time series (1960-1978), and referenced to NGVD based on adjustment of 1972 AND NOS levels of 1984.
MHW = Mean high water
MLLW = Mean lower low water
MLW = Mean Low Water

TABLE 7-6 SURFACE WATER EXPOSURE POINT CONCENTRATIONS CALCULATED USING MODEL

Analyte	Northeast/Near-Shore Grouping				Southwest/Tin Mill Canal Effluent Grouping			
	Non-Storm Reasonable Maximum EPC[3] (µg/L)	Non-Storm Maximum[4] (µg/L)	Storm Reasonable Maximum EPC[5] (µg/L)	Storm Maximum[6] (µg/L)	Non-Storm Reasonable Maximum EPC[3] (µg/L)	Non-Storm Maximum[4] (µg/L)	Storm Reasonable Maximum EPC[5] (µg/L)	Storm Maximum[6] (µg/L)
Antimony	0.0734	0.187	0.376	0.894	0.120	0.329	0.186	0.588
Arsenic	0.180	0.708	0.388	2.10	0.513	0.960	0.547	1.03
Chromium	0.216	0.671	0.524	4.26	0.257	0.963	0.318	1.26
Copper	0.248	0.641	0.642	2.57	0.299	0.969	0.335	0.979
Lead	0.0980	0.440	0.103	0.447	0.0799	0.537	0.0874	0.544
Mercury	0.154	0.663	0.157	0.664	0.114	0.325	0.120	0.328
Nickel	1.34	3.77	1.66	4.09	1.68	5.80	1.80	5.81
Selenium	0	0	0.0338	1.08	0	0	0.00572	0.0748
Zinc	4.41	12.5	8.95	46.0	5.56	19.3	6.03	19.4
Cyanide	0.930	2.52	1.97	23.7	1.15	3.87	1.42	6.50
Bis(2-ethylhexyl) phthalate	0.0317	0.10	0.0790	1.04	0.0257	0.0733	0.0381	0.261
LMW PAHs[1]	0.123	0.312	0.130	0.379	0.130	0.472	0.139	0.474
HMW PAHs[2]	0.0115	0.0510	0.0118	0.0510	0.00843	0.0232	0.00891	0.0235
2,4-Dimethylphenol	0	0	0.0479	1.00	0	0	0.0108	0.184

Notes:

(1) Low Molecular Weight Polycyclic Aromatic Hydrocarbons: acenaphthene, acenaphthylene, anthracene, fluorene, fluoranthene, naphthalene, and phenanthrene

(2) High Molecular Weight Polycyclic Aromatic Hydrocarbons: Sum of concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and pyrene

(3) Calculated as the highest volume-weighted average during one tide cycle.

(4) Calculated as the highest concentration modeled in a single model cell over one tide cycle.

(5) Calculated as the highest volume-weighted average during the 24-hour design storm

(6) Calculated as the highest concentration modeled in a single model cell during the 24-hour design storm

EPC = Exposure Point Concentration

µg/L = micrograms per liter

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8. STATISTICAL DERIVATION OF EXPOSURE POINT CONCENTRATIONS

The primary use of chemical analytical data in the risk assessment is to develop EPCs. The EPC represents a reasonable estimate of the COPC concentration that likely will be contacted by a risk assessment receptor over time. Chemical analyses provide the constituent concentrations detected at each sample location. Some organisms, such as clams and worms, may be exposed to concentrations at a single location for most of their life span. However, most fish, crustaceans, wildlife, and humans are likely to move throughout the offshore area and may be exposed to sediment or surface water at many locations over time. Therefore, statistics were used to calculate EPCs that represent overall exposures to sediment and water in the Phase I area of Bear Creek (USEPA 1989, 1991, 1997a).

As discussed in the CSM (Section 6), ecological and human receptors may be exposed to chemicals in surface sediment and surface water. These receptors also may be exposed to chemicals through consumption of fish, crabs, or other aquatic organisms that have accumulated chemicals from sediment or surface water. Therefore, the risk assessment uses EPCs for exposure to three media: sediment, surface water, and tissue of organisms that accumulate chemicals from water and sediment. EPCs for sediment were calculated directly from chemical analytical results of this media. EPCs for surface water were calculated based on the results of the surface water modeling, as described in Chapter 7. EPCs for metals, PAHs, and PCBs in aquatic organism tissue are derived from the field-collected fish and crabs collected from adjacent areas in association with the Coke Point Risk Assessment and from associated laboratory bioaccumulation studies (clams and worms) (EA 2011b). EPCs for other chemicals in aquatic organism tissue are calculated using uptake factors from the scientific literature. EPCs for tissue are further distinguished as derived from fish or crab; EPCs for fish are used primarily to represent uptake of chemicals into the food chain from water, while EPCs for crab are used to represent uptake from sediment. **Tables 8-1** and **8-2** provide a description of how different EPCs for each media are used in ecological and human health risk exposure scenarios.

8.1 DATA GROUPINGS AND CONSTITUENTS OF POTENTIAL CONCERN

As described in Section 6.1, data and modeling results from the offshore investigation were divided into two data groupings/areas for separate consideration in the risk assessments:

- Grouping NNS: The Northeast/Near-Shore Grouping includes all samples from Transects A, B, C, and D, as well as the following locations in Transects DE, E, and F: DE01, E01, E02, F01, F02, and F05.

- Grouping SWTM: The Southwest/Tin Mill Canal Effluent Grouping includes all of Transects G, H, I, and J, as well as the following locations in Transects DE, E, and F: DE02, E03, F03, F04, F06, and F07.

Table 8-3 presents a summary of the samples included in each grouping. Because current inputs to the offshore area via groundwater/pore water and stormwater remain the focus in the NNS, only the Site-related COPCs for each transect presented in Section 2.2.2 are considered in calculating EPCs for this grouping. **Table 8-4** presents a summary of the Site-related COPCs in sediment for which data were used in calculating EPCs for use in the risk assessment for the NNS. In contrast, all available data from the offshore investigation are used in calculating EPCs for use in the risk assessment for the SWTM. **Tables 8-5 through 8-10** present the sediment data used in the risk assessments for each grouping. **Table 7-6** presents the modeled surface water exposure point concentrations used in the risk assessments.

8.2 METHODS OF SUMMATION FOR PCBs AND PAHs

In calculating EPCs, some classes of organic chemicals are best evaluated as a summation of individual concentrations to provide a total concentration for the group because they share similar fate and toxicity. This is the case for PCB congeners, for which special methods of summation have been developed for use in calculations for both the human health and ecological risk assessment. The exposure estimate procedures used for available PCB congener data for fish and crab tissue are described below.

- **PCB Congeners** – There are over 200 PCB congeners that can be commonly found in environmental media. USEPA guidance has identified a standard method for using congener-specific data to estimate the total concentration of PCBs (Van den Berg et al. 1998). Per this method, the concentrations of 18 specific congeners are summed and the sum doubled for each sample. The specific PCB congeners used in the evaluation are: PCB 8, PCB 18, PCB 28, PCB 44, PCB 49, PCB 52, PCB 66, PCB 77, PCB 87, PCB 90, PCB 101, PCB 105, PCB 118, PCB 126, PCB 128, PCB 138, PCB 153, PCB 156, PCB 169, PCB 170, PCB 180, PCB 183, PCB 184, PCB 187, PCB 195, PCB 206, and PCB 209. Two estimates of total PCBs are provided: one in which reporting limits (RLs) are used to represent non-detected compounds, and one in which non-detects are assumed to indicate that no compound is present. Using RLs is likely to overestimate the total amount of PCB present, while use of zero concentrations to represent non-detects is likely to underestimate concentrations.

This is also the case for PAHs and PCB Aroclors, but only as applied to the ERA. The HHRA evaluates PAHs and PCB Aroclors on an individual chemical basis. The exposure estimate procedures for each of these classes are described below.

- **LMW PAHs** – LMW PAH compounds have fewer than four aromatic rings and share similar modes of toxicity, and it is appropriate to examine exposures to these compounds as a whole for some ecological receptors (USEPA 2007a). Therefore, concentrations for individual LMW PAHs were summed. Two estimates of LMW PAHs are provided: one in which RLs are used to represent non-detected compounds, and one in which non-detects are assumed to indicate that no compound is present. Using RLs is likely to

overestimate the total amount of PAHs present, while use of zero concentrations is likely to underestimate concentrations. Therefore, both estimates are used in statistical calculation of EPCs. LMW PAHs include 1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, fluoranthene, naphthalene, and phenanthrene.

- **HMW PAHs** – EPCs for HMW PAH compounds have four or more aromatic rings share similar modes of toxicity, and it is most appropriate to examine exposures to these compounds as a whole. Therefore, concentrations for individual HMW PAHs were summed. Two estimates of HMW PAH are provided: one in which RLs are used to represent non-detected compounds, and one in which non-detects are assumed to indicate that no compound is present. Using RLs is likely to overestimate the total amount of PAH present, while use of zero concentrations is likely to underestimate concentrations. Therefore, both estimates are used in statistical calculation of EPCs. HMW PAHs include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and pyrene.

- **PCB Aroclors** – PCB Aroclors are mixtures of PCBs congeners that are grouped together based on the percentage of chlorination by weight. The specific PCB Aroclor mixtures used in the evaluation are: Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, and Aroclor 1260. Two estimates of total PCB Aroclors are provided: one in which reporting limits (RLs) are used to represent non-detected compounds, and one in which non-detects are assumed to indicate that no compound is present. Using RLs is likely to overestimate the total amount of PCB Aroclors present and is highly conservative. Use of zero concentrations to represent non-detects is realistic for the lower chlorinated Aroclors, which are not expected to occur in the sediment matrix, while this method may underestimate concentrations of Aroclors 1248, 1254, and 1260.

It is important to note that making different assumptions (Non-detects as 0 or non-detects as the RL) can drastically affect the outcome of calculations of the 95 percent upper confidence limit of the mean (95%UCLM), as it may increase not only the mean but also the variability of the data set. Sediment EPCs for use in the ERA were developed using the LMW PAH, HMW PAH, and PCB Aroclor summations as described above. To develop tissue EPCs, PAHs and PCB congeners were summed as described above for use in developing EPCs and bioaccumulation factors (BAFs). For Aroclors, tissue concentrations were not summed but were carried through exposure models for wildlife separately so that food web doses could be summed instead.

8.3 SEDIMENT EPC CALCULATION

The ERA and the HHRA evaluate two separate EPCs for sediment for each data grouping: one representing the maximum detected concentration (screening level concentration) to which a

receptor could be exposed, and one representing overall or average exposures for each constituent.

In both the HHRA and ERA, evaluation of the maximum detected concentration to which a receptor could be exposed is called the screening level EPC, and evaluation of the overall or average concentration to which a receptor could be exposed is called the reasonable maximum EPC. Assessment using the screening level EPC evaluates a worst case scenario by assuming biota or humans are exposed to the location(s) with the highest concentrations of chemicals for their entire lives/duration of exposure. This provides useful information for the ERA because some bottom-dwelling organisms live their entire lives in or around a single location. The screening level EPC is evaluated in the ERA for aquatic organism and wildlife exposures as a precautionary measure to identify COPCs that require further evaluation in the assessment. The HHRA evaluates the maximum detected concentration in sediment for initial screening of constituent concentrations as a precautionary measure.

Screening is used to identify COPCs to be carried forward into the risk assessment, but is not representative of most exposures for people or mobile organisms such as fish, crustaceans, birds, and mammals which may use the entire Phase I area. Therefore, for these receptors, a statistically derived value is used to estimate overall exposures across each grouping in the Phase I area. EPCs calculated using this statistically derived value are referred to as reasonable maximum EPCs because the exposure level is more reasonable given the fact that receptors may move around the area. The statistically derived value is a precautionary estimate of the central tendency of the chemical constituent concentrations for each grouping and represents overall exposures over time (USEPA 1989).

For both groupings within the Phase I area, the 95%UCLM is used as a precautionary estimate of central tendency; this is consistent with USEPA guidance (USEPA 1989). The 95%UCLM is determined through the use of the USEPA ProUCL program version 5.00.0 (USEPA 2013). The 95%UCLM is used as the reasonable maximum EPC except in cases where a 95%UCLM could not be calculated or where it exceeds the maximum detected concentration. In these cases, the maximum detected concentration is used as the reasonable maximum EPC. Output files of the ProUCL program are included in **Appendix F**. For inputs to the program, RLs were used to represent non-detected results.

The ERA uses both the screening level EPCs and reasonable maximum EPCs to model food web exposures for biota (**Table 8-1**). In accordance with USEPA guidance (USEPA 1989), the HHRA uses reasonable maximum EPC for all modeled exposure scenarios (**Table 8-2**). EPC calculations for both ecological and human health risk assessments utilize chemical analytical results from each sediment sample as an independent data point in the statistical evaluation.

8.4 SURFACE WATER EPC CALCULATION

Derivation of screening and reasonable maximum EPCs for modeled constituents in surface water in the NNS and SWTM groupings under the non-storm and storm scenarios (**Table 7-6**) is described in Section 7.3. The screening level EPC represents the maximum modeled concentration to which a receptor could be exposed, and the reasonable maximum EPC represents overall or average exposures for each constituent.

The screening level EPC is evaluated in the ERA for aquatic organism and wildlife exposures to identify COPCs that require further evaluation in the assessment. The ERA also uses both the screening level EPCs and reasonable maximum EPCs to model food web exposures for biota. In accordance with USEPA guidance (USEPA 1989), the HHRA uses the reasonable maximum EPC for all modeled exposure scenarios. Both risk assessments focus on the non-storm EPCs, which represent typical conditions, when a storm is not occurring.

8.5 AQUATIC ORGANISM TISSUE EPC CALCULATION

As discussed above, both wildlife and humans may be exposed to chemicals through ingestion of tissue from fish or other aquatic organisms that have accumulated chemicals from surface water or sediment. Therefore, EPCs representative of constituent concentrations in aquatic organisms are used in ingestion exposure models. The ERA and HHRA use aquatic organism food item EPCs derived from several sources in assessing each data grouping.

The ERA and HHRA examine separate scenarios that represent consumption of two different types of prey item – crab and fish. **Table 8-1** summarizes the data source used for each of these scenarios. The risk assessments assess two different scenarios for fish and crab consumption by humans and wildlife, one based on site-specific data from field-collected specimens collected near the adjacent Coke Point Peninsula (EA 2011b) and the other using tissue concentrations derived from BAFs. Where site-specific data are not available, BAFs from the scientific literature are used in both scenarios.

There are advantages to each of the two methods discussed above (BAFs versus field-collected tissue) for calculating tissue EPCs. The lab bioaccumulation tests used to derive BAFs as part of the site-specific bioaccumulation study (EA 2011b) are a highly reliable means of linking exposure to constituent concentrations in sediment to concentrations accumulated in tissue. Uptake is not influenced by the mobility of organisms or variations in field conditions. Thus, scenarios based on BAFs from lab bioaccumulation tests provide the best measure of potential contributions from chemical sources in sediments in the Phase I area to site-specific exposures and risks, assuming contact only to sediments within the grouping evaluated. Alternatively, EPCs derived from field-collected tissue are more likely to incorporate the influence of field variations and organism movement beyond the Phase I area. Therefore, tissue EPCs based on concentrations detected in actual fish and crab collected from the vicinity of Sparrows Point provide a better measure for predicting the actual exposures experienced by people and wildlife

consuming these organisms from the Phase I area at the time of sampling. Different scenarios were evaluated so that the advantages of each data source can be used to interpret risk assessment results.

Tissue concentrations for crabs are based either on tissue analyses of field collected crabs or based sediment BAFs. Sediment BAFs are multipliers that relate the concentration of chemicals expected in crab tissue to the concentrations detected in sediment. For some chemicals, site-specific BAFs are available from bioaccumulation studies using worms and clams as part of the Coke Point Risk Assessment (EA 2011b). Where available, these BAFs are used to calculate uptake from the sediment into crabs in the Phase I area. BAFs from the Coke Point Risk Assessment are considered relevant for use at Sparrows Point because the sediments evaluated for Coke Point are immediately adjacent to and generally similar to those in the Phase 1 Area. Additionally, uptake into worms and clams exposed to sediments in a controlled, enclosed setting is expected to be a conservative surrogate estimate of uptake into crabs. Fish tissue concentrations are also estimated in two different ways: based on site-specific data from field-collected specimens or using surface water BAFs from the scientific literature. Surface water BAFs are multipliers that relate the concentration of chemicals expected in fish tissue to the concentrations detected in surface water. For both crabs and fish, field collected specimens were caught and analyzed as part of the Coke Point Risk Assessment (EA 2011b). Data from these specimens are considered relevant to the Phase I area because these species are mobile and caught from other areas close to the Site.

For tissue estimates, concentrations of PCBs were summed prior to use in food web models by applying the methods described in Section 8.2 to tissue concentrations. In the HHRA, PAHs were carried through exposure models individually and risks were summed afterwards. In the ERA, individual PAHs and total summed PAHs (low molecular and high molecular weight) were evaluated during the screen, but only combined total PAHs were used for exposure and toxicity assessment.

8.5.1 EPCs Derived Using Bioaccumulation Factors (BAFs) From Coke Point Laboratory Bioaccumulation Tests

As part of the Coke Point Risk Assessment (EA 2011b), sediment from the offshore area was used in 28-day laboratory bioaccumulation tests in which clams and worms were exposed to sediment in a controlled laboratory environment. These bioaccumulation tests were specifically designed to measure uptake from sediment into the tissues of aquatic organisms (USEPA 2000a; USEPA/ United States Army Corps of Engineers [USACE] 1991, 1998). After 28 days of exposure, the organisms were removed from the test chambers, depurated, and analyzed for metals, PAHs, and PCBs.

The test species (clams and worms) used in standardized bioaccumulation tests are lower trophic level organisms. These species are directly representative of the kinds of organisms that wildlife, fish, and crabs consume routinely. They indirectly represent bottom-dwelling species that

humans are more likely to consume such as crabs, assuming that such organisms spend large amounts of time around Sparrows Point. Based on this information, laboratory bioaccumulation estimates based on lab bioaccumulation test results were determined to be applicable to ERA for the Phase I area as well.

The concentrations of metals, PAHs, and PCBs detected in clam and worm tissues were used to develop site-specific sediment BAFs (EA 2011b). Sediment BAFs are multipliers that relate the concentration of chemicals expected in tissue to the concentrations detected in sediment. Sediment BAFs used in this risk assessment are presented in **Table 8-11**. Sediment BAFs are used to predict benthic organism tissue concentrations using the following equation:

$$C_{org-sed} = C_{sed} * BAF_{org-sed}$$

where:

$C_{org-sed}$	=	EPC of chemical in benthic organism tissue (mg/kg wet weight) taken up from sediment
C_{sed}	=	EPC of chemical in sediment (mg/kg dry weight)
$BAF_{org-sed}$	=	bioaccumulation factor for chemicals from sediment into aquatic organism (unitless).

Either the screening or the reasonable maximum exposure EPCs were used as C_{sed} in the equation, dependent on the scenario. BAFs from organisms exposed to Coke Point sediment were applied to sediment concentrations from the Phase I area.

There are several advantages to using laboratory bioaccumulation test results to derive tissue EPCs. Organisms in laboratory bioaccumulation tests are exposed directly to the sediments in question under controlled conditions, providing certainty as to where and when uptake occurred. This is an advantage over field-collection of organisms because it is often uncertain as to whether certain types of field-collected organisms may have migrated from other areas. It also accounts for the effects of site-specific grain size, carbon content, and sulfide-minerals on bioavailability and uptake.

8.5.2 EPCs Derived From Field-Collected Fish and Crab Tissue

Field collection of tissue characterizes actual tissue concentrations in aquatic organisms. This presents a more realistic representation of bioaccumulation in higher trophic level game species at Sparrows Point because many aquatic organisms are mobile and may spend time feeding in other parts of Bear Creek, the Patapsco River, Baltimore Harbor, or the Chesapeake Bay.

The bioaccumulation studies performed to support the Coke Point Risk Assessment (EA 2011b) included field-collection of fish and crab tissue from the area around Sparrows Point. The species collected (white perch and blue crab) are directly representative of the kinds of organisms

that humans and larger wildlife may consume. Therefore, bioaccumulation estimates based on field-collected tissue are most directly applicable to HHRA but also bear relevance to ecological exposures. Crab and fish tissues were analyzed for metals, PAHs, and PCBs.

Tissues from common game fish species (white perch and blue crab) were collected to provide an indicator of the concentrations of chemicals to which watermen and wildlife might be exposed around Sparrows Point. Composited fish filets were analyzed as representative of what humans would most likely consume, and composited whole body fish were analyzed as representative of what wildlife would most likely consume. For crabs, both meat and "mustard" were analyzed separately. Mustard is a digestive organ within the crab that may accumulate higher concentrations of chemicals than muscle. It is often consumed as a delicacy. It was assumed that both humans and wildlife would consume all of the meat and mustard within an individual crab.

Therefore, to determine the total concentration of a chemical constituent within the edible portion of the crab, the following equation was used:

$$C_{EdCrab} = \frac{C_{Mustard} * M_{Mustard} + C_{Meat} * M_{Meat}}{M_{EdCrab}}$$

where:

C_{EdCrab}	=	Concentration of chemical in the edible portion of the crab(mg/kg wet weight)
$C_{Mustard}$	=	Concentration of chemical in crab mustard (mg/kg wet weight)
C_{Meat}	=	Concentration of chemical in crabmeat (mg/kg wet weight)
$M_{Mustard}$	=	Weight of mustard per individual crab (grams [g] wet weight)
M_{Meat}	=	Weight of meat per individual crab (g wet weight)
M_{EdCrab}	=	Summed Weight of the meat and mustard from individual crab (g wet weight).

The ratio of meat to mustard in the crab by mass was assumed to be 4.36:1 based on information from the literature (Weidou 1981).

Tissue concentrations were summarized statistically to create EPCs. **Tables 8-1** and **8-2** present which EPCs (screening or reasonable maximum) were used for each ecological and human health scenario and each data grouping. For the reasonable maximum exposure scenario, the 95%UCLM of tissue concentrations for each chemical constituent were used as the EPCs in fish filets and whole body fish. The 95%UCLMs for crab meat and mustard were used as described above to calculate the concentration in edible crab tissue.

8.5.3 EPCs Derived Using Sediment BAFs From Literature Sources

Laboratory bioaccumulation tests for Coke Point (EA 2011b) focused on the environmental medium (sediment) and the chemical constituent types (metals, PAHs, and PCBs) considered most likely to drive source-related risks. Therefore, they did not include testing and analysis of other chemicals in tissue. Instead, BAFs for these chemicals and media were derived from the scientific literature.

Literature Sources for Sediment BAFs – Sediment BAFs are derived from the scientific literature for VOCs and non-PAH SVOCs. These compounds were not included in site-specific bioaccumulation studies as a cost-saving measure because screening analysis indicated that these chemicals were likely to produce risks lower than metals, PAHs, and PCBs. Sediment BAFs are presented in **Table 8-11**. These sediment BAFs are considered technically defensible for use in wildlife exposure models because they are developed from consideration of a variety of studies and organisms, incorporate site-specific physical data factors, are developed from well-accepted guidance, and are specific to marine and estuarine environments. When sediment BAFs were not available from this source, a default value of 1 was assigned. This assumes that the concentration in the organism is the same as the concentration in the sediment. This default is used as a standard practice in risk assessment.

8.5.4 EPCs Derived Using Surface Water BAFs From Literature Sources

As discussed above, laboratory bioaccumulation tests for Coke Point (EA 2011b) focused on the environmental medium (sediment) considered most likely to drive source-related risks. Therefore, they did not include testing and analysis of uptake from surface water. Instead, BAFs for chemicals in surface water are derived from information reported in the scientific literature.

Literature-based water-to-fish uptake factors or bioaccumulation equations are used to estimate concentrations of COPCs in fish tissue using the following equation:

$$C_{fish} = C_{water} * BAF_{fish\ -\ water}$$

where:

C_{fish}	=	Concentration of chemical in fish (mg/kg wet weight)
C_{water}	=	Maximum concentration or 95%UCLM of COPC in water (mg/L)
$BAF_{fish-water}$	=	Uptake factor for chemicals in fish (unitless).

The maximum or reasonable maximum scenario COPC concentrations detected in surface water are used as the C_{water} value in the equation. Bioaccumulation factors and their sources are summarized in **Table 8-12**. Uptake factors for several organics are derived using regressions from the BCF Win Program developed by the USEPA's Office of Pollution Prevention and Toxics and Syracuse Research Corporation (USEPA 2012a). When these uptake factors are not

available for a chemical, literature-based factors are used from sources such as the Risk Assessment Information System (Oak Ridge National Laboratory 2009); USEPA's Ambient Aquatic Life Water Quality Criteria documents (USEPA 1980, 1985a-c, 1986, 1987a,b) the California Office of Environmental Health Hazard Assessment (2000); and sources cited in USEPA guidance for risk assessment of hazardous waste combustion products (USEPA 1999).

In the absence of a literature-based bioaccumulation model or uptake factor for a COPC, an accumulation factor of 1 is used to estimate constituent concentrations in fish. Use of this default accumulation factor assumes that the concentration in the organism is the same as the concentration in the surface water, is expected to provide a conservative estimate of accumulation for most chemicals, and is expected to overestimate accumulation for non-bioaccumulative compounds. This default is used as a standard practice in risk assessment.

TABLE 8-1
SUMMARY OF DATA INPUTS FOR ECOLOGICAL RISK ASSESSMENT SCENARIOS
SPARROWS POINT AREAS

Media of Concern	Aquatic Organism Exposures to Sediment and Surface Water	Wildlife Exposures for Birds and Mammals	
		Exposures via Ingestion of Sediment, Crab, and Surface Water	Exposures via Ingestion of Sediment, Fish, and Surface Water
Sediment	▪ Site-specific data used from field collected sediment samples ▪ Both Screening Level EPCs and Reasonable Maximum EPCs, evaluated separately	▪ Site-specific data used from field collected sediment samples ▪ Both Screening Level EPCs and Reasonable Maximum EPCs, evaluated separately	▪ Site-specific data used from field collected sediment samples ▪ Both Screening Level EPCs and Reasonable Maximum EPCs, evaluated separately
Surface Water	▪ Modeled surface water concentrations derived from site-specific stormwater and pore water concentrations ▪ Both Screening Level EPCs and Reasonable Maximum EPCs, evaluated separately	▪ Modeled surface water concentrations derived from site-specific stormwater and pore water concentrations ▪ Both Screening Level EPCs and Reasonable Maximum EPCs, evaluated separately	▪ Modeled surface water concentrations derived from site-specific stormwater and pore water concentrations ▪ Assessed typical conditions (influence from porewater and constant outfalls) for both groupings; assessed conditions when stormwater affects concentrations during storm event ▪ Both Screening Level EPCs and Reasonable Maximum EPCs, evaluated separately
Prey Item Tissue	▪ Tissue EPCs were not used in quantitative evaluation for this receptor.	▪ Both Screening Level EPCs and Reasonable Maximum EPCs evaluated separately ▪ Scenario evaluating uptake using BAFs: identifies contributions of site to food chain ▪ Tissue concentrations modeled using sediment BAFs developed from worm and clam bioassays collected in conjunction with the Coke Point Risk Assessment* ▪ Tissue concentrations modeled using sediment BAFs developed from the scientific literature for analytes not included in bioassays ▪ Scenario evaluating uptake based on actual tissue: most realistic indicator of risk ▪ Tissue concentrations statistically derived from field collected crab tissue data collected in conjunction with the Coke Point Risk Assessment* ▪ Meat and mustard concentrations were weighted and summed to estimate total edible crab concentrations.	▪ Both Screening Level EPCs and Reasonable Maximum EPCs evaluated separately ▪ Scenario evaluating uptake using BAFs: identifies contributions of site to food chain ▪ Tissue concentrations modeled using surface water BAFs from the scientific literature ▪ Scenario evaluating uptake based on actual tissue: most realistic indicator of risk ▪ Tissue concentrations statistically derived from field collected fish tissue data collected in conjunction with the Coke Point Risk Assessment*

* EA Engineering, Science, and Technology, Inc. 2011. *Laboratory Bioaccumulation and Field-Collected Tissue Study in Support of the Risk Assessment of the Offshore Areas Adjacent to the Proposed Coke Point Dredged Material Containment Facility at Sparrows Point* . January.

BAFs = Bioaccumulation Factors

EPCs = Exposure Point Concentrations

PAHs = Polyaromatic Hydrocarbons

PCBs = Polychlorinated Biphenyls

SVOCs = Semi-Volatile Organic Compounds

VOCs = Volatile Organic Compounds

TABLE 8-2 SUMMARY OF DATA INPUTS FOR HUMAN HEALTH RISK ASSESSMENT SCENARIOS PHASE I AREA OF THE SPARROWS POINT SITE

Media of Concern	Initial Comparison to Screening Levels	Human Health Risk Assessment
Sediment	▪ Site-specific data used from field collected sediment samples ▪ Based on Screening level EPCs	▪ Site-specific data used from field collected sediment samples ▪ Based on Reasonable Maximum EPCs
Surface Water	▪ Modeled surface water EPCs from site-specific porewater and stormwater data ▪ Based on Reasonable Maximum EPCs	▪ Modeled surface water EPCs from site-specific porewater and stormwater data ▪ Based on Reasonable Maximum EPCs
Crab	▪ Site-specific data used from field collected tissue samples* ▪ Based on Reasonable Maximum EPCs	For inorganics, PAHs, and PCBs: ▪ Tissue concentrations statistically derived from field collected crab tissue data* ▪ Meat and mustard concentrations were weighted and summed to estimate total edible crab concentrations ▪ Based on Reasonable Maximum EPCs in tissue
	▪ Tissue concentrations modeled using sediment BAFs developed from the scientific literature ▪ Based on Reasonable Maximum EPCs	▪ Tissue concentrations modeled using sediment BAFs developed from the scientific literature ▪ Based on Reasonable Maximum EPCs in sediment
Fish	▪ Site-specific data used from field collected tissue samples* ▪ Based on Reasonable Maximum EPCs	For inorganics, PAHs, and PCBs: ▪ Tissue concentrations statistically derived from field collected fish filet tissue data* ▪ Based on Reasonable Maximum EPCs in tissue
	▪ Tissue concentrations modeled using sediment BAFs developed from the scientific literature ▪ Based on Reasonable Maximum EPCs	▪ Tissue concentrations modeled using surface water BAFs developed from the scientific literature ▪ Based on Reasonable Maximum EPCs in surface water

* EA Engineering, Science, and Technology, Inc. 2011. *Laboratory Bioaccumulation and Field-Collected Tissue Study in Support of the Risk Assessment of the Offshore Areas Adjacent to the Proposed Coke Point Dredged Material Containment Facility at Sparrows Point*. January.

Notes:
PAHs = Polyaromatic Hydrocarbons
PCBs = Polychlorinated Biphenyls
VOCs = Volatile Organic Compounds
SVOCs = Semi-Volatile Organic Compounds
BAFs = Bioaccumulation Factors
EPCs = Exposure Point Concentrations

TABLE 8-3 GROUPINGS AND SAMPLES USED IN THE RISK ASSESSMENT OF THE PHASE I AREA OF THE SPARROWS POINT SITE

Group	Media	Sample Location	Sample Name	Sample Date
Northeast/Near Shore	Sediment	A01	SD-A01	10/13/2014
Northeast/Near Shore	Sediment	A02	SD-A02	10/13/2014
Northeast/Near Shore	Sediment	A03	SD-A03	10/13/2014
Northeast/Near Shore	Sediment	B01	SD-B01	10/13/2014
Northeast/Near Shore	Sediment	B02	SD-B02	10/13/2014
Northeast/Near Shore	Sediment	C01	SD-C01	10/13/2014
Northeast/Near Shore	Sediment	C02	SD-C02	10/13/2014
Northeast/Near Shore	Sediment	C03	SD-C03	10/13/2014
Northeast/Near Shore	Sediment	D01	SD-D01	10/14/2014
Northeast/Near Shore	Sediment	D02	SD-D02	10/14/2014
Northeast/Near Shore	Sediment	DE01	DE01-SD	4/23/2015
Northeast/Near Shore	Sediment	E01	SD-E01	10/14/2014
Northeast/Near Shore	Sediment	E02	SD-E02	10/14/2014
Northeast/Near Shore	Sediment	F01	SD-F01	10/14/2014
Northeast/Near Shore	Sediment	F02	SD-F02	10/14/2014
Northeast/Near Shore	Sediment	F05	F05-SD	4/23/2015
Northeast/Near Shore	Surface Water	Modeled	Modeled	NA
Southwest/Tin Mill Canal Effluent	Sediment	DE02	SD-DE02-0002	4/30/2015
Southwest/Tin Mill Canal Effluent	Sediment	E03	SD-E03	10/14/2014
Southwest/Tin Mill Canal Effluent	Sediment	E03	SD-E03-0002	4/30/2015
Southwest/Tin Mill Canal Effluent	Sediment	F03	SD-F03-0002	5/1/2015
Southwest/Tin Mill Canal Effluent	Sediment	F04	SD-F04-0002	5/1/2015
Southwest/Tin Mill Canal Effluent	Sediment	F06	SD-F06-0002	5/1/2015
Southwest/Tin Mill Canal Effluent	Sediment	F07	SD-F07-0002	4/30/2015
Southwest/Tin Mill Canal Effluent	Sediment	G01	SD-G01	10/14/2014
Southwest/Tin Mill Canal Effluent	Sediment	G01	SD-G01-0002	5/1/2015
Southwest/Tin Mill Canal Effluent	Sediment	G02	SD-G02	10/14/2014
Southwest/Tin Mill Canal Effluent	Sediment	G02	SD-G02-0002	4/30/2015
Southwest/Tin Mill Canal Effluent	Sediment	G03	SD-G03-0002	4/30/2015
Southwest/Tin Mill Canal Effluent	Sediment	G04	SD-G04-0002	5/1/2015
Southwest/Tin Mill Canal Effluent	Sediment	G05	SD-G05-0002	5/1/2015
Southwest/Tin Mill Canal Effluent	Sediment	G06	SD-G06-0002	4/30/2015
Southwest/Tin Mill Canal Effluent	Sediment	H01	SD-H01	10/14/2014
Southwest/Tin Mill Canal Effluent	Sediment	H01	SD-H01-0002	5/1/2015
Southwest/Tin Mill Canal Effluent	Sediment	H02	SD-H02	10/14/2014
Southwest/Tin Mill Canal Effluent	Sediment	H03	SD-H03	10/14/2014
Southwest/Tin Mill Canal Effluent	Sediment	H03	SD-H03-0002	5/1/2015
Southwest/Tin Mill Canal Effluent	Sediment	H04	SD-H04-0002	5/1/2015
Southwest/Tin Mill Canal Effluent	Sediment	H05	SD-H05-0002	4/30/2015
Southwest/Tin Mill Canal Effluent	Sediment	H06	SD-H06-0002	4/30/2015
Southwest/Tin Mill Canal Effluent	Sediment	H07	SD-H07-0002	4/30/2015
Southwest/Tin Mill Canal Effluent	Sediment	I01	SD-I01-0001	5/1/2015
Southwest/Tin Mill Canal Effluent	Sediment	I01	SD-I01-0102	5/1/2015
Southwest/Tin Mill Canal Effluent	Sediment	I02	SD-I02-0002	4/30/2015
Southwest/Tin Mill Canal Effluent	Sediment	I03	SD-I03-0002	4/30/2015
Southwest/Tin Mill Canal Effluent	Sediment	J02	SD-J02-0002	5/1/2015
Southwest/Tin Mill Canal Effluent	Surface Water	Modeled	Modeled	NA
Coke Point Offshore Area*	Crab Tissue	--	CP-CASA-MT-A	10/4/2010
Coke Point Offshore Area*	Crab Tissue	--	CP-CASA-MT-B	10/4/2010
Coke Point Offshore Area*	Crab Tissue	--	CP-CASA-MT-C	10/4/2010
Coke Point Offshore Area*	Crab Tissue	--	CP-CASA-MT-D	10/4/2010
Coke Point Offshore Area*	Crab Tissue	--	CP-CASA-MT-E	10/4/2010

TABLE 8-3 GROUPINGS AND SAMPLES USED IN THE RISK ASSESSMENT OF THE PHASE I AREA OF THE SPARROWS POINT SITE

Group	Media	Sample Location	Sample Name	Sample Date
Coke Point Offshore Area*	Crab Tissue	--	CP-CASA-MU-A	10/4/2010
Coke Point Offshore Area*	Crab Tissue	--	CP-CASA-MU-B	10/4/2010
Coke Point Offshore Area*	Crab Tissue	--	CP-CASA-MU-C	10/4/2010
Coke Point Offshore Area*	Crab Tissue	--	CP-CASA-MU-D	10/4/2010
Coke Point Offshore Area*	Crab Tissue	--	CP-CASA-MU-E	10/4/2010
Coke Point Offshore Area*	Fish Tissue	--	CP-MOAM-FT-A	10/1/2010
Coke Point Offshore Area*	Fish Tissue	--	CP-MOAM-FT-B	10/1/2010
Coke Point Offshore Area*	Fish Tissue	--	CP-MOAM-FT-C	10/1/2010
Coke Point Offshore Area*	Fish Tissue	--	CP-MOAM-FT-D	10/1/2010
Coke Point Offshore Area*	Fish Tissue	--	CP-MOAM-FT-E	10/1/2010
Coke Point Offshore Area*	Fish Tissue	--	CP-MOAM-WB-A	10/1/2010
Coke Point Offshore Area*	Fish Tissue	--	CP-MOAM-WB-B	10/1/2010
Coke Point Offshore Area*	Fish Tissue	--	CP-MOAM-WB-C	10/1/2010
Coke Point Offshore Area*	Fish Tissue	--	CP-MOAM-WB-D	10/1/2010
Coke Point Offshore Area*	Fish Tissue	--	CP-MOAM-WB-E	10/1/2010

* EA Engineering, Science, and Technology, Inc. 2011. *Laboratory Bioaccumulation and Field-Collected Tissue Study in Support of the Risk Assessment of the Offshore Areas Adjacent to the Proposed Coke Point Dredged Material Containment Facility at Sparrows Point* . January.

TABLE 8-4 SUMMARY OF SEDIMENT AND PORE WATER DATA USED IN CALCULATION OF EPCs FOR THE NORTHEAST/NEAR-SHORE (NNS) GROUPING WITHIN THE PHASE I AREA OF THE SPARROWS POINT SITE

Transect	Associated Monitoring Wells/Outfalls	Location	Medium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Silver	Zinc	Cyanide	DEHP	LMW PAHs	HMW PAHs
A	GL16, GL02, TS01	A01	Sediment			X			X		X		X		
		A02	Sediment			X			X		X		X		
		A03	Sediment			X			X		X		X		
B	GL05, GL15, Outfall 071	B01	Sediment		X	X			X	X	X		X		
		B02	Sediment		X	X			X	X	X		X		
C	GL12, Outfall UNNAMED	C01	Sediment					X	X	X	X		X		
		C02	Sediment					X	X	X	X		X		
		C03	Sediment					X	X	X	X		X		
D	RW18-20, TS04	D01	Sediment	X		X	X		X		X	X	X	X	X
		D02	Sediment	X		X	X		X		X	X	X	X	X
DE	RW18-20, TS04	DE01	Sediment	X		X	X		X		X	X	X	X	X
E	RW18-20, TS04	E01	Sediment	X		X	X		X		X	X	X	X	X
		E02	Sediment	X		X	X		X		X	X	X	X	X
F	HI08, Outfall 018	F01	Sediment			X	X					X	X	X	X
		F02	Sediment			X	X					X	X	X	X
		F05	Sediment			X	X					X	X	X	X

Notes:

X = Site-related COPC for the transect, for which sediment and surface water data were utilized in calculating EPCs for the Northeast/Near-Shore Grouping.

Grey cells represent analytes which were not found to be Site-related COPCs for a given transect (based on screening of groundwater and stormwater).

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TABLE 8-5 SEDIMENT CONCENTRATIONS OF SITE-RELATED CONTAMINANTS OF POTENTIAL CONCERN USED IN THE RISK ASSESSMENTS FOR THE NORTHEAST/NEAR-SHORE GROUPING.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

ANALYTE	UNITS	AVG RL	BTAG[1]	PEC[2]	HHRA[3]	SD-A01	SD-A02	SD-A03	SD-B01	SD-B02	SD-B02-FD	SD-C01	SD-C02	SD-C03	SD-D01	SD-D02	DE01-SD[4]	SD-E01	SD-E02	SD-F01	F05-SD[4]	SD-F02	F05-SD
CADMIUM	MG/KG	0.25	0.68	4.98	1706	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	**4.4**	**4.8**	**1.8**	**0.97**	**0.72**	NCOPC	NCOPC	NCOPC	NCOPC
CHROMIUM	MG/KG	0.67	52.3	111	133098	NCOPC	NCOPC	NCOPC	**33**	**790**	**710**	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC
COPPER	MG/KG	0.51	18.7	149	273022	**8.7**	**98.00**	**160**	**5.5**	**160**	**140**	NCOPC	NCOPC	NCOPC	**11**	**19**	**8.5**	**9.1**	**11**	**77**	**80**	**29**	**66**
LEAD	MG/KG	0.25	30.2	128	--	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	**16**	**25**	**15**	**16**	**16**	**110**	**110**	**46**	**75**
MERCURY	MG/KG	0.05	0.18*	1.06	48	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	**0.0079 J**	**0.086**	**0.42**	NCOPC	NCOPC	NCOPC	NCOPC	SE	NCOPC	NCOPC	NCOPC	NCOPC
NICKEL	MG/KG	0.25	15.9	48.6	136511	**3.7**	**30**	**46**	**2.2**	**46**	**41**	**2.7**	**8.6**	**46**	**5.5**	**6.4**	**4.1**	**4.9**	**5.6**	NCOPC	NCOPC	NCOPC	NCOPC
SILVER	MG/KG	0.25	0.73	--	1365	NCOPC	NCOPC	NCOPC	**0.026 J**	**1.7**	**1.5**	**0.03 J**	**0.23**	**1.7**	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC
ZINC	MG/KG	1.83	124	459	2047665	**130 J**	**980 J**	**1400 J**	**99 J**	**1600 J**	**1500 J**	**98 J**	**380 J**	**1500 J**	**510**	**670**	**290**	**220**	**140**	NCOPC	NCOPC	NCOPC	NCOPC
CYANIDE, TOTAL	MG/KG	0.72	0.1*	--	4095	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	0.38 U	**0.66**	**1.60**	**0.21 J**	**0.18 J**	**0.4**	**0.22 J**	**0.31 J**	**0.74**
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	2689.99	182.16	2647	2959359	**27 J**	**250 J**	2900 U	190 U	**910 J**	3100 U	490 U	1400 U	3500 U	250 U	**29 J**	230 U	**18 J**	**42 J**	**1600**	**--**	**300 J**	**790**
ACENAPHTHENE	UG/KG	298.57	6.71	--	31502532	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	25 U	18 U	23 U	17 U	26 U	82 UJ	--	48 U	23 U
ACENAPHTHYLENE	UG/KG	298.57	5.87	--	31502532	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	25 U	18 U	23 U	17 U	**8.5 J**	82 UJ	--	48 U	**110**
ANTHRACENE	UG/KG	298.57	46.9	845	157512659	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	25 U	18 U	23 U	17 U	26 U	82 U	--	48 U	**62**
FLUORENE	UG/KG	298.57	21.2	536	21001688	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	25 U	18 U	23 U	17 U	26 U	82 UJ	--	48 U	23 U
NAPHTHALENE	UG/KG	298.57	34.6	561	10500844	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	25 U	**4.2 J**	23 U	17 U	**17 J**	**34 J**	--	**16 J**	**37**
PHENANTHRENE	UG/KG	298.57	86.7	1170	15751266	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	25 U	18 U	23 U	17 U	26 U	82 U	--	48 U	**37**
BENZO[A]ANTHRACENE	UG/KG	298.57	74.8	1050	16782	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	**14 J**	18 U	23 U	17 U	26 U	**130**	--	48 U	**320**
BENZO[A]PYRENE	UG/KG	298.57	88.8	1450	1678	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	25 U	18 U	23 U	17 U	26 U	82 U	--	48 U	**400**
BENZO[B]FLUORANTHENE	UG/KG	298.57	27.2	--	16782	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	**11 J**	18 U	23 U	17 U	26 U	82 U	--	48 U	**370**
BENZO[G,H,I]PERYLENE	UG/KG	298.57	170*	--	--	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	25 U	18 U	23 U	17 U	26 U	82 U	--	48 U	**500**
BENZO[K]FLUORANTHENE	UG/KG	298.57	240*	--	167822	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	25 U	18 U	23 U	17 U	26 U	82 U	--	48 U	**160**
CHRYSENE	UG/KG	298.57	108	1290	1678217	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	**13 J**	18 U	23 U	17 U	26 U	**240**	--	48 U	**280**
DIBENZ(A,H)ANTHRACENE	UG/KG	298.57	6.22	--	1678	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	25 U	18 U	23 U	17 U	26 U	82 U	--	48 U	**45**
FLUORANTHENE	UG/KG	298.57	113	2230	21001688	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	**22 J**	**14 J**	**7.2 J**	**17**	**17 J**	**450**	--	**75**	**1400**
INDENO[1,2,3-CD]PYRENE	UG/KG	298.57	17	--	16782	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	25 U	18 U	23 U	17 U	26 U	82 U	--	48 U	**310**
PYRENE	UG/KG	298.57	153	1520	15751266	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	**16 J**	**6.3 J**	**6.5 J**	**7.1 J**	**18 J**	**750**	--	**140**	**690**
TOTAL LMW PAHs ND=0	UG/KG	--	312	--	--	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	0	**4.2**	0	0	**25.5**	**34**	--	**16**	**246**
TOTAL LMW PAHs ND=RL	UG/KG	--	312	--	--	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	**150**	**94.2**	**138**	**102**	**129.5**	**444**	--	**256**	**292**
TOTAL HMW PAHs ND=0	UG/KG	--	655	--	--	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	**76**	**20.3**	**13.7**	**24.1**	**35**	**1570**	--	**215**	**4475**
TOTAL HMW PAHs ND=RL	UG/KG	--	655	--	--	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	**201**	**164.3**	**197.7**	**160.1**	**243**	**2062**	--	**599**	**4475**
TOTAL PAHs ND=0	UG/KG	--	2900	22800	--	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	**76**	**24.5**	**13.7**	**24.1**	**60.5**	**1604**	--	**231**	**4524**
TOTAL PAHs ND=DL	UG/KG	--	2900	22800	--	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	NCOPC	**351**	**258.5**	**335.7**	**262.1**	**372.5**	**2506**	--	**855**	**4767**

NOTES: Bold values represent detected concentrations. RL is reported for non-detected constituents. In the case of duplicate (FD) samples, 1) if an analyte is detected in both samples, the average of the two detected concentrations is retained in the risk assessment, 2) if an analyte is detected in neither sample, the average of the two RLs is retained for the non-detect, and 3) if an analyte is detected in only one sample, the detected concentration is retained.

Note that only surface grab samples (no core samples) were collected in the Northeast/Near-Shore Grouping.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater sediment benchmark

[2] Probable Effects Concentrations from MacDonald, 2000.

[3] Calculated site-specific human health screening levels, Appendix H.

[4] Samples DE01-SD and F05-SD are identified on data figures as SD-DE01 and SD-F05, respectively, for consistency.

Value exceeds BTAG benchmark

Value exceeds PEC

-- = no screening criterion or not analyzed

mg/kg = milligrams per kilogram

NCOPC = not identified as a site-related constituent of potential concern for the transect/location; therefore, not included in the risk assessments for the northeast grouping.

RL = reporting limit

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

U = compound was analyzed, but not detected

TABLE 8-6 SEDIMENT CONCENTRATIONS OF METALS AND CYANIDE USED IN THE RISK ASSESSMENTS FOR THE SOUTHWEST/TIN MILL CANAL EFFLUENT GROUPING.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

ANALYTE	UNITS	AVG RL	BTAG[1]	PEC[2]	HHRA[3]	SD-DE02-0002	SD-E03-0002	SD-E03	SD-F03-0002	SD-F04-0002	SD-F06-0002	SD-F07-0002	SD-G01-0002	SD-G01	SD-G02-0002	SD-G02	SD-G03-0002	SD-G04-0002	SD-G05-0002	SD-G06-0002
ANTIMONY	MG/KG	0.51	--	--	410	3.7 J	6.2 J	4.1	3.2 J	6.3 J	4.6 J	0.48 UJ	6.2 J	7.8	6.9 J	7	6.7 J	6.2 J	3.1 J	3
ARSENIC	MG/KG	0.14	7.24	33	92	35 J	60 J	25	22	27	79 J	77 J	21	17	29 J	23	29 J	41 J	22 J	120
BERYLLIUM	MG/KG	0.25	--	--	96	1.3 J	0.5 J	0.92	0.2	0.36	1.6 J	1.1 J	0.17	0.24 J	0.26 J	0.46 J	0.6 J	0.36 J	0.84 J	0.99
CADMIUM	MG/KG	0.25	0.68	4.98	1706	26 J	13 J	5.3	7.5	4.6	27 J	22 J	2.1 J	2.5	33 J	5.7	14 J	34 J	8 J	5.8 J
CHROMIUM	MG/KG	0.67	52.3	111	133098	2300 J	1600 J	1400	1500	3100	3300 J	2700 J	2900	800	3900 J	2700	2600 J	4200 J	1100 J	560
COPPER	MG/KG	0.51	18.7	149	273022	290 J	330 J	190	260	250	540 J	480 J	200	110	400 J	260	290 J	440 J	180 J	230
LEAD	MG/KG	0.25	30.2	128	--	320 J	860 J	190	290	130	710 J	920 J	77	67	300 J	130	190 J	560 J	180 J	1100
MERCURY	MG/KG	0.05	0.18*	1.06	48	0.69 J	1 J	---	0.77	0.4	1.3 J	1.6 J	0.32	0.26	0.63 J	0.53	0.53 J	1.5 J	0.49 J	0.95
NICKEL	MG/KG	0.25	15.9	48.6	136511	67 J	56 J	76	49 J	160 J	71 J	69 J	180	63	170 J	130	140 J	92 J	60 J	30
SELENIUM	MG/KG	1.28	2*	--	34128	4.4 J	9.7 J	2.6	1.9 J	1.3 J	14 J	13 J	0.88	6 U	1.5 J	8.7 U	2 J	3.4 J	2.3 J	16 J
SILVER	MG/KG	0.25	0.73	--	1365	3.9 J	3.8 J	2.5	3.5 J	2.3 J	5.5 J	6.2 J	2	0.89 J	4.8 J	5.4	3 J	8.1 J	2.2 J	1.4
THALLIUM	MG/KG	0.25	--	--	68	0.7 J	0.51 J	0.49	0.16	0.22	0.98 J	0.86 J	0.16	0.14 J	0.28 J	0.3 J	0.34 J	0.55 J	0.38 J	0.7
ZINC	MG/KG	1.83	124	459	2047665	4100 J	3400 J	1200	2200	2000	4200 J	4600 J	880	1100	11000 J	1700	3900 J	8000 J	1900 J	2000
CYANIDE, TOTAL	MG/KG	0.72	0.1*	--	4095	4.5 J	29 J	7.3	6.2	4.2	0.42 J	15 J	17 J	0.37 J	8.4 J	21	4 J	8.2 J	12 J	18

ANALYTE	UNITS	AVG RL	BTAG[1]	PEC[2]	HHRA[3]	SD-H01-0002	SD-H01	SD-H02	SD-H03-0002	SD-H03	SD-H04-0002	SD-H04-0002-FD	SD-H05-0002	SD-H06-0002	SD-H06-0002-FD	SD-H07-0002	SD-H07-0002-FD	SD-I01-0001	SD-I01-0102	SD-I02-0002	SD-I03-0002	SD-J02-0002
ANTIMONY	MG/KG	0.51	--	--	410	10 J	6.1	6.6	3.8 J	6.8	7.4 J	10 J	6.8	4.2 J	4 J	3.2 J	2.6	1.1 J	0.13 J	3.3 J	3.4	2.1 J
ARSENIC	MG/KG	0.14	7.24	33	92	25	20	23	43 J	27	28 J	37 J	31	26 J	28 J	67 J	57	35	9.6	47 J	99	27 J
BERYLLIUM	MG/KG	0.25	--	--	96	0.35	0.35 J	0.31 J	0.26 J	0.29 J	0.37 J	0.35 J	0.63	1 J	1.2 J	1.2 J	1	0.6	0.32	0.96 J	1.1	1.5 J
CADMIUM	MG/KG	0.25	0.68	4.98	1706	3.5 J	4.9	4.5	110 J	45	21 J	22 J	4.6 J	4.4 J	5.4 J	8.6 J	7.5 J	2.9	0.26	17 J	8.9 J	4.8 J
CHROMIUM	MG/KG	0.67	52.3	111	133098	1900	1400	1700	4600 J	2600	3400 J	4300 J	2100	1600 J	2100 J	1100 J	900	190	22	1900 J	1000	750 J
COPPER	MG/KG	0.51	18.7	149	273022	180	180	190	550 J	470	350 J	510 J	240	200 J	240 J	290 J	230	110	13	370 J	270	200 J
LEAD	MG/KG	0.25	30.2	128	--	94	110	120	500 J	260	300 J	410 J	130	150 J	190 J	570 J	570	450	27	430 J	840	210 J
MERCURY	MG/KG	0.05	0.18*	1.06	48	0.053 U	0.38	0.36	0.74 J	0.83	0.74 J	0.67 J	0.38	0.47 J	0.54 J	0.91 J	0.97	0.72	0.054	0.58 J	1.5	0.57 J
NICKEL	MG/KG	0.25	15.9	48.6	136511	110	95	120	210 J	170	140 J	220 J	120	78 J	79 J	43 J	39	23 J	9.1 J	61 J	46	56 J
SELENIUM	MG/KG	1.28	2*	--	34128	1.2	5.2 U	4.9 U	1.3 J	7.7 U	1.8 J	2.2 J	2.1 J	2.6 J	2.8 J	9.9 J	10 J	8 J	0.67 J	7.3 J	17 J	3.7 J
SILVER	MG/KG	0.25	0.73	--	1365	2.1	1.9	2	6 J	4.8	5.4 J	6.3 J	3.1	2.4 J	3.2 J	2.5 J	2	0.51 J	0.057 J	4.3 J	1.6	1.8 J
THALLIUM	MG/KG	0.25	--	--	68	0.23	0.3 J	0.27 J	0.65 J	0.2 J	0.35 J	0.44 J	0.41	0.4 J	0.48 J	0.81 J	0.64	0.36	0.085	0.86 J	0.81	0.41 J
ZINC	MG/KG	1.83	124	459	--	1400	1900	1900	17000 J	10000	5500 J	11000 J	1700	1300 J	1500 J	2000 J	1700	990	71	3000 J	1900	1200 J
CYANIDE, TOTAL	MG/KG	0.72	0.1*	--	4095	0.81 UJ	2.8	1.2	16 J	12	7.1 J	9.5 J	3.3	2.5 J	6.5 J	34 J	36	9.6 J	2 J	13 J	22	2.8 J

NOTES: Bold values represent detected concentrations. RL is reported for non-detected constituents.
In the case of duplicate (FD) samples, 1) if an analyte is detected in both samples, the average of the two detected concentrations is retained in the risk assessment, 2) if an analyte is detected in neither sample, the average of the two RLs is retained for the non-detect, and 3) if an analyte is detected in only one sample, the detected concentration is retained.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater sediment benchmark

[2] Probable Effects Concentrations from MacDonald, 2000.

[3] Calculated site-specific human health screening levels, Appendix H.

Value exceeds BTAG benchmark

Value exceeds PEC

Value exceeds human health screening level

-- = no screening criterion or not analyzed

mg/kg = milligrams per kilogram

RL = reporting limit

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

U = compound was analyzed, but not detected

TABLE 8-7 SEDIMENT CONCENTRATIONS OF POLYCYCLIC AROMATIC HYDROCARBONS USED IN THE RISK ASSESSMENTS FOR THE SOUTHWEST/TIN MILL CANAL EFFLUENT GROUPING.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

ANALYTE	UNITS	AVG RL	BTAG[1]	PEC[2]	HHRA[3]	SD-DE02-0002	SD-E03-0002	SD-E03	SD-F03-0002	SD-F04-0002	SD-F06-0002	SD-F07-0002	SD-G01-0002	SD-G01	SD-G02-0002	SD-G02	SD-G03-0002	SD-G04-0002	SD-G05-0002	SD-G06-0002
ACENAPHTHENE	UG/KG	298.57	6.71	--	3.15E+07	240 J	140 J	730 U	770	840 U	670 J	850 J	450	880 UJ	890 J	660 UJ	380 J	640 J	110 J	110
ACENAPHTHYLENE	UG/KG	298.57	5.87	--	3.15E+07	610 J	360 J	320 J	170	1500	740 J	620 J	1800	880 UJ	950 J	660 UJ	710 J	580 J	260 J	400
ANTHRACENE	UG/KG	298.57	46.9	845	1.58E+08	1100 J	750 J	730 U	460 J	2100	1100 J	1300 J	3100	880 UJ	1000 J	660 UJ	560 J	1200 J	280 J	660
FLUORENE	UG/KG	298.57	21.2	536	2.10E+07	380 J	170 J	730 U	980	1700	650 J	1500 J	2000	880 UJ	2000 J	660 UJ	730 J	1200 J	180 J	290
NAPHTHALENE	UG/KG	298.57	34.6	561	1.05E+07	1200 J	950 J	530 J	230	1700	9100 J	2900 J	1800	200 J	2100 J	430 J	1600 J	920 J	690 J	3500
PHENANTHRENE	UG/KG	298.57	86.7	1170	1.58E+07	1400 J	930 J	730 U	3500 J	7900	2800 J	7000 J	11000	880 UJ	5800 J	660 UJ	2400 J	5800 J	630 J	990
BENZO[A]ANTHRACENE	UG/KG	298.57	74.8	1050	1.68E+04	3700 J	2000 J	610 J	660	2600	3800 J	3600 J	3500	880 U	1200 J	2300	1100 J	1300 J	710 J	1500
BENZO[A]PYRENE	UG/KG	298.57	88.8	1450	1.68E+03	3500 J	1500 J	1300	110 U	2500	3000 J	3700 J	3300	880 U	260 UJ	1700	950 J	2600 J	800 J	1600
BENZO[B]FLUORANTHENE	UG/KG	298.57	27.2	--	1.68E+04	3000 J	1400 J	1700	440	2600	3100 J	4600 J	1300	880 U	800 J	660 U	1000 J	680 J	660 J	1800
BENZO[G,H,I]PERYLENE	UG/KG	298.57	170*	--	--	3200 J	1400 J	1000	110 U	2800	2500 J	3500 J	3500	880 U	760 J	660 U	1500 J	1000 J	830 J	1600
BENZO[K]FLUORANTHENE	UG/KG	298.57	240*	--	1.68E+05	1500 J	890 J	280 J	370	810 J	1600 J	2400 J	3300	880 U	350 J	660 U	260 J	1000 J	500 J	800
CHRYSENE	UG/KG	298.57	108	1290	1.68E+06	3600 J	2000 J	720 J	1100	2800	4300 J	4100 J	3200	880 U	1500 J	2200	1100 J	2200 J	710 J	1300
DIBENZ(A,H)ANTHRACENE	UG/KG	298.57	6.22	--	1.68E+03	600 J	330 J	730 U	110 U	840 U	610 J	320 UJ	800	880 U	260 UJ	660 U	250 UJ	130 UJ	140 J	380
FLUORANTHENE	UG/KG	298.57	113	2230	2.10E+07	7600 J	4900 J	1900	2300 J	8600	6900 J	7900 J	12000	1200 J	4000 J	4900 J	3100 J	5300 J	1600 J	4000
INDENO[1,2,3-CD]PYRENE	UG/KG	298.57	17	--	1.68E+04	2400 J	1100 J	730 U	110 U	1800	1900 J	2600 J	2600	880 U	520 J	660 U	840 J	630 J	580 J	1400
PYRENE	UG/KG	298.57	153	1520	1.58E+07	5700 J	2800 J	2000	1700	6600	4700 J	5300 J	6300	1000	2700 J	2800	2000 J	3800 J	1100 J	2400
TOTAL LMW PAHs ND=0	UG/KG	--	312	--	--	4930	3300	850	6110	14900	15060	14170	20150	200	12740	430	6380	10340	2150	5950
TOTAL LMW PAHs ND=RL	UG/KG	--	312	--	--	4930	3300	3770	6110	15740	15060	14170	20150	4600	12740	3730	6380	10340	2150	5950
TOTAL HMW PAHs ND=0	UG/KG	--	655	--	--	34800	18320	9510	6570	31110	32410	37700	39800	2200	11830	13900	11850	18510	7630	16780
TOTAL HMW PAHs ND=RL	UG/KG	--	655	--	--	34800	18320	10970	7010	31950	32410	38020	39800	9240	12350	17200	12100	18640	7630	16780
TOTAL PAHs ND=0	UG/KG	--	2900	22800	--	39730	21620	10360	12680	46010	47470	51870	59950	2400	24570	14330	18230	28850	9780	22730
TOTAL PAHs ND=RL	UG/KG	--	2900	22800	--	39730	21620	14740	13120	47690	47470	52190	59950	13840	25090	20930	18480	28980	9780	22730

ANALYTE	UNITS	AVG RL	BTAG[1]	PEC[2]	HHRA[3]	SD-H01-0002	SD-H01	SD-H02	SD-H03-0002	SD-H03	SD-H04-0002	SD-H04-0002-FD	SD-H05-0002	SD-H06-0002	SD-H06-0002-FD	SD-H07-0002	SD-H07-0002-FD	SD-I01-0001	SD-I01-0102	SD-I02-0002	SD-I03-0002	SD-J02-0002
ACENAPHTHENE	UG/KG	298.57	6.71	--	3.15E+07	1400	1200 UJ	1200 UJ	1400 UJ	1900 UJ	1400 UJ	3100 J	330 J	150 J	280 J	160 J	110	32	7.1 J	100 J	79	91 J
ACENAPHTHYLENE	UG/KG	298.57	5.87	--	3.15E+07	2500	1200 UJ	1200 UJ	1000 UJ	1900 UJ	2500 J	2900 J	920	640 J	1000 J	790 J	660	220	14 J	250 J	560	280 J
ANTHRACENE	UG/KG	298.57	46.9	845	1.58E+08	4100	1200 UJ	1200 UJ	950 UJ	1900 UJ	3200 J	3300 J	1300	520 J	930 J	1300 J	1000	280	20	440 J	650	340 J
FLUORENE	UG/KG	298.57	21.2	536	2.10E+07	3200	1200 UJ	1200 UJ	2000 J	1900 UJ	4000 J	4600 J	850	220 J	490 J	300 J	280	77	12 J	170 J	210	110 J
NAPHTHALENE	UG/KG	298.57	34.6	561	1.05E+07	3300	220 J	210 J	6000 J	4000	5500 J	5900 J	760	820 J	1000 J	4800 J	4200	750	89	1000 J	2300	1400 J
PHENANTHRENE	UG/KG	298.57	86.7	1170	1.58E+07	14000	1200 UJ	1200 UJ	6400 J	1900 UJ	14000 J	17000 J	3900	950 J	2000 J	1000 J	920	240	42	920 J	660	390 J
BENZO[A]ANTHRACENE	UG/KG	298.57	74.8	1050	1.68E+04	4900	1200 U	1200 U	980 J	1900 U	4400 J	4100 J	2400	1600 J	2000 J	6400 J	5600	790	52	2000 J	3500	1300 J
BENZO[A]PYRENE	UG/KG	298.57	88.8	1450	1.68E+03	4300	1200 U	1200 U	300 UJ	1900 U	3300 J	3500 J	2200	1700 J	1900 J	5300 J	4600	930	56	1800 J	3200	1700 J
BENZO[B]FLUORANTHENE	UG/KG	298.57	27.2	--	1.68E+04	5800	1200 U	1200 U	300 UJ	1900 U	2600 J	2100 J	2100	1600 J	1800 J	6100 J	5000	1100	74	1700 J	3300	2000 J
BENZO[G,H,I]PERYLENE	UG/KG	298.57	170*	--	--	4300	1200 U	1200 U	300 UJ	1900 U	1400 UJ	2800 J	2600	2000 J	2200 J	4500 J	4000	820	47	1900 J	2700	1700 J
BENZO[K]FLUORANTHENE	UG/KG	298.57	240*	--	1.68E+05	1100 U	1200 U	1200 U	300 UJ	1900 U	2200 J	3300 J	890	730 J	720 J	1500 J	1700	550	18	830 J	1500	550 J
CHRYSENE	UG/KG	298.57	108	1290	1.68E+06	4500	1200 U	1200 U	1300 UJ	1900 U	5200 J	5400 J	2400	1600 J	1900 J	5800 J	4900	750	49	1700 J	3000	1400 J
DIBENZ(A,H)ANTHRACENE	UG/KG	298.57	6.22	--	1.68E+03	1100 U	1200 U	1200 U	300 UJ	1900 U	1400 UJ	1400 UJ	440 U	310 UJ	410 J	1100 J	1100	250	14 J	320 J	780	390 J
FLUORANTHENE	UG/KG	298.57	113	2230	2.10E+07	14000	1400 J	3200 J	2800 J	2600 J	11000 J	12000 J	7300	4300 J	4900 J	13000 J	10000	950	75	4100 J	6700	2800 J
INDENO[1,2,3-CD]PYRENE	UG/KG	298.57	17	--	1.68E+04	3200	1200 U	1200 U	300 UJ	1900 U	1800 J	1800 J	1800	1300 J	1500 J	3600 J	3300	750	42	1200 J	2400	1300 J
PYRENE	UG/KG	298.57	153	1520	1.58E+07	10000	1300	2500	3200 J	5000	9500 J	11000 J	3800	2400 J	2700 J	7200 J	6500	940	70	2800 J	4200	1800 J
TOTAL LMW PAHs ND=0	UG/KG	--	312	--	--	28500	220	210	17750	4000	29200	36800	8060	3300	5700	8350	7170	1599	184.1	2880	4459	2611
TOTAL LMW PAHs ND=RL	UG/KG	--	312	--	--	28500	6220	6210	17750	13500	30600	36800	8060	3300	5700	8350	7170	1599	184.1	2880	4459	2611
TOTAL HMW PAHs ND=0	UG/KG	--	655	--	--	51000	2700	5700	8280	7600	40000	46000	25490	17230	20030	54500	46700	7830	497	18350	31280	14940
TOTAL HMW PAHs ND=RL	UG/KG	--	655	--	--	53200	12300	15300	10080	22800	42800	47400	25930	17540	20030	54500	46700	7830	497	18350	31280	14940
TOTAL PAHs ND=0	UG/KG	--	2900	22800	--	79500	2920	5910	26030	11600	69200	82800	33550	20530	25730	62850	53870	9429	681.1	21230	35739	17551
TOTAL PAHs ND=RL	UG/KG	--	2900	22800	--	81700	18520	21510	27830	36300	73400	84200	33990	20840	25730	62850	53870	9429	681.1	21230	35739	17551

NOTES: Bold values represent detected concentrations. RL is reported for non-detected constituents.
In the case of duplicate (FD) samples, 1) if an analyte is detected in both samples, the average of the two detected concentrations is retained in the risk assessment, 2) if an analyte is detected in neither sample, the average of the two RLs is retained for the non-detect, and 3) if an analyte is detected in only one sample, the detected concentration is retained.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater sediment benchmark

[2] Probable Effects Concentrations from MacDonald, 2000.

[3] Calculated site-specific human health screening levels, Appendix H.

Value exceeds BTAG benchmark

Value exceeds PEC

Value exceeds human health screening level

-- = no screening criterion

ug/kg = micrograms per kilogram

RL = reporting limit

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

U = compound was analyzed, but not detected

TABLE 8-8 SEDIMENT CONCENTRATIONS OF POLYCHLORINATED BIPHENYLS USED IN THE RISK ASSESSMENTS FOR THE SOUTHWEST/TIN MILL CANAL EFFLUENT GROUPING.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

ANALYTE	UNITS	AVG RL	BTAG[1]	PEC[2]	HHRA[3]	SD-DE02-0002	SD-E03-0002	SD-F03-0002	SD-F04-0002	SD-F06-0002	SD-F07-0002	SD-G01-0002	SD-G01	SD-G02-0002	SD-G02	SD-G03-0002	SD-G04-0002	SD-G05-0002	SD-G06-0002
PCB-1016	UG/KG	26.56	--	--	3.41E+04	21 UJ	10 UJ	66 U	11 U	19 UJ	200 UJ	11 U	22 U	16 UJ	17 U	16 UJ	170 UJ	9.4 UJ	6.3 U
PCB-1221	UG/KG	26.56	--	--	1.48E+04	21 UJ	10 UJ	66 U	11 U	19 UJ	200 UJ	11 U	22 U	16 UJ	17 U	16 UJ	170 UJ	9.4 UJ	6.3 U
PCB-1232	UG/KG	26.56	--	--	1.48E+04	21 UJ	10 UJ	66 U	11 U	19 UJ	200 UJ	11 U	22 U	16 UJ	17 U	16 UJ	170 UJ	9.4 UJ	6.3 U
PCB-1242	UG/KG	26.56	--	--	--	21 UJ	10 UJ	66 U	11 U	19 UJ	200 UJ	11 U	22 U	16 UJ	17 U	16 UJ	170 UJ	9.4 UJ	6.3 U
PCB-1248	UG/KG	26.56	--	--	1.48E+04	320 J	2500 J	5100	220	2200 J	5100 J	260	**260**	600 J	**230**	470 J	9000 J	290 J	94 J
PCB-1254	UG/KG	26.56	--	--	9.75E+03	290 J	840 J	1800	230	1400 J	1800 J	100	22 U	560 J	17 U	580 J	3200 J	320 J	130 J
PCB-1260	UG/KG	26.56	--	--	1.48E+04	160 J	320 J	540	160	490 J	550 J	11 U	22 U	390 J	17 U	300 J	1000 J	170 J	50 J
Total PCBs ND=0	UG/KG	--	40	676	--	**770**	**3660**	**7440**	**610**	**4090**	**7450**	**360**	**260**	**1550**	**230**	**1350**	**13200**	**780**	**274**
Total PCBs ND=RL	UG/KG	--	40	676	--	**854**	**3700**	**7704**	**654**	**4166**	**8250**	**415**	**392**	**1614**	**332**	**1414**	**13880**	**817.6**	**299.2**

ANALYTE	UNITS	AVG RL	BTAG[1]	PEC[2]	HHRA[3]	SD-H01-0002	SD-H01	SD-H02	SD-H03-0002	SD-H03	SD-H04-0002	SD-H04-0002-FD	SD-H05-0002	SD-H06-0002	SD-H06-0002-FD	SD-H07-0002	SD-H07-0002-FD	SD-I01-0001	SD-I01-0102	SD-I02-0002	SD-I03-0002	SD-J02-0002
PCB-1016	UG/KG	26.56	--	--	3.41E+04	13 U	19 U	20 U	19 UJ	32 U	17 UJ	17 UJ	6.8 U	9.7 UJ	9.9 UJ	35 UJ	34 U	0.78 U	0.6 U	9.2 UJ	6.2 U	17 UJ
PCB-1221	UG/KG	26.56	--	--	1.48E+04	13 U	19 U	20 U	19 UJ	32 U	17 UJ	17 UJ	6.8 U	9.7 UJ	9.9 UJ	35 UJ	34 U	0.78 U	0.6 U	9.2 UJ	6.2 U	17 UJ
PCB-1232	UG/KG	26.56	--	--	1.48E+04	13 U	19 U	20 U	19 UJ	32 U	17 UJ	17 UJ	6.8 U	9.7 UJ	9.9 UJ	35 UJ	34 U	0.78 U	0.6 U	9.2 UJ	6.2 U	17 UJ
PCB-1242	UG/KG	26.56	--	--	--	13 U	19 U	20 U	19 UJ	32 U	17 UJ	17 UJ	6.8 U	9.7 UJ	9.9 UJ	35 UJ	34 U	0.78 U	0.6 U	9.2 UJ	6.2 U	17 UJ
PCB-1248	UG/KG	26.56	--	--	1.48E+04	300 J	**680**	**570**	1600 J	**910 J**	530 J	510 J	120 J	89 J	100 J	520 J	420 J	4.4 J	0.33 J	650 J	260 J	200 J
PCB-1254	UG/KG	26.56	--	--	9.75E+03	13 U	19 U	20 U	2400 J	32 U	770 J	690 J	6.8 U	9.7 UJ	9.9 UJ	310 J	260 J	9.2	0.55 J	470 J	120 J	190 J
PCB-1260	UG/KG	26.56	--	--	1.48E+04	44 J	19 U	20 U	2000 J	**1000 J**	560 J	540 J	37 J	42 J	47 J	100 J	81 J	5.3 J	0.35 J	160 J	40 J	100 J
Total PCBs ND=0	UG/KG	--	40	676	--	**344**	**680**	**570**	**6000**	**1910**	**1860**	**1740**	**157**	**131**	**147**	**930**	**761**	**18.9**	**1.23**	**1280**	**420**	**490**
Total PCBs ND=RL	UG/KG	--	40	676	--	**409**	**794**	**690**	**6076**	**2070**	**1928**	**1808**	**191**	**179.5**	**196.5**	**1070**	**897**	**22.02**	**3.63**	**1316.8**	**444.8**	**558**

NOTES: Bold values represent detected concentrations. RL is reported for non-detected constituents.
In the case of duplicate (FD) samples, 1) if an analyte is detected in both samples, the average of the two detected concentrations is retained in the risk assessment, 2) if an analyte is detected in neither sample, the average of the two RLs is retained for the non-detect, and 3) if an analyte is detected in only one sample, the detected concentration is retained.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group.

[2] Probable Effects Concentrations from MacDonald, 2000.

[3] Calculated site-specific human health screening levels, Appendix H.

Value exceeds BTAG benchmark

Value exceeds PEC

RL = reporting limit

P = The %RPD between the primary and confirmation column/detector is >40%. The lower value has been reported

U = compound was analyzed, but not detected

TABLE 8-9 SEDIMENT CONCENTRATIONS OF VOLATILE ORGANIC COMPOUNDS USED IN THE RISK ASSESSMENTS FOR THE SOUTHWEST/TIN MILL CANAL EFFLUENT GROUPING.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

ANALYTE	UNITS	AVG RL	BTAG[1]	HHRA[2]	SD-DE02-0002	SD-E03-0002	SD-F03-0002	SD-F04-0002	SD-F06-0002	SD-F07-0002	SD-G01-0002	SD-G01	SD-G02-0002	SD-G02	SD-G03-0002	SD-G04-0002	SD-G05-0002	SD-G06-0002
1,1,1-TRICHLOROETHANE	UG/KG	15.11	856	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 UJ	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U
1,1,2,2-TETRACHLOROETHANE	UG/KG	15.11	202	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 U	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U
1,1,2-TRICHLOROETHANE	UG/KG	15.11	570	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 U	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U
1,1-DICHLOROETHANE	UG/KG	15.11	--	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 U	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U
1,1-DICHLOROETHENE	UG/KG	15.11	2780	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 U	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U
1,2-DICHLOROBENZENE	UG/KG	15.11	989	6.14E+07	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 U	13 U	**180 J**	**8.8 J**	**16 J**	20 UJ	23 UJ	15 U
1,2-DICHLOROETHANE	UG/KG	15.11	--	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 U	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U
1,2-DICHLOROPROPANE	UG/KG	15.11	--	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 U	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U
1,3-DICHLOROBENZENE	UG/KG	15.11	842	6.14E+07	26 UJ	25 UJ	**2.4 J**	13 U	22 UJ	24 UJ	14 U	13 U	19 UJ	20 U	**6.7 J**	20 UJ	23 UJ	15 U
1,4-DICHLOROBENZENE	UG/KG	15.11	460	7.67E+06	26 UJ	25 UJ	**3.5 J**	13 U	22 UJ	24 UJ	**2.8 J**	13 U	**28 J**	20 U	**10 J**	20 UJ	23 UJ	15 U
2-CHLOROETHYL VINYL ETHER	UG/KG	30.27	--	--	52 UJ	50 UJ	16 U	25 U	45 UJ	48 UJ	28 U	26 U	39 UJ	40 U	38 UJ	40 UJ	46 UJ	30 U
ACROLEIN	UG/KG	302.72	--	--	520 UJ	500 UJ	160 U	250 U	450 UJ	480 UJ	280 UJ	260 U	390 UJ	400 U	380 UJ	400 UJ	460 UJ	300 U
ACRYLONITRILE	UG/KG	302.72	--	--	520 UJ	500 UJ	160 U	250 U	450 UJ	480 UJ	280 U	260 U	390 UJ	400 U	380 UJ	400 UJ	460 UJ	300 U
BENZENE	UG/KG	15.11	137	1.51E+08	26 UJ	25 UJ	7.9 U	**2.6 J**	22 UJ	24 UJ	**2.7 J**	13 U	**12 J**	20 U	**4.5 J**	**8 J**	23 UJ	15 U
BROMOFORM	UG/KG	15.11	1310	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 U	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U
BROMOMETHANE	UG/KG	15.11	--	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 U	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U
CARBON TETRACHLORIDE	UG/KG	15.11	7240	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 UJ	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U
CHLOROBENZENE	UG/KG	15.11	162	1.37E+07	26 UJ	25 UJ	**32**	**4.6 J**	22 UJ	24 UJ	**9.7 J**	13 U	**45 J**	**16 J**	**84 J**	**14 J**	23 UJ	15 U
CHLORODIBROMOMETHANE	UG/KG	15.11	--	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 U	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U
CHLOROETHANE	UG/KG	15.11	--	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 U	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U
CHLOROFORM	UG/KG	15.11	--	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 U	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U
CHLOROMETHANE	UG/KG	15.11	--	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 U	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U
CIS-1,3-DICHLOROPROPENE	UG/KG	15.11	--	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 U	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U
DICHLOROBROMOMETHANE	UG/KG	15.11	--	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 U	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U
ETHYLBENZENE	UG/KG	15.11	305	1.26E+07	26 UJ	25 UJ	7.9 U	**4.7 J**	22 UJ	24 UJ	**8.6 J**	**2.1 J**	**89 J**	**5.8 J**	**33 J**	20 UJ	23 UJ	15 U
METHYLENE CHLORIDE	UG/KG	15.11	--	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 U	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U
TETRACHLOROETHENE	UG/KG	15.11	190	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 U	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U
TOLUENE	UG/KG	15.11	1090	1.82E+08	26 UJ	25 UJ	**1.3 J**	**12 J**	22 UJ	24 UJ	**34**	**3.6 J**	**66 J**	**5.3 J**	**21 J**	**6.3 J**	23 UJ	15 U
TRANS-1,2-DICHLOROETHENE	UG/KG	15.11	1050*	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 U	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U
TRANS-1,3-DICHLOROPROPENE	UG/KG	15.11	--	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 U	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U
TRICHLOROETHENE	UG/KG	15.11	8950	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 U	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U
VINYL CHLORIDE	UG/KG	15.11	--	--	26 UJ	25 UJ	7.9 U	13 U	22 UJ	24 UJ	14 U	13 U	19 UJ	20 U	19 UJ	20 UJ	23 UJ	15 U

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

In the case of duplicate (FD) samples, 1) if an analyte is detected in both samples, the average of the two detected concentrations is retained in the risk assessment, 2) if an analyte is detected in neither sample, the average of the two RLs is retained for the non-detect, and 3) if an analyte is detected in only one sample, the detected concentration is retained.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater sediment benchmark

[2] Calculated site-specific human health screening levels, Appendix H.

RL = reporting limit

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

U = compound was analyzed, but not detected

*BTAG value from freshwater sediment screening values

TABLE 8-9 SEDIMENT CONCENTRATIONS OF VOLATILE ORGANIC COMPOUNDS USED IN THE RISK ASSESSMENTS FOR THE SOUTHWEST/TIN MILL CANAL EFFLUENT GROUPING.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

ANALYTE	UNITS	AVG RL	BTAG[1]	HHRA[2]	SD-H01-0002	SD-H01	SD-H02	SD-H03-0002	SD-H03	SD-H04-0002	SD-H04-0002-FD	SD-H05-0002	SD-H06-0002	SD-H06-0002-FD	SD-H07-0002	SD-H07-0002-FD	SD-I01-0001	SD-I01-0102	SD-I02-0002	SD-I03-0002	SD-J02-0002
1,1,1-TRICHLOROETHANE	UG/KG	15.11	856	--	16 UJ	12 U	12 U	22 UJ	19 U	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 UJ	22 UJ	15 U	21 UJ
1,1,2,2-TETRACHLOROETHANE	UG/KG	15.11	202	--	16 U	12 U	12 U	22 UJ	19 U	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
1,1,2-TRICHLOROETHANE	UG/KG	15.11	570	--	16 U	12 U	12 U	22 UJ	19 U	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
1,1-DICHLOROETHANE	UG/KG	15.11	--	--	16 U	12 U	12 U	22 UJ	19 U	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
1,1-DICHLOROETHENE	UG/KG	15.11	2780	--	16 U	12 U	12 U	22 UJ	19 U	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
1,2-DICHLOROBENZENE	UG/KG	15.11	989	6.14E+07	16 U	12 U	12 U	**92 J**	19 U	**5.1 J**	**3.4 J**	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
1,2-DICHLOROETHANE	UG/KG	15.11	--	--	16 U	12 U	12 UJ	22 UJ	19 UJ	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
1,2-DICHLOROPROPANE	UG/KG	15.11	--	--	16 U	12 U	12 U	22 UJ	19 U	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
1,3-DICHLOROBENZENE	UG/KG	15.11	842	6.14E+07	16 U	12 U	12 U	**13 J**	19 U	**4.8 J**	**6.1 J**	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
1,4-DICHLOROBENZENE	UG/KG	15.11	460	7.67E+06	**4.4 J**	12 U	12 U	**19 J**	19 U	**6.7 J**	**7.9 J**	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
2-CHLOROETHYL VINYL ETHER	UG/KG	30.27	--	--	32 U	23 U	24 U	45 UJ	38 U	41 UJ	41 UJ	32 U	46 UJ	48 UJ	34 UJ	33 U	19 U	15 U	44 UJ	30 U	41 UJ
ACROLEIN	UG/KG	302.72	--	--	320 UJ	230 U	240 U	450 UJ	380 U	410 UJ	410 UJ	320 U	460 UJ	480 UJ	340 UJ	330 U	190 U	150 U	440 UJ	300 U	410 UJ
ACRYLONITRILE	UG/KG	302.72	--	--	320 U	230 U	240 U	450 UJ	380 U	410 UJ	410 UJ	320 U	460 UJ	480 UJ	340 UJ	330 U	190 U	150 U	440 UJ	300 U	410 UJ
BENZENE	UG/KG	15.11	137	1.51E+08	**4.5 J**	12 U	12 U	**9.6 J**	**6.9 J**	**3.6 J**	**3.8 J**	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
BROMOFORM	UG/KG	15.11	1310	--	16 U	12 U	12 U	22 UJ	19 U	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
BROMOMETHANE	UG/KG	15.11	--	--	16 U	12 U	12 UJ	22 UJ	19 UJ	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
CARBON TETRACHLORIDE	UG/KG	15.11	7240	--	16 UJ	12 U	12 UJ	22 UJ	19 UJ	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
CHLOROBENZENE	UG/KG	15.11	162	1.37E+07	**11 J**	12 U	**2.4 J**	**50 J**	**250**	**67 J**	**72 J**	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
CHLORODIBROMOMETHANE	UG/KG	15.11	--	--	16 U	12 U	12 U	22 UJ	19 U	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
CHLOROETHANE	UG/KG	15.11	--	--	16 U	12 U	12 U	22 UJ	19 U	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
CHLOROFORM	UG/KG	15.11	--	--	16 U	12 U	12 U	22 UJ	19 U	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
CHLOROMETHANE	UG/KG	15.11	--	--	16 U	12 U	12 U	22 UJ	19 U	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
CIS-1,3-DICHLOROPROPENE	UG/KG	15.11	--	--	16 U	12 U	12 U	22 UJ	19 U	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
DICHLOROBROMOMETHANE	UG/KG	15.11	--	--	16 U	12 U	12 U	22 UJ	19 U	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
ETHYLBENZENE	UG/KG	15.11	305	1.26E+07	**4.8 J**	12 U	12 U	**80 J**	**33**	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
METHYLENE CHLORIDE	UG/KG	15.11	--	--	16 U	12 U	12 U	22 UJ	19 U	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
TETRACHLOROETHENE	UG/KG	15.11	190	--	16 U	12 U	12 U	22 UJ	19 U	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
TOLUENE	UG/KG	15.11	1090	1.82E+08	**24**	**2.6 J**	12 U	**71 J**	**16 J**	**11 J**	**12 J**	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
TRANS-1,2-DICHLOROETHENE	UG/KG	15.11	1050*	--	16 U	12 U	12 U	22 UJ	19 U	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
TRANS-1,3-DICHLOROPROPENE	UG/KG	15.11	--	--	16 U	12 U	12 U	22 UJ	19 U	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
TRICHLOROETHENE	UG/KG	15.11	8950	--	16 U	12 U	12 U	22 UJ	19 U	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ
VINYL CHLORIDE	UG/KG	15.11	--	--	16 U	12 U	12 U	22 UJ	19 U	20 UJ	20 UJ	16 U	23 UJ	24 UJ	17 UJ	16 U	9.4 U	7.3 U	22 UJ	15 U	21 UJ

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

In the case of duplicate (FD) samples, 1) if an analyte is detected in both samples, the average of the two detected concentrations is retained in the risk assessment, 2) if an analyte is detected in neither sample, the average of the two RLs is retained for the non-detect, and 3) if an analyte is detected in only one sample, the detected concentration is retained.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater sediment benchmark

[2] Calculated site-specific human health screening levels, Appendix H.

RL = reporting limit

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

U = compound was analyzed, but not detected

*BTAG value from freshwater sediment screening values

TABLE 8-10 SEDIMENT CONCENTRATIONS OF SEMIVOLATILE ORGANIC COMPOUNDS USED IN THE RISK ASSESSMENTS FOR THE SOUTHWEST/TIN MILL CANAL EFFLUENT GROUPING.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

ANALYTE	UNITS	AVG RL	BTAG[1]	PEC[2]	HHRA[3]	SD-DE02-0002	SD-E03-0002	SD-E03	SD-F03-0002	SD-F04-0002	SD-F06-0002	SD-F07-0002	SD-G01-0002	SD-G01	SD-G02-0002	SD-G02	SD-G03-0002	SD-G04-0002	SD-G05-0002	SD-G06-0002	SD-H01-0002	SD-H01
1,2,4-TRICHLOROBENZENE	UG/KG	1419.15	473	--	--	1700 UJ	410 UJ	---	520 U	4200 U	1500 UJ	1600 UJ	910 U	4300 U	1300 UJ	3300 U	1300 UJ	650 UJ	380 UJ	250 U	5300 U	5800 U
1,2-DIPHENYLHYDRAZINE(AS AZOBENZENE)	UG/KG	1419.15	--	--	--	1700 UJ	410 UJ	---	520 UJ	4200 U	1500 UJ	1600 UJ	910 U	4300 UJ	1300 UJ	3300 UJ	1300 UJ	650 UJ	380 UJ	250 U	5300 U	5800 UJ
2,2'-OXYBIS[1-CHLOROPROPANE]	UG/KG	289.25	--	--	--	340 UJ	83 UJ	---	110 U	840 U	300 UJ	320 UJ	180 U	880 U	260 UJ	660 U	250 UJ	130 UJ	76 UJ	50 U	1100 U	1200 U
2,4,6-TRICHLOROPHENOL	UG/KG	1419.15	2650	--	--	1700 UJ	410 UJ	---	520 U	4200 U	1500 UJ	1600 UJ	910 U	4300 UJ	1300 UJ	3300 UJ	1300 UJ	650 UJ	380 UJ	250 U	5300 U	5800 UJ
2,4-DICHLOROPHENOL	UG/KG	289.25	117*	--	--	340 UJ	83 UJ	---	110 U	840 U	300 UJ	320 UJ	180 U	880 U	260 UJ	660 U	250 UJ	130 UJ	76 UJ	50 U	1100 U	1200 U
2,4-DIMETHYLPHENOL	UG/KG	1419.15	29*	--	1.37E+07	1700 UJ	410 UJ	---	520 U	4200 U	1500 UJ	1600 UJ	910 U	4300 U	1300 UJ	3300 U	1300 UJ	650 UJ	380 UJ	250 U	5300 U	5800 U
2,4-DINITROPHENOL	UG/KG	7311.47	41.6*	--	--	8700 UJ	2100 UJ	---	2700 U	21000 U	7600 UJ	8200 UJ	4700 U	22000 UJ	6600 UJ	17000 UJ	6500 UJ	3400 UJ	1900 UJ	1300 U	27000 U	30000 UJ
2,4-DINITROTOLUENE	UG/KG	1419.15	41.6	--	--	1700 UJ	410 UJ	---	520 U	4200 U	1500 UJ	1600 UJ	910 U	4300 UJ	1300 UJ	3300 UJ	1300 UJ	650 UJ	380 UJ	250 U	5300 U	5800 UJ
2,6-DINITROTOLUENE	UG/KG	1419.15	--	--	--	1700 UJ	410 UJ	---	520 U	4200 U	1500 UJ	1600 UJ	910 U	4300 UJ	1300 UJ	3300 UJ	1300 UJ	650 UJ	380 UJ	250 U	5300 U	5800 UJ
2-CHLORONAPHTHALENE	UG/KG	289.25	--	--	--	340 UJ	83 UJ	---	110 U	840 U	300 UJ	320 UJ	180 U	880 UJ	260 UJ	660 UJ	250 UJ	130 UJ	76 UJ	50 U	1100 U	1200 UJ
2-CHLOROPHENOL	UG/KG	1419.15	344	--	--	1700 UJ	410 UJ	---	520 U	4200 U	1500 UJ	1600 UJ	910 U	4300 U	1300 UJ	3300 U	1300 UJ	650 UJ	380 UJ	250 U	5300 U	5800 U
2-NITROPHENOL	UG/KG	1419.15	--	--	--	1700 UJ	410 UJ	---	520 U	4200 U	1500 UJ	1600 UJ	910 U	4300 U	1300 UJ	3300 U	1300 UJ	650 UJ	380 UJ	250 U	5300 U	5800 U
3,3'-DICHLOROBENZIDINE	UG/KG	1419.15	2060	--	--	1700 UJ	410 UJ	---	520 U	4200 U	1500 UJ	1600 UJ	910 U	4300 U	1300 UJ	3300 U	1300 UJ	650 UJ	380 UJ	250 U	5300 U	5800 U
4,6-DINITRO-2-METHYLPHENOL	UG/KG	7311.47	--	--	--	8700 UJ	2100 UJ	---	2700 UJ	21000 U	7600 UJ	8200 UJ	4700 U	22000 UJ	6600 UJ	17000 UJ	6500 UJ	3400 UJ	1900 UJ	1300 U	27000 U	30000 UJ
4-BROMOPHENYL PHENYL ETHER	UG/KG	1419.15	1230*	--	--	1700 UJ	410 UJ	---	520 UJ	4200 U	1500 UJ	1600 UJ	910 U	4300 UJ	1300 UJ	3300 UJ	1300 UJ	650 UJ	380 UJ	250 U	5300 U	5800 UJ
4-CHLORO-3-METHYLPHENOL	UG/KG	1419.15	--	--	--	1700 UJ	410 UJ	---	520 U	4200 U	1500 UJ	1600 UJ	910 U	4300 U	1300 UJ	3300 U	1300 UJ	650 UJ	380 UJ	250 U	5300 U	5800 U
4-CHLOROPHENYL PHENYL ETHER	UG/KG	1419.15	--	--	--	1700 UJ	410 UJ	---	520 U	4200 U	1500 UJ	1600 UJ	910 U	4300 UJ	1300 UJ	3300 UJ	1300 UJ	650 UJ	380 UJ	250 U	5300 U	5800 UJ
4-NITROPHENOL	UG/KG	7311.47	--	--	--	8700 UJ	2100 UJ	---	2700 U	21000 UJ	7600 UJ	**3600 J**	4700 U	22000 UJ	6600 UJ	17000 UJ	6500 UJ	3400 UJ	1900 UJ	1300 U	27000 U	30000 UJ
BENZIDINE	UG/KG	28924.85	--	--	--	34000 UJ	8300 UJ	---	11000 U	84000 U	30000 UJ	32000 UJ	18000 U	88000 U	26000 UJ	66000 U	25000 UJ	13000 UJ	7600 UJ	5000 UJ	110000 U	120000 U
BENZOIC ACID	UG/KG	7311.47	650*	--	2.73E+09	8700 UJ	**1400 J**	---	2700 U	21000 UJ	7600 UJ	8200 UJ	4700 U	22000 U	6600 UJ	17000 U	6500 UJ	3400 UJ	1900 UJ	**790 J**	27000 U	30000 U
BIS(2-CHLOROETHOXY)METHANE	UG/KG	1419.15	--	--	--	1700 UJ	410 UJ	---	520 U	4200 U	1500 UJ	1600 UJ	910 U	4300 U	1300 UJ	3300 U	1300 UJ	650 UJ	380 UJ	250 U	5300 U	5800 U
BIS(2-CHLOROETHYL)ETHER	UG/KG	289.25	--	--	--	340 UJ	83 UJ	---	110 U	840 U	300 UJ	320 UJ	180 U	880 U	260 UJ	660 U	250 UJ	130 UJ	76 UJ	50 U	1100 U	1200 U
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	2689.99	182.16	2647	2.96E+06	**12000 J**	**3600 J**	**3700 J**	**6500**	**7600 J**	**16000 J**	**14000 J**	**6600**	**3300 J**	**18000 J**	**13000**	**11000 J**	**17000 J**	**3900 J**	**180 J**	**23000**	**7500 J**
BUTYL BENZYL PHTHALATE	UG/KG	1419.15	16800	--	--	1700 UJ	410 UJ	---	520 U	4200 U	1500 UJ	1600 UJ	910 U	4300 U	1300 UJ	3300 U	1300 UJ	650 UJ	380 UJ	250 U	5300 U	5800 U
DIETHYL PHTHALATE	UG/KG	1419.15	218	--	--	1700 UJ	410 UJ	---	520 U	4200 U	1500 UJ	1600 UJ	910 U	4300 UJ	1300 UJ	3300 UJ	1300 UJ	650 UJ	380 UJ	250 U	5300 U	5800 UJ
DIMETHYL PHTHALATE	UG/KG	1419.15	--	--	--	1700 UJ	410 UJ	---	520 U	4200 U	1500 UJ	1600 UJ	910 U	4300 UJ	1300 UJ	3300 UJ	1300 UJ	650 UJ	380 UJ	250 U	5300 U	5800 UJ
DI-N-BUTYL PHTHALATE	UG/KG	1419.15	1160	--	6.83E+07	1700 UJ	410 UJ	---	520 UJ	4200 U	1500 UJ	1600 UJ	910 U	4300 UJ	1300 UJ	3300 UJ	1300 UJ	650 UJ	**180 J**	250 U	5300 U	5800 UJ
DI-N-OCTYL PHTHALATE	UG/KG	1419.15	--	--	--	1700 UJ	410 UJ	---	520 U	4200 U	1500 UJ	1600 UJ	910 U	4300 U	1300 UJ	3300 U	1300 UJ	650 UJ	380 UJ	250 U	5300 U	5800 U
HEXACHLOROBENZENE	UG/KG	289.25	20*	--	--	340 UJ	83 UJ	---	110 UJ	840 U	300 UJ	320 UJ	180 U	880 UJ	260 UJ	660 UJ	250 UJ	130 UJ	76 UJ	50 U	1100 U	1200 UJ
HEXACHLOROBUTADIENE	UG/KG	289.25	--	--	--	340 UJ	83 UJ	---	110 U	840 U	300 UJ	320 UJ	180 U	880 U	260 UJ	660 U	250 UJ	130 UJ	76 UJ	50 U	1100 U	1200 U
HEXACHLOROCYCLOPENTADIENE	UG/KG	1419.15	139	--	--	1700 UJ	410 UJ	---	520 U	4200 U	1500 UJ	1600 UJ	910 UJ	4300 UJ	1300 UJ	3300 UJ	1300 UJ	650 UJ	380 UJ	250 UJ	5300 U	5800 UJ
HEXACHLOROETHANE	UG/KG	1419.15	804	--	--	1700 UJ	410 UJ	---	520 U	4200 U	1500 UJ	1600 UJ	910 U	4300 U	1300 UJ	3300 U	1300 UJ	650 UJ	380 UJ	250 U	5300 U	5800 U
ISOPHORONE	UG/KG	1419.15	--	--	--	1700 UJ	410 UJ	---	520 U	4200 U	1500 UJ	1600 UJ	910 U	4300 U	1300 UJ	3300 U	1300 UJ	650 UJ	380 UJ	250 U	5300 U	5800 U
NITROBENZENE	UG/KG	2869.99	--	--	--	3400 UJ	830 UJ	---	1100 U	8400 U	3000 UJ	3200 UJ	1800 U	8800 U	2600 UJ	6600 U	2500 UJ	1300 UJ	760 UJ	500 U	11000 U	12000 U
N-NITROSODIMETHYLAMINE	UG/KG	1419.15	--	--	--	1700 UJ	410 UJ	---	520 U	4200 U	1500 UJ	1600 UJ	910 UJ	4300 U	1300 UJ	3300 U	1300 UJ	650 UJ	380 UJ	250 UJ	5300 U	5800 U
N-NITROSODI-N-PROPYLAMINE	UG/KG	289.25	--	--	--	340 UJ	83 UJ	---	110 U	840 U	300 UJ	320 UJ	180 U	880 U	260 UJ	660 U	250 UJ	130 UJ	76 UJ	50 U	1100 U	1200 U
N-NITROSODIPHENYLAMINE	UG/KG	1419.15	422000	--	--	1700 UJ	410 UJ	---	520 UJ	4200 U	1500 UJ	1600 UJ	910 U	4300 UJ	1300 UJ	3300 UJ	1300 UJ	650 UJ	380 UJ	250 U	5300 U	5800 UJ
PENTACHLOROPHENOL	UG/KG	1419.15	7970	--	--	1700 UJ	410 UJ	---	520 UJ	4200 UJ	1500 UJ	1600 UJ	910 UJ	4300 UJ	1300 UJ	3300 UJ	1300 UJ	650 UJ	380 UJ	250 UJ	5300 U	5800 UJ
PHENOL	UG/KG	289.25	420*	--	2.05E+08	**180 J**	**250 J**	---	110 U	840 U	**330 J**	**390 J**	180 U	880 U	260 UJ	660 U	250 UJ	**110 J**	76 UJ	**170**	1100 U	1200 U

NOTES: Bold values represent detected concentrations. RL is reported for non-detected constituents.
In the case of duplicate (FD) samples, 1) if an analyte is detected in both samples, the average of the two detected concentrations is retained in the risk assessment, 2) if an analyte is detected in neither sample, the average of the two RLs is retained for the non-detect, and 3) if an analyte is detected in only one sample, the detected concentration is retained.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater sediment benchmark

[2] Probable Effects Concentrations from MacDonald, 1996.

[3] Calculated site-specific human health screening levels, Appendix H.

Value exceeds BTAG benchmark

Value exceeds PEC

RL = reporting limit

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

U = compound was analyzed, but not detected

TABLE 8-10 SEDIMENT CONCENTRATIONS OF SEMIVOLATILE ORGANIC COMPOUNDS USED IN THE RISK ASSESSMENTS FOR THE SOUTHWEST/TIN MILL CANAL EFFLUENT GROUPING.
SPARROWS POINT PHASE I OFFSHORE INVESTIGATION

ANALYTE	UNITS	AVG RL	BTAG[1]	PEC[2]	HHRA[3]	SD-H02	SD-H03-0002	SD-H03	SD-H04-0002	SD-H04-0002-FD	SD-H05-0002	SD-H06-0002	SD-H06-0002-FD	SD-H07-0002	SD-H07-0002-FD	SD-I01-0001	SD-I01-0102	SD-I02-0002	SD-I03-0002	SD-J02-0002
1,2,4-TRICHLOROBENZENE	UG/KG	1419.15	473	--	--	5900 U	1500 UJ	9400 U	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 U	120 U	72 U	360 UJ	240 U	1700 UJ
1,2-DIPHENYLHYDRAZINE(AS AZOBENZENE)	UG/KG	1419.15	--	--	--	5900 UJ	1500 UJ	9400 UJ	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 U	120 U	72 U	360 UJ	240 U	1700 UJ
2,2'-OXYBIS[1-CHLOROPROPANE]	UG/KG	289.25	--	--	--	1200 U	300 UJ	1900 U	1400 UJ	1400 UJ	440 U	310 UJ	320 UJ	110 UJ	110 U	25 U	15 U	74 UJ	50 U	350 UJ
2,4,6-TRICHLOROPHENOL	UG/KG	1419.15	2650	--	--	5900 UJ	1500 UJ	9400 UJ	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 U	120 U	72 U	360 UJ	240 U	1700 UJ
2,4-DICHLOROPHENOL	UG/KG	289.25	117*	--	--	1200 U	300 UJ	1900 U	1400 UJ	1400 UJ	440 U	310 UJ	320 UJ	110 UJ	110 U	25 U	15 U	74 UJ	50 U	350 UJ
2,4-DIMETHYLPHENOL	UG/KG	1419.15	29*	--	1.37E+07	5900 U	1500 UJ	9400 U	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 U	120 U	72 U	360 UJ	**59 J**	1700 UJ
2,4-DINITROPHENOL	UG/KG	7311.47	41.6*	--	--	31000 UJ	7600 UJ	49000 UJ	35000 UJ	34000 UJ	11000 U	7900 UJ	8100 UJ	2800 UJ	2800 U	640 U	370 U	1900 UJ	1300 U	8800 UJ
2,4-DINITROTOLUENE	UG/KG	1419.15	41.6	--	--	5900 UJ	1500 UJ	9400 UJ	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 U	120 U	72 U	360 UJ	240 U	1700 UJ
2,6-DINITROTOLUENE	UG/KG	1419.15	--	--	--	5900 UJ	1500 UJ	9400 UJ	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 U	120 U	72 U	360 UJ	240 U	1700 UJ
2-CHLORONAPHTHALENE	UG/KG	289.25	--	--	--	1200 UJ	300 UJ	1900 UJ	1400 UJ	1400 UJ	440 U	310 UJ	320 UJ	110 UJ	110 U	25 U	15 U	74 UJ	50 U	350 UJ
2-CHLOROPHENOL	UG/KG	1419.15	344	--	--	5900 U	1500 UJ	9400 U	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 U	120 U	72 U	360 UJ	240 U	1700 UJ
2-NITROPHENOL	UG/KG	1419.15	--	--	--	5900 U	1500 UJ	9400 U	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 U	120 U	72 U	360 UJ	240 U	1700 UJ
3,3'-DICHLOROBENZIDINE	UG/KG	1419.15	2060	--	--	5900 U	1500 UJ	9400 U	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 U	120 U	72 U	360 UJ	240 U	1700 UJ
4,6-DINITRO-2-METHYLPHENOL	UG/KG	7311.47	--	--	--	31000 UJ	7600 UJ	49000 UJ	35000 UJ	34000 UJ	11000 U	7900 UJ	8100 UJ	2800 UJ	2800 U	640 U	370 U	1900 UJ	1300 U	8800 UJ
4-BROMOPHENYL PHENYL ETHER	UG/KG	1419.15	1230*	--	--	5900 UJ	1500 UJ	9400 UJ	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 U	120 U	72 U	360 UJ	240 U	1700 UJ
4-CHLORO-3-METHYLPHENOL	UG/KG	1419.15	--	--	--	5900 U	1500 UJ	9400 U	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 U	120 U	72 U	360 UJ	240 U	1700 UJ
4-CHLOROPHENYL PHENYL ETHER	UG/KG	1419.15	--	--	--	5900 UJ	1500 UJ	9400 UJ	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 U	120 U	72 U	360 UJ	240 U	1700 UJ
4-NITROPHENOL	UG/KG	7311.47	--	--	--	31000 UJ	7600 UJ	49000 UJ	35000 UJ	34000 UJ	11000 U	7900 UJ	8100 UJ	2800 UJ	2800 U	640 U	370 U	1900 UJ	1300 U	8800 UJ
BENZIDINE	UG/KG	28924.85	--	--	--	120000 U	30000 UJ	190000 U	140000 UJ	140000 UJ	44000 U	31000 UJ	32000 UJ	11000 UJ	11000 UJ	2500 U	1500 U	7400 UJ	5000 UJ	35000 UJ
BENZOIC ACID	UG/KG	7311.47	650*	--	2.73E+09	31000 U	7600 UJ	49000 U	35000 UJ	34000 UJ	11000 UJ	7900 UJ	8100 UJ	2800 UJ	2800 U	640 U	370 U	1900 UJ	**960 J**	8800 UJ
BIS(2-CHLOROETHOXY)METHANE	UG/KG	1419.15	--	--	--	5900 U	1500 UJ	9400 U	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 U	120 U	72 U	360 UJ	240 U	1700 UJ
BIS(2-CHLOROETHYL)ETHER	UG/KG	289.25	--	--	--	1200 U	300 UJ	1900 U	1400 UJ	1400 UJ	440 U	310 UJ	320 UJ	110 UJ	110 U	25 U	15 U	74 UJ	50 U	350 UJ
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	2689.99	182.16	2647	2.96E+06	**3500 J**	19000 UJ	**33000**	**48000 J**	**54000 J**	**8700**	**5200 J**	**7600 J**	**3300 J**	**2800**	250 U	150 U	**2800 J**	**220 J**	**2000 J**
BUTYL BENZYL PHTHALATE	UG/KG	1419.15	16800	--	--	5900 U	1500 UJ	9400 U	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 U	120 U	72 U	360 UJ	240 U	1700 UJ
DIETHYL PHTHALATE	UG/KG	1419.15	218	--	--	5900 UJ	1500 UJ	9400 UJ	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 U	120 U	72 U	360 UJ	240 U	1700 UJ
DIMETHYL PHTHALATE	UG/KG	1419.15	--	--	--	5900 UJ	1500 UJ	9400 UJ	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 U	120 U	72 U	360 UJ	240 U	1700 UJ
DI-N-BUTYL PHTHALATE	UG/KG	1419.15	1160	--	6.83E+07	5900 UJ	1500 UJ	9400 UJ	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 U	120 U	72 U	**77 J**	240 U	1700 UJ
DI-N-OCTYL PHTHALATE	UG/KG	1419.15	--	--	--	5900 U	1500 UJ	9400 U	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 U	120 U	72 U	360 UJ	240 U	1700 UJ
HEXACHLOROBENZENE	UG/KG	289.25	20*	--	--	1200 UJ	300 UJ	1900 UJ	1400 UJ	1400 UJ	440 U	310 UJ	320 UJ	110 UJ	110 U	25 U	15 U	74 UJ	50 U	350 UJ
HEXACHLOROBUTADIENE	UG/KG	289.25	--	--	--	1200 U	300 UJ	1900 U	1400 UJ	1400 UJ	440 U	310 UJ	320 UJ	110 UJ	110 U	25 U	15 U	74 UJ	50 U	350 UJ
HEXACHLOROCYCLOPENTADIENE	UG/KG	1419.15	139	--	--	5900 UJ	1500 UJ	9400 UJ	6700 UJ	6700 UJ	2100 UJ	1500 UJ	1600 UJ	550 UJ	540 UJ	120 U	72 U	360 UJ	240 UJ	1700 UJ
HEXACHLOROETHANE	UG/KG	1419.15	804	--	--	5900 U	1500 UJ	9400 U	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 U	120 U	72 U	360 UJ	240 U	1700 UJ
ISOPHORONE	UG/KG	1419.15	--	--	--	5900 U	1500 UJ	9400 U	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 U	120 U	72 U	360 UJ	240 U	1700 UJ
NITROBENZENE	UG/KG	2869.99	--	--	--	12000 U	3000 UJ	19000 U	14000 UJ	13000 UJ	4300 U	3100 UJ	3200 UJ	1100 UJ	1100 U	250 U	150 U	730 UJ	490 U	3400 UJ
N-NITROSODIMETHYLAMINE	UG/KG	1419.15	--	--	--	5900 U	1500 UJ	9400 U	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 UJ	120 U	72 U	360 UJ	240 UJ	1700 UJ
N-NITROSODI-N-PROPYLAMINE	UG/KG	289.25	--	--	--	1200 U	300 UJ	1900 U	1400 UJ	1400 UJ	440 U	310 UJ	320 UJ	110 UJ	110 U	25 U	15 U	74 UJ	50 U	350 UJ
N-NITROSODIPHENYLAMINE	UG/KG	1419.15	422000	--	--	5900 UJ	1500 UJ	9400 UJ	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 U	120 U	72 U	360 UJ	240 U	1700 UJ
PENTACHLOROPHENOL	UG/KG	1419.15	7970	--	--	5900 UJ	1500 UJ	9400 UJ	6700 UJ	6700 UJ	2100 U	1500 UJ	1600 UJ	550 UJ	540 UJ	120 U	72 U	360 UJ	240 UJ	1700 UJ
PHENOL	UG/KG	289.25	420*	--	2.05E+08	1200 U	300 UJ	1900 U	1400 UJ	1400 UJ	440 U	310 UJ	320 UJ	110 UJ	110 U	**58**	15 U	74 UJ	**79**	**170 J**

NOTES: Bold values represent detected concentrations. RL is reported for non-detected constituents.
In the case of duplicate (FD) samples, 1) if an analyte is detected in both samples, the average of the two detected concentrations is retained in the risk assessment, 2) if an analyte is detected in neither sample, the average of the two RLs is retained for the non-detect, and 3) if an analyte is detected in only one sample, the detected concentration is retained.

[1] Sediment Benchmarks from the U.S. Environmental Protection Agency Biological Technical Assistance Group. Marine values unless marked with asterisk.

*BTAG freshwater sediment benchmark

[2] Probable Effects Concentrations from MacDonald, 1996.

[3] Calculated site-specific human health screening levels, Appendix H.

Value exceeds BTAG benchmark

Value exceeds PEC

RL = reporting limit

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

U = compound was analyzed, but not detected

Table 8-11
Uptake Models Relating Concentrations in Sediment to Concentrations in Benthos

Chemical	Food Item (Benthos) Uptake			
	Uptake Model[A, B]	SEDBAF (mg/kg dry wt. sediment to mg/kg wet wt. tissue)	SEDBAF (mg/kg dry wt. to mg/kg dry wt.)	Source
Inorganics				
Antimony	Uptake Factor	3.15E-02	1.26E-01	95% UCLM from bioaccumulation tests - clam value
Arsenic	Uptake Factor	5.41E-02	2.16E-01	95% UCLM from bioaccumulation tests - clam value
Beryllium	Uptake Factor	1.00E+00	4.00E+00	Default
Cadmium	Uptake Factor	7.76E-03	3.10E-02	95% UCLM from bioaccumulation tests - worm value
Chromium	Uptake Factor	4.68E-03	1.87E-02	95% UCLM from bioaccumulation tests - worm value
Copper	Uptake Factor	7.75E-03	3.10E-02	95% UCLM from bioaccumulation tests - worm value
Cyanide (Total)[C]	Uptake Factor	1.00E+00	4.00E+00	Default
Iron	Uptake Factor	4.63E-03	1.85E-02	95% UCLM from bioaccumulation tests - worm value
Lead	Uptake Factor	3.62E-03	1.45E-02	95% UCLM from bioaccumulation tests - worm value
Mercury	Uptake Factor	1.43E-02	5.73E-02	95% UCLM from bioaccumulation tests - worm value
Nickel	Uptake Factor	1.14E-02	4.55E-02	95% UCLM from bioaccumulation tests - worm value
Selenium	Uptake Factor	5.24E-02	2.10E-01	95% UCLM from bioaccumulation tests - worm value
Silver	Uptake Factor	2.02E-02	8.09E-02	95% UCLM from bioaccumulation tests - worm value
Thallium	Uptake Factor	1.39E-02	5.56E-02	95% UCLM from bioaccumulation tests - clam value
Zinc	Uptake Factor	2.45E-02	9.78E-02	95% UCLM from bioaccumulation tests - worm value
PAHs				
Total LMW PAH (ND=0)	Uptake Factor	1.13E-01	4.53E-01	95% UCLM from bioaccumulation tests - clam value
Total LMW PAH (ND=1/2)	Uptake Factor	1.13E-01	4.53E-01	95% UCLM from bioaccumulation tests - clam value
Total LMW PAH (ND=DL)	Uptake Factor	1.15E-01	4.62E-01	95% UCLM from bioaccumulation tests - clam value
Total HMW PAH (ND=0)	Uptake Factor	1.11E-01	4.44E-01	95% UCLM from bioaccumulation tests - clam value
Total HMW PAH (ND=1/2)	Uptake Factor	1.11E-01	4.44E-01	95% UCLM from bioaccumulation tests - clam value
Total HMW PAH (ND=DL)	Uptake Factor	1.12E-01	4.48E-01	95% UCLM from bioaccumulation tests - clam value
Total PAH (ND=0)	Uptake Factor	1.09E-01	4.36E-01	95% UCLM from bioaccumulation tests - clam value
Total PAH (ND=1/2DL)	Uptake Factor	1.10E-01	4.39E-01	95% UCLM from bioaccumulation tests - clam value
Total PAH (ND=DL)	Uptake Factor	1.11E-01	4.43E-01	95% UCLM from bioaccumulation tests - clam value
PCBs				
Aroclor-1248	Uptake Factor	3.53E+00	1.41E+01	BSAF value from EPA 2009 dataset used to calculate uptake factor using 7.1% lipids and 6.8% TOC
Aroclor-1254	Uptake Factor	3.53E+00	1.41E+01	BSAF value from EPA 2009 dataset used to calculate uptake factor using 7.1% lipids and 6.8% TOC
Aroclor-1260	Uptake Factor	3.53E+00	1.41E+01	BSAF value from EPA 2009 dataset used to calculate uptake factor using 7.1% lipids and 6.8% TOC
Total PCBs (ND=0)	Uptake Factor	6.35E+00	2.54E+01	95% UCLM from bioaccumulation tests - clam value
Total PCBs (ND=1/2DL)	Uptake Factor	6.63E+00	2.65E+01	95% UCLM from bioaccumulation tests - clam value
Total PCBs (ND=DL)	Uptake Factor	6.90E+00	2.76E+01	95% UCLM from bioaccumulation tests - clam value
SVOCs				
Bis(2-ethylhexyl)phthalate	Uptake Factor	1.00E+00	4.00E+00	Default
VOCs				
Chlorobenzene	Uptake Factor	1.00E+00	4.00E+00	Default

A - Equation types:
Uptake Factor:
B - Uptake factor from bioaccumulation tests of worms and clams
C - It is recognized that cyanide does not bioaccumulate into crab tissue.

HMW= High Molecular Weight
LMW= Low Molecular Weight
NA - TRV not available
NAWQC - National Ambient Water Quality Criteria.
PAH= Polyaromatic Hydrocarbon
PCB= Polychlorinated Biphenyl
PEC= Probable Effects Concentration
SVOC= Semi-Volatile Organic Compound
TEC= Threshold Effects Concentration
TRV= Toxicity Reference Value

Table 8-12
Uptake Models Relating Concentrations in Surface Water to Concentrations in Fish

Chemical	Food Item (Fish) Uptake			
	Uptake Model[A, B, C]	BCFBAF value (L/kg wet weight)	BAF (mg/L dry wt. to mg/kg dry wt.)	Source
Inorganics				
Antimony	Uptake Factor	1.00E+00	4.00E+00	Based on bluegill in Table 5 - USEPA 1980
Arsenic	Uptake Factor	4.00E+00	1.60E+01	Based on bluegill in Table 5 - USEPA 1985a
Beryllium	Uptake Factor	6.20E+01	2.48E+02	From Table C-5 - USEPA 1999
Cadmium	Uptake Factor	5.90E+01	2.36E+02	Based on bluegill in Table 5 geometric mean - USEPA 2001
Chromium	Uptake Factor	2.00E+02	8.00E+02	BCF from http://rais.ornl.gov/cgi-bin/tools/TOX_search
Copper	Uptake Factor	4.64E+02	1.86E+03	Based on fathead minnow in Table 5 - USEPA 2003
Cyanide (Total)[D]	Uptake Factor	1.00E+00	4.00E+00	Default
Iron	Uptake Factor	2.50E-01	1.00E+00	Default
Lead	Uptake Factor	1.13E+01	4.50E+01	Based on bluegill in Table 5 - USEPA 1985b
Mercury	Uptake Factor	1.80E+03	7.20E+03	Based on rainbow trout in Table 5 - USEPA 1985c
Nickel	Uptake Factor	2.40E+01	9.60E+01	Based on rainbow trout/fathead minnow in Table 5 geometric mean - USEPA 1986
Selenium	Uptake Factor	2.42E+02	9.70E+02	Based on bluegill in Table 5 geometric mean - USEPA 1987a
Silver	Uptake Factor	8.77E+01	3.51E+02	From Table C-5 - USEPA 1999
Thallium	Uptake Factor	1.00E+04	4.00E+04	BCF from http://rais.ornl.gov/cgi-bin/tools/TOX_search
Zinc	Uptake Factor	6.30E+01	2.52E+02	Based on mummichog in Table 5 geometric mean- USEPA 1987b
PAHs				
1-Methylnaphthalene	Uptake Factor	1.66E+02	6.64E+02	BCF calculated via Regression from BCFBAF Program
2-Methylnaphthalene	Uptake Factor	1.64E+02	6.56E+02	BCF calculated via Regression from BCFBAF Program
Acenaphthene	Uptake Factor	7.17E+02	1.79E+02	BCF calculated via Regression from BCFBAF Program
Acenaphthylene	Uptake Factor	1.85E+02	7.40E+02	BCF calculated via Regression from BCFBAF Program
Anthracene	Uptake Factor	4.01E+02	1.60E+03	BCF calculated via Regression from BCFBAF Program
Benzo(a)Anthracene	Uptake Factor	3.18E+03	1.27E+04	BCF calculated via Regression from BCFBAF Program
Benzo(a)Pyrene	Uptake Factor	5.15E+03	2.06E+04	BCF calculated via Regression from BCFBAF Program
Benzo(b)Fluoranthene	Uptake Factor	3.02E+03	1.21E+04	BCF calculated via Regression from BCFBAF Program
Benzo(g,h,i)Perylene	Uptake Factor	1.10E+04	4.40E+04	BCF calculated via Regression from BCFBAF Program
Benzo(k)Fluoranthene	Uptake Factor	4.99E+03	2.00E+04	BCF calculated via Regression from BCFBAF Program
Chrysene	Uptake Factor	3.17E+03	1.27E+04	BCF calculated via Regression from BCFBAF Program
Dibenzo(a,h)Anthracene	Uptake Factor	9.60E+03	3.84E+04	BCF calculated via Regression from BCFBAF Program
Fluoranthene	Uptake Factor	1.18E+03	4.72E+03	BCF calculated via Regression from BCFBAF Program
Fluorene	Uptake Factor	2.66E+02	1.06E+03	BCF calculated via Regression from BCFBAF Program
Indeno(1,2,3-Cd)Pyrene	Uptake Factor	1.22E+04	4.88E+04	BCF calculated via Regression from BCFBAF Program
Naphthalene	Uptake Factor	6.99E+01	2.80E+02	BCF calculated via Regression from BCFBAF Program
Phenanthrene	Uptake Factor	1.86E+03	7.44E+03	BCF calculated via Regression from BCFBAF Program
Pyrene	Uptake Factor	7.71E+02	3.08E+03	BCF calculated via Regression from BCFBAF Program
Total LMW PAH (ND=0)	Uptake Factor	--	1.28E+04	Average of BCFs of individual PAH BAFs calculated via Regression from BCFBAF Program
Total LMW PAH (ND=DL)	Uptake Factor	--	1.28E+04	Average of BCFs of individual PAH BAFs calculated via Regression from BCFBAF Program
Total HMW PAH (ND=0)	Uptake Factor	--	1.28E+04	Average of BCFs of individual PAH BAFs calculated via Regression from BCFBAF Program
Total HMW PAH (ND=1/2DL)	Uptake Factor	--	1.28E+04	Average of BCFs of individual PAH BAFs calculated via Regression from BCFBAF Program
Total HMW PAH (ND=DL)	Uptake Factor	--	1.28E+04	Average of BCFs of individual PAH BAFs calculated via Regression from BCFBAF Program
Total PAH (ND=0)	Uptake Factor	--	1.28E+04	Average of BCFs of individual PAH BAFs calculated via Regression from BCFBAF Program
Total PAH (ND=DL)	Uptake Factor	--	1.28E+04	Average of BCFs of individual PAH BAFs calculated via Regression from BCFBAF Program
PCBs				
Aroclor-1248	Uptake Factor	2.21E+04	8.83E+04	BCF calculated via Regression from BCFBAF Program
Aroclor-1254	Uptake Factor	5.41E+04	2.16E+05	BCF calculated via Regression from BCFBAF Program
Aroclor-1260	Uptake Factor	2.76E+04	1.10E+05	BCF calculated via Regression from BCFBAF Program
Total PCBs (ND=0)	Uptake Factor	2.53E+04	1.01E+05	BCF calculated via Regression from BCFBAF Program
Total PCBs (ND=1/2DL)	Uptake Factor	2.53E+04	1.01E+05	BCF calculated via Regression from BCFBAF Program
Total PCBs (ND=DL)	Uptake Factor	2.53E+04	1.01E+05	BCF calculated via Regression from BCFBAF Program
SVOCs				
Bis(2-ethylhexyl)phthalate	Uptake Factor	1.71E+03	6.85E+03	BCF calculated via Regression from BCFBAF Program
VOCs				
Chlorobenzene	Uptake Factor	3.47E+01	8.68E+00	BCF calculated via Regression from BCFBAF Program

A - Equation types:
Uptake Factor:

B -Uptake factor for organics derived using the BCFBAF Program from USEPA, in EPI Suite™
http://www.epa.gov/tsca-screening-tools/epi-suitetm-estimation-program-interfac

C - Uptake factor for inorganics from the following sources:
ORNL 2009, BCF from http://rais.ornl.gov/cgi-bin/tox/TOX_select?select=chem
ORNL 2009, BCF from http://rais.ornl.gov/cgi-bin/tools/TOX_search
USEPA 1999, Table C-5
USEPA 1980, Table 5 (bluegill)
USEPA 1985a, Table 5
USEPA 1985b, Table 5
USEPA 1985c, Table 5
Uptake factors from given in wet weight were divided by 0.25 to account for wet weight to dry weight conversion
D - It is recognized that cyanide does not bioaccumulate into fish tissue.

HMW= High Molecular Weight
LMW= Low Molecular Weight
NA - TRV not available
NAWQC - National Ambient Water Quality Criteria
PAH= Polyaromatic Hydrocarbon
PCB= Polychlorinated Biphenyl
PEC= Probable Effects Concentration
SVOC= Semi-Volatile Organic Compound
TEC= Threshold Effects Concentration
TRV= Toxicity Reference Value

9. ECOLOGICAL RISK ASSESSMENT

The CSM for ecological receptors presented in Chapter 6 identified specific assessment endpoints and representative receptor species for evaluation. The ERA for the Phase I area is conducted in accordance with USEPA guidance applicable to RCRA sites (USEPA 1997a). ERA follows a process in which exposure and toxicity data are combined to develop an estimate of the potential for adverse impacts on ecological receptors from chemicals in the environment. Per USEPA guidance, an ERA begins with a very precautionary evaluation of the potential for risks (USEPA 1997a). This is called a screening level ERA (SLERA). The ERA for the Phase I area includes methods typical of a SLERA, but also incorporates more refined evaluation methods such as evaluation of a reasonable maximum exposure scenario, inclusion of site-specific tissue data, and discussion of site-specific habitat and bioavailability considerations. **Tables 9-1 and 9-2** present a summary of the COPCs for the NNS and SWTM groupings, respectively, for sediment and surface water. Consistent with guidance (USEPA 1997a), the ERA includes an exposure assessment, toxicity assessment, risk characterization, and uncertainty analysis for each receptor evaluated.

The ERA applies a weight of evidence approach in which multiple lines of evidence are evaluated, and their individual significance, or weight, is considered to derive a conclusion. In the case of ERA, each line of evidence is a measurement endpoint. Measurement endpoints are quantifiable ecological characteristics that are related to each assessment endpoint (USEPA 1989). Because assessment endpoints are often defined in terms of ecological characteristics that are difficult to measure (e.g., the health of a population or community), measurement endpoints are selected to provide a quantifiable means of characterizing risks. The measurement endpoints for this ERA were selected based on standard risk assessment methodology (USEPA 1997a) with consideration of the available data.

Quantitative and qualitative measurement endpoints are summarized in **Table 9-3** and used to characterize risks as described in the sections below. Section 9.1 presents the screening level assessment. Section 9.2 describes the methods used to assess exposure. Section 9.3 presents the methods used to assess toxicity. Assessment of ecological risks for the NNS grouping is presented in Section 9.4. Assessment of ecological risks for the SWTM grouping is presented in Section 9.5. Discussion of uncertainties is presented in Section 9.6 and the ERA conclusions are presented in Section 9.7.

9.1 SCREENING LEVEL ASSESSMENT

A screening level evaluation of the potential for risk was conducted by comparing concentrations in sediment and surface water to the lower value of either the freshwater or marine USEPA Region III BTAG screening values (USEPA Region III 2006). Screening levels are presented in **Tables 9-1 and 9-2**.

It is important to note that sediments in the SWTM grouping contain oil and grease. Toxicity-based comparison criteria are not available from regulatory guidance. As such, comparisons for oil and grease are not presented in ERA tables. Instead, a qualitative discussion of oil and grease toxicity is included as part of the weights of evidence involving sediment screening in the SWTM grouping; this includes a discussion of the ways in which oil and grease can cause both toxicologically mediated impacts and physical impacts.

9.2 EXPOSURE ASSESSMENT

9.2.1 Aquatic and Benthic Organisms

The primary route of exposure for aquatic or free swimming organisms is through direct contact with and ingestion of surface water. The primary route of exposure for benthic organisms is through direct contact with and ingestion of sediment.

To represent potential aquatic and benthic organism exposures in Grouping NNS in the Phase I area, two scenarios were evaluated as representative of potential exposures. Because some bottom-dwelling organisms live their entire lives in or around a single location, the maximum concentration of each constituent detected in sediment and surface water was evaluated as an EPC. EPCs are presented in **Tables 9-4** and **9-5**. This is referred to as the screening level exposure scenario, and evaluates a worst case scenario for relatively immobile organisms that could be exposed to the location(s) with the highest concentrations of chemicals for their entire lives. Similarly, the maximum detected concentration in surface water was used as the EPC for the screening level exposure scenario to represent potential worst case conditions that could occur in water, and to provide a conservative estimate given uncertainty in modeling water concentrations in the Phase I area.

The screening level exposure scenario is not realistically representative for mobile aquatic and benthic organisms such as fish and crustaceans, which may use the entire offshore area. Also, the screening level exposure scenario focused only on the highest concentrations within each grouping in the Phase I area, and does not represent population-wide exposures, that are the focus of ERA (USEPA 1997b). Therefore, the reasonable maximum exposure scenario was also assessed.

Several classes of organic chemicals assessed for aquatic and benthic organisms share a common mode of exposure and/or toxicity. For example, chemical analytical data are available for a range of PCB Aroclors. While each Aroclor is a different chemical, all Aroclors produce the same types of effects and share similar patterns of uptake. The same is true for HMW PAHs and LMW PAHs. As discussed in Chapter 8, concentrations of individual compounds were combined for these chemical classes in sediment and surface water using methodologies specific to their chemical class.

It is important to note that sediments in the SWTM grouping contain oil and grease. Oil and grease cannot be evaluated quantitatively because, as discussed below, toxicity-based comparison criteria are not available for this analyte. As such, EPCs for oil and grease are not presented in ERA tables. Instead, a qualitative discussion of oil and grease is included as part of weights of evidence involving sediment screening in the SWTM grouping; this includes a discussion of the range of oil and grease concentrations detected.

9.2.2 Wildlife

As discussed in the CSM (Chapter 6), the primary route of exposure for wildlife to chemicals in sediment and surface water is through the food chain. Wildlife may be exposed to chemicals in sediment and surface water through direct ingestion. They also may be exposed to chemicals in sediment and surface water through ingestion of prey items (i.e., benthic organisms, crabs, and fish) that have accumulated chemicals from these media. Food web modeling was performed to estimate combined exposures from these pathways. EPCs for sediment, surface water, and prey item tissue (**Tables 9-4 and 9-5**) were combined with data concerning ingestion rates to estimate a dose to each receptor.

This section presents the methods used to quantify the potential exposure of wildlife to chemicals via the ingestion of food, surface water, and sediment. The methods were derived based on equations presented in USEPA (1993) and Sample et al. (1996). The equations and exposure parameters discussed below are consistent with USEPA (1997b) guidance and standard risk assessment practice. All chemicals detected in sediment and surface water were evaluated in the exposure models. Concentrations of these chemicals within other media to which a receptor could be exposed were then also considered for evaluation. Wildlife exposure factors are presented in **Table 9-6**. Dose-based toxicity reference values (TRVs) for birds and mammals are presented in **Tables 9-7 and 9-8**, respectively.

It should be noted that, in general, conservative assumptions were used in the food web models. The objective of the models was to provide an upper bound risk estimate. Accordingly, in almost all cases, actual risks are likely to be over-estimated by the models. Uncertainties associated with precautionary assumptions and other exposure estimation factors are discussed in Section 9.6.

9.2.2.1 Exposure Point Concentrations and Scenarios

To represent wildlife exposures to chemicals in sediment, surface water, and prey items, two EPCs (screening level and reasonable maximum) were evaluated for each of two exposure scenarios (modeled uptake versus measured tissue) for each of two types of prey (crab and fish). For EPCs, both screening and reasonable maximum exposure scenario EPCs for all media were used in exposure models. The screening level exposure scenario was included to provide a precautionary bound, but the reasonable maximum exposure scenario is considered most representative of exposures for wildlife because birds and mammals may range over the entire

offshore area, contacting exposure media in multiple locations and consuming organisms that have similarly utilized other portions of the Phase I area. As discussed in Chapter 8, the 95%UCLM is used as a precautionary estimate of mean exposures over time, with the maximum detected concentration used as the reasonable maximum EPC when there are too few samples to calculate a 95%UCLM.

For sediment, a single set of EPCs were utilized to represent conditions within each grouping. For the NNS grouping, EPCs were developed only for those chemicals identified as related to groundwater or stormwater by screening conducted at the direction of USEPA and MDE, as documented in the discussion of Site-related COPCs in Section 2.2.2. This is because only groundwater and stormwater can be ongoing sources from the Sparrows Point property in this area. For the SWTM grouping, EPCs were developed for all chemicals, since the Tin Mill Canal outfall may have contained any of the potential chemicals. For surface water, two sets of EPCs were evaluated. The risk assessment relies primarily on EPCs modeled assuming discharge from groundwater/pore water into surface water as the long term typical, non-storm condition in the Phase I area. The model for the non-storm condition incorporated both the groundwater/pore water flux and flow from Outfall 014 as inputs (see Section 7.3). The risk assessment also considers the EPCs modeled for a 1-year storm condition, using stormwater inputs into surface water, in addition to the groundwater/pore water flux and flow from Outfall 014, as a short term worst case scenario condition; this was evaluated for aquatic and benthic receptors only, and showed little difference from groundwater/pore water-based model results.

Two separate exposure scenarios were evaluated based on two different methods for estimating concentrations in prey-item tissue. The first scenario uses BAFs to evaluate localized exposures of wildlife to crabs and fish. Using BAFs to estimate bioaccumulation provides a direct link between concentrations in each grouping within the Phase I area and concentrations in prey and serves as a useful indicator of contributions of chemicals from the Phase I area to the food chain. Use of BAFs provides conservative estimates of chemical contributions if prey and wildlife travel beyond the Phase I area. As discussed in Chapter 8, concentrations of metals, PAHs, and PCBs in the tissue of prey items were derived from site-specific laboratory bioaccumulation studies performed using sediment from Coke Point (EA 2011b). Site-specific BAFs are available from bioaccumulation studies to estimate uptake of chemicals from sediment into benthos such as clams and worms. For chemicals that were not included in these bioaccumulation studies, sediment-to-benthos BAFs are available from the scientific literature. BAFs are also available from scientific literature and regulatory guidance that relate surface water concentrations to concentrations in fish.

Site-specific tissue EPCs are also available for chemical concentrations in whole body fish and total crab tissue from field-collected specimens. These EPCs are most representative of tissue concentrations in higher trophic level prey. Measured tissue concentrations represent the most realistic estimate of bioaccumulation into prey. Therefore, the ERA evaluates risks from consumption of crabs and fish; consumption of each type of prey was modeled separately. Data inputs to each scenario are detailed in **Table 8-1**. EPCs are presented in **Tables 9-4 and 9-5**.

Tissue EPCs for metals and SVOCs in aquatic and benthic organisms were derived from sediment and surface water concentrations using literature-based BAFs. BAFs were developed to separately model accumulation of chemicals into prey item tissues from sediment and surface water.

As discussed for aquatic and benthic organisms, several classes of organic chemicals (PAHs and PCBs) share a common mode of exposure and/or toxicity and concentrations were summed as discussed in Chapter 8.

9.2.2.2 Ingestion of Chemicals from Abiotic Media

As discussed in the conceptual model (Section 6.4), terrestrial wildlife may ingest sediment while foraging or grooming. Therefore, food web models account for incidental ingestion of sediment. Based on their foraging and habitat characteristics, it was assumed for the purposes of the models that great blue heron and raccoon would be exposed to sediment.

The following equation was used to calculate the dose of chemical that piscivorous wildlife would obtain from the ingestion of sediment ($Dose_{sed}$, mg/kg):

$$Dose_{sed} = SI * C_{sed}$$

where:

$Dose_{sed}$	=	amount of chemical ingested per day from sediment [milligrams per kilogram body weight per day (mg/kg bw-day)];
SI	=	sediment ingestion rate [kilograms per kilogram body weight per day (kg/kg bw-d) on a dry weight basis]; and
C_{sed}	=	chemical concentration in surface sediment (mg/kg dry weight).

Percent sediment ingestion values taken from the scientific literature for the terrestrial wildlife species of concern were multiplied by the food ingestion rates (FIs) for these species to estimate sediment ingestion rates. A summary of the percent sediment ingestion rates and food ingestion rates taken from the scientific literature is presented in **Table 9-6**.

Exposures to surface water were calculated in a manner similar to those in sediment by multiplying the daily drinking water ingestion rate by the concentrations of chemicals in surface water. The following equation was used to calculate the upper bound dose of chemical that terrestrial wildlife could obtain from the ingestion of surface water:

$$Dose_{sw} = WI * C_{sw}$$

where:

$Dose_{sw}$ = amount of chemical ingested per day from surface water (mg/kg bw-day)
WI = surface water ingestion rate (liters per kilogram body weight per day)
C_{sw} = maximum chemical concentration in surface water (µg/L).

9.2.2.3 Ingestion of Chemicals from Food

The following equation was used to calculate the dose of chemicals that a terrestrial wildlife species could obtain from the ingestion of food ($Dose_{food/prey}$, mg/kg bw-day):

$$Dose_{prey} = FI * C_{org}$$

where:

FI = food ingestion rate (kg/kg bw-d on a wet weight basis)
C_{org} = estimated maximum concentration of chemical in food/prey (mg/kg wet weight).

A summary of the FIs used in the Baseline ERA for each of the wildlife species selected for evaluation is presented in **Table 9-6**. As discussed above, separate scenarios were run to model ingestion of lower trophic level benthos (e.g., clams and worms), higher trophic level benthos (crabs), and higher trophic level fish.

9.2.2.4 Total Chemical Ingestion

The total dietary exposure doses for piscivorous birds (heron) and piscivorous mammals (raccoon) ($Dose_{total}$, mg/kg bw-day) for the evaluated chemicals were determined using the following equation:

$$Dose_{total} = Dose_{prey} + Dose_{sed} + Dose_{water}$$

where:

$Dose_{prey}$ = amount of chemical ingested per day from prey (mg/kg bw-day)
$Dose_{sed}$ = amount of chemical ingested per day from sediment (mg/kg bw-day)
$Dose_{water}$ = amount of chemical ingested per day from water (mg/kg bw-day).

The total dietary intakes were compared to dietary toxicity values to determine if adverse effects are likely to occur to wildlife from the ingestion of chemicals in food, sediment, and surface water.

9.3 TOXICITY ASSESSMENT

9.3.1 Aquatic and Benthic Organisms

To assess the potential impact on aquatic and benthic organisms from exposures to chemicals in sediment and surface water, benchmarks have been compiled from guidance and the scientific literature. Therefore, these benchmarks are considered protective comparison values for aquatic and benthic organisms and are referred to as TRVs. Two types of TRVs were considered. The first group, referred to as threshold effects levels (TELs), are benchmarks that represent concentrations corresponding to either no toxicological effect or a very low toxicological effect of chemicals on aquatic and benthic organisms. As discussed further below, these TEL TRVs are considered precautionary. The second type, referred to as probable effects levels (PELs), are values above which effects are probable. These benchmarks are considered a strong indicator that there is risk.

TRVs for comparison against sediment concentrations were derived from a number of sources. TELs and PELs for coastal sediments derived by MacDonald et al. (1996 and 2000), and reported in Buchman (2008), were employed as TRVs. Effects Range−Low (ER-L) and Effects Range−Medium (ER-M) values reported in Long et al. (1995) and Long and Morgan (1991) were used in the absence of TELs and PELs. In the absence of these TRVs, the lowest value was chosen from sediment quality benchmark values in Jones et al. (1997), ecotoxicological threshold values from USEPA (1996), and Washington State sediment quality standards from Jones et al. (1997). If TRVs were not available from these sources, sources were sought from scientific literature and other guidance (Persaud et al. 1993, DiToro et al. 2000). TRVs for sediment are presented in **Table 9-9**. Threshold level TRVs were unavailable for cyanide and two metals, and PEL TRVs were unavailable for cyanide, five metals, and volatiles; uncertainty associated with the lack of TRVs is discussed in Section 9.6.

For comparisons involving surface water, NRWQCs developed by USEPA (2009) for the protection of aquatic life were used as TRVs. These values were developed to be protective of a broad range of taxa, feeding habits, and life stages of aquatic receptors. When a chronic or acute NRWQC was not available for a particular constituent, the Tier II chronic value from Suter and Tsao (1996) was used as the TRV. These values are also highly conservative. TRVs for surface water are presented in **Table 9-10**. It is important to note that benchmarks for metals are usually established for dissolved concentrations, rather than total concentrations in water; only total surface water concentrations were available for the risk assessment.

It is also important to note that TRVs derived from these sources are highly precautionary. They are typically developed to be protective of highly sensitive organisms, and are often based on studies using highly bioavailable or toxic forms of chemicals in laboratory bioaccumulation tests. As such, these TRVs are not necessarily reflective of conditions specific to the Phase I area, and may overestimate risks. Chemical conditions in sediment may decrease the toxicity of metals

through formation of sulfides and insoluble chemical compounds. The precautionary nature of benchmarks is a source of uncertainty discussed further in Section 9.6.

9.3.2 Wildlife

Potential impacts on wildlife were evaluated using dose-based toxicological benchmarks. **Tables 9-7** and **9-8** show the dose based TRVs for birds and mammals, respectively. First, modeled doses were compared to dose-based no-observed-adverse-effect levels (NOAELs). NOAELs are doses that have been shown to cause no adverse impacts in test species. Because NOAELs are precautionary and highly protective, they are used as TRVs in this ERA. The NOAELs used in this ERA were derived, in descending order of preference, from studies by USEPA (USEPA 2003 a-b, 2005 b-f, 2006, 2007 a-g) and by Oak Ridge National Laboratory (Sample et al. 1996). The Oak Ridge National Laboratory NOAELs were generally derived based upon measurements of survival, growth, or reproduction in the laboratory. The derived NOAEL values from USEPA Ecological Soil Screening Levels (EcoSSLs) are either equal to the greatest NOAEL, less than the lowest LOAEL from multiple toxicological studies, or are equal to the geometric mean of the NOAELs based upon growth and reproduction endpoints. While the EcoSSLs were developed for soil exposures, the models used to develop these benchmarks include ingestion rates, dose-based toxicity values, and other useful information for use in assessing exposures of the receptors to sediment dwelling organisms (benthos and crabs) in the study.

The second set of benchmarks utilized were lowest-observed-adverse-effect levels (LOAELs). These are doses at which a very low level of adverse effect is observed on individual test organisms. The severity of effects considered "low level" varies based on the study from which LOAELs are derived; in general, they correspond to minor changes in growth or reproduction. LOAELs are useful because there is considerable uncertainty associated with NOAELs. Because NOAELs are associated with no effects in a test study, it is uncertain whether they are close to or far below the threshold value at which effects would first be observed. LOAELs thus serve to bound the range of NOAELs, and the threshold of toxic effects is considered to lie between the NOAEL and the LOAEL. Therefore, LOAELs are also utilized as TRVs. It is often standard practice to focus on NOAEL exceedances in the risk assessment, which is more precautionary, and focus on LOAEL exceedances in risk management and risk reduction. In this risk assessment, exceedance of a NOAEL was considered an indicator of risk, and exceedance of a LOAEL was considered an indicator that the constituent in exceedance is a primary risk driver.

Where available, the LOAEL corresponding to the selected NOAEL from USEPA EcoSSL sources was utilized. In the cases where the selected NOAEL was based upon a geometric mean, the geometric means of the LOAELs based on growth and reproduction endpoints was utilized. LOAELs for several chemicals are available from studies by Oak Ridge National Laboratory (Sample et al. 1996).

In some cases, TRVs were not available for specific organic chemicals, but TRVs were available for compounds with similar structures and expected biological activity. In these cases, one chemical was used to provide a surrogate for the other. This is a standard risk assessment practice with a sound technical basis in toxicology; however, use of surrogates does introduce uncertainty as discussed in Section 9.6. Specific surrogates are indicated in **Tables 9-7 and 9-8.**

9.4 ASSESSMENT OF RISKS FOR THE NORTHEAST/NEAR-SHORE GROUPING

Ecological receptors potentially present in the Phase I area include aquatic and benthic organisms and wildlife (birds, mammals, etc.). Selection of representative receptor species was based primarily on several factors: (1) the likelihood of a species to use the Phase I area and the immediately surrounding area, (2) the potential for exposure to site-related contaminants based on the feeding habits and life history of the organisms/guild represented by the receptor species, (3) the availability of life history and exposure information for the selected receptor species, and (4) the availability of toxicity information for the representative receptor species. Based on these factors, aquatic and benthic organisms, great blue heron, and raccoon were chosen as the representative receptor species for the Phase I area. The primary use anticipated for the risk assessment results for this grouping is evaluation of whether current impacts are associated with unacceptable risk in this area.

9.4.1 Assessment of Risks to Aquatic and Benthic Organisms

The CSM for the Phase I area in **Figure 6-1** identifies the viability of aquatic and benthic organism communities as an assessment endpoint for protection. Because most toxicological data for benthic and aquatic organisms are based on a broad range of species, specific representative receptors were not selected. Instead the overall aquatic and benthic communities were identified as representative receptors.

Measurement endpoints evaluated for aquatic and benthic organisms include the following:

- Comparison of screening level and reasonable maximum EPCs in sediment to toxicological benchmarks

- Comparison of non-storm conditions and storm event conditions exposure EPCs in surface water to toxicological benchmarks

- Evaluation of bioavailability for the Phase I area.

Exposure and toxicity assessments are presented in Sections 9.2 and 9.3 to support evaluation of these measurement endpoints.

9.4.1.1 Measurement Endpoint: Comparisons to Sediment EPCs

The first measurement endpoint evaluated is comparison of sediment EPCs to TEL and PEL TRVs protective of benthic organisms. EPCs are divided by TRVs to produce a hazard quotient (HQ). If the HQ is greater than 1 (rounded to one significant digit), the EPC is greater than the TRV, and there is a potential for risks. If the HQ is less than or equal to 1, the EPC does not exceed the TRV, and there is no expected potential for risks. Comparisons and HQs for sediment are presented in **Table 9-11**.

9.4.1.1.1 Screening Level Exposure Scenario: Long Term Maximum Concentrations

When screening level exposure scenario EPCs are compared to sediment TEL TRVs for benthic organisms, nine metals, total HMW and LMW PAHs, total PAHs, and bis(2-ethylhexyl)phthalate, exceed TEL TRVs and produce HQs greater than 1. Each constituent for which the screening level scenario HQ is greater than or equal to 1 is listed below with the HQ in parentheses. Chemicals with doses also exceeding PELs are bolded with an asterisk:

- Cadmium (7.06)
- **Chromium (14.3)***
- Copper (8.56)
- Cyanide (total) (1.60)
- Lead (3.64)
- Mercury (3.23)
- Nickel (2.89)
- Silver (2.33)
- **Zinc (12.5)***
- Total HMW PAH (ND = RL) (4.69)
- Total LMW PAH (ND = RL) (5.42)
- Total PAHs (ND = RL) (2.83)
- Bis(2-ethyhexyl)phthalate (8.79)

The fact that maximum concentrations of these chemicals exceed TEL TRVs indicates that there is a potential for risks to benthic organisms. Exceedance of PEL TRVs in addition to TELs represents a more certain potential for risk. Comparison of the screening level EPC to TRVs is precautionary, and results should be evaluated in light of the additional measurement endpoints listed below.

9.4.1.1.2 Reasonable Maximum Exposure Scenario: Long Term Reasonable Maximum EPCs

Because some benthic organisms are mobile, and because the screening level EPC may represent exposures for only a small portion of the benthic organism community as a whole, reasonable maximum exposure scenarios are evaluated using reasonable maximum exposure scenario EPCs. When reasonable maximum exposure scenario EPCs are compared to TRVs for benthic organisms, eight metals, total HMW and LMW PAHs, total PAHs, and bis(2-ethylhexyl)phthalate exceed TEL TRVs and produce HQs greater than 1 (**Table 9-11**). Each constituent for which the reasonable maximum exposure scenario HQ are greater than or equal to 1 is listed below with the HQ in parentheses.

Chemicals with doses also exceeding PELs are bolded with an asterisk:

- Cadmium (7.06)
- Copper (5.01)
- **Chromium (14.3)***
- Lead (2.45)
- Mercury (3.23)
- Nickel (2.38)
- Silver (2.33)
- **Zinc (8.34)***
- Total HMW PAH (ND = RL) (4.69)
- Total LMW PAH (ND = RL) (4.24)
- Total PAHs (ND = RL) (2.83)
- Bis(2-ethyhexyl)phthalate (2.99)

Cyanide is the only constituent with concentrations that exceed TRVs under screening level exposure scenarios that do not exceed under reasonable maximum exposure scenario. The fact that reasonable maximum exposure scenario concentrations of the above chemicals exceed TRVs indicates that elevated concentrations of these chemicals produce a potential for risks to benthic organisms.

9.4.1.2 Measurement Endpoint: Comparisons to Surface Water TRVs

The primary exposure medium for many free swimming aquatic organisms is surface water. Therefore, comparison of modeled surface water EPCs to chronic and acute TRVs protective of aquatic organisms is evaluated as a measurement endpoint. EPCs are divided by TRVs to produce an HQ. If the HQ is greater than 1 (rounded to one significant digit), the EPC is greater than the TRV, and there is a potential for risks. If the HQ is less than or equal to 1, the EPC does not exceed the TRV, and there is no expected potential for risks. Comparisons and HQs for surface water are presented in **Table 9-12**.

9.4.1.2.1 Screening Level and Reasonable Maximum Exposure Scenarios – Non-Storm Conditions

When screening level exposure scenario surface water EPCs from the modeled non-storm condition are compared to surface water TRVs for aquatic organisms, only one constituent (cyanide, total) produced an HQ greater than 1 (2.52) when compared both chronic and acute TRVs. For the reasonable maximum exposure scenario, no constituents exceed TRVs.

The fact that the screening level concentration of total cyanide exceeds both chronic and acute surface water TRVs indicates a potential risk to aquatic organisms. It is worth noting that in the case of cyanide, the chronic and acute surface water TRVs are both 1 µg/L. Comparison of the modeled screening level EPC to TRVs is precautionary, and results should be evaluated in light of the additional measurement endpoints listed below.

9.4.1.2.2 Screening Level Exposure Scenario: Storm Event Conditions

When storm events occur in the NNS area, EPCs for COPCs in surface water based on the modeled 1-year design storm scenario (Chapter 7) apply. This scenario represents a periodic

acute exposure scenario reflecting likely surface water maximum concentrations during moderate storm events only.

When screening level exposure scenario EPCs for storm conditions are compared to surface water TRVs for aquatic organisms (**Table 9-12**), only one constituent (cyanide, total) produced an HQ greater than 1 (23.7) when compared to both chronic and acute TRVs.

The fact that the maximum concentration of total cyanide exceeds both chronic and acute surface water TRVs indicates that the concentration may be occasionally elevated in surface water and produce a potential for risk to aquatic organisms. Comparison of the modeled screening level EPC to TRVs is precautionary, and results should be evaluated in light of the additional measurement endpoints listed below.

9.4.1.3 Measurement Endpoint: Evaluation of Bioavailability

Evaluation of bioavailability information for the offshore area is included as a measurement endpoint because, as discussed in Section 9.3, TRVs may overestimate risks because they do not incorporate consideration of site-specific bioavailability. This is especially true of metals in anaerobic sediments where chemically reducing conditions favor the binding of metals in sulfide compounds, which are relatively non-bioavailable and non-toxic. It is also true for organic compounds that may bind to organic carbon or fine-grained sediments. Several sources of data are available to evaluate site-specific bioavailability.

9.4.1.3.1 Simultaneously Extracted Metals/Acid Volatile Sulfides

One measure of the potential for metals to bind in sediments and become less bioavailable is the ratio of SEM to AVS. In reduced, anoxic systems, many metals bind to sulfides and become non-bioavailable. As a general guideline, SEM/AVS ratios of less than 1.0 are an indicator that metals are bound and unlikely to be bioavailable to organisms (USEPA 2005a). The SEM/AVS ratio in the sediment samples from the NNS grouping ranged from 0.28 to 38 (**Table 5-7**). Ratios less than 1 were reported in the A, B, C, and F transects, providing an indication that metals are likely to be bound in sulfide compounds that reduce their bioavailability and toxicity in these areas. However, the SEM/AVS ratios at locations D02 (38), DE01 (19), and E01 (9.7), adjacent to the former location of the Rod & Wire Mill, suggest that metals in this area may be bioavailable. The non-detectable AVS, which prevented calculation of ratios for locations A01, B01, C01, D01, and E02, also suggests that metals may be bioavailable in these near-shore locations, where metals concentrations are relatively low. Overall, ratios less than 1 were reported in nearly half of the sampling locations in the NNS grouping, including locations with high metals concentrations; therefore, bioavailability is expected to be overestimated.

9.4.1.3.2 Site-Specific Uptake Evaluation and Field-Collected Fish and Crab Tissue

As part of the Coke Point Risk Assessment (EA 2011b), sediment from the Coke Point Offshore Area was used in 28-day laboratory bioaccumulation tests in which clams and worms were exposed to sediment in a controlled laboratory environment. At the end of the exposure period, tissues were analyzed for lipids, metals, PAHs, and PCBs. The resulting concentration data were analyzed statistically to provide descriptive statistics and perform comparison between pre-test and post-test tissue concentrations. The statistical results indicated that most metals, PAHs, and PCB congeners were bioavailable in sediments from the Coke Point Offshore Area, as evidenced by uptake into clam and worm tissues compared to pre-test tissues. Concentrations of metals in tissue were typically less than 1 percent of sediment concentrations on a wet weight tissue to dry weight sediment basis. A few metals had higher percentages between 1 and 6 percent. Percentages for PAHs and PCBs were higher, with several PAHs and PCBs found at wet weight concentrations in tissue of 10 to 35 percent of the concentration in sediment. Due to the proximity of Coke Point to the Phase I area, it is expected that metals, PAHs, and PCBs are likely to be bioavailable in the Phase I area as well.

Also as part of the Coke Point Risk Assessment, white perch (*Morone americana*) and blue crabs (*Callinectes sapidus*) were collected from the Coke Point Offshore Area. Specimens were collected and processed to create composites consisting of tissue from several individual organisms. Separate analyses of lipids, metals, PAHs, and PCBs were performed on whole body fish tissue, fish filets, crab meat, and crab digestive gland (mustard). Concentration data were analyzed statistically to provide descriptive statistics, and create crab and fish EPCs for use in the risk assessment. Results showed that metals, PAHs, and PCBs were present in whole body fish and crab tissues. Based on the proximity of Coke Point to the Phase I area and the typical range of fish and crabs, these results are considered applicable to the Phase I area.

9.4.1.4 Risk Characterization for Aquatic and Benthic Organisms in the Northeast/Near-Shore Grouping

The risk characterization of aquatic and benthic organisms draws from three measurement endpoints to obtain conclusions regarding the potential for risks. The results for each measurement endpoint are discussed and weighed as evidence to determine whether chemicals in the Phase I area are expected to pose potential risk to aquatic and benthic organisms.

The first measurement endpoint is a comparison of sediment EPCs to TEL and PEL TRVs protective of benthic organisms. TEL benchmarks are most precautionary, while PEL benchmarks provide a more definite indicator of risks. Screening level exposure scenario concentrations of nine metals (cadmium, chromium, copper, cyanide, lead, mercury, nickel, silver, and zinc), total HMW and LMW PAHs, total PAHs, and bis(2-ethylhexyl)phthalate exceed TELs. Concentrations of chromium and zinc also exceed PELs. Reasonable maximum exposure scenario concentrations of eight metals (cadmium, chromium, copper, lead, mercury,

nickel, silver, and zinc), total HMW and LMW PAHs, total PAHs, and bis(2-ethylhexyl)phthalate exceed TELs. Concentrations of chromium and zinc also exceed PELs.

The second measurement endpoint is a comparison of modeled surface water EPCs to chronic and acute TRVs protective of aquatic organisms. Chronic benchmarks are most precautionary, while acute benchmarks provide a more definite indicator of risks. Screening level and reasonable maximum exposure scenario concentrations are evaluated for non-storm conditions. Concentrations of cyanide exceed both chronic and acute TRVs in the screening level exposure scenario but not in the reasonable maximum exposure scenario. Periodic acute exposure scenario concentrations represent a periodic acute exposure scenario reflecting likely surface water maximum concentrations during storm events only. Periodic acute concentrations of cyanide exceed both chronic and acute TRVs under this scenario.

The third measurement endpoint is consideration of chemical bioavailability. Reasonable maximum exposure scenario doses of chromium and zinc exceed PEL benchmarks. SEM/AVS data for nearly half of the NNS grouping locations indicate that not all of the metal present in sediment is available for uptake through direct exposure; this indicates that risks from direct exposure to sediment may be over-estimated. Also, concentrations of metals in tissue were typically less than 1 percent of sediment concentrations on a wet weight tissue to dry weight sediment basis, further indicating that bioavailability may be overestimated.

Taken together, the lines of evidence presented above indicate that two metals (chromium and zinc) had concentrations exceeding sediment PEL benchmarks and pose a risk to benthic organisms. The screening level exposure scenario concentration of cyanide and the cyanide concentration during storm event conditions pose a potential risk to aquatic organisms but the reasonable maximum exposure scenario does not pose risk to aquatic organisms.

The finding of the ERA is that aquatic and benthic organisms are potentially at risk from chromium and zinc from sediment in the NNS grouping and cyanide from surface water only during storm events in the NNS grouping. Based on maximum case exposures, which are precautionary, and TELs, which are conservative, initial screening identified cadmium, chromium, copper, cyanide, lead, mercury, nickel, silver, zinc, total HMW and LMW PAHs, total PAHs, and bis(2-ethylhexyl)phthalate as a potential concern in sediment. When a more reasonable estimate of exposures based on the 95%UCLM is considered with less conservative PELs, which are a better indicator of the potential for actual impacts, chromium and zinc exceed. While sediment metals and PAHs appear to be somewhat bioavailable based on uptake and tissue studies, the SEM/AVS data indicate that metal bioavailability may be over-estimated. Conclusions are synthesized and used as the basis for recommendations in Chapter 11. There are a number of uncertainties associated with the risk assessment that are discussed in Section 9.6.

9.4.2 Assessment of Risks to Wildlife

The CSM for the Phase I area in Chapter 6 identifies the viability of wildlife, including birds and mammals, as an assessment endpoint for evaluation. Great blue heron and raccoon are selected as specific representative receptor species.

Because wildlife may be exposed to multiple media via the food chain, measurement endpoints for wildlife are based on food web modeling to estimate ingested doses (**Table 9-6**). Measurement endpoints evaluated for wildlife in the NNS grouping include:

- Comparison of modeled food web doses to NOAEL and LOAEL TRVs for birds and mammals using a precautionary screening level exposure scenarios with tissue concentrations based on BAFs

- Comparison of modeled food web doses to NOAEL and LOAEL TRVs for birds and mammals using a precautionary screening level exposure scenarios with tissue concentrations based on field-collected crab and fish tissue

- Comparison of modeled food web doses to NOAEL and LOAEL TRVs for birds and mammals using a reasonable maximum exposure scenario with tissue concentrations based on BAFs

- Comparison of modeled food web doses to NOAEL and LOAEL TRVs for birds and mammals using a reasonable maximum exposure scenario with tissue concentrations based on field-collected crab and fish tissue

- Qualitative evaluation of chemical bioavailability in sediment.

Exposure and toxicity assessments are presented below to support evaluation of these measurement endpoints.

9.4.2.1 Measurement Endpoint: Comparison of Screening Level Exposure Scenario Modeled Doses to TRVs with Tissue Concentrations Based on BAFs

The first measurement endpoint evaluated is a comparison of modeled doses based on screening level EPCs to NOAEL- and LOAEL-based TRVs protective of birds and mammals. Use of screening level EPCs is highly precautionary and represents exposures that are limited to areas of highest concentrations offshore; this is a relatively unrealistic exposure scenario for wildlife such as heron and raccoon, which may have home ranges of several hundred acres or more. However, the measurement endpoint is evaluated as a precaution.

Doses are calculated based on direct ingestion of sediment, ingestion of surface water, and ingestion of aquatic organisms as food (**Appendix G**). Screening level exposure scenario doses

are presented side-by-side with both NOAEL and LOAEL TRVs in **Table 9-13** for birds and **Table 9-14** for mammals. These tables include one set of results assuming uptake from crab and one set of results assuming prey uptake from fish. Chemicals with doses exceeding their NOAEL-based HQs are listed below. Chemicals with doses also exceeding LOAELs are bolded with an asterisk.

Chemicals with screening level scenario doses exceeding TRVs for Great Blue Heron

Prey: Crabs	Prey: Fish
• None	• None

Chemicals with screening level scenario doses exceeding TRVs for Raccoon

Prey: Crabs	Prey: Fish
• Chromium (2.06)	• None

No doses exceed NOAEL-based TRVs for birds. When screening level exposure scenario doses are compared to benchmarks for mammals, one metal (chromium) exceeds NOAEL-based TRVs. No doses exceed LOAEL-based TRVs.

Results for this measurement endpoint indicate that chromium may cause a potential for risk to mammalian wildlife at locations where concentrations are highest. Given the highly precautionary nature of this measurement endpoint, it must be interpreted in light of results for other endpoints and given a relatively low weight of evidence.

9.4.2.2 Measurement Endpoint: Comparison of Screening Level Exposure Scenario Modeled Doses to TRVs with Tissue Concentrations Based on Crab and Fish Tissue

The second measurement endpoint evaluated is a comparison of modeled doses based on maximum EPCs derived from field-collected fish and crab tissue from the area around Sparrows Point to NOAEL- and LOAEL-based TRVs protective of birds and mammals. Use of EPCs derived from field-collected tissue presents a more realistic representation of bioaccumulation in higher trophic level game species at Sparrows Point because many aquatic organisms are mobile and may spend time feeding in other parts of Bear Creek, the Patapsco River, Baltimore Harbor, or the Chesapeake Bay.

Doses are calculated based on direct ingestion of sediment, ingestion of surface water, and ingestion of aquatic organisms as food (**Appendix G**). Screening level exposure scenario doses are presented side-by-side with both NOAEL and LOAEL TRVs in **Table 9-15** for birds and **Table 9-16** for mammals. These tables include one set of results assuming prey uptake of chemicals from crab and one set of results assuming prey uptake from fish. Chemicals with

doses exceeding their NOAEL-based HQs are listed below. Chemicals with doses also exceeding LOAELs are bolded with an asterisk.

Chemicals with screening level scenario doses exceeding TRVs for Great Blue Heron

Prey: Crabs	Prey: Fish
• None	• None

Chemicals with screening level scenario doses exceeding TRVs for Raccoon

Prey: Crabs	Prey: Fish
• None	• None

When screening level exposure scenario doses are compared to benchmarks, no constituents exceed NOAEL-based TRVs for heron or raccoon under either prey uptake scenarios.

9.4.2.3 Measurement Endpoint: Comparison of Reasonable Maximum Exposure Scenario Modeled Doses to TRVs with Tissue Concentrations Based on BAFs

The third measurement endpoint evaluated is a comparison of modeled doses based on reasonable maximum EPCs to NOAEL- and LOAEL-based TRVs protective of birds and mammals. Use of reasonable maximum EPCs is more realistic for wildlife and provides the most representative results for exposures experienced by wildlife populations.

Doses are calculated based on direct ingestion of sediment, ingestion of surface water, and ingestion of aquatic organisms as food (**Appendix G**). Reasonable maximum exposure scenario doses are presented side-by-side with both NOAEL and LOAEL TRVs in **Table 9-17** for birds and **Table 9-18** for mammals. These tables include one set of results assuming prey uptake of chemicals from crab and one set of results assuming prey uptake from fish. Chemicals with doses exceeding their NOAEL-based HQs are listed below. Chemicals with doses also exceeding LOAELs are bolded with an asterisk.

Chemicals with reasonable maximum exposure scenario doses exceeding TRVs for Great Blue Heron

Prey: Crabs	Prey: Fish
• None	• None

Chemicals with reasonable maximum exposure scenario doses exceeding TRVs for Raccoon

Prey: Crabs	Prey: Fish
• Chromium (2.06)	• None

When reasonable maximum exposure scenario doses are compared to benchmarks, chromium exceeds NOAEL-based TRVs for raccoon under the crab uptake scenario. For heron, no doses exceed NOAEL-based TRVs. No chemicals had doses that exceed LOAEL-based TRVs for birds or mammals.

9.4.2.4 Measurement Endpoint: Comparison of Reasonable Maximum Exposure Scenario Modeled Doses to TRVs with Tissue Concentrations Based on Crab and Fish Tissue

The fourth measurement endpoint evaluated is a comparison of modeled doses based on reasonable maximum EPCs derived from field-collected fish and crab tissue from the area around Sparrows Point to NOAEL- and LOAEL-based TRVs protective of birds and mammals. Use of EPCs derived from field-collected tissue presents a more realistic representation of bioaccumulation in higher trophic level game species at Sparrows Point because many aquatic organisms are mobile and may spend time feeding in other parts of Bear Creek, the Patapsco River, Baltimore Harbor, or the Chesapeake Bay.

Doses are calculated based on direct ingestion of sediment, ingestion of surface water, and ingestion of aquatic organisms as food (**Appendix G**). Reasonable maximum exposure scenario doses are presented side-by-side with both NOAEL and LOAEL TRVs in **Table 9-19** for birds and **Table 9-20** for mammals. These tables include one set of results assuming prey uptake of chemicals from crab and one set of results assuming prey uptake from fish. Chemicals with doses exceeding their NOAEL-based HQs are listed below. Chemicals with doses also exceeding LOAELs are bolded with an asterisk.

Chemicals with reasonable maximum exposure scenario doses exceeding TRVs for Great Blue Heron

Prey: Crabs	Prey: Fish
• None	• None

Chemicals with reasonable maximum exposure scenario doses exceeding TRVs for Raccoon

Prey: Crabs	Prey: Fish
• None	• None

When reasonable maximum exposure scenario doses are compared to benchmarks, no constituents exceed NOAEL-based TRVs for raccoon or heron under either uptake scenario.

9.4.2.5 Measurement Endpoint: Evaluation of Bioavailability

Evaluation of bioavailability information for the offshore area is included as a measurement endpoint because, as discussed in Section 9.3, TRVs may overestimate risks because they do not incorporate consideration of site-specific bioavailability from sediment. As discussed above for aquatic and benthic organisms, there is evidence from SEM/AVS data that metals in sediment in Grouping NNS may be bound to sulfides that decrease their bioavailability and toxicity. This bears relevance for wildlife food web modeling, especially where a precautionary default factor of 1 is assumed for bioaccumulation of chemicals into prey item tissue. If metals are bound to sulfides in sediment, their potential to bioaccumulate would be limited. This measurement endpoint indicates that the potential for risks associated with these metals in sediment may be over-estimated.

While sediment metals and PAHs appear to be somewhat bioavailable based on uptake and tissue studies, the metal BAFs derived from the laboratory bioaccumulation studies of Coke Point sediments (EA 2011b) are lower, sometimes an order of magnitude, than commonly used reference BAFs (i.e., Bechtel Jacobs Company LLC 1998). Concentrations of metals in tissue were typically less than 1 percent of sediment concentrations on a wet weight tissue to dry weight sediment basis based on site-specific uptake. Additionally, the SEM/AVS data indicate that metal bioavailability may be over-estimated.

9.4.2.6 Risk Characterization for Wildlife in the Northeast/Near-Shore Grouping

The risk characterization for wildlife draws from five measurement endpoints (Section 9.4.2) to derive conclusions regarding the potential for risks. The results for each measurement endpoint are discussed and weighed as evidence to determine whether chemicals in the Phase I area are expected to pose potential risk to wildlife. Within these measurement endpoints, bioaccumulation to wildlife from consumption of two different types of prey – crabs and fish – were considered, as well as consumption of sediment and water.

The first measurement endpoint—benchmark comparisons using screening level exposure scenario doses and tissue concentrations based on BAFs—provides a precautionary initial estimate of risks under worst case exposures in which a receptor is constantly exposed to the highest concentrations detected in the grouping. Use of BAFs to estimate transfer from sediment and water into tissue provides a strong indicator of potential contributions to the food chain from environmental media within the NNS grouping. NOAEL benchmarks are most precautionary, while LOAEL benchmarks provide a more definite indicator of risks. Based on screening level exposure scenario doses (based on maximum detected sediment and water concentrations), one metal (chromium) exceeds NOAEL-based TRVs for mammals. No doses exceed LOAEL TRVs.

The second measurement endpoint—benchmark comparisons using screening level exposure scenario doses and tissue concentrations based on field-collected crab and fish tissue—provides precautionary initial estimate of risks under worst case exposures in which a receptor is constantly exposed to the highest concentrations detected in the NNS grouping. Use of actual tissue concentrations from specimens in the vicinity of the Site provides an indication of whether contributions from the area translate into increased exposures across wild populations. NOAEL benchmarks are most precautionary, while LOAEL benchmarks provide a more definite indicator of risks. Screening level exposure scenario doses did not exceed bird or mammal TRVs.

The third and fourth measurement endpoints—benchmark comparisons using reasonable maximum exposure scenario doses with tissue concentrations based on BAFs and benchmark comparisons using reasonable maximum exposure scenario doses with tissue concentrations based on field-collected crab and fish tissue—provide a more realistic indicator of risks to wildlife because they characterize exposures throughout the NNS grouping rather than worst case exposures. The reasonable maximum exposure scenario dose for chromium based on BAF uptake into crab was the only dose to exceed mammal NOAEL-based TRVs. No doses exceeded LOAEL-based TRVs.

The fifth measurement endpoint is consideration of chemical bioavailability. As described in Section 9.4.1.3.2, laboratory bioaccumulation tests provide evidence that chemicals in sediment are bioavailable and may be taken up into prey tissue. BAFs and tissue data provide site-specific estimates of bioaccumulation that were used in exposure models. However, concentrations of metals in tissue were typically less than 1 percent of sediment concentrations on a wet weight tissue to dry weight sediment basis. SEM/AVS data indicate that not all of the metal present in sediment is available for uptake and direct exposure; this indicates that risks from direct exposure to sediment may be over-estimated.

Taken together, these lines of evidence indicate that chemicals in the NNS grouping area are not present in concentrations that pose a risk to wildlife. Chromium had screening level scenario doses that exceeded NOAELs; however, chromium is not considered a contaminant of concern (COC) because it demonstrates reasonable maximum scenario doses that are below LOAELs.

The finding of the ERA is that wildlife that consume aquatic and benthic organisms are not at risk from sediment in the NNS grouping. Conclusions are synthesized and used as the basis for recommendations in Chapter 11. There are a number of uncertainties associated with the risk assessment that are discussed in Section 9.6.

9.5 ASSESSMENT OF RISKS FOR THE SOUTHWEST/TIN MILL CANAL EFFLUENT GROUPING

Ecological receptors potentially present at the SWTM area of the Phase I area include aquatic and benthic organisms and wildlife (birds, mammals, etc.). Selection of representative receptor species was based primarily on factors described in Section 9.4. Based on these factors, aquatic

and benthic organisms, great blue heron, and raccoon were chosen as the representative receptor species for the Phase I area. As discussed in Section 9.2.1, a qualitative discussion of oil and grease toxicity is included for each receptor in the SWTM grouping.

9.5.1 Assessment of Risks to Aquatic and Benthic Organisms

The CSM for the Phase I area in **Figure 6-1** identifies the viability of aquatic and benthic organism communities as an assessment endpoint for protection. Because most toxicological data for benthic and aquatic organisms are based on a broad range of species, specific representative receptors were not selected. Instead the overall aquatic and benthic communities are identified as representative receptors.

Measurement endpoints evaluated for aquatic and benthic organisms include:

- Comparison of screening level and reasonable maximum EPCs in sediment to toxicological benchmarks
- Comparison of screening level exposure EPCs in surface water to toxicological benchmarks
- Evaluation of bioavailability for the Phase I area.

Exposure and toxicity assessments are presented in Sections 9.2 and 9.3 to support evaluation of these measurement endpoints.

9.5.1.1 Measurement Endpoint: Comparisons to Sediment EPCs

The first measurement endpoint evaluated is comparison of sediment EPCs to TEL and PEL TRVs protective of benthic organisms. EPCs are divided by TRVs to produce an HQ. If the HQ is greater than 1 (rounded to one significant digit), the EPC is greater than the TRV, and there is a potential for risks. If the HQ is less than or equal to 1, the EPC does not exceed the TRV, and there is no expected potential for risks. Comparisons and HQs for sediment are presented in **Table 9-21**.

9.5.1.1.1 Screening Level Exposure Scenario

When screening level exposure scenario EPCs are compared to sediment TEL TRVs for benthic organisms, 12 metals, total HMW and LMW PAHs, total PAHs, bis(2-ethylhexyl)phthalate, total PCBs, and chlorobenzene exceed TEL TRVs and produce HQs greater than 1. Each constituent for which the screening level exposure scenario HQ is greater than or equal to 1 is listed below with the HQ in parentheses. Chemicals with doses also exceeding PELs are bolded with an asterisk:

- Antimony (5.0)
- **Arsenic (16.6)***
- **Cadmium (162)***
- **Chromium (88)***
- **Copper (29.4)***
- **Cyanide (total) (35)***
- **Lead (36.4)***
- **Mercury (12.3)***
- **Nickel (13.2)***
- Selenium (24.3)
- **Silver (11.1)***
- **Zinc (137)***
- **Total HMW PAH (ND = RL) (59.8)***
- **Total LMW PAH (ND = RL) (145)***
- **Total PAHs (ND = RL) (48.5)***
- **Total PCBs (ND = RL) (232)***
- **Bis(2-ethyhexyl)phthalate (280)***
- Chlorobenzene (8.33)

The fact that maximum concentrations of these chemicals exceed TEL TRVs indicates that there is a potential for risks to benthic organisms. Exceedance of PEL TRVs in addition to TELs represents a more certain potential for risk. Comparison of the screening level EPC to TRVs is precautionary, and results should be evaluated in light of the additional measurement endpoints listed below.

9.5.1.1.2 Reasonable Maximum Exposure Scenario: Long Term Reasonable Maximum EPCs

Because some benthic organisms are mobile, and because the screening level EPC may represent exposures for only a small portion of the benthic organism community as a whole, reasonable maximum exposure scenarios are evaluated using reasonable maximum exposure scenario EPCs. When reasonable maximum exposure scenario EPCs are compared to TRVs for benthic organisms, 12 metals, total HMW and LMW PAHs, total PAHs, bis(2-ethylhexyl)phthalate, and total PCBs exceed TEL TRVs and produce HQs greater than 1 (**Table 9-21**). Each constituent for which the screening level exposure scenario HQ are greater than or equal to 1 is listed below with the HQ in parentheses.

Chemicals with doses also exceeding PELs are bolded with an asterisk:

- Antimony (2.82)
- Arsenic (6.62)
- **Cadmium (44.7)***
- **Chromium (46.5)***
- **Copper (17.2)***
- Cyanide (total) (17.1)
- **Lead (15.4)***
- Mercury (6.36)
- **Nickel (6.99)***
- Selenium (12.6)
- **Silver (5.3)***
- **Zinc (53.8)***
- **Total HMW PAH (ND = RL) (32.2)***
- **Total LMW PAH (ND = RL) (59.7)***
- **Total PAHs (ND = RL) (23.3)*Total PCBs (ND = RL) (59.0)***
- **Bis(2-ethyhexyl)phthalate (103)***

The fact that reasonable maximum exposure scenario concentrations of the above chemicals exceed TRVs indicates that elevated concentrations of these chemicals produce a potential for risks to benthic organisms.

9.5.1.1.3 Qualitative Evaluation of Oil and Grease

Oil and grease were observed in Sparrows Point sediments in the SWTM grouping. Oil and grease are suspected to have been deposited from discharges from Tin Mill Canal. Concentrations of hexane extractable oil and grease in sediment range up to 110,000 mg/kg or 11 percent, and field observations indicate oily, grease sediment and sheens as part of sediment lithology. While the exact composition of this material is uncertain, it is expected to consist largely of palm oil which was frequently used in steelmaking as part of rolling steel. It is also possible the material could be a mix of palm oil and petroleum-based oils.

Oil and grease can impact aquatic organisms in two general ways. The first is as a source of chemical toxicity. Natural oils (e.g., palm oil) are typically considered to have low toxicity (USEPA 1976). Petroleum-based oils can contain PAHs and metals, and other industrial oils (hydraulic fluid) may contain PCBs. These man-made oils may produce toxic effects on organisms; this has already been evaluated quantitatively using concentrations of these chemicals and toxicity-based comparison criteria in the sections above.

The second way in which oil and grease can impact aquatic and benthic organisms is through physical impacts. These are often difficult to quantify but can have substantive effects on the ability of invertebrates and fish to utilize and survive in benthic habitats. Both natural and artificial oils can produce the following major physical effects on aquatic and benthic organisms:

- Coating the gills of fish and invertebrates, which inhibits respiration (USEPA 1976)
- Increasing biological oxygen demand which can lead to fish kills due to low oxygen in the water column (USEPA 1976)
- Interferences with organism mobility and foraging by fouling and adhesion.

Based on these factors there is a potential for sediments which contain oil and grease to cause impacts to aquatic and benthic organisms.

9.5.1.2 Measurement Endpoint: Comparisons to Surface Water TRVs

The primary exposure medium for many free-swimming aquatic organisms is surface water. Therefore, comparison of modeled surface water EPCs to chronic and acute TRVs protective of aquatic organisms is evaluated as a measurement endpoint. EPCs are divided by TRVs to produce an HQ. If the HQ is greater than 1 (rounded to 1 significant digit), the EPC is greater than the TRV, and there is a potential for risks. If the HQ is less than or equal to 1, the EPC does

not exceed the TRV, and there is no expected potential for risks. Comparisons and HQs for surface water are presented in **Table 9-22**.

9.5.1.2.1 Non-Storm Conditions

When screening level exposure scenario EPCs are compared to surface water TRVs for aquatic organisms, only one constituent produced an HQ greater than 1 when compared to acute TRVs. Cyanide (total) had a screening level exposure scenario HQ of 3.87 for chronic and acute TRVs, as they are both equal to 1 µg/L. When compared to chronic TRVs, cyanide had a reasonable maximum exposure scenario HQ equal to 1.

The fact that screening level exposure concentrations of total cyanide exceed both chronic and acute surface water TRVs indicates that the concentration may be occasionally elevated in surface water and produce a potential for risk to aquatic organisms. As the reasonable maximum exposure scenario is equal to the TRVs, surface water will generally not pose risk to aquatic organisms. Comparison of the modeled screening level EPC to TRVs is precautionary, and results should be evaluated in light of the additional measurement endpoints listed below.

9.5.1.2.2 Screening Level Exposure Scenario: Storm Event Conditions

When storm events occur in the SWTM area, EPCs for COPCs in surface water based on the modeled 1-year design storm scenario (Chapter 7) apply. This scenario represents a periodic acute exposure scenario reflecting likely surface water maximum concentrations during moderate storm events only.

When screening level exposure scenario EPCs for storm conditions are compared to surface water TRVs for aquatic organisms (**Table 9-22**), only one constituent (cyanide, total) produced an HQ greater than 1 (6.5) when compared to both chronic and acute TRVs.

The fact that the maximum concentration of total cyanide exceeds both chronic and acute surface water TRVs indicates that the concentration may be occasionally elevated in surface water and produce a potential for risk to aquatic organisms. Comparison of the modeled screening level EPC to TRVs is precautionary, and results should be evaluated in light of the additional measurement endpoints listed below.

9.5.1.3 Measurement Endpoint: Evaluation of Bioavailability

Evaluation of bioavailability information for the offshore area is included as a measurement endpoint because, as discussed in Section 9.3, TRVs may overestimate risks because they do not incorporate consideration of site-specific bioavailability. This is especially true of metals in anaerobic sediments where chemically reducing conditions favor the binding of metals in sulfide compounds which are relatively non-bioavailable and non-toxic. It is also true for organic

compounds that may bind to organic carbon or fine-grained sediments. Several sources of data are available to evaluate site-specific bioavailability.

9.5.1.3.1 Simultaneously Extracted Metals/Acid Volatile Sulfides

One measure of the potential for metals to bind in sediments and become less bioavailable is the ratio of SEM to AVS. In reduced, anoxic systems, many metals bind to sulfides and become non-bioavailable. As a general guideline, SEM/AVS ratios of less than 1.0 are an indicator that metals are bound and unlikely to be bioavailable to organisms (USEPA 2005a). The SEM/AVS ratio in the sediments samples from Grouping SWTM ranged from 0.038 to 21 (**Tables 5-7 and 5-13**). Ratios less than 1 were reported in the majority of locations in this grouping, providing an indication that metals are likely to be bound in sulfide compounds that reduce their bioavailability and toxicity in most of the SWTM. SEM/AVS ratios in excess of 1 were reported in samples from H transect locations H01 (grab sample), H02 (grab sample), and H03 (grab sample and surface interval of core), suggesting that metals in this area may be bioavailable. As ratios less than 1 were reported for most samples, bioavailability is expected to be overestimated.

9.5.1.3.2 Site-Specific Uptake Evaluation and Field-Collected Fish and Crab Tissue

As discussed for the NNS grouping, tissue data from studies of Coke Point indicate that metals, PAHs, and PCBs are likely to be bioavailable in the SWTM grouping as well. Concentrations of metals in tissue were typically less than 1 percent of sediment concentrations on a wet weight tissue to dry weight sediment basis. A few metals had higher percentages between 1 and 6 percent. Percentages for PAHs and PCBs were higher, with several PAHs and PCBs found at wet weight concentrations in tissue of 10 to 35 percent of the concentration in sediment.

Also as part of the Coke Point Risk Assessment, white perch and blue crabs were collected from the Coke Point Offshore Area. Specimens were collected and processed to create composites consisting of tissue from several individual organisms. Separate analyses of lipids, metals, PAHs, and PCBs were performed on whole body fish tissue, fish filets, crab meat, and crab digestive gland (mustard). Concentration data were analyzed statistically to provide descriptive statistics, and create crab and fish EPCs for use in the risk assessment. Results showed that metals, PAHs, and PCBs were present in whole body fish and crab tissues. Based on the proximity of Coke Point to the Phase I area and the typical range of fish and crabs, these results are considered applicable to the Phase I area.

9.5.1.4 Risk Characterization for Aquatic and Benthic Organisms in the Southwest/Tin Mill Canal Effluent Grouping

The risk characterization of aquatic and benthic organisms draws from three measurement endpoints (Section 9.5.1) to obtain conclusions regarding the potential for risks. The results for each measurement endpoint are discussed and weighed as evidence to determine whether

chemicals in the Phase I area are expected to pose potential risk to aquatic and benthic organisms.

The first measurement endpoint is a comparison of sediment EPCs to TEL and PEL TRVs protective of benthic organisms. TEL benchmarks are most precautionary, while PEL benchmarks provide a more definite indicator of risks. Screening level exposure scenario concentrations of 12 metals (antimony, arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, selenium, silver, and zinc), total HMW and LMW PAHs, total PAHs, total PCBs, bis(2-ethylhexyl)phthalate, and chlorobenzene exceed TELs. Concentrations of arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, silver, zinc, HMW and LMW PAHs, total PAHs, total PCBs, and bis(2-ethylhexyl)phthalate also exceed PELs. Reasonable maximum exposure scenario concentrations of 12 metals (antimony, arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, selenium, silver, and zinc), total HMW and LMW PAHs, total PAHs, total PCBs, and bis(2-ethylhexyl)phthalate exceed TELs. Concentrations of cadmium, chromium, copper, lead, nickel, silver, zinc, HMW and LMW PAHs, total PAHs, total PCBs, and bis(2-ethylhexyl)phthalate also exceed PELs.

Screening level and reasonable maximum exposure scenario concentrations are evaluated for non-storm conditions. Concentrations of cyanide exceed both chronic and acute TRVs in the screening level exposure scenario but not in the reasonable maximum exposure scenario. Periodic acute exposure scenario concentrations represent a periodic acute exposure scenario reflecting likely surface water maximum concentrations during storm events only. Periodic acute concentrations of cyanide exceed both chronic and acute TRVs under this scenario.

The third measurement endpoint is consideration of chemical bioavailability. Reasonable maximum exposure scenario doses of cadmium, chromium, copper, lead, nickel, silver, zinc, HMW and LMW PAHs, total PAHs, total PCBs, and bis(2-ethylhexyl)phthalate exceed PEL benchmarks. SEM/AVS data indicate that not all of the metal present in sediment is available for uptake and direct exposure in most of the SWTM; this indicates that risks from direct exposure to sediment may be over-estimated. Also, concentrations of metals in tissue were typically less than 1 percent of sediment concentrations on a wet weight tissue to dry weight sediment basis, indicating bioavailability may be overestimated.

Taken together, the lines of evidence presented above indicate that 9 metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc), total HMW and LMW PAHs, total PAHs, total PCBs, and bis(2-ethylhexyl)phthalate had screening level exposure scenario concentrations exceeding sediment PEL benchmarks and potentially pose a risk to benthic organisms. The screening level exposure scenario concentration of cyanide and the cyanide concentration during storm event conditions pose a potential risk to aquatic organisms but the reasonable maximum exposure scenario does not pose risk to aquatic organisms.

In addition to risks from chemical toxicity, there is also the potential for risk from oil and grease, which may cause physical impacts associated with coating gills, increasing biological oxygen demand, and fouling organisms.

The findings of the ERA are that benthic organisms are potentially at risk from metals, PAHs, PCBs, and bis(2-ethylhexyl)phthalate in sediment and aquatic organisms are potentially at risk from cyanide during storm events in the SWTM grouping. Based on maximum case exposures, which are precautionary, and TELs, which are conservative, initial screening identified 12 metals (antimony, arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, selenium, silver, and zinc), total HMW and LMW PAHs, total PAHs, total PCBs, bis(2-ethylhexyl)phthalate, and chlorobenzene as a potential concern. When a more reasonable estimate of exposures based on the 95%UCLM is considered with less conservative PELs, which are a better indicator of the potential for actual impacts, 7 metals (cadmium, chromium, copper, lead, nickel, silver, and zinc), total HMW and LMW PAHs, total PAHs, total PCBs, and bis(2-ethylhexyl)phthalate exceed PELs. While sediment metals, PAHs, and PCBs appear to be somewhat bioavailable based on uptake and tissue studies, the SEM/AVS data indicate that metal bioavailability may be over-estimated. Benthic organisms are likely also at risk from oil and grease. Conclusions are synthesized and used as the basis for recommendations in Chapter 11. There are a number of uncertainties associated with the risk assessment that are discussed in Section 9.6.

9.5.2 Assessment of Risks to Wildlife

The CSM for the Phase I area in Chapter 6 identifies the viability of wildlife, including birds and mammals, as an assessment endpoint for evaluation. Great blue heron and raccoon are selected as specific representative receptor species.

Because wildlife may be exposed to multiple media via the food chain, measurement endpoints for wildlife are based on food web modeling to estimate ingested doses (**Table 9-6**). Measurement endpoints evaluated for wildlife include:

- Comparison of modeled food web doses to NOAEL and LOAEL TRVs for birds and mammals using a precautionary screening level scenario with tissue concentrations based on BAFs

- Comparison of modeled food web doses to NOAEL and LOAEL TRVs for birds and mammals using a precautionary screening level scenario with tissue concentrations based on field-collected crab and fish tissue

- Comparison of modeled food web doses to NOAEL and LOAEL TRVs for birds and mammals using a reasonable maximum scenario with tissue concentrations based on BAFs

- Comparison of modeled food web doses to NOAEL and LOAEL TRVs for birds and mammals using a reasonable maximum scenario with tissue concentrations based on field-collected crab and fish tissue

- Qualitative evaluation of chemical bioavailability.

Exposure and toxicity assessments are presented below to support evaluation of these measurement endpoints.

9.5.2.1 Measurement Endpoint: Comparison of Screening Level Exposure Scenario Modeled Doses to TRVs with Tissue Concentrations Based on BAFs

The first measurement endpoint evaluated is a comparison of modeled doses based on screening level EPCs to NOAEL- and LOAEL-based TRVs protective of birds and mammals. Use of screening level EPCs is highly precautionary and represents exposures that are limited to areas highest concentrations offshore; this is a relatively unrealistic exposure scenario for wildlife such as heron and raccoon, which may have home ranges of several hundred acres or more. However, the measurement endpoint is evaluated as a precaution.

Doses are calculated based on direct ingestion of sediment, ingestion of surface water, and ingestion of aquatic organisms as food (**Appendix G**). Screening level exposure scenario doses are presented side-by-side with both NOAEL and LOAEL TRVs in **Table 9-23** for birds and **Table 9-24** for mammals. These tables include one set of results assuming uptake from crab and one set of results assuming prey uptake from fish. Chemicals with doses exceeding their NOAEL-based HQs are listed below. Chemicals with doses also exceeding LOAELs are bolded with an asterisk.

Chemicals with screening level scenario level exposure doses exceeding for Great Blue Heron

Prey: Crabs

- Chromium (3.01)
- **Total PCBs (ND=RL) (95.9)***
- Bis(2-ethylhexyl)phthalate (8.39)

Prey: Fish

- Chromium (1.57)

Chemicals with screening level scenario level exposure doses exceeding TRVs for Raccoon

Prey: Crabs

- Antimony (4.20)
- **Arsenic (4.64)***
- **Beryllium (2.06)***
- Chromium (12.6)
- **Selenium (4.64)***
- Thallium (1.70)
- Zinc (4.52)
- Total HMW PAH (ND = RL) (5.07)
- **Total PAHs (ND=RL) (10.4)***
- **Total PCBs (ND=RL) (6,520)***
- Bis(2-ethylhexyl)phthalate (1.90)

Prey: Fish

- Chromium (6.57)
- Total PAHs (ND=RL) (2.20)
- Total PCBs (ND=RL) (4.72)

Doses exceeded TRVs more often for mammals than for birds. When screening level exposure scenario doses are compared to benchmarks, 7 metals, total HMW PAHs, total PAHs, total PCBs, and bis(2-ethylhexyl)phthalate exceed NOAEL-based TRVs for raccoon under one of the two prey uptake scenarios. Chromium, total PCBs, and bis(2-ethylhexyl)phthalate exceed NOAEL-based TRVs for heron under one of the two prey uptake scenarios.

When LOAEL TRVs are considered, doses for three metals (arsenic, beryllium, and selenium), total PAHs, and total PCBs exceed for raccoon. Total PCBs exceed for heron.

In addition to these TRV exceedances, oil and grease were observed in Sparrows Point sediments in the SWTM grouping with concentrations in sediment up to 110,000 mg/kg or 11 percent, and field observations included sheen and odor indicating likely petroleum contamination in sediment. While the potential toxicity of chemicals in oil and grease is evaluated as part of the benchmark comparisons, the potential physical impacts warrant further evaluation.

Both natural and artificial oils can produce the following major impacts on wildlife through physical effects:

- Coating feathers, which affects the ability of waterfowl to float and insulate themselves (USEPA 1976)

- Coating fur, which impacts the ability to groom and maintain insulation for mammals
- Decreased mobility due to fouling, which increases vulnerability to predators and decreases ability to forage (USEPA 1976)
- Impacts on benthic and aquatic organisms (USEPA 1976) that may serve as a food source.

Based on these factors, there is a potential for sediments which contain oil and grease to cause impacts to wildlife.

Results for this measurement endpoint indicate that these constituents may cause a potential for risk at locations where concentrations are highest. Given the highly precautionary nature of this measurement endpoint, it must be interpreted in light of results for other endpoints and given a relatively low weight of evidence.

9.5.2.2 Measurement Endpoint: Comparison of Screening Level Exposure Scenario Modeled Doses to TRVs with Tissue Concentrations Based on Crab and Fish Tissue

The second measurement endpoint evaluated is a comparison of modeled doses based on maximum EPCs derived from field-collected fish and crab tissue from the area around Sparrows Point to NOAEL- and LOAEL-based TRVs protective of birds and mammals. Use of EPCs derived from field-collected tissue presents a more realistic representation of bioaccumulation in higher trophic level game species at Sparrows Point because many aquatic organisms are mobile and may spend time feeding in other parts of Bear Creek, the Patapsco River, Baltimore Harbor, or the Chesapeake Bay.

Doses are calculated based on direct ingestion of sediment, ingestion of surface water, and ingestion of aquatic organisms as food (**Appendix G**). Screening level exposure scenario doses are presented side-by-side with both NOAEL and LOAEL TRVs in **Table 9-25** for birds and **Table 9-26** for mammals. These tables include one set of results assuming prey uptake of chemicals from crab and one set of results assuming prey uptake from fish. Chemicals with doses exceeding their NOAEL-based HQs are listed below. Chemicals with doses also exceeding LOAELs are bolded with an asterisk.

Chemicals with screening level exposure scenario doses exceeding TRVs for Great Blue Heron

Prey: Crabs	Prey: Fish
• Chromium (1.56)	• Chromium (1.56)

Chemicals with screening level exposure scenario doses exceeding TRVs for Raccoon

Prey: Crabs

- Chromium (6.53)
- Selenium (1.68)
- Thallium (1.53)
- Total PCBs (ND=RL) (8.28)

Prey: Fish

- Chromium (6.54)
- **Selenium (2.54)***
- Total PCBs (ND=RL) (14.2)

Doses exceeded TRVs more often for mammals than for birds. When screening level exposure scenario doses are compared to benchmarks, chromium exceeds NOAEL-based TRVs for heron under both prey uptake scenarios. Three metals and total PCBs exceed NOAEL-based TRVs for raccoon under the crab prey scenario, while two metals and total PCBs exceed under the fish prey scenario.

When LOAEL TRVs are considered, selenium doses exceed for raccoon under the fish uptake scenario.

9.5.2.3 Measurement Endpoint: Comparison of Reasonable Maximum Exposure Scenario Modeled Doses to TRVs with Tissue Concentrations Based on BAFs

The third measurement endpoint evaluated is a comparison of modeled doses based on reasonable maximum EPCs to NOAEL- and LOAEL-based TRVs protective of birds and mammals. Use of reasonable maximum EPCs is more realistic for wildlife and provides the most representative results for exposures experienced by wildlife populations.

Doses are calculated based on direct ingestion of sediment, ingestion of surface water, and ingestion of aquatic organisms as food. Reasonable maximum exposure scenario doses are presented side-by-side with both NOAEL and LOAEL TRVs in **Table 9-27** for birds and **Table 9-28** for mammals. These tables include one set of results assuming uptake from crab and one set of results assuming prey uptake from fish. Chemicals exceeding their NOAEL-based HQs are listed below. Chemicals with doses also exceeding LOAELs are bolded with an asterisk.

Chemicals with reasonable maximum exposure scenario doses exceeding TRVs for Great Blue Heron

Prey: Crabs

- Chromium (1.59)
- **Total PCBs (ND=RL) (24.4)***
- Bis(2-ethylhexyl)phthalate (3.09)

Prey: Fish

- None

Chemicals with reasonable maximum exposure scenario doses exceeding TRVs for Raccoon

Prey: Crabs

- Antimony (2.37)
- Arsenic (1.85)
- Chromium (6.67)
- **Selenium (2.41)***
- Zinc (1.77)
- HMW PAH (ND=RL) (2.73)
- Total PAHs (ND=RL) (5.02)
- **Total PCBs (ND=RL) (1,660)***

Prey: Fish

- Chromium (3.46)

Doses exceeded TRVs more often for mammals than for birds. When reasonable maximum exposure scenario doses are compared to benchmarks, chromium, total PCBs, and bis(2-ethylhexyl)phthalate exceed NOAEL-based TRVs for heron under the crab prey uptake scenario. Five metals, total PCBs, total HMW PAHs, and total PAHs exceed NOAEL-based TRVs for raccoon under the crab uptake scenario, while only chromium exceeds under the fish uptake scenario. When LOAEL TRVs are considered for raccoon, doses of selenium and total PCBs also exceed LOAELs. For heron, doses of total PCBs exceed LOAEL TRVs.

Results for this measurement endpoint indicate that, based on exceedance of LOAEL TRVs, selenium and total PCBs may cause a potential for risks to wildlife in the Phase I area. Antimony, arsenic, chromium, zinc, HMW PAHs, total PAHs, and bis(2-ethylhexyl)phthalate could also pose a risk, although to a lesser extent, based on the fact that reasonable maximum exposure scenario doses exceed NOAEL TRVs. Given the highly precautionary nature of TRVs, it is recommended that results for benchmark comparisons be interpreted with consideration of the role of factors that may affect site-specific bioavailability.

9.5.2.4 Measurement Endpoint: Comparison of Reasonable Maximum Exposure Scenario Modeled Doses to TRVs with Tissue Concentrations Based on Crab and Fish Tissue

The fourth measurement endpoint evaluated is a comparison of modeled doses based on reasonable maximum EPCs derived from field-collected fish and crab tissue from the area around Sparrows Point to NOAEL- and LOAEL-based TRVs protective of birds and mammals. Use of EPCs derived from field-collected tissue presents a more realistic representation of bioaccumulation in higher trophic level game species at Sparrows Point because many aquatic organisms are mobile and may spend time feeding in other parts of Bear Creek, the Patapsco River, Baltimore Harbor, or the Chesapeake Bay.

Doses are calculated based on direct ingestion of sediment, ingestion of surface water, and ingestion of aquatic organisms as food (**Appendix G**). Reasonable maximum scenario doses are presented side-by-side with both NOAEL and LOAEL TRVs in **Table 9-29** for birds and **Table 9-30** for mammals. These tables include one set of results assuming prey uptake of chemicals from crab and one set of results assuming prey uptake from fish. Chemicals with doses exceeding their NOAEL-based HQs are listed below. Chemicals with doses also exceeding LOAELs are bolded with an asterisk.

Chemicals with reasonable maximum exposure scenario doses exceeding TRVs for Great Blue Heron

Prey: Crabs	Prey: Fish
• None	• None

Chemicals with reasonable maximum exposure scenario doses exceeding TRVs for Raccoon

Prey: Crabs	Prey: Fish
• Chromium (3.46)	• Chromium (3.47)
• Total PCBs (ND=RL) (4.76)	• **Selenium (2.35) ***
	• Total PCBs (ND=RL) (10.7)

Doses did not exceed TRVs for birds. When reasonable maximum exposure scenario doses are compared to benchmarks, chromium and total PCBs, exceed NOAEL-based TRVs for raccoon under the crab uptake scenario, and chromium, selenium, and total PCBs exceed under the fish uptake scenario.

When LOAEL TRVs are considered, the dose for selenium exceeded for raccoon under the fish prey uptake scenario.

9.5.2.5 Measurement Endpoint: Qualitative Evaluation of Bioavailability

Evaluation of bioavailability information for the offshore area is included as a measurement endpoint because, as discussed in Section 9.3, TRVs may overestimate risks because they do not incorporate consideration of site-specific bioavailability from sediment. As discussed in Section 9.5.1.3.1, the SEM/AVS ratios in sediment samples from the SWTM grouping indicate that metals in sediment may be bound to sulfides that decrease their bioavailability and toxicity in a majority of samples. This bears relevance for wildlife food web modeling, especially where a precautionary default factor of 1 is assumed for bioaccumulation of chemicals into prey item tissue. If metals are bound to sulfides in sediment, their potential to bioaccumulate would be limited. This measurement endpoint indicates that the potential for risks associated with these metals in sediment may be over-estimated.

Concentrations of metals in tissue were typically less than 1 percent of sediment concentrations on a wet weight tissue to dry weight sediment basis based on site-specific uptake. While sediment metals, PAHs, and PCBs appear to be somewhat bioavailable based on uptake and tissue studies, the metal BAFs derived from the laboratory bioaccumulation studies of Sparrows Point sediments are lower, sometimes an order of magnitude, than commonly used reference BAFs (*i.e., Bechtel Jacobs 1998*). Additionally, the SEM/AVS data indicate that metal bioavailability may be over-estimated.

9.5.2.6 Risk Characterization for Wildlife in the Southwest/Tin Mill Canal Effluent Grouping

The risk characterization for wildlife draws from five measurement endpoints to derive conclusions regarding the potential for risks. The results for each measurement endpoint are discussed and weighed as evidence to determine whether chemicals in the Phase I area are expected to pose potential risk to wildlife. Within these measurement endpoints, bioaccumulation to wildlife from consumption of two different types of prey—crabs, and fish—were considered, as well as consumption of sediment and water.

The first measurement endpoint—benchmark comparisons using screening level doses with tissue concentrations from BAFs—provides a precautionary initial estimate of risks under worst case exposures in which a receptor is constantly exposed to the highest concentrations detected onsite. Use of BAFs to estimate transfer from sediment and water into tissue provides a strong indicator of the Site's potential contributions to the food chain from environmental media within the SWTM grouping. NOAEL benchmarks are most precautionary, while LOAEL benchmarks provide a more definite indicator of risks. For this measurement endpoint, screening level scenario doses (based on maximum detected sediment and water concentrations) of 7 metals, total HMW PAHs, total PAHs, total PCBs, and bis(2-ethylhexyl)phthalate exceed NOAEL-based TRVs under the crab prey scenario. The 7 metals are antimony, arsenic, beryllium, chromium, selenium, thallium, and zinc. Doses of chromium, total PAHs, and total PCBs exceed NOAEL-based TRVs for the fish uptake scenario.

When LOAEL TRVs are considered, screening level scenario doses for three metals (arsenic, beryllium, and selenium), total PAHs, and total PCBs exceed under the crab uptake scenario. In addition to the TRV exceedances, there is the potential for risk from oil and grease, which may cause physical impacts associated with fouling wildlife and decreasing their supply of prey.

The second measurement endpoint—benchmark comparisons using screening level doses with tissue concentrations from field-collected crab and fish tissue—provides the most realistic precautionary initial estimate of risks under worst case exposures in which a receptor is constantly exposed to the highest concentrations detected in the grouping. Use of actual tissue concentrations from specimens in the vicinity of the Site provides an indication of whether contributions from the area translate into increased exposures across wild populations. Where tissue data were not available for a COPC, overall findings were based on literature-based BAFs. NOAEL benchmarks are most precautionary, while LOAEL benchmarks provide a more definite indicator of risks. For this endpoint, screening level scenario doses (based on maximum detected sediment and water concentrations) of three metals (chromium, selenium, and thallium), and total PCBs exceed NOAEL based TRVs under the crab scenario. Doses for two metals (chromium and selenium) and total PCBs exceed NOAEL-based TRVs under the fish uptake scenario. When LOAEL TRVs are considered, the screening level scenario dose of selenium under the fish uptake scenario exceeds.

The third measurement endpoint—benchmark comparisons using reasonable maximum exposure scenario doses with tissue concentrations based on BAFs—provides a more realistic indicator of risks to wildlife because it characterizes exposures throughout the grouping rather than worst case exposures. Using BAFs, reasonable maximum exposure scenario doses of five metals (antimony, arsenic, chromium, selenium, and zinc), total PCBs, total HMW PAHs, total PAHs, and bis(2-ethylhexyl)phthalate exceed NOAEL-based TRVs under the crab uptake scenario, while chromium exceeds NOAEL based TRVs under the fish uptake scenario. When LOAEL TRVs are considered, doses for selenium and total PCBs exceed under the crab prey scenario and no doses exceed under the fish prey scenario. Reasonable maximum exposure scenario results are considered more relevant than screening level scenario results to characterization of risks to wildlife.

The fourth measurement endpoint—benchmark comparisons using reasonable maximum exposure scenario doses with tissue concentrations based on field-collected crab and fish tissue—provides a more realistic indicator of risks to wildlife because it characterizes exposures throughout the grouping rather than worst case exposures. Using tissue concentrations, reasonable maximum exposure scenario doses of chromium and total PCBs exceed NOAEL-based TRVs under the crab uptake scenario, while chromium, selenium, and total PCBs exceed under fish uptake scenario. When LOAEL TRVs are considered, doses for selenium under the fish uptake scenario exceed LOAELs.

The fifth measurement endpoint is consideration of chemical bioavailability. As described in Section 9.5.1.3.2, laboratory bioaccumulation tests provide evidence that chemicals in sediment

are bioavailable and may be taken up into prey tissue. BAFs and tissue data provide site-specific estimates of bioaccumulation that were used in exposure models. Results of exposure models based on ingestion of fish and crab produced fewer exceedances than exposure models based on ingestion of benthos. This indicates that wildlife exposures are greater when wildlife ingest benthos than fish and crab. SEM/AVS data indicate that not all of the metal present in sediment is available for uptake and direct exposure; this indicates that risks from direct exposure to sediment may be over-estimated.

Taken together, these lines of evidence indicate selenium and total PCBs are the COCs for the Phase I area SWTM grouping based on reasonable maximum exposure scenario dose exceedances of LOAEL-based TRVs. Doses for selenium exceed LOAEL-based TRVs when EPCs are derived from both BAFs and field-collected tissue, while total PCBs exceed LOAEL-based TRVs only when EPCs are derived from BAFs. While doses for antimony, arsenic, beryllium, chromium, thallium, zinc, total HMW PAHs, total PAHs, and bis(2-ethylhexyl)phthalate demonstrate HQs greater than 1 when the screening level exposure scenario dose is compared to NOAEL-based TRVs, these are not considered COCs because the screening level exposure scenario considers worst case exposures in which a receptor is constantly exposed to the highest concentrations detected onsite and is therefore not representative of actual site conditions.

The finding of the ERA is that wildlife which consume aquatic and benthic organisms are potentially at risk from selenium and total PCBs in sediment in the SWTM grouping. However, SEM/AVS data indicate that not all of the metal present in sediment is available for uptake and direct exposure; this indicates that risks from direct exposure to sediment may be over-estimated. Wildlife are also at risk from oil and grease. Conclusions are synthesized and used as the basis for recommendations in Chapter 11. There are a number of uncertainties associated with the risk assessment that are discussed in Section 9.6.

9.6 UNCERTAINTY ANALYSIS

ERAs conducted under USEPA guidance for contaminated sites involve a number of uncertainties (USEPA 1997a). These uncertainties must be taken into consideration when interpreting risk characterization results. The following sections discuss uncertainties associated with the ERA for the Phase I area, and how these uncertainties may affect interpretation.

9.6.1 Scope and the CSM

Several uncertainties are associated with the scope of the ERA and the ecological CSM. The ERA is designed to evaluate potential risks under existing conditions in the Phase I area. The risk assessment focuses on surface sediments (up to 2 ft in depth) and surface water because these are the most likely exposure media for ecological receptors. However, the Site Assessment (EA 2009) found higher concentrations of some metals and PAHs in offshore subsurface sediments than in surface sediments. The risk assessment does not evaluate future hypothetical

risks that could occur if erosion or mixing changes the distribution of constituent concentrations in the sediment profile. If higher constituent concentrations in the subsurface are exposed, risks would be expected to increase.

The ERA concludes that COPCs in the NNS grouping area are not present in concentrations that pose a risk to wildlife; however, Site-related COPCs in sediment may pose risks to benthic organisms. It is important to note that the risk assessment for the NNS included only Site-related COPCs for each sediment and pore water sampling transect. Since there is no clear evidence of historical impacts in the sample results for the NNS grouping, constituents potentially derived from current inputs via groundwater/pore water and stormwater were the focus of the risk assessment for this grouping. Therefore, not all constituents included in the risk assessment for the SWTM grouping were included in the risk assessment for the NNS grouping.

There are also uncertainties associated in differences between the area of concern selected for evaluation in the assessment and the home ranges of ecological receptors. Heron, raccoon, and represented wildlife may have home ranges larger than the Phase I area. The risk assessment assumes that these receptors receive all of their food and ingested media from the offshore area. In actuality, wildlife may receive inputs from other nearby areas. Depending on the inputs received from other nearby sources, total risks to receptors may be either over or underestimated. Data from fish and crabs collected from the nearby Coke Point Offshore Area (EA 2011b) help diminish this uncertainty because these are mobile receptors and because these are likely prey species for wildlife; there is some uncertainty associated with field collected tissue since it is not known what percentage of the time specimens were present at the Site.

9.6.2 Data Used in the Risk Assessment

There are uncertainties associated with the data set used in the ERA. Constituent concentrations in environmental media may vary over space and time. If this variation occurs over small scales, it is possible that the data set over- or under-estimates overall concentrations.

As described in Chapter 7, the surface water EPCs were derived from a numerical model which used stormwater and pore water concentrations as inputs to Bear Creek surface water. The model was not calibrated using measured surface water concentrations, because the objective of the modeling was to determine surface water concentrations derived from Site-related inputs. Many conservative assumptions were made in constructing the model, as described in Chapter 7, and these likely resulted in overestimation of the constituent concentrations in surface water resulting from Site-related inputs. Conversely, the model did not include constituents from other potential sources, which could also affect ecological receptors.

Use of tissue data from laboratory bioaccumulation studies (EA 2011b) reduces the potential uncertainty associated with food web exposure models used in the risk assessment when compared to use of literature-based BAFs. However, there are some uncertainties associated with these data. Laboratory bioaccumulation tests are conducted in a controlled environment.

Because lab bioaccumulation test conditions may differ from those experienced by aquatic organisms in the field, bioaccumulation may differ and thus be over-estimated or under-estimated by laboratory bioaccumulation test results. To minimize this uncertainty, the sediment used for laboratory bioaccumulation tests was carefully selected to represent site-wide conditions as closely as possible, and standard test methods were used which utilize organisms and parameters representative of a range of situations. There are also uncertainties associated with field-collection of fish and crabs for tissue. Collection of tissue in a single event may not account for variability in concentrations over long periods of time due to seasonal variation, migration, or changing site conditions. This may result in over- or under- estimation of risks. To minimize these uncertainties, a large number of individual specimens were collected and composited using sampling criteria that help minimize the impacts of variation.

9.6.3 Exposure and Toxicity Assessment

The selection of exposure and toxicity data for inclusion in the ERA involves a number of uncertainties. Actual exposure factors and toxic responses for ecological receptors vary. The risk assessment mitigates for uncertainty associated with this variability by utilizing technically defensible values provided by guidance, scientific literature, and field/laboratory collected tissue data. Where necessary, statistical analyses are used to summarize a range of exposure and toxicity data to provide a single value for use in the ERA. In cases where estimation is necessary, values are selected with precaution to further mitigate uncertainty. In cases where no data are available for a constituent, exposure or toxicity data for chemicals with similar structures and expected modes of toxicity are substituted as surrogates. Where surrogate data are not available for exposure factors, conservative default values consistent with standard practices are utilized.

Surface water ingestion by wildlife is a source of uncertainty. Surface water ingestion rates are based on USEPA guidance (USEPA 1993), which provides rates based on estimated metabolic requirements for consumption of water. However, while wildlife are likely to consume some water while swimming (for mammals) or grooming and feeding (birds and mammals), they are unlikely to intentionally consume brackish water such as that of the Bear Creek for metabolic purposes. No rates are available for incidental ingestion of water; therefore, available values are used unchanged as a precaution. These surface water ingestion rates provide conservative overestimates of exposure. Based on the rates and body masses provided in **Table 9-6,** the ingestion rates used in the assessment equate to ingestion of 107 milliliters (mL) per day (1/3 to 1/5 cup) of water per day for heron, and 564 mL per day (2.4 to 2.5 cups) of water per day for raccoon.

Area use by wildlife is a source of uncertainty. The Phase I area provides little upland habitat to support nearby foraging for wildlife, and offshore area may provide limited habitat for foraging. Additionally, the NNS and SWTM groupings do not represent clearly defined exposure areas, but rather were selected to reflect the differentiation in risk assessment objectives and nature and

extent of contamination. Thus, the assumption that wildlife use one grouping within the Phase I area 100 percent of the time is likely an over-estimate and could lead to over-estimation of risks.

In some cases, toxicity data are unavailable for specific chemicals, and no surrogates are found appropriate. In such cases, risks from these chemicals cannot be quantitatively evaluated. The potential for risks from these chemicals is identified as an uncertainty. Also, some of the benchmarks used in the ERA for metals may be inherently conservative because they utilize bioavailable, more toxic forms of metals that may not be present at the site.

9.6.4 Risk Characterization

There are uncertainties associated with the overall characterization of risks in the ERA. One apparent uncertainty results from the extrapolation of assumptions about the potential for adverse effects from individual organisms to populations. The intent of this ERA, as set forth in the assessment endpoints, is to ultimately evaluate risks to populations. However, for wildlife, the models perform calculations concerning the potential for adverse effects to individual organisms. Few methods are available to extrapolate the potential for adverse effects from the individual level to the population level. It is generally assumed that if there is no potential for direct adverse effects to individual organisms then it is also unlikely for there to be the potential for direct adverse effects to populations. Similarly, it is assumed that if there is the potential for adverse effects to individual organisms there is also the potential for adverse effects to populations. However, there is uncertainty associated with the assumption that potential impacts at the individual level will impact the populations in the surrounding ecosystem.

9.7 CONCLUSIONS OF THE ECOLOGICAL RISK ASSESSMENT

The risk characterization for aquatic and benthic organisms draws from measurement endpoints to derive conclusions regarding the potential for risks. The results for each measurement endpoint were discussed and weighed as evidence to determine whether chemicals in the Phase I area are expected to pose potential risk to aquatic and benthic organisms. Conclusions of the risk assessment are drawn from reasonable maximum exposure scenario doses, as these doses represent the most realistic exposure scenario for receptors within each grouping in the Phase I area.

The finding of the ERA for the NNS grouping is that aquatic and benthic organisms are potentially at risk from chromium and zinc from sediment based on comparison to PELs and cyanide from surface water only during storm events based on comparison to acute and chronic TRVs at the NNS grouping. It should be noted that based on SEM/AVS data, metal bioavailability may be over-estimated.

The finding of the ERA for the SWTM grouping is that aquatic and benthic organisms are potentially at risk from cadmium, chromium, copper, lead, nickel, silver, zinc, HMW and LMW PAHs, total PAHs, PCBs, and bis(2-ethylhexyl)phthalate in sediment based on comparison to

PELs and cyanide in surface water only during storm events. It should be noted that based on SEM/AVS data, metal bioavailability may be over-estimated. Benthic organisms are likely also at risk from oil and grease in the SWTM grouping.

The risk characterization for wildlife draws from measurement endpoints to derive conclusions regarding the potential for risks. The results for each measurement endpoint were discussed and weighed as evidence to determine whether chemicals in the Phase I area are expected to pose potential risk to wildlife. Conclusions of the risk assessment are drawn from reasonable maximum exposure scenario doses, as these doses represent the most realistic exposure scenario for receptors within each grouping in the Phase I area.

The lines of evidence suggest that that the Site-related COPCs identified based on groundwater and stormwater screening in the NNS grouping area are not present at concentrations that pose a risk to wildlife. However, as discussed above, COPCs in sediment may pose risks to benthic organisms. It is important to note that the risk assessment for the NNS included only Site-related COPCs for each sediment and pore water sampling transect. Because current inputs via groundwater/pore water and stormwater were the focus of the risk assessment for the NNS grouping, not all constituents included in the risk assessment for the SWTM grouping were included in the risk assessment for the NNS grouping. Therefore, the ERA concludes that aquatic and benthic organisms are potentially at risk from chromium and zinc from sediment and cyanide from surface water only during storm events and wildlife in the NNS grouping are not at risk from the Site-related COPCs, derived from the adjacent onshore areas, in sediment and surface water.

In the SWTM grouping, lines of evidence indicate selenium and total PCBs are the COCs based on reasonable maximum exposure scenario dose exceedances of LOAEL-based TRVs. However, doses for total PCBs only exceed when EPCs are derived from BAFs; doses from EPCs derived from field-collected tissue fall below LOAEL-based TRVs. Doses for selenium exceed LOAEL-based TRVs when EPCs are derived from both BAFs and field-collected tissue. Doses from tissue are considered to best represent realistic conditions in the Phase I area, as these concentrations are based on actual data from field-collected crabs and fish. Although the potential risk from chemicals is based on tissue concentrations, it is important to note that since doses of total PCBs exceed LOAEL-based TRVs when BAFs are used, it is likely that media in this grouping are contributing these constituents to the food chain. Also, oil and grease were identified as likely to pose risks in the SWTM grouping because of their potential physical effects on wildlife. The overall conclusions for the SWTM grouping are that aquatic and benthic organisms are potentially at risk from metals, PAHs, PCBs, and bis(2-ethylhexyl)phthalate in sediment and cyanide from surface water only during storm events, and that wildlife that consume aquatic and benthic organisms are potentially at risk from selenium and total PCBs in sediment.

Table 9-1
Detection Comparison to Screening Levels
Sparrows Point Northeast/Near-Shore

Chemical[A]	Sediment (mg/kg)				Surface Water - Modeled (µg/L)				COPC?
	Frequency	Screening Level EPC (mg/kg)	Reasonable Maximum (95% UCLM) EPC (mg/kg)[B]	Screening Criteria (mg/kg)[C]	Screening Level (Maximum) EPC-Non-Storm Conditions (µg/L)	Reasonable Maximum (weighted average) EPC-Non-Storm Conditions (µg/L)[D]	Screening Level (Maximum) EPC-Storm Conditions (µg/L)	Screening Criteria (µg/L)	
Inorganics									
Cadmium	5/5	4.80E+00	4.80E+00	6.80E-01	0.00E+00	0.00E+00	0.00E+00	1.20E-01	YES
Chromium	2/2	7.50E+02	7.50E+02	5.23E+01	6.71E-01	2.16E-01	4.26E+00	5.75E+01	YES
Copper	13/13	1.60E+02	9.38E+01	1.87E+01	6.41E-01	2.48E-01	2.57E+00	3.10E+00	YES
Cyanide (Total)	7/8	1.60E+00	8.25E-01	1.00E-01	2.52E+00	9.30E-01	2.37E+01	1.00E+00	YES
Lead	8/8	1.10E+02	7.41E+01	3.02E+01	4.40E-01	9.80E-02	4.47E-01	8.10E+00	YES
Mercury	3/3	4.20E-01	4.20E-01	1.80E-01	6.63E-01	1.54E-01	6.64E-01	1.60E-02	YES
Nickel	13/13	4.60E+01	3.79E+01	1.59E+01	3.77E+00	1.34E+00	4.09E+00	8.20E+00	YES
Silver	5/5	1.70E+00	1.70E+00	7.30E-01	0.00E+00	0.00E+00	0.00E+00	2.30E-01	YES
Zinc	13/13	1.55E+03	1.03E+03	1.24E+02	1.25E+01	4.41E+00	4.60E+01	8.10E+01	YES
PAHs									
Total LMW PAH (ND=RL)	8/8	1.69E+00	1.32E+00	3.12E-01	3.12E-01	1.23E-01	3.79E-01	NA	YES
Total HMW PAH (ND=RL)	8/8	3.08E+00	3.08E+00	6.55E-01	5.10E-02	1.15E-02	5.10E-02	NA	YES
Total PAH (ND=RL)	8/8	4.77E+00	4.77E+00	2.90E+00	3.63E-01	1.34E-01	4.30E-01	NA	YES
SVOCs									
Bis(2-ethylhexyl)phthalate	9/16	1.60E+00	5.45E-01	1.82E-01	1.00E-01	3.17E-02	1.04E+00	1.60E+01	YES

A-Only analytes identified based on the groundwater/porewater/stormwater screen for source-relatedness were included in the risk assessment per direction from USEPA and MDE as described in Section 9.2 .

B-For analytes with insufficient sample number to calculate a 95% UCLM, the maximum concentration was used as the best available predictor of the 95% UCLM.

C-Screening criteria are the lower value of either the freshwater or marine USEPA Region III BTAG screening values (USEPA Region III 2006)

D-For some analytes, surface water concentrations were not selected for modeling based on the source-relatedness screen performed at the direction of USEPA as described in Section 3.0.

COPC=Chemical of Potential Concern
EPC=Exposure Point Concentration
HMW = High Molecular Weight
LMW= Low Molecular Weight
NA= Not Applicable
ND= Non-detect
PAH= Polycyclic Aromatic Hydrocarbon
RL= Reporting Limit
SVOC= Semi-volatile Organic Compound
UCLM=Upper Confidence Limit of the Mean

Table 9-2
Detection Comparison to Screening Levels
Sparrows Point Southwest/Tin Mill Canal Effluent

Chemical	Sediment (mg/kg)				Surface Water - Modeled (µg/L)				COPC?
	Frequency of detection	Screening Level EPC (mg/kg)	Reasonable Maximum (95% UCLM) EPC (mg/kg)[A]	Screening Criteria (mg/kg)[B]	Screening Level (Maximum) EPC- Non-Storm Conditions (µg/L)	Reasonable Maximum (weighted average) EPC- Non-Storm Conditions (µg/L)[C]	Screening Level (Maximum) EPC-Storm Conditions (µg/L)	Screening Criteria (µg/L)	
Inorganics									
Antimony	28/29	1.00E+01	5.64E+00	2.00E+00	3.29E-01	1.20E-01	5.88E-01	5.00E+02	YES
Arsenic	29/29	1.20E+02	4.79E+01	7.24E+00	9.60E-01	5.13E-01	1.03E+00	1.25E+01	YES
Beryllium	29/29	1.60E+00	8.68E-01	NA	0.00E+00	0.00E+00	0.00E+00	6.60E-01	YES
Cadmium	29/29	1.10E+02	3.04E+01	6.80E-01	0.00E+00	0.00E+00	0.00E+00	1.20E-01	YES
Chromium	29/29	4.60E+03	2.43E+03	5.23E+01	9.63E-01	2.57E-01	1.26E+00	5.75E+01	YES
Copper	29/29	5.50E+02	3.22E+02	1.87E+01	9.69E-01	2.99E-01	9.79E-01	3.10E+00	YES
Cyanide (Total)	28/29	3.50E+01	1.71E+01	1.00E-01	3.87E+00	1.15E+00	6.50E+00	1.00E+00	YES
Lead	29/29	1.10E+03	4.67E+02	3.02E+01	5.37E-01	7.99E-02	5.44E-01	8.10E+00	YES
Mercury	27/28	1.60E+00	8.27E-01	1.80E-01	3.25E-01	1.14E-01	3.28E-01	1.60E-02	YES
Nickel	29/29	2.10E+02	1.11E+02	1.59E+01	5.80E+00	1.68E+00	5.81E+00	8.20E+00	YES
Selenium	24/29	1.70E+01	8.83E+00	2.00E+00	0.00E+00	0.00E+00	7.48E-02	7.10E+01	YES
Silver	29/29	8.10E+00	3.87E+00	7.30E-01	0.00E+00	0.00E+00	0.00E+00	2.30E-01	YES
Thallium	29/29	9.80E-01	5.23E-01	NA	0.00E+00	0.00E+00	0.00E+00	2.13E+01	YES
Zinc	29/29	1.70E+04	6.68E+03	1.24E+02	1.93E+01	5.56E+00	1.94E+01	8.10E+01	YES
PAHs									
Total LMW PAH (ND=RL)	29/29	4.52E+01	1.86E+01	3.12E-01	4.72E-01	1.30E-01	4.74E-01	NA	YES
Total HMW PAH (ND=RL)	29/29	3.92E+01	2.11E+01	6.55E-01	2.32E-02	8.43E-03	2.35E-02	NA	YES
Total PAH (ND=RL)	29/29	8.17E+01	3.93E+01	2.90E+00	4.95E-01	1.38E-01	4.98E-01	NA	YES
PCBs									
Aroclor-1248	28/28	9.00E+00	3.58E+00	NA	0.00E+00	0.00E+00	0.00E+00	7.40E-05	YES
Aroclor-1254	20/28	3.20E+00	1.24E+00	6.33E-02	0.00E+00	0.00E+00	0.00E+00	7.40E-05	YES
Aroclor-1260	23/28	2.00E+00	6.57E-01	NA	0.00E+00	0.00E+00	0.00E+00	7.40E-05	YES
Total PCBs (ND=0)	28/28	1.32E+01	3.40E+00	4.00E-02	0.00E+00	0.00E+00	0.00E+00	7.40E-05	YES
Total PCBs (ND=RL)	28/28	1.39E+01	3.53E+00	4.00E-02	0.00E+00	0.00E+00	0.00E+00	7.40E-05	YES
SVOCs									
2,4-Dimethylphenol	1/28	5.90E-02	5.90E-02	2.90E-02	0.00E+00	0.00E+00	1.84E-01	NA	YES
4-Nitrophenol	1/28	3.60E+00	3.60E+00	NA	0.00E+00	0.00E+00	0.00E+00	7.17E+01	YES
Benzoic Acid	3/28	1.40E+00	1.40E+00	6.50E-01	0.00E+00	0.00E+00	0.00E+00	4.20E+01	YES
Bis(2-ethylhexyl)phthalate	26/29	5.10E+01	1.88E+01	1.82E-01	7.33E-02	2.57E-02	2.61E-01	1.60E+01	YES
Butyl benzyl phthalate	2/28	1.80E-01	1.80E-01	1.68E+01	0.00E+00	0.00E+00	0.00E+00	2.94E+01	NO
Phenol	9/28	3.90E-01	1.90E-01	4.20E-01	0.00E+00	0.00E+00	0.00E+00	5.80E+01	NO

Table 9-2
Detection Comparison to Screening Levels
Sparrows Point Southwest/Tin Mill Canal Effluent

Chemical	Sediment (mg/kg)				Surface Water - Modeled (µg/L)				COPC?
	Frequency of detection	Screening Level EPC (mg/kg)	Reasonable Maximum (95% UCLM) EPC (mg/kg)[A]	Screening Criteria (mg/kg)[B]	Screening Level (Maximum) EPC- Non-Storm Conditions (µg/L)	Reasonable Maximum (weighted average) EPC- Non-Storm Conditions (µg/L)[C]	Screening Level (Maximum) EPC-Storm Conditions (µg/L)	Screening Criteria (µg/L)	
VOCs									
1,2-Dichlorobenzene	4/28	1.80E-01	3.67E-02	9.89E-01	0.00E+00	0.00E+00	0.00E+00	ND	NO
1,3-Dichlorobenzene	5/28	1.30E-02	8.59E-03	8.42E-01	0.00E+00	0.00E+00	0.00E+00	ND	NO
1,4-Dichlorobenzene	7/28	2.80E-02	9.56E-03	4.60E-01	0.00E+00	0.00E+00	0.00E+00	ND	NO
Benzene	9/28	1.20E-02	7.05E-03	1.37E-01	0.00E+00	0.00E+00	0.00E+00	ND	NO
Chlorobenzene	12/28	2.50E-01	4.10E-02	1.62E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	YES
Ethylbenzene	9/28	8.90E-02	2.00E-02	3.05E-01	0.00E+00	0.00E+00	0.00E+00	ND	NO
Toluene	13/28	7.10E-02	1.89E-02	1.09E+00	0.00E+00	0.00E+00	0.00E+00	ND	NO

A-For analytes with insufficient sample number to calculate a 95% UCLM, the maximum concentration was used as the best available predictor of the 95% UCLM.

B-Screening criteria are the lower value of either the freshwater or marine USEPA Region III BTAG screening values (USEPA Region III 2006).

C-For some analytes, surface water concentrations were not selected for modeling based on the source-relatedness screen performed at the direction of USEPA as described in Section 3.0.

COPC=Chemical of Potential Concern
EPC=Exposure Point Concentration
HMW = High Molecular Weight
LMW = Low Molecular Weight
NA = Not Applicable
ND = Non-detect
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated biphenyl
RL = Reporting Limit
SVOC = Semi-volatile Organic Compound
UCLM=Upper Confidence Limit of the Mean
VOC = Volatile Organic Compound

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TABLE 9-3
MEASUREMENT ENDPOINTS FOR ECOLOGICAL RISK ASSESSMENT FOR THE SPARROWS POINT SITE

Assessment Endpoint	Measurement Endpoint	On Site-Measurements/Exposure Point Concentrations (EPC)	Evaluation Method	Risk Indicators
Receptor-Specific Evaluation (SLERA & BRAPF)				
Viability of aquatic and benthic organism communities • Fish • Crustaceans • Algae	Comparison of sediment and surface water concentrations to toxological benchmarks	• Sediment concentrations measured at site, and modeled surface water concentrations - Screening Level Concentrations - Reasonable Maximum concentrations and concentrations on a sample by sample basis	• Direct comparison to aquatic organism benchmarks from literature-based studies • Direct comparison to NRWQCs • Qualitative evaluation of oil and grease in sediment	• Exceedence of benchmarks indicates potential for risks • Exceedence of benchmarks indicates a site related potential for risks
	Evaluation of bioavailability	• Sediment concentrations measured at site, and modeled surface water concentrations	• Measure the potential for metals to bind using the ratio of simultaneously extracted metals (SEM) to acid volatile sulfides (AVS) • Measure uptake into clam and worm tissue in bioassays and into fish and crab tissue in the field	• SEM/AVS ratios of less than 1.0 are an indicator that metals are bound and unlikely to be bioavailable to organisms
Viability of wildlife communities • Piscivorous mammals and birds	Comparison of modeled food web doses to benchmarks • Great Blue Heron • Raccoon	Tissue concentrations from bioassays and field collected organisms from Coke Point Offshore Investigation: • Using a precautionary screening level scenario • Using a reasonable maximum scenario	• Compare modeled wildlife doses to no-effects benchmarks • Compare modeled wildlife doses to low-effects benchmarks • Dose-based benchmarks from 1) USEPA EcoSSL Methodology 2) ORNL benchmarks (Sample et al., 1996) 3) Additional literatue-based sources as relevant • Qualitative evaluation of oil and grease in sediment	• Exceedence of no-effects benchmarks indicates a potential for risks • Exceedence of low-effects benchmarks indicates a more certain potential for risks
	Evaluation of bioavailability	• Sediment concentrations measured at site	• Measure the potential for metals to bind using the ratio of SEM to AVS • Measure uptake into clam and worm tissue in bioassays and into fish and crab tissue in the field	• SEM/AVS ratios of less than 1.0 are an indicator that metals are bound and unlikely to be bioavailable to organisms

BRAPF: Baseline Risk Assessment Problem Formulation
EcoSSL= Ecological Soil Screening Level
NRWQC: National Recommended Water Quality Criteria
ORNL: Oak Ridge National Laboratory
SLERA: Screening Level Ecological Risk Assessment
TRVs: Toxicity Reference Value
USEPA: U.S. Environmental Protection Agency

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Table 9-4
Frequency of Detection and Exposure Point Concentrations
Sparrows Point Northeast/Near-Shore

Chemical	Surface Water (Modeled Concentration)				Sediment			Crab Tissue		Whole Body Fish Tissue	
	Frequency of Detection	Screening Level (Maximum) EPC-Non-Storm Conditions (µg/L)	Reasonable Maximum (weighted average) EPC-Non-Storm Conditions (µg/L)	Screening Level (Maximum) EPC-Storm Conditions (µg/L)	Frequency of Detection	Screening Level EPC (mg/kg)	Reasonable Maximum (95% UCLM) EPC (mg/kg)	Frequency of Detection	Maximum EPC (mg/kg)	Frequency of Detection	Maximum EPC (mg/kg)
Inorganics											
Cadmium	NA	0.00E+00	0.00E+00	0.00E+00	5/5	4.80E+00	4.80E+00	5/5	1.58E-01	ND	0.00E+00
Chromium	NA	6.71E-01	2.16E-01	4.26E+00	2/2	7.50E+02	7.50E+02	3.4/5	2.39E-01	5/5	3.60E-01
Copper	NA	6.41E-01	2.48E-01	2.57E+00	13/13	1.60E+02	9.38E+01	5/5	1.25E+01	5/5	3.41E+01
Cyanide (Total)	NA	2.52E+00	9.30E-01	2.37E+01	7/8	1.60E+00	8.25E-01	ND	0.00E+00	ND	0.00E+00
Lead	NA	4.40E-01	9.80E-02	4.47E-01	8/8	1.10E+02	7.41E+01	5/5	1.71E-01	5/5	7.80E-01
Mercury	NA	6.63E-01	1.54E-01	6.64E-01	3/3	4.20E-01	4.20E-01	4.3/5	2.10E-02	5/5	3.40E-02
Nickel	NA	3.77E+00	1.34E+00	4.09E+00	13/13	4.60E+01	3.79E+01	5/5	1.95E-01	5/5	1.50E-01
Silver	NA	0.00E+00	0.00E+00	0.00E+00	5/5	1.70E+00	1.70E+00	5/5	3.61E-01	5/5	4.90E-01
Zinc	NA	1.25E+01	4.41E+00	4.60E+01	13/13	1.55E+03	1.03E+03	5/5	4.59E+01	5/5	3.21E+01
PAHs											
Total LMW PAH (ND=RL)	NA	3.12E-01	1.23E-01	3.79E-01	8/8	1.69E+00	1.32E+00	4.19/5	2.59E-01	5/5	1.78E-01
Total HMW PAH (ND=RL)	NA	5.10E-02	1.15E-02	5.10E-02	8/8	3.08E+00	3.08E+00	2.37/5	2.27E-01	2/5	1.33E-01
Total PAH (ND=RL)	NA	3.63E-01	1.34E-01	4.30E-01	8/8	4.77E+00	4.77E+00	4.19/5	5.44E-01	5/5	3.11E-01
SVOCs											
Bis(2-ethylhexyl)phthalate	NA	1.00E-01	3.17E-02	1.04E+00	9/16	1.60E+00	5.45E-01	ND	0.00E+00	ND	0.00E+00

A-Crab frequency of detection is a mass-weighted average based on the combined detection of chemicals in the meat and mustard of crab samples.

EPC=Exposure Point Concentration
HMW= High Molecular Weight
LMW= Low Molecular Weight
NA= Not Applicable
ND= Non-detect
PAH = Polycyclic Aromatic Hydrocarbon
RL= Reporting Limit
SVOC= Semi-volatile Organic Compound
UCLM=Upper Confidence Limit of the Mean

Table 9-5
Frequency of Detection and Exposure Point Concentrations
Sparrows Point Southwest/Tin Mill Canal Effluent

Analyte	Sediment			Surface Water (Modeled Concentration)			Crab Tissue		Whole Body Fish Tissue	
	Frequency	Screening Level EPC (mg/kg)	Reasonable Maximum (95% UCLM) EPC (mg/kg)	Screening Level (Maximum) EPC-Non-Storm Conditions (µg/L)	Reasonable Maximum (weighted average) EPC-Non-Storm Conditions (µg/L)	Screening Level (Maximum) EPC-Storm Conditions (µg/L)	Frequency[A]	Maximum EPC (mg/kg)	Frequency	Maximum EPC (mg/kg)
Inorganics										
Antimony	28/29	1.00E+01	5.64E+00	3.29E-01	1.20E-01	5.88E-01	5/5	3.91E-02	5/5	8.30E-02
Arsenic	29/29	1.20E+02	4.79E+01	9.60E-01	5.13E-01	1.03E+00	5/5	1.24E+00	5/5	7.00E-01
Beryllium	29/29	1.60E+00	8.68E-01	0.00E+00	0.00E+00	0.00E+00	ND	0.00E+00	ND	0.00E+00
Cadmium	29/29	1.10E+02	3.04E+01	0.00E+00	0.00E+00	0.00E+00	5/5	1.58E-01	ND	0.00E+00
Chromium	29/29	4.60E+03	2.43E+03	9.63E-01	2.57E-01	1.26E+00	3.4/5	2.39E-01	5/5	3.60E-01
Copper	29/29	5.50E+02	3.22E+02	9.69E-01	2.99E-01	9.79E-01	5/5	1.25E+01	5/5	3.41E+01
Cyanide (Total)	28/29	3.50E+01	1.71E+01	3.87E+00	1.15E+00	6.50E+00	ND	0.00E+00	ND	0.00E+00
Lead	29/29	1.10E+03	4.67E+02	5.37E-01	7.99E-02	5.44E-01	5/5	1.71E-01	5/5	7.80E-01
Mercury	27/28	1.60E+00	8.27E-01	3.25E-01	1.14E-01	3.28E-01	4.3/5	2.10E-02	5/5	3.40E-02
Nickel	29/29	2.10E+02	1.11E+02	5.80E+00	1.68E+00	5.81E+00	5/5	1.95E-01	5/5	1.50E-01
Selenium	24/29	1.70E+01	8.83E+00	0.00E+00	0.00E+00	7.48E-02	5/5	1.07E+00	5/5	1.80E+00
Silver	29/29	8.10E+00	3.87E+00	0.00E+00	0.00E+00	0.00E+00	5/5	3.61E-01	5/5	4.90E-01
Thallium	29/29	9.80E-01	5.23E-01	0.00E+00	0.00E+00	0.00E+00	0.56/5	4.69E-02	2/5	4.40E-02
Zinc	29/29	1.70E+04	6.68E+03	1.93E+01	5.56E+00	1.94E+01	5/5	4.59E+01	5/5	3.21E+01
PAHs										
Total LMW PAH (ND=RL)	29/29	4.52E+01	1.86E+01	4.72E-01	1.30E-01	4.74E-01	4.19/5	2.59E-01	5/5	1.78E-01
Total HMW PAH (ND=RL)	29/29	3.92E+01	2.11E+01	2.32E-02	8.43E-03	2.35E-02	2.37/5	2.27E-01	2/5	1.33E-01
Total PAH (ND=RL)	29/29	8.17E+01	3.93E+01	4.95E-01	1.38E-01	4.98E-01	4.19/5	5.44E-01	5/5	3.11E-01
PCBs										
Aroclor-1248	28/28	9.00E+00	3.58E+00	0.00E+00	0.00E+00	0.00E+00	ND	0.00E+00	ND	0.00E+00
Aroclor-1254	20/28	3.20E+00	1.24E+00	0.00E+00	0.00E+00	0.00E+00	ND	0.00E+00	ND	0.00E+00
Aroclor-1260	23/28	2.00E+00	6.57E-01	0.00E+00	0.00E+00	0.00E+00	ND	0.00E+00	ND	0.00E+00
Total PCBs (ND=0)	28/28	1.32E+01	3.40E+00	0.00E+00	0.00E+00	0.00E+00	5/5	1.44E-01	5/5	5.37E-01
Total PCBs (ND=RL)	28/28	1.39E+01	3.53E+00	0.00E+00	0.00E+00	0.00E+00	5/5	2.10E-01	5/5	5.57E-01
SVOCs										
2,4-Dimethylphenol	1/28	5.90E-02	5.90E-02	0.00E+00	0.00E+00	1.84E-01	ND	0.00E+00	ND	0.00E+00
4-Nitrophenol	1/28	3.60E+00	3.60E+00	0.00E+00	0.00E+00	0.00E+00	ND	0.00E+00	ND	0.00E+00
Benzoic Acid	3/28	1.40E+00	1.40E+00	0.00E+00	0.00E+00	0.00E+00	ND	0.00E+00	ND	0.00E+00
Bis(2-ethylhexyl)phthalate	26/29	5.10E+01	1.88E+01	7.33E-02	2.57E-02	2.61E-01	ND	0.00E+00	ND	0.00E+00
VOCs										
Chlorobenzene	12/28	2.50E-01	4.10E-02	0.00E+00	0.00E+00	0.00E+00	ND	0.00E+00	ND	0.00E+00

A-Crab frequency of detection is a mass-weighted average based on the combined detection of chemicals in the meat and mustard of crab samples.

EPC=Exposure Point Concentration
HMW = High Molecular Weight
LMW = Low Molecular Weight
ND = Non-detect
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated biphenyl
RL = Reporting Limit
SVOC = Semi-volatile Organic Compound
UCLM=Upper Confidence Limit of the Mean
VOC = Volatile Organic Compound

TABLE 9-6
WILDLIFE EXPOSURE FACTORS FOR ECOLOGICAL RISK ASSESSMENT
FOR THE SPARROWS POINT SITE

Exposure Parameter	Value	Units	Notes
GREAT BLUE HERON			
Body Weight	2.390	kg	USEPA 1993 (Value is average of male and female weights, 2.576 and 2.204 respectively)
Dry Food Ingestion Rate	0.045	g dry wt./g-day	USEPA 1993, converted assuming 75% prey moisture (USACHPPM 2004)
Wet Food Ingestion Rate	0.18	g wet wt./g-day	USEPA 1993
Incidental Sediment Ingestion Rate	2%	% of total mass of diet, dry wt.	As a default, ingestion rate is assumed to be 2%.
Water Ingestion Rate	0.045	g/g-day	USEPA, 1993
RACCOON			
Body Weight	6.8	kg	USEPA, 1993 (Value is average of adult male and female weights, 7.6 and 6.0 respectively)
Dry Food Ingestion Rate	0.17	kg dry wt./kg-day	FI (kg dry wt./kg-day) = [(0.235 $Wt^{0.822}$) / Wt. (kg)] (USEPA 1993, supported by USACHPPM 2004)
Wet Food Ingestion Rate	0.68	kg wet wt./kg-day	Converted assuming 75% prey moisture (USACHPPM 2004)
Incidental Sediment Ingestion Rate	2%	% of total mass of diet, dry wt.	As a default, ingestion rate is assumed to be 2%.
Water Ingestion Rate	0.083	g/g-day	USEPA, 1993

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Table 9-7
Dose-based Toxicity Reference Values for Birds

Chemical	Avian NOAEL (mg/kg-bw day)	Avian NOAEL Source and Notes	Avian LOAEL (mg/kg-bw day)	Avian LOAEL Source and Notes
Inorganics				
Aluminum	1.10E+02	Sample et al. 1996	NA	---
Antimony	NA	---	NA	---
Arsenic	2.24E+00	USEPA 2005b	7.40E+00	Sample et al. 1996
Barium	2.08E+01	Sample et al. 1996	4.17E+01	Sample et al. 1996
Beryllium	NA	---	NA	---
Cadmium	1.47E+00	USEPA 2005e	6.35E+00	Geometric mean of LOAELs for growth and reproduction in USEPA 2005e
Calcium	NA	---	NA	---
Chromium	2.66E+00	USEPA 2008	1.56E+01	Geometric mean of LOAELs for growth and reproduction in USEPA 2008
Chromium, hexavalent	2.66E+00	USEPA 2008 value for triavalent chromium	1.56E+01	Geometric mean of LOAELs for growth and reproduction for trivalent chromium in USEPA 2008
Cobalt	7.61E+00	USEPA 2005f	1.83E+01	Geometric mean of LOAELs for growth and reproduction in USEPA 2005f
Copper	4.05E+00	USEPA 2007b	1.21E+01	Corresponding LOAEL from USEPA 2007b
Cyanide (Total)	NA	---	NA	--
Iron	NA	---	NA	---
Lead	1.63E+00	USEPA 2005g	3.26E+00	Corresponding LOAEL from USEPA 2005g
Magnesium	NA	---	NA	---
Manganese	1.79E+02	USEPA 2007c	3.77E+02	Geometric mean of LOAELs for growth and reproduction in USEPA 2007c
Mercury	4.50E-01	Sample et al. 1996	9.00E-01	Sample et al. 1996
Nickel	6.71E+00	USEPA 2007d	1.86E+01	Geometric mean of LOAELs for growth and reproduction in USEPA 2007d
Potassium	NA	---	NA	---
Selenium	2.90E-01	USEPA 2007f	5.79E-01	Corresponding LOAEL from USEPA 2007f
Silver	2.02E+00	USEPA 2006	2.02E+01	Corresponding LOAEL from USEPA 2006
Sodium	NA	---	NA	---
Thallium	NA	---	NA	---
Tin	6.80E+00	Sample et al. 1996	1.69E+01	Sample et al. 1996
Vanadium	3.44E-01	USEPA 2005h	6.88E-01	Corresponding LOAEL from USEPA 2005h

Table 9-7
Dose-based Toxicity Reference Values for Birds

Chemical	Avian NOAEL (mg/kg-bw day)	Avian NOAEL Source and Notes	Avian LOAEL (mg/kg-bw day)	Avian LOAEL Source and Notes
Zinc	6.61E+01	USEPA 2007g	1.71E+02	Geometric mean of LOAELs for growth and reproduction in USEPA 2007g
PAHs				
Total LMW PAH (ND=RL)	5.62E+03	USEPA 2007e did not derive value due to too few studies, value is from the only study not rejected for use (Landis Associates Inc. 1985)	NA	---
Total HMW PAH (ND=RL)	2.00E+00	USEPA 2007e did not derive value due to too few studies, valuse if from the only study not rejected for use (Trust et al. 1994)	2.00E+01	USEPA 2007e did not derive value due to too few studies, valuse if from the only study not rejected for use (Trust et al. 1994)
Total PAH (ND=RL)	2.00E+00	More conservative value for LMW and HMW PAHs chosen--value for HMW PAHs from USEPA 2007e	2.00E+01	More conservative value for LMW and HMW PAHs chosen--value for HMW PAHs from USEPA 2007e
PCBs				
Aroclor-1248	1.80E-01	Sample et al. 1996, value for Aroclor-1254	1.80E+00	Sample et al. 1996, value for Aroclor-1254
Aroclor-1254	1.80E-01	Sample et al. 1996	1.80E+00	Sample et al. 1996
Aroclor-1260	1.80E-01	Sample et al. 1996, value for Aroclor-1254	1.80E+00	Sample et al. 1996, value for Aroclor-1254
Total PCBs (ND=0)	1.80E-01	Sample et al. 1996, value for Aroclor-1254	1.80E+00	Sample et al. 1996, value for Aroclor-1254
Total PCBs (ND=1/2RL)	1.80E-01	Sample et al. 1996, value for Aroclor-1254	1.80E+00	Sample et al. 1996, value for Aroclor-1254
Total PCBs (ND=RL)	1.80E-01	Sample et al. 1996, value for Aroclor-1254	1.80E+00	Sample et al. 1996, value for Aroclor-1254
SVOCs				
2,4-Dimethylphenol	NA	---	NA	---
4-Chloroaniline	NA	---	NA	---
4-Nitrophenol	NA	---	NA	---
6-Methyl Chrysene	NA	---	NA	---
Acetophenone	NA	---	NA	---
Benzaldehyde	NA	---	NA	---
Benzoic Acid	NA	---	NA	---
Bis(2-ethylhexyl)phthalate	1.10E+00	Sample et al. 1996	NA	---
Butyl benzyl phthalate	1.10E-01	Sample et al. 1996, value for di-n-butyl phthalate	1.10E+00	Sample et al. 1996, value for di-n-butyl phthalate
Caprolactam	NA	---	NA	---
Carbazole	NA	---	NA	---

Table 9-7
Dose-based Toxicity Reference Values for Birds

Chemical	Avian NOAEL (mg/kg-bw day)	Avian NOAEL Source and Notes	Avian LOAEL (mg/kg-bw day)	Avian LOAEL Source and Notes
Dalapon	NA	---	NA	---
Diethyl phthalate	1.10E-01	Sample et al. 1996, value for di-n-butyl phthalate	1.10E+00	Sample et al. 1996, value for di-n-butyl phthalate
Dimethyl phthalate	NA	---	NA	---
Di-N-Butyl phthalate	1.10E-01	Sample et al. 1996	1.10E+00	Sample et al. 1996
Hexane	NA	---	NA	---
n-Butyl Alcohol	NA	---	NA	---
Phenol	3.77E+00	Derived from Schafer et al. 1983	NA	---
VOCs				
1,2-Dichlorobenzene	NA	---	NA	---
1,3-Dichlorobenzene	NA	---	NA	---
1,4-Dichlorobenzene	NA	---	NA	---
1,2,4-Trimethlybenzene	NA	---	NA	---
1,3,5-Trimethylbenzene	NA	---	NA	---
2-Butanone	NA	---	NA	---
Acetone	NA	---	NA	---
Acetophenone	NA	---	NA	---
Benzene	NA	---	NA	---
Carbon disulfide	NA	---	NA	---
Chlorobenzene	NA	---	NA	---
Chloroform	NA	---	NA	---
Chloromethane (Methyl chloride)	NA	---	NA	---
Ethylbenzene	NA	---	NA	---
Isopropylbenzene (Cumene)	NA	---	NA	---
Methylene chloride	NA	---	NA	---
n-Propylbenzene	NA	---	NA	---
p-Isopropyltoluene	NA	---	NA	---
Styrene	NA	---	NA	---
Tetrachloroethene (PCE)	NA	---	NA	---
Toluene	NA	---	NA	---
Trichlorofluoromethane	NA	---	NA	---
Xylenes (m & p)	NA	---	NA	---
Xylenes (o)	NA	---	NA	---

Table 9-7
Dose-based Toxicity Reference Values for Birds

Chemical	Avian NOAEL (mg/kg-bw day)	Avian NOAEL Source and Notes	Avian LOAEL (mg/kg-bw day)	Avian LOAEL Source and Notes
Xylenes (Total)	NA	---	NA	---

--= Does Not Apply
HMW= High Molecular Weight
LMW= Low Molecular Weight
LOAEL= Lowest Observed Adverse Effect Level
mg/kg-bw day= milligram per kilogram of body weight per day
NA - TRV not available
ND= Non-detect
NOAEL= No Observed Adverse Effect Level
PAH= Polyaromatic Hydrocarbon
PCB= Polychlorinated Biphenyl
PEC= Probable Effects Concentration
RL= Reporting Limit
SVOC= Semi-Volatile Organic Compound
TEC= Threshold Effects Concentration
TRV= Toxicity Reference Value
VOC= Volatile Organic Compound

Table 9-8
Dose-based Toxicity Reference Values for Mammals

Chemical	Mammalian NOAEL (mg/kg-bw day)	Mammalian NOAEL Source and Notes	Mammalian LOAEL (mg/kg-bw day)	Mammalian LOAEL Source and Notes
Inorganics				
Aluminum	1.93E+00	Sample et al. 1996	1.93E+01	Sample et al. 1996
Antimony	5.90E-02	USEPA 2005a	5.90E-01	Corresponding LOAEL from USEPA 2005a
Arsenic	1.04E+00	USEPA 2005b	1.66E+00	Corresponding LOAEL from USEPA 2005b
Barium	5.18E+01	USEPA 2005c	8.27E+01	Geometric mean of LOAELs for growth and reproduction in USEPA 2005c
Beryllium	5.32E-01	USEPA 2005d	6.73E-01	Geometric mean of LOAELs for growth and reproduction in USEPA 2005d
Cadmium	7.70E-01	USEPA 2005e	7.70E+00	Corresponding LOAEL from USEPA 2005e
Calcium	NA	---	NA	---
Chromium	2.40E+00	USEPA 2008 value for trivalent chromium	5.82E+01	Geometric mean of LOAELs for growth and reproduction for trivalent chromium in USEPA 2008
Chromium, hexavalent	9.24E+00	USEPA 2008	3.84E+01	Geometric mean of LOAELs for growth and reproduction in USEPA 2008
Cobalt	7.33E+00	USEPA 2005f	1.89E+01	Geometric mean of LOAELs for growth and reproduction in USEPA 2005f
Copper	5.60E+00	USEPA 2007b	9.34E+00	Corresponding LOAEL from USEPA 2007b
Cyanide (Total)	6.87E+01	Sample et al. 1996	NA	---
Iron	NA	---	NA	---
Lead	4.70E+00	USEPA 2005g	8.90E+00	Corresponding LOAEL from USEPA 2005g
Mercury	1.32E+01	Sample et al. 1996	NA	---
Nickel	1.70E+00	USEPA 2007d	3.40E+00	Corresponding LOAEL from USEPA 2007d
Selenium	1.43E-01	USEPA 2007f	2.15E-01	Corresponding LOAEL from USEPA 2007f
Silver	6.02E+00	USEPA 2006	6.02E+01	Corresponding LOAEL from USEPA 2006
Thallium	7.40E-03	Sample et al. 1996	7.40E-02	Sample et al. 1996
Zinc	7.54E+01	USEPA 2007g	2.98E+02	Geometric mean of LOAELs for growth and reproduction in USEPA 2007g
PAHs				
Total LMW PAH (ND=RL)	6.56E+01	USEPA 2007e	3.28E+02	Corresponding LOAEL from USEPA 2007e
Total HMW PAH (ND=RL)	6.15E-01	USEPA 2007e	3.01E+00	Corresponding LOAEL from USEPA 2007e

Table 9-8
Dose-based Toxicity Reference Values for Mammals

Chemical	Mammalian NOAEL (mg/kg-bw day)	Mammalian NOAEL Source and Notes	Mammalian LOAEL (mg/kg-bw day)	Mammalian LOAEL Source and Notes
Total PAH (ND=RL)	6.15E-01	More conservative value for LMW and HMW PAHs chosen--value for HMW PAHs from USEPA 2007e	3.01E+00	More conservative value for LMW and HMW PAHs chosen--value for HMW PAHs from USEPA 2007e
PCBs				
Aroclor-1248	1.00E-02	Sample et al. 1996	1.00E-01	Sample et al. 1996
Aroclor-1254	1.40E-01	Sample et al. 1996	6.90E-01	Sample et al. 1996
Aroclor-1260	1.00E-02	Sample et al. 1996, value for Aroclor-1248	1.00E-01	Sample et al. 1996, value for Aroclor-1248
Total PCBs (ND=0)	1.00E-02	Sample et al. 1996, value for Aroclor-1248	1.00E-01	Sample et al. 1996, value for Aroclor-1248
Total PCBs (ND=1/2RL)	1.00E-02	Sample et al. 1996, value for Aroclor-1248	1.00E-01	Sample et al. 1996, value for Aroclor-1248
Total PCBs (ND=RL)	1.00E-02	Sample et al. 1996, value for Aroclor-1248	1.00E-01	Sample et al. 1996, value for Aroclor-1248
SVOCs				
2,4-Dimethylphenol	NA	---	NA	---
4-Chloroaniline	NA	---	NA	---
4-Nitrophenol	NA	---	NA	---
6-Methyl Chrysene	NA	---	NA	---
Acetophenone	NA	---	NA	---
Benzaldehyde	NA	---	NA	---
Benzoic Acid	NA	---	NA	---
Bis(2-ethylhexyl)phthalate	1.83E+01	Sample et al. 1996	1.83E+02	Sample et al. 1996
Butyl benzyl phthalate	5.50E+02	Sample et al. 1996, value for di-n-butyl phthalate	1.83E+03	Sample et al. 1996, value for di-n-butyl phthalate
Caprolactam	NA	---	NA	---
Carbazole	NA	---	NA	---
Dalapon	NA	---	NA	---
Diethyl phthalate	4.58E+03	Sample et al. 1996	NA	---
Dimethyl phthalate	NA	---	NA	---
Di-N-Butyl phthalate	5.50E+02	Sample et al. 1996	1833	Sample et al. 1996
Hexane	NA	---	NA	---
n-Butyl Alcohol	NA	---	NA	---
Phenol	1.20E+01	USACHPPM 2008	3.60E+01	USACHPPM 2008

Table 9-8
Dose-based Toxicity Reference Values for Mammals

Chemical	Mammalian NOAEL (mg/kg-bw day)	Mammalian NOAEL Source and Notes	Mammalian LOAEL (mg/kg-bw day)	Mammalian LOAEL Source and Notes
VOCs				
Chlorobenzene	NA	---	NA	---

---= Does Not Apply
HMW= High Molecular Weight
LMW= Low Molecular Weight
LOAEL= Lowest Observed Adverse Effect Level
mg/kg-bw day= milligram per kilogram of body weight per day
NA - TRV not available
ND= Non-detect
NOAEL= No Observed Adverse Effect Level
PAH= Polyaromatic Hydrocarbon
PCB= Polychlorinated Biphenyl
PEC= Probable Effects Concentration
SVOC= Semi-Volatile Organic Compound
TEC= Threshold Effects Concentration
TRV= Toxicity Reference Value
VOC= Volatile Organic Compound

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Table 9-9
Sediment Toxicity Reference Values for Benthic Organism Exposures

Chemical	Sediment TRV based on threshold effects (mg/kg dry wt.)	Sediment TRV based on probable effects (mg/kg dry wt.)	Source
Inorganics			
Antimony	2.00E+00	2.50E+01	ER-L and ER-M values (Long and Morgan 1991)
Arsenic	7.24E+00	4.16E+01	TEL and PEL values (MacDonald et al. 1996)
Barium	1.30E+02	NA	TEL value based on SLC approach using sensitive species HC5% (Leung et al. 2005
Beryllium	1.10E+00	3.00E+01	Dutch Target and Intervention values for soil (Verbruggen et al. 2001)
Cadmium	6.80E-01	4.21E+00	TEL and PEL values (MacDonald et al. 1996)
Calcium	NA	NA	TEL and PEL values (MacDonald et al. 1996)
Chromium	5.23E+01	1.60E+02	TEL and PEL values (MacDonald et al. 1996)
Chromium, hexavalent	5.23E+01	1.60E+02	TEL and PEL values for trivalent chromium (MacDonald et al. 1996)
Cobalt	NA	NA	---
Copper	1.87E+01	1.08E+02	TEL and PEL values (MacDonald et al. 1996)
Cyanide (Total)	1.00E+00	2.00E+01	Dutch Target and Intervention values for soil (Verbruggen et al. 2001)
Iron	2.00E+04	4.00E+04	TEC and PEC values (MacDonald et al. 1996)
Lead	3.02E+01	1.12E+02	TEL and PEL values (MacDonald et al. 1996)
Magnesium	NA	NA	---
Manganese	4.60E+02	NA	Freshwater value is TEL (MacDonald et al. 1996)
Mercury	1.30E-01	7.00E-01	TEL and PEL values (MacDonald et al. 1996)
Nickel	1.59E+01	4.28E+01	TEC and PEC values (MacDonald 1994)
Potassium	NA	NA	---
Selenium	7.00E-01	1.00E+02	Dutch Target and Intervention values for soil (Verbruggen et al. 2001)
Silver	7.30E-01	1.77E+00	TEC and PEC values (MacDonald 1994)
Sodium	NA	NA	---
Thallium	1.00E+00	1.50E+01	Dutch Target and Intervention values for soil (Verbruggen et al. 2001)
Tin	4.80E+01	NA	Field et. al, 2002
Vanadium	4.20E+01	2.50E+02	Dutch Target and Intervention values for soil (Verbruggen et al. 2001)
Zinc	1.24E+02	2.71E+02	TEC and PEC values (MacDonald 1994)
PAHs			
1-Methylnaphthalene	NA	NA	--
2-Methylnaphthalene	2.02E-02	2.01E-01	MacDonald et al. 1996
Acenaphthene	6.71E-03	8.89E-02	MacDonald et al. 1996
Acenaphthylene	5.87E-03	1.28E-01	MacDonald et al. 1996
Anthracene	4.69E-02	2.45E-01	MacDonald et al. 1996
Benzo(a)Anthracene	7.48E-02	6.93E-01	MacDonald et al. 1996
Benzo(a)Pyrene	8.88E-02	7.63E-01	MacDonald et al. 1996
Benzo(b)Fluoranthene	1.30E-01	1.11E+00	Marine T20 and T50 values from Field et al. 2002
Benzo(g,h,i)Perylene	6.70E-02	4.97E-01	Marine T20 and T50 values from Field et al. 2002
Benzo(k)Fluoranthene	7.00E-02	5.37E-01	Marine T20 and T50 values from Field et al. 2002
Chrysene	1.08E-01	8.46E-01	MacDonald et al. 1996
Dibenzo(a,h)Anthracene	6.22E-03	1.35E-01	MacDonald et al. 1996
Fluoranthene	1.13E-01	1.49E+00	MacDonald et al. 1996
Fluorene	2.12E-02	1.44E-01	MacDonald et al. 1996
Indeno(1,2,3-Cd)Pyrene	6.80E-02	4.88E-01	Marine T20 and T50 values (Field et al. 2002)
Naphthalene	3.46E-02	3.91E-01	MacDonald et al. 1996
Phenanthrene	8.67E-02	5.44E-01	MacDonald et al. 1996
Pyrene	1.53E-01	1.40E+00	MacDonald et al. 1996
Total LMW PAH (ND=RL)	3.12E-01	1.44E+00	MacDonald et al. 1996
Total HMW PAH (ND=RL)	6.55E-01	6.68E+00	MacDonald et al. 1996
Total PAH (ND=RL)	1.68E+00	1.68E+01	MacDonald et al. 1996
PCBs			
Aroclor-1248	6.33E-02	7.09E-01	MacDonald et al. 1996, value for Aroclor-1254
Aroclor-1254	6.33E-02	7.09E-01	MacDonald et al. 1996
Aroclor-1260	6.33E-02	7.09E-01	MacDonald et al. 1996, value for Aroclor-1254
Total PCBs (ND=0)	5.98E-02	6.76E-01	MacDonald et al. 2000
Total PCBs (ND=RL)	5.98E-02	6.76E-01	MacDonald et al. 2000
SVOCs			
2,4-Dimethylphenol	NA	NA	---
4-Chloroaniline	5.00E-03	5.00E+01	Dutch Target and Intervention values for sediment from Verbruggen et al. 2001.
4-Nitrophenol	NA	NA	---
6-Methyl Chrysene	NA	NA	---
Acetophenone	NA	NA	---

Table 9-9
Sediment Toxicity Reference Values for Benthic Organism Exposures

Chemical	Sediment TRV based on threshold effects (mg/kg dry wt.)	Sediment TRV based on probable effects (mg/kg dry wt.)	Source
Benzaldehyde	NA	NA	---
Benzoic Acid	NA	NA	---
Bis(2-ethylhexyl)phthalate	1.82E-01	2.65E+00	MacDonald et al. 1996

ER-L= Effects Range Low
ER-M= Effects Range Median
HMW= High Molecular Weight
LMW= Low Molecular Weight
NA - TRV not available
ND= Non-detect
PAH= Polyaromatic Hydrocarbon
PCB= Polychlorinated Biphenyl
PEC= Probable Effects Concentration
PEL= Probable Effects Level
RL= Reporting Limit
SVOC= Semi-Volatile Organic Compound
TEC= Threshold Effects Concentration
TEL= Threshold Effects Level
TRV= Toxicity Reference Value

Table 9-10
Surface Water Toxicity Reference Values for Aquatic Organism Exposures

Chemical	Chronic Surface Water TRV (ug/L)	Acute Surface Water TRV (ug/L)	Source for Surface Water TRVs
Inorganics			
Aluminum	8.70E+01	7.50E+02	NAWQC freshwater value from Suter and Tsao 1996
Antimony	5.00E+02	1.50E+03	Proposed marine value (Government of British Columbia Ministry of the Environment 2015)
Arsenic	3.60E+01	6.90E+01	NAWQC (USEPA 2015), value for total arsenic
Barium	2.00E+02	1.00E+03	Marine value (Government of British Columbia Ministry of the Environment 2015)
Beryllium	1.00E+02	1.50E+03	Marine value (Government of British Columbia Ministry of the Environment 2015)
Cadmium	8.80E+00	4.00E+01	NAWQC (USEPA 2015)
Calcium	NA	NA	---
Chromium	5.00E+01	1.10E+03	Hexavalent chromium value from NAWQC (USEPA 2015)
Chromium, hexavalent	5.00E+01	1.10E+03	NAWQC (USEPA 2015)
Cobalt	1.00E+00	NA	Trigger value for marine water from Australian and New Zealand Guidelines (ANZECC 2000)
Copper	3.10E+00	4.80E+00	NAWQC (USEPA 2015), based on dissolved concentrations
Cyanide (Total)	1.00E+00	1.00E+00	NAWQC (USEPA 2015), based on dissolved concentrations
Iron	1.00E+03	NA	NAWQC (USEPA 2015)
Lead	8.10E+00	2.10E+02	NAWQC (USEPA 2015)
Magnesium	NA	NA	---
Manganese	1.00E+02	NA	Marine value from British Columbia Water Quality Guidelines
Mercury	9.40E-01	1.80E+00	NAWQC (USEPA 2015), Value for total mercury (organic & inorganic)
Nickel	8.20E+00	7.40E+01	NAWQC (USEPA 2015)
Potassium	NA	NA	---
Selenium	7.10E+01	2.90E+02	NAWQC (USEPA 2015), Value reflects the use of a conversion factor (0.998) suggested by USEPA (1999) to convert total metal to dissolved metal criterion
Silver	3.60E-01	1.90E+00	Chronic value is Tier II freshwater value from Suter and Tsao 1996, acute value is from NAWQC (USEPA 2015)
Sodium	NA	NA	---
Thallium	1.70E+01	NA	Trigger value for marine water from Australian and New Zealand Guidelines (ANZECC 2000)
Tin	7.30E+01	2.70E+03	Tier II freshwater values from Suter and Tsao 1996
Vanadium	5.00E+01	NA	Marine value (Government of British Columbia Ministry of the Environment 2015)
Zinc	8.10E+01	9.00E+01	NAWQC (USEPA 2015)
PAHs			
1-Methylnaphthalene	2.10E+00	3.70E+01	Suter and Tsao 1996
2-Methylnaphthalene	2.10E+00	3.70E+01	Tier II freshwater value for 1-methylnaphthalene from Suter and Tsao 1996
Acenaphthene	4.00E+01	9.70E+02	Value presented is the LOEL
Acenaphthylene	4.84E+03	NA	USEPA Region 5 Ecological Screening Level, freshwater value (USEPA 2003)
Anthracene	7.30E-01	1.30E+01	Tier II freshwater value from Suter and Tsao 1996
Benzo(a)Anthracene	2.70E-02	4.90E-01	Tier II freshwater value from Suter and Tsao 1996
Benzo(a)Pyrene	1.40E-02	2.40E-01	Tier II freshwater value from Suter and Tsao 1996
Benzo(b)Fluoranthene	9.07E+00	NA	USEPA Region 5 Ecological Screening Level, freshwater value (USEPA 2003)
Benzo(g,h,i)Perylene	7.64E+00	NA	USEPA Region 5 Ecological Screening Level, freshwater value (USEPA 2003)
Benzo(k)Fluoranthene	NA	NA	---
Chrysene	NA	NA	---
Dibenzo(a,h)Anthracene	NA	NA	---
Fluoranthene	1.10E+01	NA	Final chronic value, marine (USEPA 1993)
Fluorene	3.90E+00	7.00E+01	Tier II freshwater value from Suter and Tsao 1996
Indeno(1,2,3-Cd)Pyrene	4.31E+00	NA	USEPA Region 5 Ecological Screening Level, freshwater value (USEPA 2003)
Naphthalene	1.40E+00	NA	Canadian Water Quality Guidelines (Canadian Council of Ministers of the Environment 1999)
Phenanthrene	4.60E+00	7.70E+00	Proposed marine value (Government of British Columbia Ministry of the Environment 2015)
Pyrene	NA	NA	---
Total LMW PAH (ND=RL)	1.40E+00	3.70E+01	Naphthalene was the most abundant LMW PAH detected in porewater; chronic TRV for naphthalene is from Canadian Water Quality Guidelines (Canadian Council of Ministers of the Environment 1999). The acute TRV is for 1-methylnaphthalene (a surrogate for naphthalene) from Suter and Tsao (1996).

Table 9-10
Surface Water Toxicity Reference Values for Aquatic Organism Exposures

Chemical	Chronic Surface Water TRV (ug/L)	Acute Surface Water TRV (ug/L)	Source for Surface Water TRVs
Total HMW PAH (ND=RL)	4.60E+00	7.70E+00	Phenanthrene was the most abundant PAH in stormwater; HMW PAHs were not detected in porewater. Chronic and acute TRVs for phenanthrene are proposed marine values (Government of British Columbia Ministry of the Environment 2015).
Total PAH (ND=RL)	4.60E+00	3.70E+01	More conservative value for LMW and HMW PAHs chosen for each value. Chronic TRV is for naphthalene from Canadian Water Quality Guidelines (Canadian Council of Ministers of the Environment 1999). Acute TRV is for phenanthrene from proposed marine values (Government of British Columbia Ministry of the Environment 2015).
PCBs			
Aroclor-1248	8.10E-02	1.40E+00	Tier II freshwater value from Suter and Tsao 1996
Aroclor-1254	3.30E-02	6.00E-01	Tier II freshwater value from Suter and Tsao 1996
Aroclor-1260	9.40E+01	1.70E+03	Tier II freshwater value from Suter and Tsao 1996
Total PCBs (ND=0)	3.00E-02	1.40E-01	Chronic value from NRWQC (USEPA 2015), based on dissolved concentrations. Acute value fromTier II freshwater value from Suter and Tsao 1996
Total PCBs (ND=1/2RL)	3.00E-02	1.40E-01	Chronic value from NRWQC (USEPA 2015), based on dissolved concentrations. Acute value fromTier II freshwater value from Suter and Tsao 1996
Total PCBs (ND=RL)	3.00E-02	1.40E-01	Chronic value from NRWQC (USEPA 2015), based on dissolved concentrations. Acute value fromTier II freshwater value from Suter and Tsao 1996
SVOCs			
2,4-Dimethylphenol	NA	NA	---
4-Chloroaniline	NA	NA	---
4-Nitrophenol	3.00E+02	1.20E+03	Tier II value from Suter and Tsao 1996, value for freshwater
6-Methyl Chrysene	NA	NA	---
Acetophenone	NA	NA	---
Benzaldehyde	NA	NA	---
Benzoic Acid	4.20E+01	7.40E+02	Tier II value from Suter and Tsao 1996, value for freshwater
Bis(2-ethylhexyl)phthalate	3.60E+02	4.00E+02	Proposed marine value (Government of British Columbia Ministry of the Environment 2015)
Butyl benzyl phthalate	1.90E+01	NA	Tier II value from Suter and Tsao 1996, value for freshwater
Caprolactam	NA	NA	---
Carbazole	NA	NA	---
Dalapon	NA	NA	---
Diethyl phthalate	2.10E+02	1.80E+03	Tier II values from Suter and Tsao 1996, value for freshwater
Dimethyl phthalate	NA	NA	---
Di-N-Butyl phthalate	3.50E+01	1.90E+02	Tier II values from Suter and Tsao 1996, value for freshwater
Hexane	5.80E-01	1.00E+01	Tier II values from Suter and Tsao 1996, value for freshwater
n-Butyl Alcohol	NA	NA	---
Phenol	4.00E+02	NA	Trigger value for marine water from Australian and New Zealand Guidelines (ANZECC 2000)
VOCs			
1,2-Dichlorobenzene	1.40E+01	2.60E+02	Tier II values from Suter and Tsao 1996, value for freshwater
1,3-Dichlorobenzene	7.10E+01	6.30E+02	Tier II values from Suter and Tsao 1996, value for freshwater
1,4-Dichlorobenzene	1.50E+01	1.80E+02	Tier II values from Suter and Tsao 1996, value for freshwater
1,2,4-Trimethlybenzene	NA	NA	---
1,3,5-Trimethylbenzene	NA	NA	---
2-Butanone	1.40E+04	2.40E+05	Tier II freshwater values from Suter and Tsao 1996
Acetone	1.50E+03	2.80E+04	Tier II freshwater values from Suter and Tsao 1996
Acetophenone	NA	NA	---
Benzene	1.10E+02	NA	Canadian Water Quality Guidelines (Canadian Council of Ministers of the Environment 1999)
Carbon disulfide	9.20E-01	1.70E+01	Tier II freshwater values from Suter and Tsao 1996
Chlorobenzene	6.40E+01	1.10E+03	Tier II freshwater values from Suter and Tsao 1996
Chloroform	2.80E+01	4.90E+02	Tier II freshwater values from Suter and Tsao 1996
Chloromethane (Methyl chloride)	NA	NA	---
Ethylbenzene	2.50E+01	NA	Canadian Water Quality Guidelines (Canadian Council of Ministers of the Environment 1999)
Isopropylbenzene (Cumene)	NA	NA	---
Methylene chloride	2.20E+03	2.60E+04	Tier II freshwater value from Suter and Tsao 1996
n-Propylbenzene	NA	NA	---

Table 9-10
Surface Water Toxicity Reference Values for Aquatic Organism Exposures

Chemical	Chronic Surface Water TRV (ug/L)	Acute Surface Water TRV (ug/L)	Source for Surface Water TRVs
p-Isopropyltoluene	NA	NA	---
Styrene			
Tetrachloroethene (PCE)	9.80E+01	8.30E+02	Tier II freshwater value from Suter and Tsao 1996
Toluene	2.15E+02	NA	Canadian Water Quality Guidelines (Canadian Council of Ministers of the Environment 1999)
Trichlorofluoromethane	NA	NA	---
Xylenes (m & p)	1.80E+00	3.20E+01	Tier II value for m-Xylene from Suter and Tsao 1996, value for freshwater
Xylenes (o)	NA	NA	---
Xylenes (Total)	1.30E+01	2.30E+02	Tier II value from Suter and Tsao 1996, value for freshwater

---= Does not apply
HMW= High Molecular Weight
LMW= Low Molecular Weight
NA - TRV not available
NAWQC - National Ambient Water Quality Criteria.
ND= Non-detect
PAH= Polyaromatic Hydrocarbon
PCB= Polychlorinated Biphenyl
PEC= Probable Effects Concentration
RL= Reporting Limit
SVOC= Semi-Volatile Organic Compound
TEC= Threshold Effects Concentration
TRV= Toxicity Reference Value
ug/L= micrograms per liter
VOC= Volatile Organic Compound

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Table 9-11
Comparison of Exposure Point Concentrations (EPCs) in Sediment to Benthic Organism Toxicity Reference Values
Sparrows Point Northeast/Near-Shore

Chemical	Sediment TEL TRV (mg/kg)	Sediment PEL TRV (mg/kg)	Frequency of Detection	Screening Level EPC (mg/kg)	TEL Hazard Quotient for Maximum EPC	PEL Hazard Quotient for Maximum EPC	Reasonable Maximum (95% UCLM) EPC (mg/kg)	TEL Hazard Quotient for 95UCLM EPC	PEL Hazard Quotient for 95UCLM EPC
Inorganics									
Cadmium	6.80E-01	4.21E+00	5/5	4.80E+00	**7.06E+00**	1.14E+00	4.80E+00	**7.06E+00**	1.14E+00
Chromium	5.23E+01	1.60E+02	2/2	7.50E+02	**1.43E+01**	**4.69E+00**	7.50E+02	**1.43E+01**	**4.69E+00**
Copper	1.87E+01	1.08E+02	13/13	1.60E+02	**8.56E+00**	1.48E+00	9.38E+01	**5.01E+00**	8.68E-01
Cyanide (Total)	1.00E+00	2.00E+01	7/8	1.60E+00	**1.60E+00**	8.00E-02	8.25E-01	8.25E-01	4.13E-02
Lead	3.02E+01	1.12E+02	8/8	1.10E+02	**3.64E+00**	9.82E-01	7.41E+01	**2.45E+00**	6.62E-01
Mercury	1.30E-01	7.00E-01	3/3	4.20E-01	**3.23E+00**	6.00E-01	4.20E-01	**3.23E+00**	6.00E-01
Nickel	1.59E+01	4.28E+01	13/13	4.60E+01	**2.89E+00**	1.07E+00	3.79E+01	**2.38E+00**	8.85E-01
Silver	7.30E-01	1.77E+00	5/5	1.70E+00	**2.33E+00**	9.60E-01	1.70E+00	**2.33E+00**	9.60E-01
Zinc	1.24E+02	2.71E+02	13/13	1.55E+03	**1.25E+01**	**5.72E+00**	1.03E+03	**8.34E+00**	**3.82E+00**
PAHs									
Total LMW PAH (ND=RL)	3.12E-01	1.44E+00	8/8	1.69E+00	**5.42E+00**	1.17E+00	1.32E+00	**4.24E+00**	9.17E-01
Total HMW PAH (ND=RL)	6.55E-01	6.68E+00	8/8	3.08E+00	**4.69E+00**	4.61E-01	3.08E+00	**4.69E+00**	4.61E-01
Total PAH (ND=RL)	1.68E+00	1.68E+01	8/8	4.77E+00	**2.83E+00**	2.84E-01	4.77E+00	**2.83E+00**	2.84E-01
SVOCs									
Bis(2-ethylhexyl)phthalate	1.82E-01	2.65E+00	9/16	1.60E+00	**8.79E+00**	6.04E-01	5.45E-01	**2.99E+00**	2.06E-01

Bolded HQs exceed 1 (to one significant digit) and are associated with exposures that exceed TRVs.
HMW= High Molecular Weight
LMW= Low Molecular Weight
mg/kg= milligrams per kilogram
ND= Non-detect
PAH= Polyaromatic Hydrocarbon
PEL= Probable Effect Level
RL= Reporting Limit
SVOC= Semi-Volatile Organic Compound
TEL= Threshold Effect Level
TRV= Toxicity Reference Value
UCLM= Upper Confidence Limit of the Mean

Table 9-12
Comparison of Exposure Point Concentrations in Surface Water to Aquatic Organism TRVs
Sparrows Point Northeast/Near-Shore

Chemical	Surface Water Toxicity Reference Value (µg/L)		Screening Level (Maximum) EPC-Non-Storm Conditions (µg/L)				Reasonable Maximum (weighted average) EPC-Non-Storm Conditions (µg/L)				Screening Level (Maximum) EPC-Storm Conditions (µg/L)			
	Chronic	Acute	Frequency of Detection	EPC (µg/L)	Hazard Quotient for Comparison to Chronic TRV	Hazard Quotient for Comparison to Acute TRV	Frequency of Detection	EPC (µg/L)	Hazard Quotient for Comparison to Chronic TRV	Hazard Quotient for Comparison to Acute TRV	Frequency of Detection	EPC (µg/L)	Hazard Quotient for Comparison to Chronic TRV	Hazard Quotient for Comparison to Acute TRV
Inorganics														
Chromium	5.00E+01	1.10E+03	NA	6.71E-01	1.34E-02	6.10E-04	NA	2.16E-01	4.33E-03	1.97E-04	NA	4.26E+00	8.52E-02	3.87E-03
Copper	3.10E+00	4.80E+00	NA	6.41E-01	2.07E-01	1.34E-01	NA	2.48E-01	8.00E-02	5.17E-02	NA	2.57E+00	8.29E-01	5.35E-01
Cyanide (Total)	1.00E+00	1.00E+00	NA	2.52E+00	**2.52E+00**	**2.52E+00**	NA	9.30E-01	9.30E-01	9.30E-01	NA	2.37E+01	**2.37E+01**	**2.37E+01**
Lead	8.10E+00	2.10E+02	NA	4.40E-01	5.43E-02	2.09E-03	NA	9.80E-02	1.21E-02	4.67E-04	NA	4.47E-01	5.52E-02	2.13E-03
Mercury	9.40E-01	1.80E+00	NA	6.63E-01	7.06E-01	3.68E-01	NA	1.54E-01	1.63E-01	8.54E-02	NA	6.64E-01	7.06E-01	3.69E-01
Nickel	8.20E+00	7.40E+01	NA	3.77E+00	4.60E-01	5.10E-02	NA	1.34E+00	1.64E-01	1.81E-02	NA	4.09E+00	4.99E-01	5.53E-02
Silver	3.60E-01	1.90E+00	NA	0.00E+00	0.00E+00	0.00E+00	NA	0.00E+00	0.00E+00	0.00E+00	NA	0.00E+00	0.00E+00	0.00E+00
Zinc	8.10E+01	9.00E+01	NA	1.25E+01	1.54E-01	1.39E-01	NA	4.41E+00	5.45E-02	4.90E-02	NA	4.60E+01	5.68E-01	5.11E-01
PAHs														
Total LMW PAH (ND=RL)	1.40E+00	3.70E+01	NA	3.12E-01	2.23E-01	8.43E-03	NA	1.23E-01	8.78E-02	3.32E-03	NA	3.79E-01	2.71E-01	1.02E-02
Total HMW PAH (ND=RL)	4.60E+00	7.70E+00	NA	5.10E-02	1.11E-02	6.62E-03	NA	1.15E-02	2.50E-03	1.49E-03	NA	5.10E-02	1.11E-02	6.62E-03
Total PAH (ND=RL)	4.60E+00	3.70E+01	NA	3.63E-01	7.89E-02	9.81E-03	NA	1.34E-01	2.92E-02	3.63E-03	NA	4.30E-01	9.35E-02	1.16E-02
SVOCs														
Bis(2-ethylhexyl)phthalate	3.60E+02	4.00E+02	NA	1.00E-01	2.78E-04	2.50E-04	NA	3.17E-02	8.81E-05	7.93E-05	NA	1.04E+00	2.89E-03	2.60E-03

Bolded HQs exceed 1 (to one significant digit) and are associated with exposures that exceed TRVs.

µg/L= micrograms per liter
EPC= Exposure Point Concentration
HMW= High Molecular Weight
LMW= Low Molecular Weight
NA=Not Available
ND= Non-detect
PAH= Polyaromatic Hydrocarbon
RL= Reporting Limit
SVOC= Semi-Volatile Organic Compound
TRV= Toxicity Reference Value
UCLM= Upper Confidence Limit of the Mean

Table 9-13
Comparison of Screening Level Modeled Wildlife Doses to Birds based on Uptake Factors to Avian TRVs
Sparrows Point Northeast/Near-Shore

Chemical	Avian TRVs (mg/kg-bw day)		Screening Level Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Fish, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Fish, Sediment, and Surface Water
	NOAEL	LOAEL	Great Blue Heron	Great Blue Heron	Great Blue Heron	Great Blue Heron
Inorganics						
Cadmium	1.47E+00	6.35E+00	7.50E-03	2.94E-03	1.74E-03	6.81E-04
Chromium	2.66E+00	1.56E+01	4.91E-01	2.63E-01	8.36E-02	4.47E-02
Copper	4.05E+00	1.21E+01	9.07E-02	4.88E-02	3.03E-02	1.63E-02
Cyanide (Total)	NA	NA	--	--	--	--
Lead	1.63E+00	3.26E+00	1.05E-01	6.13E-02	5.24E-02	3.06E-02
Mercury	4.50E-01	9.00E-01	3.31E-03	4.78E-01	1.66E-03	2.39E-01
Nickel	6.71E+00	1.86E+01	2.02E-02	8.62E-03	7.31E-03	3.12E-03
Silver	2.02E+00	2.02E+01	3.82E-03	7.57E-04	3.82E-04	7.57E-05
Zinc	6.61E+01	1.71E+02	1.24E-01	2.33E-02	4.79E-02	8.97E-03
PAHs						
Total LMW PAH (ND=RL)	5.62E+03	NA	6.53E-06	3.21E-05	--	--
Total HMW PAH (ND=RL)	2.00E+00	2.00E+01	3.24E-02	1.60E-02	3.24E-03	1.60E-03
Total PAH (ND=RL)	2.00E+00	2.00E+01	4.96E-02	1.06E-01	4.96E-03	1.06E-02
SVOCs						
Bis(2-ethylhexyl)phthalate	1.10E+00	NA	2.63E-01	2.93E-02	--	--

Bolded HQs exceed 1 (to one significant digit) and are associated with exposures that exceed TRVs.
--= does not apply
HMW= High Molecular Weight
HQ= Hazard Quotient
LMW= Low Molecular Weight
LOAEL= Lowest Observed Adverse Effect Level
mg/kg-bw day= milligrams per kilogram of body weight per day
NA= Not Available
ND= Non-detect
NOAEL= No Observed Adverse Effect Level
PAH= Polyaromatic Hydrocarbon
RL= Reporting Limit
SVOC= Semi-Volatile Organic Compound
TRV= Toxicity Reference Value

Table 9-14
Comparison of Screening Level Modeled Wildlife Doses to Mammals based on Uptake Factors to Mammalian TRVs
Sparrows Point Northeast/Near-Shore

Chemical	Mammalian TRVs (mg/kg bw day)		Screening Level Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Fish, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Fish, Sediment, and Surface Water
	NOAEL	LOAEL	Raccoon	Raccoon	Raccoon	Raccoon
Inorganics						
Cadmium	7.70E-01	7.70E+00	5.41E-02	2.12E-02	5.41E-03	2.12E-03
Chromium	2.40E+00	5.82E+01	**2.06E+00**	1.10E+00	8.49E-02	4.54E-02
Copper	5.60E+00	9.34E+00	2.48E-01	1.33E-01	1.49E-01	7.99E-02
Cyanide (Total)	6.87E+01	NA	1.59E-02	1.07E-04	--	--
Lead	4.70E+00	8.90E+00	1.37E-01	8.03E-02	7.25E-02	4.24E-02
Mercury	1.32E+01	NA	4.22E-04	6.16E-02	--	--
Nickel	1.70E+00	3.40E+00	3.02E-01	1.28E-01	1.51E-01	6.42E-02
Silver	6.02E+00	6.02E+01	4.85E-03	9.60E-04	4.85E-04	9.60E-05
Zinc	7.54E+01	2.98E+02	4.12E-01	7.70E-02	1.04E-01	1.95E-02
PAHs						
Total LMW PAH (ND=RL)	6.56E+01	3.28E+02	2.11E-03	1.04E-02	4.22E-04	2.08E-03
Total HMW PAH (ND=RL)	6.15E-01	3.01E+00	3.98E-01	1.97E-01	8.13E-02	4.02E-02
Total PAH (ND=RL)	6.15E-01	3.01E+00	6.10E-01	1.31E+00	1.25E-01	2.67E-01
SVOCs						
Bis(2-ethylhexyl)phthalate	1.83E+01	1.83E+02	5.98E-02	6.66E-03	5.98E-03	6.66E-04

Bolded HQs exceed 1 (to one significant digit) and are associated with exposures that exceed TRVs.
HMW= High Molecular Weight
HQ= Hazard Quotient
LMW= Low Molecular Weight
LOAEL= Lowest Observed Adverse Effect Level
NOAEL= No Observed Adverse Effect Level
mg/kg= milligrams per kilogram
PAH= Polyaromatic Hydrocarbon
TRV= Toxicity Reference Value
SVOC= Semi-Volatile Organic Compound

Table 9-15
Comparison of Screening Level Modeled Wildlife Doses to Birds based on Tissue Concentrations to Avian TRVs
Sparrows Point Northeast/Near-Shore

Chemical	Avian TRVs (mg/kg-bw day)		Screening Level Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Fish, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Fish, Sediment, and Surface Water
	NOAEL	LOAEL	Great Blue Heron	Great Blue Heron	Great Blue Heron	Great Blue Heron
Inorganics						
Cadmium	1.47E+00	6.35E+00	7.78E-03	**no tissue**	1.80E-03	**no tissue**
Chromium	2.66E+00	1.56E+01	2.58E-01	2.60E-01	4.39E-02	4.42E-02
Copper	4.05E+00	1.21E+01	1.74E-01	4.14E-01	5.83E-02	1.39E-01
Lead	1.63E+00	3.26E+00	6.55E-02	8.23E-02	3.27E-02	4.11E-02
Mercury	4.50E-01	9.00E-01	3.00E-03	4.31E-03	1.50E-03	2.15E-03
Nickel	6.71E+00	1.86E+01	7.50E-03	7.20E-03	2.71E-03	2.60E-03
Silver	2.02E+00	2.02E+01	8.81E-03	1.17E-02	8.81E-04	1.17E-03
Zinc	6.61E+01	1.71E+02	5.24E-02	4.30E-02	2.02E-02	1.66E-02
PAHs						
Total LMW PAH (ND=RL)	5.62E+03	NA	2.35E-06	1.70E-06	--	--
Total HMW PAH (ND=RL)	2.00E+00	2.00E+01	6.49E-03	4.39E-03	6.49E-04	4.39E-04
Total PAH (ND=RL)	2.00E+00	2.00E+01	1.44E-02	9.16E-03	1.44E-03	9.16E-04

Bolded HQs exceed 1 (to one significant digit) and are associated with exposures that exceed TRVs.
--= does not apply
HMW= High Molecular Weight
HQ= Hazard Quotient
LMW= Low Molecular Weight
LOAEL= Lowest Observed Adverse Effect Level
mg/kg-bw day= milligrams per kilogram of body weight per day
NA= Not Available
ND= Non-detect
NOAEL= No Observed Adverse Effect Level
PAH= Polyaromatic Hydrocarbon
RL= Reporting Limit
TRV= Toxicity Reference Value

Table 9-16
Comparison of Screening Level Modeled Wildlife Doses to Mammals based on Tissue Concentrations to Mammalian TRVs
Sparrows Point Northeast/Near-Shore

Chemical	Mammalian TRVs (mg/kg-bw day)		Screening Level Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Fish, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Fish, Sediment, and Surface Water
	NOAEL	LOAEL	Raccoon	Raccoon	Raccoon	Raccoon
Inorganics						
Cadmium	7.70E-01	7.70E+00	5.61E-02	**no tissue**	5.61E-03	**no tissue**
Chromium	2.40E+00	5.82E+01	1.08E+00	1.09E+00	4.45E-02	4.49E-02
Copper	5.60E+00	9.34E+00	4.76E-01	1.13E+00	2.85E-01	6.79E-01
Lead	4.70E+00	8.90E+00	8.58E-02	1.08E-01	4.53E-02	5.69E-02
Mercury	1.32E+01	NA	3.82E-04	5.50E-04	--	--
Nickel	1.70E+00	3.40E+00	1.12E-01	1.07E-01	5.58E-02	5.36E-02
Silver	6.02E+00	6.02E+01	1.12E-02	1.48E-02	1.12E-03	1.48E-03
Zinc	7.54E+01	2.98E+02	1.73E-01	1.42E-01	4.39E-02	3.61E-02
PAHs						
Total LMW PAH (ND=RL)	6.56E+01	3.28E+02	7.59E-04	5.49E-04	1.52E-04	1.10E-04
Total HMW PAH (ND=RL)	6.15E-01	3.01E+00	7.98E-02	5.39E-02	1.63E-02	1.10E-02
Total PAH (ND=RL)	6.15E-01	3.01E+00	1.77E-01	1.12E-01	3.61E-02	2.30E-02

Bolded HQs exceed 1 (to one significant digit) and are associated with exposures that exceed TRVs.
--= does not apply
HMW= High Molecular Weight
HQ= Hazard Quotient
LMW= Low Molecular Weight
LOAEL= Lowest Observed Adverse Effect Level
mg/kg-bw day= milligrams per kilogram of body weight per day
NA= Not Available
ND= Non-detect
NOAEL= No Observed Adverse Effect Level

Table 9-17
Comparison of Reasonable Maximum Modeled Wildlife Doses to Birds based on Uptake Factors to Avian TRVs
Sparrows Point Northeast/Near-Shore

Chemical	Avian TRVs (mg/kg-bw day)		Reasonable Maximum Case Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Fish, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Fish, Sediment, and Surface Water
	NOAEL	LOAEL	Great Blue Heron	Great Blue Heron	Great Blue Heron	Great Blue Heron
Inorganics						
Cadmium	1.47E+00	6.35E+00	7.50E-03	2.94E-03	1.74E-03	6.81E-04
Chromium	2.66E+00	1.56E+01	4.91E-01	2.57E-01	8.36E-02	4.37E-02
Copper	4.05E+00	1.21E+01	5.31E-02	2.60E-02	1.78E-02	8.69E-03
Cyanide (Total)	NA	NA	--	--	--	--
Lead	1.63E+00	3.26E+00	7.06E-02	4.11E-02	3.53E-02	2.05E-02
Mercury	4.50E-01	9.00E-01	3.26E-03	1.12E-01	1.63E-03	5.58E-02
Nickel	6.71E+00	1.86E+01	1.67E-02	5.96E-03	6.02E-03	2.15E-03
Silver	2.02E+00	2.02E+01	3.82E-03	7.57E-04	3.82E-04	7.57E-05
Zinc	6.61E+01	1.71E+02	8.30E-02	1.48E-02	3.20E-02	5.72E-03
PAHs						
Total LMW PAH (ND=RL)	5.62E+03	NA	5.10E-06	1.28E-05	--	--
Total HMW PAH (ND=RL)	2.00E+00	2.00E+01	3.24E-02	4.69E-03	3.24E-03	4.69E-04
Total PAH (ND=RL)	2.00E+00	2.00E+01	4.96E-02	4.07E-02	4.96E-03	4.07E-03
SVOCs						
Bis(2-ethylhexyl)phthalate	1.10E+00	NA	8.96E-02	9.33E-03	--	--

Bolded HQs exceed 1 (to one significant digit) and are associated with exposures that exceed TRVs.
--= does not apply
HMW= High Molecular Weight
HQ= Hazard Quotient
LMW= Low Molecular Weight
LOAEL= Lowest Observed Adverse Effect Level
mg/kg-bw day= milligrams per kilogram of body weight per day
NA= Not Available
ND= Non-detect
NOAEL= No Observed Adverse Effect Level
PAH= Polyaromatic Hydrocarbon
RL= Reporting Limit
SVOC= Semi-Volatile Organic Compound
TRV= Toxicity Reference Value

Table 9-18
Comparison of Reasonable Maximum Modeled Wildlife Doses to Mammals based on Uptake Factors to Mammalian TRVs
Sparrows Point Northeast/Near-Shore

Chemical	Mammalian TRVs (mg/kg-bw day)		Reasonable Maximum Case Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Fish, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Fish, Sediment, and Surface Water
	NOAEL	LOAEL	Raccoon	Raccoon	Raccoon	Raccoon
Inorganics						
Cadmium	7.70E-01	7.70E+00	5.41E-02	2.12E-02	5.41E-03	2.12E-03
Chromium	2.40E+00	5.82E+01	**2.06E+00**	1.07E+00	8.49E-02	4.43E-02
Copper	5.60E+00	9.34E+00	1.45E-01	7.09E-02	8.70E-02	4.25E-02
Cyanide (Total)	6.87E+01	NA	8.21E-03	5.12E-05	--	--
Lead	4.70E+00	8.90E+00	9.25E-02	5.38E-02	4.88E-02	2.84E-02
Mercury	1.32E+01	NA	4.19E-04	1.44E-02	--	--
Nickel	1.70E+00	3.40E+00	2.48E-01	8.87E-02	1.24E-01	4.44E-02
Silver	6.02E+00	6.02E+01	4.85E-03	9.60E-04	4.85E-04	9.60E-05
Zinc	7.54E+01	2.98E+02	2.75E-01	4.91E-02	6.96E-02	1.25E-02
PAHs						
Total LMW PAH (ND=RL)	6.56E+01	3.28E+02	1.65E-03	4.13E-03	3.30E-04	8.27E-04
Total HMW PAH (ND=RL)	6.15E-01	3.01E+00	3.98E-01	5.76E-02	8.13E-02	1.18E-02
Total PAH (ND=RL)	6.15E-01	3.01E+00	6.10E-01	5.00E-01	1.25E-01	1.02E-01
SVOCs						
Bis(2-ethylhexyl)phthalate	1.83E+01	1.83E+02	2.04E-02	2.12E-03	2.04E-03	2.12E-04

Bolded HQs exceed 1 (to one significant digit) and are associated with exposures that exceed TRVs.
--= does not apply
HMW= High Molecular Weight
HQ= Hazard Quotient
LMW= Low Molecular Weight
LOAEL= Lowest Observed Adverse Effect Level
mg/kg-bw day= milligrams per kilogram of body weight per day
NA= Not Available
ND= Non-detect
NOAEL= No Observed Adverse Effect Level
PAH= Polyaromatic Hydrocarbon
RL= Reporting Limit
SVOC= Semi-Volatile Organic Compound
TRV= Toxicity Reference Value

Table 9-19
Comparison of Reasonable Maximum Modeled Wildlife Doses to Birds based on Tissue Concentrations to Avian TRVs
Sparrows Point Northeast/Near-Shore

Chemical	Avian TRVs (mg/kg-bw day)		Reasonable Maximum Case Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Fish, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Fish, Sediment, and Surface Water
	NOAEL	LOAEL	Great Blue Heron	Great Blue Heron	Great Blue Heron	Great Blue Heron
Inorganics						
Cadmium	1.47E+00	6.35E+00	7.78E-03	**no tissue**	1.80E-03	**no tissue**
Chromium	2.66E+00	1.56E+01	2.58E-01	2.60E-01	4.39E-02	4.42E-02
Copper	4.05E+00	1.21E+01	1.60E-01	4.00E-01	5.34E-02	1.34E-01
Lead	1.63E+00	3.26E+00	4.57E-02	6.25E-02	2.28E-02	3.12E-02
Mercury	4.50E-01	9.00E-01	2.95E-03	4.26E-03	1.48E-03	2.13E-03
Nickel	6.71E+00	1.86E+01	6.40E-03	6.10E-03	2.31E-03	2.20E-03
Silver	2.02E+00	2.02E+01	8.81E-03	1.17E-02	8.81E-04	1.17E-03
Zinc	6.61E+01	1.71E+02	4.53E-02	3.59E-02	1.75E-02	1.39E-02
PAHs						
Total LMW PAH (ND=RL)	5.62E+03	NA	2.28E-06	1.64E-06	--	--
Total HMW PAH (ND=RL)	2.00E+00	2.00E+01	6.49E-03	4.39E-03	6.49E-04	4.39E-04
Total PAH (ND=RL)	2.00E+00	2.00E+01	1.44E-02	9.15E-03	1.44E-03	9.15E-04

Bolded HQs exceed 1 (to one significant digit) and are associated with exposures that exceed TRVs.

--= does not apply
HMW= High Molecular Weight
HQ= Hazard Quotient
LMW= Low Molecular Weight
LOAEL= Lowest Observed Adverse Effect Level
mg/kg-bw day= milligrams per kilogram of body weight per day
NA= Not Available
ND= Non-detect
NOAEL= No Observed Adverse Effect Level
PAH= Polyaromatic Hydrocarbon
RL= Reporting Limit
TRV= Toxicity Reference Value

Table 9-20
Comparison of Reasonable Maximum Modeled Wildlife Doses to Mammals based on Tissue Concentrations to Mammalian TRVs
Sparrows Point Northeast/Near-Shore

Chemical	Mammalian TRVs (mg/kg-bw day)		Reasonable Maximum Case Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Fish, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Fish, Sediment, and Surface Water
	NOAEL	LOAEL	Raccoon	Raccoon	Raccoon	Raccoon
Inorganics						
Cadmium	7.70E-01	7.70E+00	5.61E-02	**no tissue**	5.61E-03	**no tissue**
Chromium	2.40E+00	5.82E+01	1.08E+00	1.09E+00	4.45E-02	4.49E-02
Copper	5.60E+00	9.34E+00	4.36E-01	1.09E+00	2.61E-01	6.55E-01
Lead	4.70E+00	8.90E+00	5.98E-02	8.18E-02	3.16E-02	4.32E-02
Mercury	1.32E+01	NA	3.79E-04	5.47E-04	--	--
Nickel	1.70E+00	3.40E+00	9.53E-02	9.08E-02	4.77E-02	4.54E-02
Silver	6.02E+00	6.02E+01	1.12E-02	1.48E-02	1.12E-03	1.48E-03
Zinc	7.54E+01	2.98E+02	1.50E-01	1.19E-01	3.80E-02	3.02E-02
PAHs						
Total LMW PAH (ND=RL)	6.56E+01	3.28E+02	7.39E-04	5.30E-04	1.48E-04	1.06E-04
Total HMW PAH (ND=RL)	6.15E-01	3.01E+00	7.98E-02	5.39E-02	1.63E-02	1.10E-02
Total PAH (ND=RL)	6.15E-01	3.01E+00	1.77E-01	1.12E-01	3.61E-02	2.30E-02

Bolded HQs exceed 1 (to one significant digit) and are associated with exposures that exceed TRVs.
--= does not apply
HMW= High Molecular Weight
HQ= Hazard Quotient
LMW= Low Molecular Weight
LOAEL= Lowest Observed Adverse Effect Level
mg/kg-bw day= milligrams per kilogram of body weight per day
NA= Not Available
ND= Non-detect
NOAEL= No Observed Adverse Effect Level
PAH= Polyaromatic Hydrocarbon
RL= Reporting Limit
TRV= Toxicity Reference Value

Table 9-21
Comparison of Exposure Point Concentrations (EPCs) in Sediment to Benthic Organism TRVs
Sparrows Point Southwest/Tin Mill Canal Effluent

Chemical	Sediment TEL TRV (mg/kg)	Sediment PEL TRV (mg/kg)	Frequency of Detection	Screening Level EPC (mg/kg)	TEL Hazard Quotient for Maximum EPC	PEL Hazard Quotient for Maximum EPC	Reasonable Maximum (95% UCLM) EPC (mg/kg)	TEL Hazard Quotient for 95UCLM EPC	PEL Hazard Quotient for 95UCLM EPC
Inorganics									
Antimony	2.00E+00	2.50E+01	28/29	1.00E+01	**5.00E+00**	4.00E-01	5.64E+00	**2.82E+00**	2.26E-01
Arsenic	7.24E+00	4.16E+01	29/29	1.20E+02	**1.66E+01**	**2.88E+00**	4.79E+01	**6.62E+00**	1.15E+00
Beryllium	1.10E+00	3.00E+01	29/29	1.60E+00	1.45E+00	5.33E-02	8.68E-01	7.89E-01	2.89E-02
Cadmium	6.80E-01	4.21E+00	29/29	1.10E+02	**1.62E+02**	**2.61E+01**	3.04E+01	**4.47E+01**	**7.22E+00**
Chromium	5.23E+01	1.60E+02	29/29	4.60E+03	**8.80E+01**	**2.88E+01**	2.43E+03	**4.65E+01**	**1.52E+01**
Copper	1.87E+01	1.08E+02	29/29	5.50E+02	**2.94E+01**	**5.09E+00**	3.22E+02	**1.72E+01**	**2.98E+00**
Cyanide (Total)	1.00E+00	2.00E+01	28/29	3.50E+01	**3.50E+01**	**1.75E+00**	1.71E+01	**1.71E+01**	8.54E-01
Lead	3.02E+01	1.12E+02	29/29	1.10E+03	**3.64E+01**	**9.82E+00**	4.67E+02	**1.54E+01**	**4.17E+00**
Mercury	1.30E-01	7.00E-01	27/28	1.60E+00	**1.23E+01**	**2.29E+00**	8.27E-01	**6.36E+00**	1.18E+00
Nickel	1.59E+01	4.28E+01	29/29	2.10E+02	**1.32E+01**	**4.91E+00**	1.11E+02	**6.99E+00**	**2.60E+00**
Selenium	7.00E-01	1.00E+02	24/29	1.70E+01	**2.43E+01**	1.70E-01	8.83E+00	**1.26E+01**	8.83E-02
Silver	7.30E-01	1.77E+00	29/29	8.10E+00	**1.11E+01**	**4.58E+00**	3.87E+00	**5.30E+00**	**2.19E+00**
Thallium	1.00E+00	1.50E+01	29/29	9.80E-01	9.80E-01	6.53E-02	5.23E-01	5.23E-01	3.49E-02
Zinc	1.24E+02	2.71E+02	29/29	1.70E+04	**1.37E+02**	**6.27E+01**	6.68E+03	**5.38E+01**	**2.46E+01**
PAHs									
Total LMW PAH (ND=RL)	3.12E-01	1.44E+00	29/29	4.52E+01	**1.45E+02**	**3.13E+01**	1.86E+01	**5.97E+01**	**1.29E+01**
Total HMW PAH (ND=RL)	6.55E-01	6.68E+00	29/29	3.92E+01	**5.98E+01**	**5.87E+00**	2.11E+01	**3.22E+01**	**3.16E+00**
Total PAH (ND=RL)	1.68E+00	1.68E+01	29/29	8.17E+01	**4.85E+01**	**4.87E+00**	3.93E+01	**2.33E+01**	**2.34E+00**
PCBs									
Aroclor-1248	6.33E-02	7.09E-01	28/28	9.00E+00	**1.42E+02**	**1.27E+01**	3.58E+00	**5.65E+01**	**5.05E+00**
Aroclor-1254	6.33E-02	7.09E-01	20/28	3.20E+00	**5.06E+01**	**4.51E+00**	1.24E+00	**1.96E+01**	**1.75E+00**
Aroclor-1260	6.33E-02	7.09E-01	23/28	2.00E+00	**3.16E+01**	**2.82E+00**	6.57E-01	**1.04E+01**	9.27E-01
Total PCBs (ND=0)	5.98E-02	6.76E-01	28/28	1.32E+01	**2.21E+02**	**1.95E+01**	3.40E+00	**5.68E+01**	**5.03E+00**
Total PCBs (ND=RL)	5.98E-02	6.76E-01	28/28	1.39E+01	**2.32E+02**	**2.05E+01**	3.53E+00	**5.90E+01**	**5.22E+00**
SVOCs									
2,4-Dimethylphenol	NA	NA	1/28	5.90E-02	--	--	5.90E-02	--	--
4-Nitrophenol	NA	NA	1/28	3.60E+00	--	--	3.60E+00	--	--
Benzoic Acid	NA	NA	3/28	1.40E+00	--	--	1.40E+00	--	--
Bis(2-ethylhexyl)phthalate	1.82E-01	2.65E+00	26/29	5.10E+01	**2.80E+02**	**1.93E+01**	1.88E+01	**1.03E+02**	**7.10E+00**
VOCs									
Chlorobenzene	3.00E-02	3.00E+01	12/28	2.50E-01	**8.33E+00**	8.33E-03	4.10E-02	1.37E+00	1.37E-03

Bolded HQs exceed 1 (to one significant digit) and are associated with exposures that exceed TRVs.

--= does not apply
EPC=Exposure Point Concentration
HMW= High Molecular Weight
LMW= Low Molecular Weight
mg/kg= milligrams per kilogram
NA= Not Available
ND = Non-detect
PAH= Polyaromatic Hydrocarbon
PCB = Polychlorinated biphenyl
PEL= Probable Effect Level
RL = Reporting Limit
SVOC= Semi-Volatile Organic Compound
TEL= Threshold Effect Level
TRV= Toxicity Reference Value
UCLM= Upper Confidence Limit of the Mean
VOC= Volatile Organic Compound

Table 9-22
Comparison of Exposure Point Concentrations in Surface Water to Aquatic Organism TRVs
Sparrows Point Southwest/Tin Mill Canal Effluent

Chemical	Surface Water Toxicity Reference Value (µg/L)		Screening Level (Maximum) EPC-Non-Storm Conditions (µg/L)			Reasonable Maximum (weighted average) EPC-Non-Storm Conditions (µg/L)			Screening Level (Maximum) EPC-Storm Conditions (µg/L)		
	Chronic	Acute	EPC (µg/L)	Hazard Quotient for Comparison to Chronic TRV	Hazard Quotient for Comparison to Acute TRV	EPC (µg/L)	Hazard Quotient for Comparison to Chronic TRV	Hazard Quotient for Comparison to Acute TRV	EPC (µg/L)	Hazard Quotient for Comparison to Chronic TRV	Hazard Quotient for Comparison to Acute TRV
Inorganics											
Antimony	5.00E+02	1.50E+03	3.29E-01	6.58E-04	2.19E-04	1.20E-01	2.40E-04	8.01E-05	5.88E-01	1.18E-03	3.92E-04
Arsenic	3.60E+01	6.90E+01	9.60E-01	2.67E-02	1.39E-02	5.13E-01	1.43E-02	7.44E-03	1.03E+00	2.86E-02	1.49E-02
Chromium	5.00E+01	1.10E+03	9.63E-01	1.93E-02	8.75E-04	2.57E-01	5.13E-03	2.33E-04	1.26E+00	2.52E-02	1.15E-03
Copper	3.10E+00	4.80E+00	9.69E-01	3.13E-01	2.02E-01	2.99E-01	9.64E-02	6.23E-02	9.79E-01	3.16E-01	2.04E-01
Cyanide (Total)	1.00E+00	1.00E+00	3.87E+00	**3.87E+00**	**3.87E+00**	1.15E+00	1.15E+00	1.15E+00	6.50E+00	**6.50E+00**	**6.50E+00**
Lead	8.10E+00	2.10E+02	5.37E-01	6.63E-02	2.56E-03	7.99E-02	9.86E-03	3.80E-04	5.44E-01	6.72E-02	2.59E-03
Mercury	9.40E-01	1.80E+00	3.25E-01	3.46E-01	1.81E-01	1.14E-01	1.21E-01	6.32E-02	3.28E-01	3.49E-01	1.82E-01
Nickel	8.20E+00	7.40E+01	5.80E+00	7.07E-01	7.84E-02	1.68E+00	2.05E-01	2.27E-02	5.81E+00	7.09E-01	7.85E-02
Zinc	8.10E+01	9.00E+01	1.93E+01	2.38E-01	2.14E-01	5.56E+00	6.86E-02	6.18E-02	1.94E+01	2.40E-01	2.16E-01
PAHs											
Total LMW PAH (ND=RL)	1.40E+00	3.70E+01	4.72E-01	3.37E-01	1.28E-02	1.30E-01	9.29E-02	3.51E-03	4.74E-01	3.39E-01	1.28E-02
Total HMW PAH (ND=RL)	4.60E+00	7.70E+00	2.32E-02	5.04E-03	3.01E-03	8.43E-03	1.83E-03	1.09E-03	2.35E-02	5.11E-03	3.05E-03
Total PAH (ND=RL)	4.60E+00	3.70E+01	4.95E-01	1.08E-01	1.34E-02	1.38E-01	3.01E-02	3.74E-03	4.98E-01	1.08E-01	1.34E-02
SVOCs											
Bis(2-ethylhexyl)phthalate	3.60E+02	4.00E+02	7.33E-02	2.04E-04	1.83E-04	2.57E-02	7.14E-05	6.43E-05	2.61E-01	7.25E-04	6.53E-04

Bolded HQs exceed 1 (to one significant digit) and are associated with exposures that exceed TRVs.

µg/L= micrograms per liter
EPC=Exposure Point Concentration
HMW= High Molecular Weight
LMW= Low Molecular Weight
ND = Non-detect
PAH= Polyaromatic Hydrocarbon
RL = Reporting Limit
SVOC= Semi-Volatile Organic Compound
TRV= Toxicity Reference Value

Table 9-23
Comparison of Screening Level Modeled Wildlife Doses to Birds based on Uptake Factors to Avian TRVs
Sparrows Point Southwest/Tin Mill Canal Effluent

Chemical	Avian TRVs (mg/kg-bw day)		Screening Level Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Fish, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Fish, Sediment, and Surface Water
	NOAEL	LOAEL	Great Blue Heron	Great Blue Heron	Great Blue Heron	Great Blue Heron
Inorganics						
Arsenic	2.24E+00	7.40E+00	5.70E-01	4.85E-02	1.72E-01	1.47E-02
Cadmium	1.47E+00	6.35E+00	1.72E-01	6.73E-02	3.98E-02	1.56E-02
Chromium	2.66E+00	1.56E+01	**3.01E+00**	**1.57E+00**	5.13E-01	2.67E-01
Copper	4.05E+00	1.21E+01	3.12E-01	1.42E-01	1.04E-01	4.76E-02
Cyanide (Total)	NA	NA	--	--	--	--
Lead	1.63E+00	3.26E+00	1.05E+00	6.08E-01	5.24E-01	3.04E-01
Mercury	4.50E-01	9.00E-01	1.24E-02	2.37E-01	6.20E-03	1.19E-01
Nickel	6.71E+00	1.86E+01	9.23E-02	3.19E-02	3.34E-02	1.15E-02
Selenium	2.90E-01	5.79E-01	6.06E-01	5.28E-02	3.04E-01	2.64E-02
Silver	2.02E+00	2.02E+01	1.82E-02	3.61E-03	1.82E-03	3.61E-04
Zinc	6.61E+01	1.71E+02	1.36E+00	2.35E-01	5.26E-01	9.05E-02
PAHs						
Total LMW PAH (ND=RL)	5.62E+03	NA	1.74E-04	5.55E-05	--	--
Total HMW PAH (ND=RL)	2.00E+00	2.00E+01	4.13E-01	2.43E-02	4.13E-02	2.43E-03
Total PAH (ND=RL)	2.00E+00	2.00E+01	8.50E-01	1.79E-01	8.50E-02	1.79E-02
PCBs						
Aroclor-1248	1.80E-01	1.80E+00	**3.18E+01**	4.50E-02	**3.18E+00**	4.50E-03
Aroclor-1254	1.80E-01	1.80E+00	**1.13E+01**	1.60E-02	1.13E+00	1.60E-03
Aroclor-1260	1.80E-01	1.80E+00	**7.06E+00**	1.00E-02	7.06E-01	1.00E-03
Total PCBs (ND=0)	1.80E-01	1.80E+00	**8.38E+01**	6.60E-02	**8.38E+00**	6.60E-03
Total PCBs (ND=RL)	1.80E-01	1.80E+00	**9.59E+01**	6.94E-02	**9.59E+00**	6.94E-03
SVOCs						
2,4-Dimethylphenol	NA	NA	--	--	--	--
4-Nitrophenol	NA	NA	--	--	--	--
Benzoic Acid	NA	NA	--	--	--	--
Bis(2-ethylhexyl)phthalate	1.10E+00	NA	**8.39E+00**	6.23E-02	--	--
VOCs						
Chlorobenzene	NA	NA	--	--	--	--

Bolded HQs exceed 1 (to one significant digit) and are associated with exposures that exceed TRVs.
--= does not apply
HMW= High Molecular Weight
HQ= Hazard Quotient
LMW= Low Molecular Weight
LOAEL= Lowest Observed Adverse Effect Level
mg/kg-bw day= milligrams per kilogram of body weight per day
NA= Not Available
ND= Non-detect
NOAEL= No Observed Adverse Effect Level
PAH= Polyaromatic Hydrocarbon
PCB= Polychlorinated biphenyl
RL= Reporting Limit
SVOC= Semi-Volatile Organic Compound
TRV= Toxicity Reference Value
VOC= Volatile Organic Compound

Table 9-24
Comparison of Screening Level Scenario Modeled Wildlife Doses to Mammals based on Uptake Factors to Mammalian TRVs
Sparrows Point Southwest/Tin Mill Canal Effluent

Chemical	Mammalian TRVs (mg/kg-bw day)		Screening Level Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Fish, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Fish, Sediment, and Surface Water
	NOAEL	LOAEL	Raccoon	Raccoon	Raccoon	Raccoon
Inorganics						
Antimony	5.90E-02	5.90E-01	**4.20E+00**	5.81E-01	4.20E-01	5.81E-02
Arsenic	1.04E+00	1.66E+00	**4.64E+00**	3.95E-01	**2.90E+00**	2.47E-01
Beryllium	5.32E-01	6.73E-01	**2.06E+00**	1.02E-02	**1.63E+00**	8.09E-03
Cadmium	7.70E-01	7.70E+00	1.24E+00	4.86E-01	1.24E-01	4.86E-02
Chromium	2.40E+00	5.82E+01	**1.26E+01**	**6.57E+00**	5.20E-01	2.71E-01
Copper	5.60E+00	9.34E+00	8.51E-01	3.89E-01	5.10E-01	2.33E-01
Cyanide (Total)	6.87E+01	NA	3.48E-01	1.78E-03	--	--
Lead	4.70E+00	8.90E+00	1.37E+00	7.97E-01	7.25E-01	4.21E-01
Mercury	1.32E+01	NA	1.59E-03	3.06E-02	--	--
Nickel	1.70E+00	3.40E+00	1.38E+00	4.76E-01	6.88E-01	2.38E-01
Selenium	1.43E-01	2.15E-01	**4.64E+00**	4.04E-01	**3.09E+00**	2.69E-01
Silver	6.02E+00	6.02E+01	2.31E-02	4.57E-03	2.31E-03	4.57E-04
Thallium	7.40E-03	7.40E-02	**1.70E+00**	4.50E-01	1.70E-01	4.50E-02
Zinc	7.54E+01	2.98E+02	**4.52E+00**	7.78E-01	1.14E+00	1.97E-01
PAHs						
Total LMW PAH (ND=RL)	6.56E+01	3.28E+02	5.64E-02	1.80E-02	1.13E-02	3.59E-03
Total HMW PAH (ND=RL)	6.15E-01	3.01E+00	**5.07E+00**	2.99E-01	1.04E+00	6.10E-02
Total PAH (ND=RL)	6.15E-01	3.01E+00	**1.04E+01**	**2.20E+00**	**2.13E+00**	4.49E-01
PCBs						
Aroclor-1248	1.00E-02	1.00E-01	**2.16E+03**	**3.06E+00**	**2.16E+02**	3.06E-01
Aroclor-1254	1.40E-01	6.90E-01	**5.49E+01**	7.77E-02	**1.11E+01**	1.58E-02
Aroclor-1260	1.00E-02	1.00E-01	**4.80E+02**	6.80E-01	**4.80E+01**	6.80E-02
Total PCBs (ND=0)	1.00E-02	1.00E-01	**5.70E+03**	**4.49E+00**	**5.70E+02**	4.49E-01
Total PCBs (ND=RL)	1.00E-02	1.00E-01	**6.52E+03**	**4.72E+00**	**6.52E+02**	4.72E-01
SVOCs						
2,4-Dimethylphenol	NA	NA	--	--	--	--
4-Nitrophenol	NA	NA	--	--	--	--
Benzoic Acid	NA	NA	--	--	--	--
Bis(2-ethylhexyl)phthalate	1.83E+01	1.83E+02	**1.90E+00**	1.41E-02	1.90E-01	1.41E-03
VOCs						
Chlorobenzene	1.50E+01	4.10E+01	1.14E-02	5.67E-05	4.17E-03	2.07E-05

Bolded HQs exceed 1 (to one significant digit) and are associated with exposures that exceed TRVs.

--= does not apply
HMW= High Molecular Weight
HQ= Hazard Quotient
LMW= Low Molecular Weight
LOAEL= Lowest Observed Adverse Effect Level
mg/kg-bw day= milligrams per kilogram of body weight per day
NA= Not Available
ND= Non-detect
NOAEL= No Observed Adverse Effect Level
PAH= Polyaromatic Hydrocarbon
PCB= Polychlorinated biphenyl
RL= Reporting Limit
SVOC= Semi-Volatile Organic Compound
TRV= Toxicity Reference Value
VOC= Volatile Organic Compound

Table 9-25
Comparison of Screening Level Modeled Wildlife Doses to Birds based on Tissue Concentrations to Avian TRVs
Sparrows Point Southwest/Tin Mill Canal Effluent

Chemical	Avian TRVs (mg/kg-bw day)		Screening Level Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Fish, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Fish, Sediment, and Surface Water
	NOAEL	LOAEL	Great Blue Heron	Great Blue Heron	Great Blue Heron	Great Blue Heron
Inorganics						
Arsenic	2.24E+00	7.40E+00	7.32E-02	6.23E-02	2.22E-02	1.89E-02
Cadmium	1.47E+00	6.35E+00	7.22E-02	**no tissue**	1.67E-02	**no tissue**
Chromium	2.66E+00	1.56E+01	**1.56E+00**	**1.56E+00**	2.66E-01	2.66E-01
Copper	4.05E+00	1.21E+01	2.61E-01	5.01E-01	8.73E-02	1.68E-01
Lead	1.63E+00	3.26E+00	6.12E-01	6.29E-01	3.06E-01	3.14E-01
Mercury	4.50E-01	9.00E-01	5.33E-03	6.63E-03	2.66E-03	3.32E-03
Nickel	6.71E+00	1.86E+01	2.95E-02	2.92E-02	1.07E-02	1.06E-02
Selenium	2.90E-01	5.79E-01	2.20E-01	3.32E-01	1.10E-01	1.66E-01
Silver	2.02E+00	2.02E+01	1.17E-02	1.45E-02	1.17E-03	1.45E-03
Zinc	6.61E+01	1.71E+02	2.63E-01	2.53E-01	1.01E-01	9.77E-02
PAHs						
Total LMW PAH (ND=RL)	5.62E+03	NA	9.31E-06	8.67E-06	--	--
Total HMW PAH (ND=RL)	2.00E+00	2.00E+01	2.27E-02	2.06E-02	2.27E-03	2.06E-03
Total PAH (ND=RL)	2.00E+00	2.00E+01	4.90E-02	4.38E-02	4.90E-03	4.38E-03
PCBs						
Total PCBs (ND=0)	1.80E-01	1.80E+00	1.02E-01	2.00E-01	1.02E-02	2.00E-02
Total PCBs (ND=RL)	1.80E-01	1.80E+00	1.22E-01	2.09E-01	1.22E-02	2.09E-02

Bolded HQs exceed 1 (to one significant digit) and are associated with exposures that exceed TRVs.

--= does not apply
HMW= High Molecular Weight
HQ= Hazard Quotient
LMW= Low Molecular Weight
LOAEL= Lowest Observed Adverse Effect Level
mg/kg-bw day= milligrams per kilogram of body weight per day
NA= Not Available
ND= Non-detect
NOAEL= No Observed Adverse Effect Level
PAH= Polyaromatic Hydrocarbon
PCB= Polychlorinated biphenyl
RL= Reporting Limit
TRV= Toxicity Reference Value

Table 9-26
Comparison of Screening Level Modeled Wildlife Doses to Mammals based on Tissue Concentrations to Mammalian TRVs
Sparrows Point Southwest/Tin Mill Canal Effluent

Chemical	Mammalian TRVs (mg/kg-bw day)		Screening Level Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Fish, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Screening Level Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Fish, Sediment, and Surface Water
	NOAEL	LOAEL	Raccoon	Raccoon	Raccoon	Raccoon
Inorganics						
Antimony	5.90E-02	5.90E-01	6.89E-01	8.16E-01	6.89E-02	8.16E-02
Arsenic	1.04E+00	1.66E+00	5.96E-01	5.07E-01	3.73E-01	3.18E-01
Cadmium	7.70E-01	7.70E+00	5.21E-01	**no tissue**	5.21E-02	**no tissue**
Chromium	2.40E+00	5.82E+01	**6.53E+00**	**6.54E+00**	2.70E-01	2.70E-01
Copper	5.60E+00	9.34E+00	7.13E-01	1.37E+00	4.27E-01	8.21E-01
Lead	4.70E+00	8.90E+00	8.02E-01	8.24E-01	4.23E-01	4.35E-01
Mercury	1.32E+01	NA	6.84E-04	8.52E-04	--	--
Nickel	1.70E+00	3.40E+00	4.40E-01	4.35E-01	2.20E-01	2.18E-01
Selenium	1.43E-01	2.15E-01	**1.68E+00**	**2.54E+00**	1.12E+00	**1.69E+00**
Silver	6.02E+00	6.02E+01	1.48E-02	1.84E-02	1.48E-03	1.84E-03
Thallium	7.40E-03	7.40E-02	**1.53E+00**	1.46E+00	1.53E-01	1.46E-01
Zinc	7.54E+01	2.98E+02	8.70E-01	8.39E-01	2.20E-01	2.13E-01
PAHs						
Total LMW PAH (ND=RL)	6.56E+01	3.28E+02	3.01E-03	2.80E-03	6.03E-04	5.61E-04
Total HMW PAH (ND=RL)	6.15E-01	3.01E+00	2.79E-01	2.54E-01	5.71E-02	5.18E-02
Total PAH (ND=RL)	6.15E-01	3.01E+00	6.02E-01	5.38E-01	1.23E-01	1.10E-01
PCBs						
Total PCBs (ND=0)	1.00E-02	1.00E-01	**6.94E+00**	**1.36E+01**	6.94E-01	1.36E+00
Total PCBs (ND=RL)	1.00E-02	1.00E-01	**8.28E+00**	**1.42E+01**	8.28E-01	1.42E+00

Bolded HQs exceed 1 (to one significant digit) and are associated with exposures that exceed TRVs.

--= does not apply

HMW= High Molecular Weight

HQ= Hazard Quotient

LMW= Low Molecular Weight

LOAEL= Lowest Observed Adverse Effect Level

mg/kg-bw day= milligrams per kilogram of body weight per day

NA= Not Available

ND= Non-detect

NOAEL= No Observed Adverse Effect Level

PAH= Polyaromatic Hydrocarbon

PCB= Polychlorinated biphenyl

RL= Reporting Limit

TRV= Toxicity Reference Value

Table 9-27
Comparison of Reasonable Maximum Modeled Wildlife Doses to Birds based on Uptake Factors to Avian TRVs
Sparrows Point Southwest/Tin Mill Canal Effluent

Chemical	Avian TRVs (mg/kg-bw day)		Reasonable Maximum Case Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Fish, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Fish, Sediment, and Surface Water
	NOAEL	LOAEL	Great Blue Heron	Great Blue Heron	Great Blue Heron	Great Blue Heron
Inorganics						
Arsenic	2.24E+00	7.40E+00	2.28E-01	1.94E-02	6.89E-02	5.88E-03
Cadmium	1.47E+00	6.35E+00	4.75E-02	1.86E-02	1.10E-02	4.31E-03
Chromium	2.66E+00	1.56E+01	**1.59E+00**	8.26E-01	2.71E-01	1.41E-01
Copper	4.05E+00	1.21E+01	1.83E-01	7.77E-02	6.11E-02	2.60E-02
Cyanide (Total)	NA	NA	--	--	--	--
Lead	1.63E+00	3.26E+00	4.45E-01	2.58E-01	2.22E-01	1.29E-01
Mercury	4.50E-01	9.00E-01	6.40E-03	8.36E-02	3.20E-03	4.18E-02
Nickel	6.71E+00	1.86E+01	4.89E-02	1.60E-02	1.77E-02	5.78E-03
Selenium	2.90E-01	5.79E-01	3.15E-01	2.74E-02	1.58E-01	1.37E-02
Silver	2.02E+00	2.02E+01	8.70E-03	1.72E-03	8.70E-04	1.72E-04
Zinc	6.61E+01	1.71E+02	5.36E-01	9.19E-02	2.07E-01	3.54E-02
PAHs						
Total LMW PAH (ND=RL)	5.62E+03	NA	7.18E-05	1.63E-05	--	--
Total HMW PAH (ND=RL)	2.00E+00	2.00E+01	2.22E-01	1.19E-02	2.22E-02	1.19E-03
Total PAH (ND=RL)	2.00E+00	2.00E+01	4.09E-01	5.74E-02	4.09E-02	5.74E-03
PCBs						
Aroclor-1248	1.80E-01	1.80E+00	**1.26E+01**	1.79E-02	1.26E+00	1.79E-03
Aroclor-1254	1.80E-01	1.80E+00	**4.37E+00**	6.19E-03	4.37E-01	6.19E-04
Aroclor-1260	1.80E-01	1.80E+00	**2.32E+00**	3.29E-03	2.32E-01	3.29E-04
Total PCBs (ND=0)	1.80E-01	1.80E+00	**2.16E+01**	1.70E-02	**2.16E+00**	1.70E-03
Total PCBs (ND=RL)	1.80E-01	1.80E+00	**2.44E+01**	1.76E-02	**2.44E+00**	1.76E-03
SVOCs						
2,4-Dimethylphenol	NA	NA	--	--	--	--
4-Nitrophenol	NA	NA	--	--	--	--
Benzoic Acid	NA	NA	--	--	--	--
Bis(2-ethylhexyl)phthalate	1.10E+00	NA	**3.09E+00**	2.26E-02	--	--
VOCs						
Chlorobenzene	NA	NA	--	--	--	--

Bolded HQs exceed 1 (to one significant digit) and are associated with exposures that exceed TRVs.

--= does not apply
HMW= High Molecular Weight
HQ= Hazard Quotient
LMW= Low Molecular Weight
LOAEL= Lowest Observed Adverse Effect Level
mg/kg-bw day= milligrams per kilogram of body weight per day
NA= Not Available
ND= Non-detect
NOAEL= No Observed Adverse Effect Level
PAH= Polyaromatic Hydrocarbon
PCB= Polychlorinated biphenyl
RL= Reporting Limit
SVOC= Semi-Volatile Organic Compound
TRV= Toxicity Reference Value
VOC= Volatile Organic Compound

Table 9-28
Comparison of Reasonable Maximum Modeled Wildlife Doses to Mammals based on Uptake Factors to Mammalian TRVs
Sparrows Point Southwest/Tin Mill Canal Effluent

Chemical	Mammalian TRVs (mg/kg-bw day)		Reasonable Maximum Case Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Fish, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Fish, Sediment, and Surface Water
	NOAEL	LOAEL	Raccoon	Raccoon	Raccoon	Raccoon
Inorganics						
Antimony	5.90E-02	5.90E-01	**2.37E+00**	3.26E-01	2.37E-01	3.26E-02
Arsenic	1.04E+00	1.66E+00	**1.85E+00**	1.58E-01	1.16E+00	9.91E-02
Beryllium	5.32E-01	6.73E-01	1.12E+00	5.55E-03	8.82E-01	4.39E-03
Cadmium	7.70E-01	7.70E+00	3.42E-01	1.34E-01	3.42E-02	1.34E-02
Chromium	2.40E+00	5.82E+01	**6.67E+00**	**3.46E+00**	2.75E-01	1.43E-01
Copper	5.60E+00	9.34E+00	4.99E-01	2.12E-01	2.99E-01	1.27E-01
Cyanide (Total)	6.87E+01	NA	1.70E-01	8.58E-04	--	--
Lead	4.70E+00	8.90E+00	5.83E-01	3.38E-01	3.08E-01	1.78E-01
Mercury	1.32E+01	NA	8.24E-04	1.08E-02	--	--
Nickel	1.70E+00	3.40E+00	7.29E-01	2.39E-01	3.64E-01	1.19E-01
Selenium	1.43E-01	2.15E-01	**2.41E+00**	2.10E-01	**1.60E+00**	1.40E-01
Silver	6.02E+00	6.02E+01	1.10E-02	2.19E-03	1.10E-03	2.19E-04
Thallium	7.40E-03	7.40E-02	9.08E-01	2.40E-01	9.08E-02	2.40E-02
Zinc	7.54E+01	2.98E+02	**1.77E+00**	3.04E-01	4.49E-01	7.71E-02
PAHs						
Total LMW PAH (ND=RL)	6.56E+01	3.28E+02	2.32E-02	5.27E-03	4.65E-03	1.05E-03
Total HMW PAH (ND=RL)	6.15E-01	3.01E+00	**2.73E+00**	1.46E-01	5.58E-01	2.99E-02
Total PAH (ND=RL)	6.15E-01	3.01E+00	**5.02E+00**	7.06E-01	1.03E+00	1.44E-01
PCBs						
Aroclor-1248	1.00E-02	1.00E-01	**8.59E+02**	1.22E+00	**8.59E+01**	1.22E-01
Aroclor-1254	1.40E-01	6.90E-01	**2.12E+01**	3.01E-02	**4.31E+00**	6.10E-03
Aroclor-1260	1.00E-02	1.00E-01	**1.58E+02**	2.23E-01	**1.58E+01**	2.23E-02
Total PCBs (ND=0)	1.00E-02	1.00E-01	**1.47E+03**	1.16E+00	**1.47E+02**	1.16E-01
Total PCBs (ND=RL)	1.00E-02	1.00E-01	**1.66E+03**	1.20E+00	**1.66E+02**	1.20E-01
SVOCs						
2,4-Dimethylphenol	NA	NA	--	--	--	--
4-Nitrophenol	NA	NA	--	--	--	--
Benzoic Acid	NA	NA	--	--	--	--
Bis(2-ethylhexyl)phthalate	1.83E+01	1.83E+02	7.02E-01	5.13E-03	7.02E-02	5.13E-04
VOCs						
Chlorobenzene	1.50E+01	4.10E+01	1.87E-03	9.29E-06	6.83E-04	3.40E-06

Bolded HQs exceed 1 (to one significant digit) and are associated with exposures that exceed TRVs.

--= does not apply
HMW= High Molecular Weight
HQ= Hazard Quotient
LMW= Low Molecular Weight
LOAEL= Lowest Observed Adverse Effect Level
mg/kg-bw day= milligrams per kilogram of body weight per day
NA= Not Available
ND= Non-detect
NOAEL= No Observed Adverse Effect Level
PAH= Polyaromatic Hydrocarbon
PCB= Polychlorinated biphenyl
RL= Reporting Limit
SVOC= Semi-Volatile Organic Compound
TRV= Toxicity Reference Value
VOC= Volatile Organic Compound

Table 9-29
Comparison of Reasonable Maximum Modeled Wildlife Doses to Birds based on Tissue Concentrations to Avian TRVs
Sparrows Point Southwest/Tin Mill Canal Effluent

Chemical	Avian TRVs (mg/kg-bw day)		Reasonable Maximum Case Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Fish, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Fish, Sediment, and Surface Water
	NOAEL	LOAEL	Great Blue Heron	Great Blue Heron	Great Blue Heron	Great Blue Heron
Inorganics						
Antimony	NA	NA	--	--	--	--
Arsenic	2.24E+00	7.40E+00	4.42E-02	3.33E-02	1.34E-02	1.01E-02
Cadmium	1.47E+00	6.35E+00	2.35E-02	**no tissue**	5.43E-03	**no tissue**
Chromium	2.66E+00	1.56E+01	8.27E-01	8.29E-01	1.41E-01	1.41E-01
Copper	4.05E+00	1.21E+01	2.10E-01	4.50E-01	7.04E-02	1.51E-01
Lead	1.63E+00	3.26E+00	2.63E-01	2.79E-01	1.31E-01	1.40E-01
Mercury	4.50E-01	9.00E-01	3.76E-03	5.07E-03	1.88E-03	2.53E-03
Nickel	6.71E+00	1.86E+01	1.62E-02	1.59E-02	5.87E-03	5.76E-03
Selenium	2.90E-01	5.79E-01	1.94E-01	3.07E-01	9.72E-02	1.54E-01
Silver	2.02E+00	2.02E+01	9.77E-03	1.26E-02	9.77E-04	1.26E-03
Zinc	6.61E+01	1.71E+02	1.22E-01	1.13E-01	4.71E-02	4.35E-02
PAHs						
Total LMW PAH (ND=RL)	5.62E+03	NA	5.05E-06	4.41E-06	--	--
Total HMW PAH (ND=RL)	2.00E+00	2.00E+01	1.46E-02	1.25E-02	1.46E-03	1.25E-03
Total PAH (ND=RL)	2.00E+00	2.00E+01	2.99E-02	2.47E-02	2.99E-03	2.47E-03
PCBs						
Total PCBs (ND=0)	1.80E-01	1.80E+00	5.31E-02	1.51E-01	5.31E-03	1.51E-02
Total PCBs (ND=RL)	1.80E-01	1.80E+00	7.00E-02	1.57E-01	7.00E-03	1.57E-02

Bolded HQs exceed 1 (to one significant digit) and are associated with exposures that exceed TRVs.

--= does not apply
HMW= High Molecular Weight
HQ= Hazard Quotient
LMW= Low Molecular Weight
LOAEL= Lowest Observed Adverse Effect Level
mg/kg-bw day= milligrams per kilogram of body weight per day
NA= Not Available
ND= Non-detect
NOAEL= No Observed Adverse Effect Level
PAH= Polyaromatic Hydrocarbon
PCB= Polychlorinated biphenyl
RL= Reporting Limit
TRV= Toxicity Reference Value

Table 9-30
Comparison of Reasonable Maximum Modeled Wildlife Doses to Mammals based on Tissue Concentrations to Mammalian TRVs
Sparrows Point Southwest/Tin Mill Canal Effluent

Chemical	Mammalian TRVs (mg/kg-bw day)		Reasonable Maximum Case Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to NOAELs Based on Ingestion of Fish, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Crabs, Sediment, and Surface Water	Reasonable Maximum Case Scenario HQs Comparison of Doses to LOAELs Based on Ingestion of Fish, Sediment, and Surface Water
	NOAEL	LOAEL	Raccoon	Raccoon	Raccoon	Raccoon
Inorganics						
Antimony	5.90E-02	5.90E-01	4.38E-01	5.64E-01	4.38E-02	5.64E-02
Arsenic	1.04E+00	1.66E+00	3.60E-01	2.71E-01	2.25E-01	1.70E-01
Cadmium	7.70E-01	7.70E+00	1.69E-01	**no tissue**	1.69E-02	**no tissue**
Chromium	2.40E+00	5.82E+01	**3.46E+00**	**3.47E+00**	1.43E-01	1.43E-01
Copper	5.60E+00	9.34E+00	5.75E-01	1.23E+00	3.44E-01	7.38E-01
Lead	4.70E+00	8.90E+00	3.44E-01	3.66E-01	1.82E-01	1.93E-01
Mercury	1.32E+01	NA	4.84E-04	6.52E-04	--	--
Nickel	1.70E+00	3.40E+00	2.42E-01	2.37E-01	1.21E-01	1.19E-01
Selenium	1.43E-01	2.15E-01	1.49E+00	**2.35E+00**	9.89E-01	**1.56E+00**
Silver	6.02E+00	6.02E+01	1.24E-02	1.60E-02	1.24E-03	1.60E-03
Thallium	7.40E-03	7.40E-02	1.32E+00	1.25E+00	1.32E-01	1.25E-01
Zinc	7.54E+01	2.98E+02	4.05E-01	3.73E-01	1.03E-01	9.46E-02
PAHs						
Total LMW PAH (ND=RL)	6.56E+01	3.28E+02	1.64E-03	1.43E-03	3.27E-04	2.85E-04
Total HMW PAH (ND=RL)	6.15E-01	3.01E+00	1.79E-01	1.54E-01	3.67E-02	3.14E-02
Total PAH (ND=RL)	6.15E-01	3.01E+00	3.67E-01	3.03E-01	7.51E-02	6.19E-02
PCBs						
Total PCBs (ND=0)	1.00E-02	1.00E-01	**3.61E+00**	**1.03E+01**	3.61E-01	1.03E+00
Total PCBs (ND=RL)	1.00E-02	1.00E-01	**4.76E+00**	**1.07E+01**	4.76E-01	1.07E+00

Bolded HQs exceed 1 (to one significant digit) and are associated with exposures that exceed TRVs.

--= does not apply
HMW= High Molecular Weight
HQ= Hazard Quotient
LMW= Low Molecular Weight
LOAEL= Lowest Observed Adverse Effect Level
mg/kg-bw day= milligrams per kilogram of body weight per day
NA= Not Available
ND= Non-detect
NOAEL= No Observed Adverse Effect Level
PAH= Polyaromatic Hydrocarbon
PCB= Polychlorinated biphenyl
RL= Reporting Limit
TRV= Toxicity Reference Value

10. HUMAN HEALTH RISK ASSESSMENT

The HHRA was performed to estimate the risk and hazard to potential human receptors for exposure to offshore media affected by the Site. The HHRA quantitatively evaluates the complete exposure pathways identified in the CSM (Chapter 6) for potential long-term risk concerns for human health. The HHRA is a process in which exposure and toxicity data are combined to develop an estimate of the potential for adverse impacts on human receptors from chemicals in the environment. The HHRA determines baseline risks associated with long-term exposure to the Phase I offshore areas. The baseline risk does not take into account any remedial actions or other means of exposure reduction (e.g., the use of personal protective equipment, fishing restrictions, etc.). In addition, future potential risks associated with changes at the Phase I area (i.e., dredging or erosion) are not evaluated in the HHRA.

The HHRA specifically follows the methodology set forth in the following USEPA guidance:

- *Risk Assessment Guidance for Superfund (RAGS), Volume 1: Human Health Evaluation Manual (Part A) (Interim Final).* Office of Emergency and Remedial Response, EPA/540/1-89/002, USEPA 1989.

- *Risk Assessment Guidance for Superfund (RAGS), Volume 1: Human Health Evaluation Manual Supplemental Guidance – "Standard Default Exposure Factors" (Interim Final)*. Publication 9285.7-01B, USEPA 1991.

- *Guidelines for Data Usability in Risk Assessment (Part A)*. Office of Solid Waste and Emergency Response (OSWER), Publication OSWER9285.7-09A, USEPA 1992.

- *Guidance for Assessing Chemical Contaminant Data for Use in Fisher Advisories, Volume 2 Risk Assessment and Fish Consumption Limits*. Third Edition. Office of Water, EPA 823-B-00-008, USEPA 2000b.

- *Risk Assessment Guidance for Superfund (RAGS), Volume 1: Human Health Evaluation Manual (Part D, Standardized Planning, Reporting and Review of Superfund Risk Assessments)*. Office of Emergency and Remedial Response, Washington, DC, USEPA 2002.

- *Human Health Toxicity Values in Superfund Risk Assessments*. OSWER 9285.7-53. Office of Emergency and Remedial Response, USEPA 2003c.

- *Risk Assessment Guidance for Superfund (RAGS), Volume 1: Human Health Evaluation Manual (Part E: Supplemental Guidance for Dermal Risk Assessment)*. Final. Office of Superfund Remediation and Technology Innovation, EPA/540/R/99/005, USEPA 2004.

- *Exposure Factors Handbook: 2011 Edition*. Office of Research and Development, EPA/600/R-090/052F, USEPA 2011.

- *Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors*. Office of Solid Waste and Emergency Response, OSWER Directive 9200.1-120, USEPA 2014.

These guidance documents comprise the basis of risk assessment methodology in the RCRA/CERCLA programs and are intended to provide a protective estimate of potential risk within these regulatory programs. The risks determined in the HHRA represent potential risk that may occur to people who come in contact with the areas evaluated and do not represent acute risks from short-term exposures. The HHRA methodology involves a four-step process: data collection and evaluation, exposure assessment, toxicity assessment, and risk characterization. The following sections present details about HHRA methodology. Data evaluation and hazard assessment are presented in Section 10.1. The exposure assessment is presented in Section 10.2, and the toxicity assessment is presented in Section 10.3. The risk characterization methodology is presented in Section 10.4, and risk characterization results for the NNS and SWTM are presented in Section 10.5 and 10.6, respectively. A discussion of uncertainties is presented in Section 10.7, and the HHRA conclusions are presented in Section 10.8.

10.1 DATA EVALUATION AND HAZARD ASSESSMENT

For the data evaluation and hazard assessment, environmental data for the Phase I area are compiled and reviewed and are then analyzed for data quality. Data evaluated in the HHRA were collected for the Phase I offshore area as discussed in Chapter 4. In addition, tissue samples from fish and crab collected from around Coke Point and Sollers Point in Fall 2010 were also evaluated in the HHRA (EA 2011b). Since the target species for human consumption travel throughout the Chesapeake Bay during their lifetimes, field-collected tissue concentrations represent an average exposure that is the more realistic scenario for fishing anywhere in the Bay. These species integrate exposures throughout the Bay. These tissue data include blue crab meat and mustard, and white perch filets. **Table 8-3** presents the list of samples evaluated in the HHRA.

Chapter 8 presents a detailed discussion for the evaluation of fish and crab tissue. Tissue concentrations for crabs are based either on tissue analyses of field-collected crabs or on sediment BAFs. For some chemicals, site-specific BAFs are available from bioaccumulation studies using worms and clams as part of the Coke Point Risk Assessment (EA 2011b). Where available, these BAFs are used to calculate uptake from the sediment into crabs in the Phase I area. Fish tissue concentrations are estimated in two different ways: based on site-specific data from field-collected specimens or using BAFs from the scientific literature. A brief summary of the fish and crab tissue evaluation is provided below.

10.1.1 Field-Collected Sample Results

For sediment, sediment grab samples and core samples were collected. Surface sediment grab samples were collected in October 2014 (Round 1) and April 2015 (Round 2). A total of 22 surface sediment grab samples were collected along eight transects (A-H) oriented perpendicular to the shoreline (**Figure 4-1**). Based upon the results of the surface sediment grab samples, sediment cores were collected from 22 locations from the vicinity of Transects G and H. Sediment cores were sampled on 2-ft intervals below the sediment-water interface (i.e., 0–2 ft, 2–4 ft, 4–6 ft). A surface interval sample from every core was submitted for analysis. For the HHRA, the surface sediment grab samples and the sediment core interval sample (0–2 ft) were evaluated in the HHRA.

For blue crab and white perch tissue data, five composite samples were created for each species. For the white perch, filets were tested. Filet composites consisted of filets from one side of the fish. Both meat and hepatopancreas (mustard) samples were collected from blue crab. To determine the total concentration of a chemical within the edible portion of the crab, the following equation was used:

$$C_{EdCrab} = \frac{C_{Mustard} * M_{Mustard} + C_{Meat} * M_{Meat}}{M_{EdCrab}}$$

where:

C_{EdCrab}	=	Concentration of chemical in the edible portion of the crab (mg/kg wet weight)
$C_{Mustard}$	=	Concentration of chemical in crab mustard (mg/kg wet weight)
C_{Meat}	=	Concentration of chemical in crab meat (mg/kg wet weight)
$M_{Mustard}$	=	Weight of mustard per individual crab (g wet weight)
M_{Meat}	=	Weight of meat per individual crab (g wet weight)
M_{EdCrab}	=	Summed Weight of meat and mustard from individual crab (g wet weight).

The ratio of meat to mustard in the crab by mass was assumed to be 4.36:1 based on information from the literature (Weidou 1981). It is noted that tissue samples were analyzed for metals, PAHs, PCBs, and arsenic speciation. SVOCs, VOCs, and inorganics (cyanide) were detected in the Phase I sediments but were not included in the analysis of field collected tissue performed in as part of the Coke Point Risk Assessment (EA 2011b). Bis(2-ethylhexyl)phthalate was the only SVOC that was detected in more than 20 percent of the surface sediment samples collected from the Phase I area, while chlorobenzene and toluene were the most frequently detected VOCs, with detectable concentrations in approximately 30 percent of samples. Cyanide was detected in most of the surface sediment samples collected from the Phase I area. These classes of chemicals (e.g., SVOCs, VOCs, and cyanide) are discussed below as part of the Modeled Sample Results (Section 10.1.2).

10.1.2 Modeled Sample Results

For surface water, stormwater and pore water results were modeled to estimate constituent concentrations. A tidally-dynamic model was developed to examine the mixing of the constituent mass flux of groundwater and stormwater into Bear Creek (Chapter 7). The USACE models RMA2 (hydrodynamics) and RMA4 (water quality) were used. Output from the model was used to compute surface water EPCs as volume weighted averages for both non-storm and storm conditions. For the surface water evaluation in the HHRA, the non-storm reasonable maximum EPCs were used to represent the long-term surface water concentrations expected for typical human contact. The non-storm surface water EPCs include the effects of pore water and Outfall 014 as continuous sources and represent the maximum concentration over one tide cycle. The storm EPCs add the cumulative impact of stormwater discharges from outfalls ST-071, ST-UNAMED, and ST-018, and represent the maximum spatially averaged concentration seen over the course of the 24-hour design storm. The storm EPCs are evaluated in Section 10.7 as a potential short-term exposure concentration.

In addition to the field-collected tissue samples, modeled fish tissue and modeled crab tissue concentrations were evaluated in the HHRA. The modeled fish and crab tissue concentrations provide a theoretical maximum as if these species reside solely in the Phase I area. The modeled crab tissue concentrations were determined based upon site-specific bioaccumulation studies performed within the Coke Point Offshore Area (EA 2011b). Modeled fish tissue concentrations were determined through the use of literature-based BAFs. Additionally, literature-based BAFs were used for modeled crab tissue concentrations of SVOCs and VOCs. It is noted that cyanide was not analyzed in field-collected fish and crab tissue. As noted by the Agency for Toxic Substances and Disease Registry (ATSDR), cyanide is not expected to bioaccumulate in fish: "There are no data available to indicate that simple metal cyanides and hydrogen cyanide bioconcentrate in aquatic organisms. Accumulation of cyanide in food webs is not expected, considering the rapid detoxification of cyanide by most species and the lethal effects of large doses of cyanide" (ATSDR 2006). As a result, cyanide was not included in the modeled tissue determination. The determination of the modeled crab and fish tissue concentrations is discussed below.

EPCs Derived Using Sediment BAFs From Coke Point Laboratory Bioaccumulation Tests (EA 2011b)

The Coke Point laboratory bioaccumulation tests evaluated aquatic test species (clams and worms) that are directly representative of the kinds of organisms that wildlife, fish, and crabs would be expected to consume routinely. The concentrations of metals, PAHs, and PCBs detected in clam and worm tissues were used together with the concentrations detected in the exposure sediment to develop site-specific sediment BAFs (EA 2011b). Sediment BAFs are multipliers that relate the concentration of chemicals expected in tissue to the concentrations detected in sediment. Sediment BAFs used in the HHRA are presented in **Table 8-11**. Sediment BAFs are used to predict crab tissue concentrations using the following equation:

$$C_{org\text{-}sed} = C_{sed} * BAF_{org\text{-}sed}$$

where:

$C_{org\text{-}sed}$	=	EPC of chemical in crab tissue(mg/kg wet weight) taken up from sediment
C_{sed}	=	EPC (reasonable maximum) of chemical in sediment (mg/kg dry weight)
$BAF_{org\text{-}sed}$	=	bioaccumulation factor for chemicals from sediment into aquatic organism (unitless).

EPCs Derived Using Sediment BAFs From Literature Sources

Laboratory bioaccumulation tests for Coke Point focused on the environmental medium (sediment) and the chemical constituent types (metals, PAHs, and PCBs) considered most likely to drive source-related risks (EA 2011b). Therefore, they did not include testing and analysis of other chemicals in tissue. Instead, BAFs for these chemicals and media were derived from the scientific literature. Sediment BAFs are derived from the scientific literature for SVOCs and VOCs. Sediment BAFs for SVOCs and VOCs are presented in **Table 8-11**. When sediment BAFs were not available from literature sources, a default value of 1 was assigned. This assumes that the concentration in the organism is the same as the concentration in the sediment. The EPC of chemicals in crab tissue are determined in the same manner as concentrations from site-specific BAFs.

EPCs Derived Using Surface Water BAFs From Literature Sources

As discussed above, laboratory bioaccumulation tests for Coke Point focused on the environmental medium (sediment) considered most likely to drive source-related risks (EA 2011b). Therefore, they did not include testing and analysis of uptake from surface water. Instead, BAFs for chemicals in surface water are derived from information reported in the scientific literature. Literature-based water-to-fish uptake factors or bioaccumulation equations are used to estimate concentrations of COPCs in fish tissue using the following equation:

$$C_{fish} = C_{water} * BAF_{fish\text{-}water}$$

where:

C_{fish}	=	Concentration of chemical in fish (mg/kg wet weight)
C_{water}	=	Reasonable maximum EPC (modeled) in surface water (mg/L)
$BAF_{fish\text{-}water}$	=	Uptake factor for chemicals in fish (unitless).

Bioaccumulation factors and their sources are summarized in **Table 8-12**. In the absence of a literature-based bioaccumulation model or uptake factor for a chemical, an accumulation factor of 1 is used to estimate chemical concentrations in fish. Use of this default accumulation factor

assumes that the concentration in the organism is the same as the concentration in the surface water, and is expected to provide a conservative estimate of accumulation for most chemicals.

10.1.3 Data Validation

Sediment and tissue data used in the HHRA were validated per protocols identified in USEPA guidance for data usability (USEPA 1992). Inclusion or exclusion of data on the basis of analytical qualifiers is performed in accordance with USEPA guidance (USEPA 1989, 1992). The first step in the HHRA is the evaluation of analytical data on the basis of qualifiers in each medium of concern (sediment and tissue) using the rationale below.

- Analytical results bearing the R qualifier (indicating that the data point was rejected during the data validation process) are not used in the risk assessments. Only two chemical results (benzidine and hexachlorocyclopentadiene) from sediment sample SD-B01 were identified as R-qualified.

- Analytical results bearing the U or UJ qualifier (indicating that the analyte is not detected at the given RL) are retained in the data set and considered non-detects. Where warranted for statistical purposes, each COPC is assigned a numerical value equal to its RL or appropriate detection limit.

- Analytical results for organics bearing the J qualifier (the reported value is estimated and below the RL) are retained in the data set at the measured concentration.

If duplicate samples are collected or duplicate analyses are conducted on a single sample, the following guidelines are employed to select the appropriate sample measurement:

- If both samples/analyses show that the analyte is present, the average of the two detected concentrations is retained for analysis, based on conservative professional judgment.

- If both samples/analyses are not detected, the average of the two RL concentrations is retained for analysis as a non-detect.

- If only one sample/analysis indicated that the analyte is present, it is retained for analysis and the non-detect value is not included in the assessment.

10.1.4 Risk-Based Screening

The first component of COPC selection was a risk-based screening. For sediment and fish tissue results, risk-based screening was conducted by comparing maximum detected analyte concentrations to risk-based screening concentrations. For surface water and fish tissue uptake calculations, the 95%UCLM was used. Any analyte in any medium for which the maximum

detected concentration or the 95%UCLM exceeded the risk-based screening concentration was retained as a COPC.

State and federal risk-based screening criteria are not available for surface water and sediment for the complete exposure pathways identified in the CSM (**Figure 6-2)**. As a result, site-specific risk-based criteria are calculated for the exposure to surface water and sediment pathways. The derivation of site-specific risk-based screening criteria follows the methodologies set forth in USEPA guidance (USEPA 2015a). **Appendix H** presents the calculation of site-specific risk-based screening criteria for surface water and surface sediment. The site-specific risk-based screening criteria are based upon a carcinogenic risk level of 10^{-6} or non-carcinogenic HQ of 0.1. The risk levels of 10^{-6} and an HQ of 0.1 provide a level of conservancy to account for potential additive effects of multiple chemicals.

The HHRA takes into account actual field-collected fish and crab tissue and fish and crab tissue concentrations modeled from BAFs for surface water and sediment. For chemical concentrations modeled from BAFs, aquatic organisms exposed to surface water are represented by fish, and aquatic organisms exposed to sediment are represented by crabs or other bottom dwellers. Fish and crab concentrations for both field-collected organisms and modeled concentrations are compared to USEPA Region III Regional Screening Levels (RSLs) for fish tissue (USEPA 2015b). For non-carcinogens, the risk-based concentration (RBC) is based on a HQ of 1.0; for the purposes of this screening the RBC is decreased by a factor of 10 to base the screening value on an effective HQ of 0.1.

Several classes of organic chemicals assessed in the HHRA share a common mode of exposure and toxicity. For example, there are over 200 PCB congeners that can be identified by analytical chemistry. Many congeners produce the same types of effects and share similar patterns of uptake. As a result, the PCB congeners in fish and crab tissue were evaluated in accordance with the following methodologies:

- **Total PCBs** – USEPA policy identifies a standard method for using congener-specific data to estimate the total concentration of PCBs (Van den Berg et al. 1998). Per this method, the concentrations of 18 specific congeners are summed and the sum is doubled to determine a representative total PCB concentration for each sample. The specific PCB congeners used in the evaluation are: PCB 8, PCB 18, PCB 28, PCB 44, PCB 49, PCB 52, PCB 66, PCB 77, PCB 87, PCB 90, PCB 101, PCB 105, PCB 118, PCB 126, PCB 128, PCB 138, PCB 153, PCB 156, PCB 169, PCB 170, PCB 180, PCB 183, PCB 184, PCB 187, PCB 195, PCB 206, and PCB 209. Two estimates of total PCBs are provided: one in which RLs are used to represent non-detected compounds, and one in which non-detects are assumed to indicate that no compound is present (ND=0). Using RLs is likely to overestimate the total amount of PCB present. Section 10.7.2.1 of the Uncertainty Section discusses the difference in risk results for total PCBs based upon ND=RL and ND=0. To account for a total PCB congener analysis, high risk PCBs are used as a surrogate for the PCB congeners.

It is noted that the handling of PAH compounds and PCB Aroclors within the HHRA is treated differently than the ERA. The ERA evaluates the effects of PAH classes (i.e., HMW and LMW), while the HHRA evaluates individual PAH compounds. Therefore, the determination of ecological risks evaluates PAH concentrations that are summed prior to modeling, and the HHRA evaluates each individual PAH compound separately and sums the risks after modeling. However, the surface water modeling only identified HMW and LWM PAHs. To account for this assessment in surface water, surrogate chemicals were used. Benzo(a)pyrene was used as a surrogate for the HMW PAHs, and pyrene was used as a surrogate for the LMW PAHs. Similarly, the HHRA evaluated PCB Aroclors in sediment individually, before summing them as part of the final cumulative risk results, whereas the ERA evaluated the effects of total PCB concentrations calculated using the Aroclor data.

Sample results for arsenic are reported as total arsenic. However, arsenic can be present in both an organic and inorganic form. Inorganic arsenic represents the primary form of arsenic that is a concern for human health. Therefore, an arsenic speciation was performed for the field-collected tissue samples within the Coke Point Offshore Areas to quantify the various forms of arsenic (EA 2011b). The average percent of arsenic found to be in an inorganic form for crab meat, crab mustard, and fish filet were averaged together to obtain an overall aquatic organism average percent of inorganic arsenic. The average percent of inorganic arsenic is 10.4 percent for the Coke Point Offshore Area. To maintain consistency within the exposure areas, the average percent of inorganic arsenic for the Coke Point Offshore Area is used in calculating intake of inorganic arsenic in fish tissue and crab meat for the HHRA. For screening, the concentration of arsenic within fish tissue and crab meat is not reduced by the 10.4 percent. This allows for the conservative nature of the screening to remain.

10.1.4.1 Data Groupings

As discussed in Section 8.1, data and modeling results from the Phase I offshore investigation were divided into two data groupings/areas for separate consideration in the risk assessments:

- Grouping NNS: The Northeast/Near-Shore Grouping includes all samples from Transects A, B, C, and D, as well as the following locations in Transects DE, E, and F: DE01, E01, E02, F01, F02, and F05.

- Grouping SWTM: The Southwest/Tin Mill Canal Effluent Grouping includes all of Transects G, H, I, and J, as well as the following locations in Transects DE, E, and F: DE02, E03, F03, F04, F06, and F07.

These groupings were delineated based on geography as well as the characteristics of the sediment, with locations in Grouping NNS having coarser sediments and/or less observable impacts (e.g., odor, sheen). Locations in Grouping SWTM are generally silty-to-clayey and exhibit preliminary evidence of impacts from the Tin Mill Canal effluent.

It should be noted that these groupings do not represent clearly defined exposure areas. Rather, the groupings were selected to reflect a differentiation in risk assessment objectives, as described below.

In Grouping NNS, current inputs to the offshore area via groundwater/pore water and stormwater remain the focus of this investigation, including the risk assessment. Therefore, only the Site-related COPCs for each transect are considered in the NNS. **Table 8-4** presents a summary of the Site-related COPCs for sediment in each transect/location, for which data were used in the HHRA. The primary use anticipated for the HHRA results for this grouping is the evaluation of whether current impacts from the former steel mill are associated with unacceptable risk in this area.

In Grouping SWTM, constituents analyzed are potentially related to historical discharges from the Tin Mill Canal. Therefore, all available data from the Phase I offshore investigation in this area is used in the HHRA for this grouping. The primary use of risk assessment results for this grouping is delineation of areas requiring cleanup in the southern area that has been impacted by the Tin Mill Canal effluent.

10.1.5 Analytes Exceeding Risk-Based Screening Levels

The occurrence, distribution, and selection of COPCs based upon the risk-based screening are shown in medium-specific tables following the RAGS D format (USEPA 2002). **Tables 10-2.1** through **10-2.6** present the risk-based screening results for NNS grouping. **Tables 10-2.7** through **10-2.12** present the risk-based screening results for the SWTM Grouping. The tables present the minimum and maximum detected concentrations, the location of the maximum detected concentrations, as well as the frequency of detection for each chemical detected. COPCs that exceed risk-based screening criteria are highlighted and presented in bold type. COPCs for all media evaluated in the HHRA are presented in the following sections.

Northeast/Near-Shore Grouping

COPCs in Sediment

No COPCs are identified in sediment (**Table 10-2.1**) based on the risk-based screen.

COPCs in Surface Water

No COPCs are identified in surface water (**Table 10-2.2**) based on the risk-based screen.

COPCs in Field-Collected Crab

The following COPCs are identified in crabs (**Table 10-2.3**) based on the risk-based screen: cadmium, copper, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and bis(2-ethylhexyl)phthalate.

COPCs in Field-Collected Finfish Tissue

Mercury is the only COPC identified in finfish tissue (**Table 10-2.4**) based on the risk-based screen.

COPCs in Modeled Crab

The following COPCs are identified in crabs (**Table 10-2.5**) based on the risk-based screen: zinc, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and bis(2-ethylhexyl)phthalate.

COPCs in Modeled Finfish Tissue

The following COPCs are identified in finfish tissue (**Table 10-2.6**) based on the risk-based screen: mercury and HWM PAHs.

Southwest/Tin Mill Canal Effluent Grouping

COPCs in Sediment

The following COPCs are identified in sediment (**Table 10-2.7**) based on the risk-based screen: arsenic and benzo(a)pyrene.

COPCs in Surface Water

No COPCs are identified in surface water (**Table 10-2.8**) based on the risk-based screen.

COPCs in Field-Collected Crab

The following COPCs are identified in crabs (**Table 10-2.9**) based on the risk-based screen: arsenic, cadmium, cobalt, copper, selenium, thallium, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, total PCB congeners, and bis(2-ethylhexyl)phthalate.

COPCs in Field-Collected Finfish Tissue

The following COPCs are identified in finfish tissue (**Table 10-2.10**) based on the risk-based screen: arsenic, mercury, selenium, total PCB congeners.

COPCs in Modeled Crab

The following COPCs are identified in crabs (**Table 10-2.11**) based on the risk-based screen: antimony, arsenic, beryllium, cadmium, copper, mercury, nickel, selenium, thallium, zinc, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, pyrene, Aroclor 1248, Aroclor 1254, Aroclor 1260, and bis(2-ethylhexyl)phthalate.

COPCs in Modeled Finfish Tissue

The following COPCs are identified in finfish tissue (**Table 10-2.12**) based on the risk-based screen: arsenic, mercury and HWM PAHs.

10.1.6 COPCs Not Evaluated Further

Thallium was considered a COPC in both actual crab and modeled crab tissue. The toxicity values presented by USEPA for thallium are provisional values. The studies utilized in determining a reference dose (RfD) are of low quality and result in high uncertainty factors that USEPA considers unreliable (USEPA 2012b). USEPA noted, "For the reasons noted in the main document, it is inappropriate to derive a subchronic or chronic p-RfD for thallium. However, information is available which, although insufficient to support derivation of a provisional toxicity value, under current guidelines, may be of limited use to risk assessors. In such cases, the Superfund Health Risk Technical Support Center summarizes available information in an appendix and develops a screening value. Therefore, the RfD presented for thallium is only to be used for screening purposes" (USEPA 2012b). Thallium is not evaluated quantitatively in the HHRA. Thallium is evaluated qualitatively in Section 10.7.5.

10.2 EXPOSURE ASSESSMENT

The exposure assessment determines (qualitatively or quantitatively) the magnitude, frequency, duration, and route of exposure for potential human contact to COPCs in media of concern. The exposure assessment considers only existing conditions within the Phase I area of Sparrows Point and does not take into account any future actions (i.e., dredging, erosion, etc.). The CSM (**Figure 6-2**), shows the complete exposure pathways identified for human receptors within the Phase I area. The CSM characterizes the exposure setting with respect to the general physical characteristics of the offshore area and the characteristics of the populations on and near the offshore area based upon existing conditions. The HHRA did not take into account potential future exposures to the offshore area due to erosion, dredging, or other actions or future uses of the onshore areas. From this exposure characterization, potential receptors are identified. Once the receptors are identified, the pathways by which the previously identified populations may be exposed are determined. These are considered complete pathways of exposure. Each complete exposure pathway identified in the CSM (**Figure 6-2**) is evaluated in the exposure assessment and the HHRA.

Currently, the offshore area around Sparrows Point is not frequently used for swimming or other water activities. However, there are no controls against these activities, and fishing and boating have been observed in the Phase I area, as described in Section 6.5.1. Exposure for this area represents the low frequency of use for the offshore areas for recreation and takes into account exposures modeled from previous RCRA investigations site-specific inputs (ISG 2005). In addition, sample results from studies of field-collected crab and fish tissue are evaluated.

The exposure assessment includes several steps:

- Evaluating the exposure setting, including a description of the land uses and the potentially exposed human populations (see Chapter 6)
- Developing the CSM identifying the source of contamination, contamination transport and release mechanisms, exposure media, exposure routes, and potentially exposed populations (see Chapter 6)
- Calculating EPCs for each COPC for each of the complete exposure pathways identified in the CSM (see Chapter 8)
- Identifying the exposure models and parameters with which to calculate COPC intakes
- Calculating intakes (i.e., exposure doses).

10.2.1 Calculation of Intake

Intake is the numerical representation of estimated exposures. An intake is calculated for each exposure pathway identified in the CSM. Intake is expressed in terms of the quantity of substance in contact with the body per unit body weight per unit time (e.g., milligrams chemical per kilogram body weight per day, also expressed as mg/kg bw-day) (USEPA 1989). Intakes are calculated using variables for chemical concentrations, contact rates, exposure frequency, exposure duration, body weight, and exposure averaging time. The values of some of these variables depend on offshore area conditions and the characteristics of the potential receptors. Exposure estimates are representative of a reasonable maximum exposure which is expected to occur within the Phase I area (USEPA 1989). As a result, some intake variables are not at their individual maximum values, but when combined with other variables, will result in estimates of the reasonable maximum exposure (USEPA 1989).

To quantify intake, the EPCs and exposure parameters are combined to estimate daily intakes over an exposure period. The COPCs identified in surface water, sediment, and crab/fish tissue are converted into systemic doses, taking into account rates of contact (e.g., dermal exposure areas) and absorption rate of each COPC. The magnitude (i.e., EPCs), frequency (i.e., number of days per year), and duration of these exposures are then combined to obtain estimates of daily intakes over a specified period of time (i.e., lifetime, activity-specific duration). Dermal

exposure to surface water is calculated by converting the EPC into an Absorbed Dose per event (DA_{event}). This conversion takes into account the permeability of compounds across multiple layers of skin with respect to the length of the event and the fraction of each compound absorbed once dissolved into the skin.

Two different measures of intake are analyzed, depending on the nature of the effect being evaluated. When evaluating longer-term (i.e., chronic) exposures to chemicals that produce adverse non-carcinogenic effects, intakes are averaged over the period of exposure (i.e., the averaging time [AT]) (USEPA 1989). This measure of intake is referred to as the average daily intake (ADI) and is a less than lifetime exposure. For chemicals that produce carcinogenic effects, intakes are averaged over an entire lifetime and are referred to as the lifetime average daily intake (LADI) (USEPA 1989).

The generic equation to calculate intakes is given below:

$$(L)ADI = \frac{EPC \ x \ IF \ x \ EF \ x \ ED \ x \ RAF}{BW \ x \ AT} \text{ x CF}$$

where:

(L)ADI	=	(Lifetime) Average daily intake (mg/kg bw-day)
EPC	=	COPC concentration in a specific medium (mg/kg or mg/L)
IF	=	Intake factor[1] (mg/day, liters per day, or kilograms [kg]/meal)
EF	=	Exposure frequency (days/year or meals/year)
ED	=	Exposure duration (years)
RAF	=	Relative absorption factor (unitless) (Dermal exposures only)
BW	=	Body weight (kg)
AT	=	Averaging time (days)
CF	=	Conversion Factor (10^{-6} kilograms per milligram or 10^{-3} liters per cubic centimeter) (Dermal exposures only).

10.2.2 Exposure Point Concentrations

The first step in quantifying intake (or exposure) is the determination of an EPC for each COPC identified in the risk-based screening. For the HHRA, the EPC represents the concentration of COPCs in media of concern that a selected receptor is expected to contact over a designated exposure period. The EPC is represented by the 95%UCLM (USEPA 1989). The 95%UCLM is used because assuming long-term contact with the maximum concentration is not reasonable (USEPA 1989). EPCs for COPCs identified for the NNS area are presented in **Tables 10-3.1**

[1] The intake factor is the product of all intake variables that, when multiplied by the concentration of the chemical of potential concern in a specific medium, results in an estimate of the chemical intake in mg/kg-day for that population and exposure pathway. Intake factors may include ingestion rate, inhalation rate, body surface area exposed to sediment or water, dermal permeability constants, and soil adherence factors.

through 10-3.6. EPCs for COPCs identified for the SWTM area are presented in **Tables 10-3.7 through 10-3.12**.

For sediment and crab/fish field-collected tissue, the 95%UCLM is determined through the use of the USEPA ProUCL program version 5.00.00 (USEPA 2013). Where a 95%UCLM could not be calculated or where it exceeds the maximum detected concentration, the maximum concentration is used as the reasonable maximum EPC. Additionally, for sample sizes less than 5, the maximum detected concentration was used as the EPC. Output files of the ProUCL program are included in **Appendix F**. For surface water and crab/fish uptake, the determination of EPCs was detailed in Section 10.1.2.

10.2.3 Selection of Exposure Parameters

The second step in quantifying intake requires the identification of exposure parameters. The following sections and **Tables 10-4.1 through 10-4.7** detail the exposure parameters for each potential receptor. Specific exposure parameters for each receptor are chosen based on USEPA guidance (USEPA 1989, 1991, 2000b, 2004, 2011, 2015a), state advisories (MDE 2014) and other appropriate resources.

Exposure parameters include rates of contact (e.g., skin surface areas), exposure frequency and duration, body weight, and averaging time. The contact rate reflects the amount of contaminated media contacted per unit time or event. For dermal contact with chemicals in surface water or sediment, the contact rate is estimated by combining information on exposed skin surface area, dermal permeability of a chemical, and exposure time. Exposure frequency and duration are used to estimate the total time of exposure to COPCs in media of concern. The body weight represents the average body weight over an exposure period (USEPA 1989). For adults (adult recreational users and watermen), USEPA recommended body weight is 80 kg; for children (recreational users aged 3 to 6 years), it is 18 kg (USEPA 2011). The adolescent is assumed to be 45 kg (USEPA 2011).

Surface Water

As shown in Section 10.1.5, no COPCs were determined for surface water for both areas. Therefore, surface water exposure parameters are not relevant for the HHRA.

Sediment

The offshore areas near Sparrows Point are not considered a high use area for swimming or other water activities. Additionally, other public access areas are located near but not immediately adjacent to the Phase I area that present a more attractive area for swimming and other water activities (i.e., state parks, private docks, etc.). However, access is not controlled to the waters in the Phase I area; therefore, swimming is a possibility for this area. Swimming and other activities around Sparrows Point are assumed on a limited basis. An exposure frequency of

4 days per year is used based upon a previous RCRA environmental impact assessment (ISG 2005).

Due to the depth of surface water, recreational users are expected to contact sediment primarily with the feet and maybe lower legs. Based upon the age range for the child (3-6 years old), they are not expected to contact sediment. In addition, as discussed in Section 10.6, the risk and hazard estimates for sediment exposure to the longer duration adolescent and adult recreational user were all negligible, ensuring that child sediment exposure would result in negligible risk estimates as well. For the adult, the sum of the mean lower legs SA (2,710 cm^2) and mean feet (1,380 cm^2) is 4,090 cm^2 (USEPA 2011). For the adolescent, lower leg estimates are not available in USEPA guidance (USEPA 2011). Therefore, the SA identified for the entire leg is used for the adolescent as a conservative measure. Two age ranges were averaged for the adolescent: 6 to 11 years and 11 to 16 years. For the adolescent, the mean leg (1,990 cm^2) and mean feet (890 cm^2) sum is 2,880 cm^2 (USEPA 2011). For skin exposure to sediment, an adherence factor (AF) is determined that represents the ability of sediment to adhere to the skin surface (USEPA 2004). AFs for sediments are likely to be less than for soils because contact with water may wash the sediment off the skin (USEPA 2004). However, AFs for soil are used to represent the sediment AFs as a conservative measure. For the adult recreational user, the recommended weighted AF for an adult resident is used [0.07 milligrams per square centimeter (mg/cm^2)] as a conservative measure. The recommended weighted AF for an adolescent recreational user is 0.2 mg/cm^2 for children playing in wet soil (USEPA 2004, 2014a).

Watermen contact with sediment is limited to the hands and forearms as contact to sediment is expected to occur while hauling fishing nets into boats. The mean forearm SA (1,460 cm^2) and mean hand SA (1,070 cm^2) sum is 2,530 cm^2 (USEPA 2011). The recommended AF for a commercial or industrial worker contact with soil is 0.3 mg/cm^2, based upon actual body parts exposed (face, forearms and hands) and high-end contact activity (USEPA 2014a, 2015a). This worker AF is conservatively assumed for watermen. It is expected that watermen would not fish exclusively around the Sparrows Point Area, but instead would fish in this location 1 day per week for 39 weeks (March through November). Watermen are expected to have direct contact with surface water/sediment for 2 hours a day. This assumes that watermen will perform other activities (i.e., driving the boat, fixing nets, etc.) that will result in less frequent direct contact with surface water/sediment.

Fish and Crab Ingestion

Ingestion rates for the recreational user are taken from both the USEPA guidance (2000b, 2011) and the MDE 2014 Fish Advisory Table. USEPA identifies an amount of fish eaten per day from Freshwater/Estuarine areas. However, the USEPA estimate is based upon a total wet weight of fish eaten per year averaged over a number of days, not for each meal. The weights do not account for cooking. The weights for an adult, adolescent, and child are 9.8, 8.7, and 4.6 ounces per day, respectively (USEPA 2011). MDE estimated the amount of fish eaten per meal for varying receptors to determine appropriate fish advisories for the Patapsco River (MDE 2014).

MDE estimated a cooked weight of fish eaten for an adult male, adult female, and child at 8, 6, and 3 ounces, respectively (MDE 2014). The cooked weights used by MDE correspond to the wet weights presented in the USEPA guidance (USEPA 2011). These cooked weights are also consistent with USEPA guidance *Risk Assessment and Fish Consumption* Limits (USEPA 2000b). The number of meals per year is estimated based upon recreational users fishing or crabbing in the area 2 days per week from June to September (4 months or 16 weeks). The exposure frequency of 32 meals per year of fish and crabs is evenly divided between fish and crab consumption. As a result, the recreational user is assumed to eat 16 meals per year of fish and 16 meals per year of crabs.

The intake rate identified for the adult recreational user is also used for the watermen, since the watermen are not expected to fish exclusively within the area surrounding Sparrows Point. The exposure frequency identified for the surface water and sediment pathways is used as the number of meals per year (39 meals per year) of fish and crabs. The watermen are assumed to eat 19.5 meals per year of fish and 19.5 meals per year of crabs.

10.3 TOXICITY ASSESSMENT

Toxicity assessment is the third step of the HHRA process. The toxicity assessment considers the types of potential adverse health effects associated with exposures to COPCs, the relationship between the magnitude of exposure and potential adverse effects, and related uncertainties, such as the weight of evidence of a particular COPC's carcinogenicity in humans. USEPA guidance (USEPA 1989) specifies that the assessment be accomplished in two steps: hazard identification and dose-response assessment. Hazard identification is the process of determining whether studies demonstrate that exposure to a COPC may cause the incidence of an adverse effect. USEPA specifies the dose-response assessment, which involves: (1) USEPA's quantitative evaluation of the existing toxicity information, and (2) USEPA's characterization of the relationship between the dose of the COPC administered or received, and the incidence of potentially adverse health effects in the exposed population. From this quantitative dose-response relationship, specific toxicity values are derived by USEPA that can be used to estimate the incidence of potentially adverse effects occurring in humans at different exposure levels (USEPA 1989).

Toxicity values were selected in keeping with appropriate exposure durations and USEPA guidance (USEPA 2003c). Tier 1 values were found using the Integrated Risk Information System (IRIS) (USEPA 2015c) for established, current values. When toxicity values were not available from IRIS, Tier 2 values were then examined.

Tier 2 values were USEPA's Provisional Peer Reviewed Toxicity Values, which are developed by the Office of Research and Development, the National Center for Environmental Assessment, and the Superfund Health Risk Technical Support Center on a chemical-specific basis when requested by the Superfund program.

Tier 3, other toxicity values, were considered when Tier 1 or Tier 2 toxicity values were not available. These toxicity values were taken from additional USEPA and non-USEPA sources and were chosen based on the most current and best peer-reviewed source available. The Health Effects Assessment Summary Tables (USEPA 1997c) are the only Tier 3 source utilized for this HHRA.

10.3.1 Toxicity Assessment for Non-Carcinogens

USEPA-derived toxicity values for evaluating potential chronic non-carcinogenic effects for all COPCs are summarized in **Table 10-5.1**. **Table 10-5.2** presents relative chemical-specific parameters utilized in calculating dermal exposure for all COPCs.

The methodology used by USEPA for deriving non-cancer reference values for non-carcinogens, and site-specific considerations for modifying or using these concentrations are discussed in detail in USEPA guidance (USEPA 2015c). Non-carcinogens are typically judged to have a threshold daily dose below which deleterious or harmful effects are unlikely to occur. This concentration is called the no-observed-adverse-effect-level (NOAEL), and may be derived from either animal laboratory experiments or human epidemiology investigations (usually workplace studies). In developing a toxicity value or human NOAEL for non-carcinogens (i.e., an RfD), the regulatory approach is to (1) identify the critical toxic effect associated with chemical exposure (i.e., the most sensitive adverse effect); (2) identify the threshold dose in either an animal or human study; and (3) modify this dose to account for interspecies variability (where appropriate), differences in individual sensitivity (within-species variability), and other uncertainty and modifying factors.

Uncertainty factors (UFs) are intended to account for specific types of uncertainty inherent in extrapolation from the available data. The UFs are generally 10-fold, default factors used in operationally deriving the RfD from experimental data. UFs less than 10 can be used. A UF of 3 can be used in place of one-half power ($10^{0.5}$) when appropriate. The UFs are intended to account for (1) variation in susceptibility among the members of the human population (i.e., inter-individual or intraspecies variability), (2) uncertainty in extrapolating animal data to humans (i.e., interspecies uncertainty), (3) uncertainty in extrapolating from data obtained in a study with less-than-lifetime exposure (i.e., extrapolating from subchronic to chronic exposure), (4) uncertainty in extrapolating from a LOAEL rather than from an NOAEL, and (5) uncertainty associated with extrapolation when the database is incomplete. The maximum UF for the derivation of the RfDs used in this HHRA is 3,000. To calculate the RfD, the appropriate NOAEL is divided by the product of all the applicable UFs. This is expressed as:

$$RfD = NOAEL / (UF_1 \times UF_2 \times UF_3 \times UF_4)$$

The resulting RfD is expressed in units of milligrams of chemical per kilogram of body weight per day (mg/kg-bw/day).

10.3.2 Toxicity Assessment for Carcinogenicity

USEPA-derived toxicity values for evaluating potential carcinogenic effects for all COPCs are summarized in **Table 10-6.1**. Unlike non-carcinogens, carcinogens are generally assumed to have no threshold. There is presumed to be no level of exposure below which carcinogenic effects will not manifest themselves. This "non-threshold" concept supports the idea that there are small, finite probabilities of inducing a carcinogenic response associated with every level of exposure to a potential carcinogen. USEPA uses a two-part evaluation for carcinogenic effects. This evaluation includes the assignment of a weight-of-evidence classification and the quantification of a cancer toxic potency concentration. Quantification is expressed as a slope factor (SF) for oral and dermal exposures and an Inhalation Unit Risk for inhalation exposures, which reflects the dose-response data for the carcinogenic endpoint(s) (USEPA 1989).

The weight-of-evidence classification system assigns a letter or alphanumeric (A through E) to each potential carcinogen that reflects an assessment of its potential to be a human carcinogen (USEPA 1986).[2] USEPA has established five recommended standard hazard descriptors: "*Carcinogenic to Humans*," "*Likely to Be Carcinogenic to Humans*," "*Suggestive Evidence of Carcinogenic Potential*," "*Inadequate Information to Assess Carcinogenic Potential*," and "*Not Likely to Be Carcinogenic to Humans*" (USEPA 2005g). The weight-of-evidence classification is based on a thorough scientific examination of the body of available data. Only compounds that have a weight-of-evidence classification of C or above are considered to have carcinogenic potential in this HHRA.

The SF is the upper 95th percentile confidence limit of the probability of response per unit daily intake of a chemical over a lifetime. The SF is expressed in units of proportion (of a population) affected per mg/kg-day. Typically, the SF is used to estimate the upper-bound lifetime probability of a person developing cancer from exposure to a given concentration of a carcinogen. SFs are generally based on experimental animal data, unless suitable epidemiological studies are available. Because of the difficulty in detecting and measuring carcinogenic endpoints at low exposure concentrations, SFs are typically developed by using a model to fit the available high dose, experimental animal data, and then extrapolating downward to the low-dose range to which humans are typically exposed. USEPA recommends the linear multistage model to derive an SF. The model is conservative and provides an upper bound estimate of excess lifetime cancer risk. These methods and approaches are discussed in greater detail within the USEPA *Cancer Guidelines* (USEPA 2005a).

Carcinogenic compounds were also assessed for mutagenic modes of action. The mutagenic mode of action is assessed with a linear approach (USEPA 2005a). **Table 10-6.1** identifies the

[2]A = A known human carcinogen; B1 = A probable human carcinogen, based on sufficient animal data and limited human data; B2 = A probable human carcinogen based on sufficient animal data and inadequate or no human data; C = A possible human carcinogen; D = Not classifiable as to human carcinogenicity; and E = Evidence of non-carcinogenicity for humans.

COPCs with a mutagenic mode of action. The PAHs, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene were the only COPCs identified with a mutagenic mode of action. COPCs identified as mutagenic have sensitivity pertaining to cancer risks associated with early-life exposures. USEPA recommends, for mutagenic chemicals, when no chemical-specific data exist, a default approach using estimates from chronic studies (i.e., cancer slope factors) with appropriate modifications to address the potential for differential risk of early-life stage exposure (USEPA 2005h). A modification for early-life stage exposure to mutagenic COPCs is required because available studies indicate higher cancer risks resulting from a given exposure occurring early in life when compared with the same amount of exposure during adulthood (USEPA 2005h). For this HHRA, the SFs for COPCs identified with a mutagenic mode of action are modified for the following (USEPA 2005h):

- For exposures between 3and 16 years of age, a three-fold adjustment is made.
- For exposures after turning 16 years of age, no adjustment is made.

Within the HHRA, only the adolescent and child recreational user are within the age range that requires adjustment for a mutagenic mode of action. The adjustment for the mutagenic mode of action for the PAHs identified above was applied to the cancer intake calculations.

10.3.3 Toxicity Assessment Modification for Dermal Contact

Toxicity values specific to dermal exposures are not available and require adjustment of the oral toxicity values (oral RfDs or SFs). This adjustment accounts for the difference between the daily intake doses through dermal contact as opposed to ingestion. Most toxicity values are based on the actual administered dose and must be corrected for the percent of chemical-specific absorption that occurs across the gastrointestinal tract prior to use in dermal contact risk assessment (USEPA 1989 and 2004). USEPA recommends utilizing oral absorption efficiency factors in converting oral toxicity values to dermal toxicity values (USEPA 2004). This adjustment accounts for the absorption efficiency in the "critical study," which is utilized in determining the RfD and SF. Where oral absorption in the critical study is essentially complete (i.e., 100 percent), the absorbed dose is equivalent to the administered dose, and no adjustment of oral toxicity values is necessary when evaluating dermal exposures. When gastrointestinal absorption of a chemical in the critical study is poor (e.g., 1 percent), the absorbed dose is smaller than the administered dose, and toxicity values for dermal exposure are adjusted to account for the difference in the absorbed dose relative to the administered dose. To account for the differences between the administered (oral) and the absorbed (dermal) dose, RfDs and SFs are modified by the gastrointestinal absorption factor (GIABS).

In addition to the GIABS modification of the toxicity values for dermal contact, dermal contact rates are also evaluated based upon a chemical's ability to be absorbed through the skin surface. This absorption rate is dependent upon the medium evaluated. For sediments, USEPA has identified a fraction of contaminant absorbed dermally (ABS) that is chemical-specific. The

ABS value reflects the desorption of a chemical from sediment and the absorption of the chemical across the skin and into the blood stream. The USEPA-recommended ABS values are based upon available experimental data for dermal absorption from contaminated soil (USEPA 2004). Recommended values are presented that account for uncertainty which may arise from different soil types, loading rates, chemical concentrations, and other conditions.

The chemical-specific parameters utilized in assessing dermal exposure, GIABS, ABS, FA, and PC are selected from the USEPA dermal guidance (USEPA 2004, 2015a). **Table 10-5.2** presents relative chemical-specific parameters utilized in calculating dermal exposure for COPCs.

10.4 RISK CHARACTERIZATION

Risk characterization is the fourth step of the HHRA process. In this step, the toxicity values are combined with the calculated chemical intakes for the receptor populations to quantitatively estimate both carcinogenic and non-carcinogenic risks. Risks were calculated for each receptor of concern.

10.4.1 Hazard Index for Non-Carcinogenic Effects

The potential human health risks associated with exposures to non-carcinogenic COPCs are calculated by comparing the ADI with the chemical-specific RfD or reference concentration (RfC), as per USEPA Guidance (USEPA 1989). An HQ is derived for each COPC, as shown in the equation below:

$$HQ = \frac{ADI}{RfD}$$

where:

HQ	=	Hazard Quotient; ratio of average daily intake level to acceptable daily intake level (unitless)
ADI	=	Calculated non-carcinogenic average daily intake (mg/kg-day or milligrams per cubic meter)
RfD	=	Reference dose (mg/kg-day).

If the average daily dose exceeds the RfD, the HQ will exceed a ratio of one (1.0) and there may be concern that potential adverse systemic health effects will be observed in the exposed populations. If the ADI does not exceed the RfD, the HQ will not exceed 1.0 and there will be no concern that potential adverse systemic health effects will be observed in the exposed populations. However, if the sum of several HQs exceeds 1.0, and the COPCs affect the same target organ, there may be concern that potential adverse systemic health effects will be observed in the exposed populations. In general, the greater the value of the HQ above 1.0, the greater the level of concern. However, the HQ does not represent a statistical probability that an adverse health effect will occur.

For consideration of exposures to more than one chemical causing systemic toxicity via several different pathways, the individual HQs are summed to provide an overall hazard index (HI). If the HI is less than 1.0, then no adverse health effects are likely to be associated with exposures within the grouping. However, if the total HI is greater than 1.0, separate endpoint-specific HIs may be calculated based on toxic endpoint of concern or target organ (e.g., HQs for neurotoxins are summed separately from HQs for renal toxins). Only if an endpoint-specific HI is greater than 1.0 is there reason for concern about potential health effects for that endpoint.

10.4.2 Carcinogenic Risks

Carcinogenic risk is calculated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. The numerical estimate of excess lifetime cancer risk is calculated by multiplying the LADI by the risk per unit dose (the SF).

This is shown in the following equation:

$$Risk = LADI \times SF$$

where:

Risk	=	Unitless probability of an exposed individual developing cancer
LADI	=	Lifetime cancer average daily intake (mg/kg-day)
SF	=	Cancer slope factor $(mg/kg\text{-}day)^{-1}$.

Because the SF is the statistical 95^{th} percent upper-bound confidence limit on the dose-response slope, this method provides a conservative, upper-bound estimate of risk. It should be noted that the interpretation of the significance of the cancer risk estimate is based on the appropriate public policy. USEPA in the National Contingency Plan (40 Code of Federal Regulation Part 300) (USEPA 1990) states that:

> *...For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6}.*

Additionally, MDE identifies an acceptable excess cancer risk range of 10^{-5} to 10^{-6}.

10.5 RISK CHARACTERIZATION RESULTS FOR THE NORTHEAST/NEAR SHORE AREA

Calculations for this exposure area are broken down by the evaluation of fish and crab. Risk calculations are provided for exposure to field-collected crab and fish tissue concentrations. These calculations are presented by receptor in **Tables 10-7.1 through 10-7.4**. The estimates of cumulative risks across all pathways for non-carcinogenic and carcinogenic effects for all

receptors are presented in **Tables 10-9.1 through 10-9.4**. A summary of significant contributors to risk is presented in **Tables 10-10.1 through 10-10.4**. COPCs are only identified on **Tables 10-10.1 through 10-10.4** if cumulative carcinogenic risks are greater than the lower end of acceptable excess cancer risk range of 10^{-6} or cumulative non-carcinogenic risks are greater than 1.0. Significant contributors to risk are identified as COPCs with carcinogenic risks greater than 10^{-6} or non-carcinogenic risks greater than 0.1.

For the evaluation of exposure to sediment, surface water, and modeled crab and fish tissue concentrations, these calculations are presented by receptor in **Tables 10-7.5 through 10-7.8**. The estimates of cumulative risks across all pathways for non-carcinogenic and carcinogenic effects for all receptors are presented in **Tables 10-9.5 through 10-9.8**. A summary of significant contributors to risk is presented in **Tables 10-10.5 through 10-10.8**. Note that **Tables 10-10.1 through 10-10.8** only present cumulative risk results for those COPCs identified as contributing significantly to the risk results. As a result, cumulative risks and hazards for each exposure pathway and across all exposure pathways may not equal (or will not be the same) as the results presented in **Tables 10-9.1 through 10-9.8**.

The following sections provide a summary of the risk results contained on **Tables 10-9.1 through 10-9.8**. It is noted that the individual pathway-specific HIs and cancer risks may not exactly equal the cumulative non-cancer HIs and cancer risk results for each receptor, due to rounding to significant digits. In accordance with EPA guidance (1989), cancer risks and non-cancer hazards are presented to one significant figure.

10.5.1 Field-Collected Crab and Fish Tissue

For the NNS area, no COPCs were determined for surface water and sediment. As a result, the risk results for the NNS area are entirely for ingestion of crabs and fish.

10.5.1.1 Adult Recreational User

Non-Carcinogenic Results

The total calculated non-carcinogenic HI for the adult recreational user is 0.1, which is below the acceptable threshold of 1.0 (**Table 10-9.1**). The non-carcinogenic HI for ingestion of fish is 0.071 and ingestion of crabs is 0.063.

Carcinogenic Results

The excess cumulative carcinogenic risk calculated for the adult recreational user is 7×10^{-6} (**Table 10-9.1**), which is within USEPA's acceptable excess cancer risk range of 10^{-4} to 10^{-6} and is also within MDE's acceptable excess cancer risk range of 10^{-5} to 10^{-6}. The carcinogenic risk for the adult recreational user is entirely due to ingestion of crabs. Only benzo(a)pyrene (4.2×10^{-6}) has calculated carcinogenic risks greater than 10^{-6}.

10.5.1.2 Adolescent Recreational User

Non-Carcinogenic Results

The total calculated non-carcinogenic HI for the adolescent recreational user is 0.2, which is below the acceptable threshold of 1.0 (**Table 10-9.2**). The non-carcinogenic HI for ingestion of fish is 0.09 and ingestion of crabs is 0.08.

Carcinogenic Results

The excess cumulative carcinogenic risk calculated for the adolescent recreational user is 1×10^{-5} (**Table 10-9.2**), which is within USEPA's acceptable excess cancer risk range of 10^{-4} to 10^{-6} and is equal to upper end of MDE's acceptable excess cancer risk range of 10^{-5} to 10^{-6}. The carcinogenic risk for the adolescent recreational user is entirely due to ingestion of crabs. Only benzo(a)anthracene (1.3×10^{-6}), benzo(b)fluoranthene (1.6×10^{-6}) and benzo(a)pyrene (8.2×10^{-6}) have calculated carcinogenic risks greater than 10^{-6}.

10.5.1.3 Child Recreational User

Non-Carcinogenic Results

The total calculated non-carcinogenic HI for the child recreational user is 0.2, which is below the acceptable threshold of 1.0 (**Table 10-9.3**). The non-carcinogenic HI for ingestion of fish is 0.12 and ingestion of crabs is 0.1.

Carcinogenic Results

The excess cumulative carcinogenic risk calculated for the child recreational user is 5×10^{-6} (**Table 10-9.3**), which is within USEPA's acceptable excess cancer risk range of 10^{-4} to 10^{-6} and is also within MDE's acceptable excess cancer risk range of 10^{-5} to 10^{-6}. The carcinogenic risk for the child recreational user is entirely due to ingestion of crabs. Only benzo(a)pyrene (3.1×10^{-6}) has calculated carcinogenic risks greater than 10^{-6}.

10.5.1.4 Watermen

Non-Carcinogenic Results

The total calculated non-carcinogenic HI for the watermen is 0.2, which is below the acceptable threshold of 1.0 (**Table 10-9.4**). The non-carcinogenic HI for ingestion of fish is 0.086 and ingestion of crabs is 0.076.

Carcinogenic Results

The excess cumulative carcinogenic risk calculated for the watermen is 1×10^{-5} (**Table 10-9.4**), which is within USEPA's acceptable excess cancer risk range of 10^{-4} to 10^{-6} and is equal to the upper end of MDE's acceptable excess cancer risk range of 10^{-5} to 10^{-6}. The carcinogenic risk for the watermen is entirely due to ingestion of crabs. Only benzo(b)fluoranthene (1.3×10^{-6}) and benzo(a)pyrene (6.3×10^{-6}) have calculated carcinogenic risks greater than 10^{-6}.

10.5.2 Modeled Crab and Fish Tissue

10.5.2.1 Adult Recreational User

Non-Carcinogenic Results

The total calculated non-carcinogenic HI for the adult recreational user is 0.4, which is below the acceptable threshold of 1.0 (**Table 10-9.5**). The non-carcinogenic HI for ingestion of fish is 0.35 and ingestion of crabs is 0.014.

Carcinogenic Results

The excess cumulative carcinogenic risk calculated for the adult recreational user is 3×10^{-5} (**Table 10-9.5**), which within USEPA's acceptable excess cancer risk range of 10^{-4} to 10^{-6}. However, these results exceed MDE's acceptable excess cancer risk range of 10^{-5} to 10^{-6}. The calculated carcinogenic risk for the ingestion of fish is 1.6×10^{-5} and for ingestion of crabs is 1.2×10^{-5}. Benzo(a)pyrene in fish (1.6×10^{-5}) has calculated carcinogenic risks greater than 10^{-5}. The modeled concentrations of the other PAH COPCs in crabs have carcinogenic risks greater than 10^{-6}.

10.5.2.2 Adolescent Recreational User

Non-Carcinogenic Results

The total calculated non-carcinogenic HI for the adolescent recreational user is 0.5, which is below the acceptable threshold of 1.0 (**Table 10-9.6**). The non-carcinogenic HI for ingestion of fish is 0.46 and ingestion of crabs is 0.018.

Carcinogenic Results

The excess cumulative carcinogenic risk calculated for the adult recreational user is 5×10^{-5} (**Table 10-9.6**), which within USEPA's acceptable excess cancer risk range of 10^{-4} to 10^{-6}. However, these results exceed MDE's acceptable excess cancer risk range of 10^{-5} to 10^{-6}. The calculated carcinogenic risk for the ingestion of fish is 3.1×10^{-5} and for ingestion of crabs is 2.4×10^{-5}. Benzo(a)pyrene in fish (3.1×10^{-5}) and crabs (1.5×10^{-5}) is the only COPC with

carcinogenic risks greater than 10^{-5}. In crabs, benzo(a)anthracene (2.5×10^{-6}) and dibenz(a,h)anthracene (4.1×10^{-6}) have calculated carcinogenic risks greater than 10^{-6}.

10.5.2.3 Child Recreational User

Non-Carcinogenic Results

The total calculated non-carcinogenic HI for the child recreational user is 0.6, which is below the acceptable threshold of 1.0 (**Table 10-9.7**). The non-carcinogenic HI for ingestion of fish is 0.57 and ingestion of crabs is 0.023.

Carcinogenic Results

The excess cumulative carcinogenic risk calculated for the child recreational user is 2×10^{-5} (**Table 10-9.7**), which is within USEPA's acceptable excess cancer risk range of 10^{-4} to 10^{-6}. However, these results exceed MDE's acceptable excess cancer risk range of 10^{-5} to 10^{-6}. The calculated carcinogenic risk for the ingestion of fish is 1.1×10^{-5} and for ingestion of crabs is 8.9×10^{-6}. Benzo(a)pyrene in fish (1.1×10^{-5}) is the only COPC with carcinogenic risks greater than 10^{-5}. In crabs, benzo(a) pyrene (5.7×10^{-6}) and dibenz(a,h)anthracene (1.6×10^{-6}) have calculated carcinogenic risks greater than 10^{-6}.

10.5.2.4 Watermen

Non-Carcinogenic Results

The total calculated non-carcinogenic HI for the watermen is 0.4, which is below the acceptable threshold of 1.0 (**Table 10-9.8**). The non-carcinogenic HI for ingestion of fish is 0.43 and ingestion of crabs is 0.017.

Carcinogenic Results

The excess cumulative carcinogenic risk calculated for the watermen is 4×10^{-5} (**Table 10-9.8**), which is within USEPA's acceptable excess cancer risk range of 10^{-4} to 10^{-6}. However, these results exceed MDE's acceptable excess cancer risk range of 10^{-5} to 10^{-6}. The calculated carcinogenic risk for the ingestion of fish is 2.4×10^{-5} and for ingestion of crabs is 1.9×10^{-5}. Benzo(a)pyrene in fish (2.4×10^{-5}) and in crabs (1.2×10^{-5}) has calculated carcinogenic risks greater than 10^{-5}. Benzo(a)anthracene (1.9×10^{-6}), dibenz(a,h)anthracene (3.2×10^{-6}) in crabs have calculated carcinogenic risks greater than 10^{-6}.

10.6 RISK CHARACTERIZATION RESULTS FOR THE SOUTHWEST/TIN MILL CANAL EFFLUENT AREA

Calculations for this exposure area are presented by receptor in **Tables 10-7.9 through 10-7.16**. The estimates of cumulative risks across all pathways for non-carcinogenic and carcinogenic effects for all receptors are presented in **Tables 10-9.9 through 10-9.12** (including exposure to field-collected crab and fish tissue) and **Tables 10-9.13 through 10-9.16** (including exposure to modeled crab and fish tissue). A summary of significant contributors to risk is presented in **Tables 10-10.9 through 10-10.16**. Note that **Tables 10-10.9 through 10-10.16** only present cumulative risk results for those COPCs identified as contributing significantly to the risk results. As a result, cumulative risks and hazards for each exposure pathway and across all exposure pathways may not equal (or will not be the same) as the results presented in **Tables 10-9.9 through 10-9.16**.

The following sections provide a summary of the risk results contained on **Tables 10-9.9 through 10-9.16**. It is noted that the individual pathway-specific HIs and cancer risks may not exactly equal the cumulative non-cancer HIs and cancer risk results for each receptor, due to rounding to significant digits. In accordance with EPA guidance (1989), cancer risks and non-cancer hazards are presented to one significant figure.

10.6.1 Field-Collected Crab and Fish Tissue

For the SWTM Area, no COPCs were determined for surface water. As a result, the risk results for the SWTM Area are for dermal exposure to sediment and ingestion of crabs and fish.

10.6.1.1 Adult Recreational User

Non-Carcinogenic Results

The total calculated non-carcinogenic HI for the adult recreational user is 0.4, which is below the acceptable threshold of 1.0 (**Table 10-9.9**). The non-carcinogenic HI for dermal exposure to sediment is 0.0002. The non-carcinogenic HI for ingestion of fish is 0.12 and ingestion of crabs is 0.31.

Carcinogenic Results

The excess cumulative carcinogenic risk calculated for the adult recreational user is 6×10^{-5} (**Table 10-9.9**), which is within USEPA's acceptable excess cancer risk range of 10^{-4} to 10^{-6}. However, this exceeds MDE's acceptable excess cancer risk range of 10^{-5} to 10^{-6}. The calculated carcinogenic risk for the dermal exposure to sediment is 5.5×10^{-8}. The calculated carcinogenic risk for the ingestion of fish is 1.8×10^{-5} and for ingestion of crabs is 3.7×10^{-5}. Total PCBs in fish (1.5×10^{-5}) and in crabs (1.5×10^{-5}) has calculated carcinogenic risks greater than 10^{-5}. Arsenic in fish (2.7×10^{-6}) and in crabs (7.0×10^{-6}), benzo(a)pyrene in crabs (4.2×10^{-6}), and

bis(2-ethylhexyl)phthalate in crabs (9.3×10^{-6}) have calculated carcinogenic risks greater than 10^{-6}.

10.6.1.2 Adolescent Recreational User

Non-Carcinogenic Results

The total calculated non-carcinogenic HI for the adolescent recreational user is 0.6, which is below the acceptable threshold of 1.0 (**Table 10-9.10**). The non-carcinogenic HI for dermal exposure to sediment is 0.0008. The non-carcinogenic HI for ingestion of fish is 0.15 and ingestion of crabs is 0.41.

Carcinogenic Results

The excess cumulative carcinogenic risk calculated for the adolescent recreational user is 4×10^{-5} (**Table 10-9.10**), which is within USEPA's acceptable excess cancer risk range of 10^{-4} to 10^{-6}. However, these results exceed MDE's acceptable excess cancer risk range of 10^{-5} to 10^{-6}. The calculated carcinogenic risk for the dermal exposure to sediment is 1.9×10^{-7}. The calculated carcinogenic risk for the ingestion of fish is 1.2×10^{-5} and for ingestion of crabs is 3.2×10^{-5}. All carcinogenic COPCs in fish and crabs have calculated carcinogenic risks greater than 10^{-6}.

10.6.1.3 Child Recreational User

Non-Carcinogenic Results

The total calculated non-carcinogenic HI for the child recreational user is 0.7, which is below the acceptable threshold of 1.0 (**Table 10-9.11**). The non-carcinogenic HI for ingestion of fish is 0.19 and ingestion of crabs is 0.52.

The excess cumulative carcinogenic risk calculated for the child recreational user is 2×10^{-5} (**Table 10-9.11**), which is within USEPA's acceptable excess cancer risk range of 10^{-4} to 10^{-6}. However, this exceeds MDE's acceptable excess cancer risk range of 10^{-5} to 10^{-6}. The calculated carcinogenic risk for the ingestion of fish is 4.4×10^{-6} and for ingestion of crabs is 1.2×10^{-5}. Total PCBs in fish (3.8×10^{-6}) and in crabs (3.7×10^{-6}), arsenic (1.7×10^{-6}) and benzo(a)pyrene (3.1×10^{-6}) in crabs have calculated carcinogenic risks greater than 10^{-6}.

10.6.1.4 Watermen

Non-Carcinogenic Results

The total calculated non-carcinogenic HI for the watermen is 0.5, which is below the acceptable threshold of 1.0 (**Table 10-9.12**). The non-carcinogenic HI for dermal exposure to sediment is 0.006. The non-carcinogenic HI for ingestion of fish is 0.14 and ingestion of crabs is 0.39.

Carcinogenic Results

The excess cumulative carcinogenic risk calculated for the watermen is 9×10^{-5} (**Table 10-9.12**), which is within USEPA's acceptable excess cancer risk range of 10^{-4} to 10^{-6}. However, these results exceed MDE's acceptable excess cancer risk range of 10^{-5} to 10^{-6}. The calculated carcinogenic risk for the dermal exposure to sediment is 1.8×10^{-6}. The calculated carcinogenic risk for the ingestion of fish is 2.7×10^{-5} and for ingestion of crabs is 5.6×10^{-5}. Total PCBs in fish (2.3×10^{-5}) and in crabs (2.3×10^{-5}), arsenic in crabs (1.1×10^{-5}), and bis(2-ethylhexyl)phthalate (1.4×10^{-5}) have carcinogenic risks greater than 10^{-5}. Arsenic in fish (4.1×10^{-6}), and benzo(a)anthracene (1.0×10^{-6}), benzo(b)fluoranthene (1.3×10^{-6}), and benzo(a)pyrene (6.3×10^{-6}) in crabs have calculated carcinogenic risks greater than or equal to 10^{-6}.

10.6.2 Modeled Crab and Fish Tissue

10.6.2.1 Adult Recreational User

Non-Carcinogenic Results

The total calculated non-carcinogenic HI for the adult recreational user is 28, which is above the acceptable threshold of 1.0 (**Table 10-9.13**). The non-carcinogenic HI for dermal exposure to sediment is 0.0002. The non-carcinogenic HI for ingestion of fish is 0.26 and ingestion of crabs is 28. A breakdown by target organ is provided on **Table 10-10.13**. Aroclor 1254 has a HQ greater than 1. The target organs associated with this COPC also has a HI greater than 1.

Carcinogenic Results

The excess cumulative carcinogenic risk calculated for the adult recreational user is 2×10^{-3} (**Table 10-9.13**), which above the upper end of USEPA's acceptable excess cancer risk range of 10^{-4} to 10^{-6} as well as the upper end MDE's acceptable excess cancer risk range of 10^{-5} to 10^{-6}. The calculated carcinogenic risk for the dermal exposure to sediment is 5.5×10^{-8}. The calculated carcinogenic risk for the ingestion of fish is 1.1×10^{-5} and for ingestion of crabs is 1.5×10^{-3}. Modeled concentrations of Aroclor 1248 (9.1×10^{-4}), Aroclor 1254 (3.2×10^{-4}), and Aroclor 1260 (1.7×10^{-4}) have carcinogenic risks greater than 10^{-4}. Benzo(a)pyrene in fish (1.1×10^{-5}), and arsenic (1.5×10^{-5}), benzo(a)pyrene (4.5×10^{-5}), and dibenz(a,h)anthracene (2.1×10^{-5}) in crabs has calculated carcinogenic risks greater than 10^{-5}. The modeled concentrations of the other PAH COPCs in crabs have carcinogenic risks greater than 10^{-6}.

10.6.2.2 Adolescent Recreational User

Non-Carcinogenic Results

The total calculated non-carcinogenic HI for the adolescent recreational user is 37, which is above the acceptable threshold of 1.0 (**Table 10-9.14**). The non-carcinogenic HI for dermal

exposure to sediment is 0.0008. The non-carcinogenic HI for ingestion of fish is 0.34 and ingestion of crabs is 37. A breakdown by target organ is provided on **Table 10-10.14**. Aroclor 1254 has a HQ greater than 1. The target organs associated with this COPC also has a HI greater than 1.

Carcinogenic Results

The excess cumulative carcinogenic risk calculated for the adolescent recreational user is 1×10^{-3} (**Table 10-9.14**), which above the upper end of USEPA's acceptable excess cancer risk range of 10^{-4} to 10^{-6} as well as the upper end MDE's acceptable excess cancer risk range of 10^{-5} to 10^{-6}. The calculated carcinogenic risk for the dermal exposure to sediment is 1.9×10^{-7}. The calculated carcinogenic risk for the ingestion of fish is 2.3×10^{-5} and for ingestion of crabs is 1.1×10^{-3}. Modeled concentrations of Aroclor 1248 (6.0×10^{-4}), Aroclor 1254 (2.1×10^{-4}), and Aroclor 1260 (1.1×10^{-4}) in crabs have carcinogenic risks greater than 10^{-4}. Also in crabs, benzo(a)anthracene (2.0×10^{-5}), benzo(a)pyrene (8.8×10^{-5}), and dibenz(a,h)anthracene (4.2×10^{-5}) have carcinogenic risks greater than 10^{-5}. Benzo(a)pyrene (2.3×10^{-5}) in fish, and arsenic (9.6×10^{-6}), benzo(a)fluoranthene (5.6×10^{-6}), indeno(1,2,3-cd)pyrene (4.7×10^{-6}), and bis(2-ethylhexyl)phthalate (6.1×10^{-6}) in crabs have calculated carcinogenic risks greater than 10^{-6}.

10.6.2.3 Child Recreational User

Non-Carcinogenic Results

The total calculated non-carcinogenic HI for the child recreational user is 47, which is above the acceptable threshold of 1.0 (**Table 10-9.15**). The non-carcinogenic HI for ingestion of fish is 0.42 and ingestion of crabs is 46. A breakdown by target organ is provided on **Table 10-10.15**. Aroclor 1254 in crabs has an HQ greater than 1. The target organs associated with this COPC also has an HI greater than 1.

Carcinogenic Results

The excess cumulative carcinogenic risk calculated for the child recreational user is 4×10^{-4} (**Table 10-9.15**), which is above the upper end of USEPA's acceptable excess cancer risk range of 10^{-4} to 10^{-6} as well as the upper end MDE's acceptable excess cancer risk range of 10^{-5} to 10^{-6}. The calculated carcinogenic risk for the ingestion of fish is 8.5×10^{-6} and for ingestion of crabs is 4.1×10^{-4}. The modeled concentration of Aroclor 1248 (2.2×10^{-4}) in crabs is the only COPC with carcinogenic risk greater than 10^{-4}. Also in crabs, Aroclor 1254 (7.8×10^{-5}), Aroclor 1260 (4.1×10^{-5}), benzo(a)pyrene (3.3×10^{-5}), and dibenz(a,h)anthracene (1.6×10^{-5}) have carcinogenic risks greater than 10^{-5}. Benzo(a)pyrene (8.5×10^{-6}) in fish, and arsenic (3.6×10^{-6}), benzo(a)anthracene (7.3×10^{-6}), benzo(b)fluoranthene (2.1×10^{-6}), indeno(1,2,3-cd)pyrene ($1.8 \times$

10^{-6}), and bis(2-ethylhexyl)phthalate (2.3×10^{-6}) in crabs have calculated carcinogenic risks greater than 10^{-6}.

10.6.2.4 Watermen

Non-Carcinogenic Results

The total calculated non-carcinogenic HI for the watermen is 35, which is above the acceptable threshold of 1.0 (**Table 10-9.16**). The non-carcinogenic HI for dermal exposure to sediment is 0.006. The non-carcinogenic HI for ingestion of fish is 0.31 and ingestion of crabs is 34. A breakdown by target organ is provided on **Table 10-10.16**. Aroclor 1254 in crabs has an HQ greater than 1. The target organs associated with this COPC also have an HI greater than 1.

Carcinogenic Results

The excess cumulative carcinogenic risk calculated for the watermen is 2×10^{-3} (**Table 10-9.16**), which is above the upper end of USEPA's acceptable excess cancer risk range of 10^{-4} to 10^{-6} as well as the upper end MDE's acceptable excess cancer risk range of 10^{-5} to 10^{-6}. The calculated carcinogenic risk for the dermal exposure to sediment is 1.8×10^{-6}. The calculated carcinogenic risk for the ingestion of fish is 1.7×10^{-5} and for ingestion of crabs is 2.3×10^{-3}. The modeled concentration of Aroclor 1248 (1.4×10^{-3}) in crabs is the only COPC with carcinogenic risks greater than 10^{-3}. Aroclor 1254 (4.8×10^{-4}) and Aroclor 1260 (2.5×10^{-4}) in crabs have carcinogenic risks greater than 10^{-4}. Benzo(a)pyrene in fish (1.7×10^{-5}), and arsenic (2.2×10^{-5}), benzo(a)anthracene (1.5×10^{-5}), benzo(a)pyrene (6.8×10^{-5}), bis(2-ethylhexyl)phthalate (1.4×10^{-5}), and dibenz(a,h)anthracene (3.3×10^{-5}) in crabs has calculated carcinogenic risks greater than 10^{-5}. The modeled concentrations of the other PAH COPCs in crabs have carcinogenic risks greater than 10^{-6}.

10.7 RISK ASSESSMENT UNCERTAINTY

There are numerous uncertainties involved in the HHRA process. These are discussed briefly in the following sections. There are uncertainties associated with each step of the risk assessment process: Sampling and analysis, exposure assessment, exposure point concentration, dermal exposure values, toxicity assessment, and risk characterization. Where uncertainties are inherent in the USEPA guidance for the HHRA process and USEPA has recommended or incorporated methods for addressing these uncertainties, the agency's findings have been incorporated into the HHRA. This is particularly true for uncertainties associated with the toxicity assessment and exposure routes. For the toxicity assessment, appropriate uncertainty factors are applied to toxicity values as set forth by USEPA and discussed in Section 10.3 (USEPA 2015c).

10.7.1 Sampling and Analysis Uncertainties

The sampling plan can have a significant impact on the results obtained in calculating human health risk. There are uncertainties associated with the data set used in the HHRA. In particular, surface water is a fluid medium and chemical concentrations may vary spatially and temporally. Uncertainty due to spatial and temporal variability is especially relevant to surface water results because surface water is subject to mixing and variable upstream input. To mitigate this uncertainty and to focus on Site-related inputs, surface water concentrations were modeled based upon inputs from stormwater and pore water samples. Additionally, surface water concentration modeling took into account mixing and tidal influence for the Patapsco River. Therefore, the primary uncertainty associated with surface water risk results is inherent to the surface water model used to determine concentrations. However, these uncertainties are not expected to change the overall risk results for surface water in the Phase I area.

There are also uncertainties associated with field-collection of fish and crab tissue. Field-collected fish and crab tissue samples were taken during one sampling event and only consisted of five samples. Collection of tissue in a single event may not account for variability in concentrations over long periods of time due to seasonal variation, migration, or changing site conditions. This may result in over- or under- estimation of risks. To minimize these uncertainties, individual specimens were collected and composited using sampling criteria that help minimize the impacts of variation.

In addition to the evaluation of field-collected fish and crab tissue, tissue concentrations were also determined from laboratory bioaccumulation studies performed for the Coke Point Peninsula just south of the Phase I area (EA 2011b). The laboratory bioaccumulation results were used to determine potential crab tissue concentrations based upon exposure to sediments. The laboratory bioaccumulation studies reduce the potential uncertainty associated with food web exposure models used in the risk assessment when compared to use of literature-based BAFs. However, there are some uncertainties associated with these data. First, applying these BAFs to the Phase I sediment data to predict crab concentrations assumes those organisms reside solely in the Phase I area, which is not true for crabs that range widely throughout the Bay, and therefore clearly biases risk estimates toward over-estimation. Additionally, laboratory bioaccumulation tests are conducted in a controlled environment. Because laboratory bioaccumulation test conditions may differ from those experienced by aquatic organisms in the field, bioaccumulation may differ and thus be over-estimated or under-estimated by laboratory bioaccumulation test results. To minimize this uncertainty, the sediment used for laboratory bioaccumulation tests was carefully selected to represent site-wide conditions as closely as possible, and standard test methods were used which utilize organisms and parameters representative of a range of situations.

10.7.2 Uncertainties Analysis of Exposure Assessment

An analysis of uncertainties is an important aspect of the exposure assessment. It provides the risk assessor and reviewer with information relevant to the individual uncertainties associated with exposure factor assumptions and their potential impact on the final assessment.

Conservative assumptions are made about exposure to surface water, sediment, and ingestion of fish and crabs from the Phase I area. The assumptions were made to provide a protective evaluation of potential human contact with the area. However, these assumptions may result in an overestimate of potential health risks. The assumption that fishing and swimming occur with a long-term regularity only within the Phase I Area in the offshore environment of this industrialized area is conservative.

10.7.2.1 Exposure Point Concentrations

As discussed in Section 10.7. 1, there is potential variability in the sampling and analysis of the offshore areas. These variabilities can also affect the calculation of EPCs. Chemical concentrations in crab and fish tissue for VOCs and SVOCs are modeled from literature-based BAFs because tissue samples were not analyzed for these chemicals. There is uncertainty whether these chemicals would be present in tissue samples. This uncertainty may affect the HHRA risk results. Only bis(2-ethylhexyl)phthalate in crab for both groupings were determined to be a COPC in the HHRA. This chemical was not identified as COPC in fish tissue.

For the evaluation of total PCB congeners in field-collected crab and fish tissue for the SWTM Area, the EPC was determined assuming non-detect of PCB congeners was equal to the RL. Therefore, the summation of the PCB congeners to determine the total PCB congener concentration assumed the RL for those congeners that were not detected in a tissue sample. The use of the RL for non-detect PCB congeners likely overestimates potential congener concentrations when evaluating the total PCB congener concentration. **Tables 10-3.9 and 10-3.10** present the EPCs for total PCBs assuming non-detect concentrations equal the RL and non-detect concentrations equal zero. For field-collected crab tissue (**Table 10-3.9**), the EPC for total PCB congeners assuming non-detects equals the RL was approximately 1.5 times higher than the EPC for total PCB congeners assuming non-detects equals zero. For field-collected crab tissue (**Table 10-3.10**), the EPC for total PCB congeners assuming non-detects equals the RL was approximately 1.1 times higher than the EPC for total PCB congeners assuming non-detects equals zero. Based upon the HHRA results for total PCB congeners in field-collected crab and fish tissue for the SWTM Area (**Tables 10-9.9 to 10-9.16**), the difference in the EPCs would not result in a change to the overall conclusions of the HHRA for this exposure pathway.

For the evaluation of surface water, EPCs were selected for non-storm conditions. The non-storm conditions were selected because they provide a representation of typical surface water conditions within the Phase I area. EPCs were also modeled for storm conditions. These EPCs are more indicative of potential short-term exposure conditions because these chemicals

concentrations are only expected during storm events. The EPCs for modeled storm conditions are evaluated to determine if they may present a potential concern for human contact during short-term exposures. None of the storm EPCs exceeds the human health direct contact with surface water screening values (**Appendix H**). Therefore, uptake to fish tissue is the only complete exposure pathway evaluated. Modeled fish tissue concentrations were determined as discussed in Section 10.1.2. **Table 10-11.1** presents the risk-based screening for the fish tissue concentrations based on storm EPCs for the NNS grouping, and **Table 10-11.2** presents the risk-based screening for fish tissue concentrations based on storm EPCs for the SWTM grouping.

For the NNS grouping, mercury, HMW PAHs, and bis(2-ethylhexyl)phthalate are considered COPCs for fish tissue based on the storm EPCs for surface water. This is similar to the risk-based screening for the non-storm condition (**Table 10-2.6**), except for bis(2-ethylhexyl)phthalate. For the SWTM grouping, arsenic, mercury, and HWM PAHs are considered COPCs for fish tissue based on the storm EPCs for surface water, which is similar to the risk-based screening for the non-storm condition (**Table 10-2.12**). To evaluate approximate risk levels associated with the storm EPCs, they were compared to the non-storm EPCs:

COPC	Storm Fish Tissue EPC (mg/kg)	Non-Storm Fish Tissue EPC (mg/kg)
Northeast/North Shore Area		
Mercury	1.15	1.11
HMW PAHs	0.237	0.237
Bis(2-ethylhexyl)phthalate	0.548	NA
Southwest/Tin Mill Canal Area		
Arsenic	0.0088	0.00821
Mercury	0.864	0.819
HMW PAHs	0.206	0.174

As shown in the table above, the storm and non-storm fish tissue EPCs, calculated based on modeled surface water concentrations, are similar. Based upon the minimal difference between the storm and non-storm fish tissue EPCs, risks results are expected to be similar for both scenarios evaluated. None of the COPCs in fish tissue for both areas were above levels of concern. As a result, there are no potential concerns for potentially complete exposure pathways for human receptor exposure to surface water during storm events.

10.7.3 Uncertainties of Toxicity Assessment

There are numerous uncertainties associated with the toxicity assessment. These are generally due to the unavailability of data to thoroughly calculate the toxicity of COPCs. These uncertainties are described in more detail in the following sections.

10.7.3.1 Uncertainties Associated With Non-Carcinogenic Effects

Interspecies Extrapolation

The majority of toxicological information comes from experiments with laboratory animals. Experimental animal data have been relied on by regulatory agencies to assess the hazards of chemical exposures to humans. Interspecies differences in chemical absorption, metabolism, excretion, and toxic response are not well understood; therefore, conservative assumptions are applied to animal data when extrapolating to humans. These probably result in an overestimation of toxicity.

Intraspecies Extrapolation

Differences in individual human susceptibilities to the effects of chemical exposures may be caused by such variables as genetic factors (e.g., glucose-6-phosphate dehydrogenase deficiency), lifestyle (e.g., cigarette smoking and alcohol consumption), age, hormonal status (e.g., pregnancy), and disease. To take into account the diversity of human populations and their differing susceptibilities to chemically induced injury or disease, a safety factor is used. USEPA uses a factor between 1 and 10. This uncertainty may lead to overestimates of human health effects at given doses.

Exposure Routes

When experimental data available on one route of administration are different from the actual route of exposure that is of interest, route-to-route extrapolation must be performed before the risk can be assessed. Several criteria must be satisfied before route-to-route extrapolation can be undertaken. The most critical assumption is that a chemical injures the same organ(s) regardless of route, even though the injury can vary in degree. Another assumption is that the behavior of a substance in the body is similar by all routes of contact. This may not be the case when, for example, materials absorbed via the gastrointestinal tract pass through the liver prior to reaching the systemic circulation, whereas by inhalation the same chemical will reach other organs before the liver. However, when data are limited, these extrapolations are made and may result in overestimates of human toxicity.

10.7.3.2 Uncertainties Associated With Carcinogenic Effects

Interspecies Extrapolation

The majority of toxicological information for carcinogenic assessments comes from experiments with laboratory animals. There is uncertainty about whether animal carcinogens are also carcinogenic in humans. While many chemical substances are carcinogenic in one or more animal species, only a very small number of chemical substances are known to be human carcinogens. The fact that some chemicals are carcinogenic in some animal species but not in

others raises the possibility that not all animal carcinogens are human carcinogens. Regulatory agencies assume that humans are as sensitive to carcinogens as the most sensitive animal species. This policy decision, designed to prevent underestimation of risk, introduces the potential to overestimate carcinogenic risk.

High-Dose to Low-Dose Extrapolation

Typical cancer bioassays provide limited low-dose data on responses in experimental animals for chemicals being assessed for carcinogenic or chronic effects. The usual dose regime involves three dose groups per assay. The first dose group is given the highest dose that can be tolerated, the second is exposed to one-half that dose, and the third group is unexposed (control group). Because this dosing method does not reflect how animals would react to lower doses of a chemical, a dose-response assessment normally requires extrapolation from high to low doses using mathematical modeling that incorporates to varying degrees information about physiologic processes in the body.

A central problem with the low-dose extrapolation models is that they all too often fit the data from animal bioassays equally well, and it is not possible to determine their validity based on goodness of fit. Several models may fit experimental data equally well, but all may not be equally plausible biologically. The dose-response curves derived from different models diverge substantially in the dose range of interest. Therefore, low-dose extrapolation is more than a curve-fitting process, and considerations of biological plausibility of the models must be taken into account before choosing the best model for a particular set of data.

10.7.4 Uncertainties in Risk Characterization

Uncertainties in the risk characterization can stem from the inherent uncertainties in the data evaluation; the exposure assessment process, including any modeling of exposure point concentrations in secondary media from primary media; and the toxicity assessment process. The individual uncertainties in these respective processes are addressed in previous sections. Another uncertainty in the risk characterization is the summation of chemical-specific risk results across media of concern. The summation assumes an additive effect across media and all exposure pathways for each receptor. However, the summation does not take into account certain aspects. For carcinogenic risks, the summation does not take into account the weight of evidence of carcinogenicity, SFs derived from animal data are given the same weight as SFs derived from human data, and the action of two different carcinogens might not be independent. For non-carcinogenic hazards, the uncertainty of summing across media of concern is reduced through the use of target organ endpoints. In addition, cumulative risk results are provided for each receptor that sum risks across all media of concern. This presents an uncertainty because receptors may not contact all media of concern while in the offshore area.

10.7.5 Chemicals Not Assessed in the Risk Assessment

Thallium is not assessed due to uncertainties with the oral RfD (USEPA 2012b). Thallium is evaluated qualitatively below to determine potential effects on risk results. Thallium is considered a COPC for both field-collected crab tissue and modeled crab tissue.

For field-collected crab tissue, the EPC for thallium is 0.0469 mg/kg (**Table 10-3.9**). For modeled crab tissue, the 95%UCLM is 0.0291 mg/kg. The USEPA fish tissue RSL is 0.015 mg/kg based upon a non-carcinogenic HQ of 1. Both the field-collected and the modeled crab tissue EPCs would result in non-carcinogenic HQs greater than 1. However, the uncertainty associated with the thallium RfD, in which the fish tissue RSL is based upon, is 3,000. Based upon the high uncertainty associated with the oral RfD and the poor quality of the associated studies, the actual HQ for thallium is expected to less than shown. Therefore, the overall conclusions from the HHRA would not change if thallium was included in the quantitative evaluation.

10.8 HHRA CONCLUSIONS

The HHRA evaluates the potential cumulative risks for the adult recreational user, adolescent recreational user, child recreational user, and watermen for exposure to surface water, sediment, and fish and crab tissue within the Phase I area of Sparrows Point. Specific exposure pathways evaluated in the HHRA are presented in **Figure 6-2**. To facilitate the evaluation of the Phase I area, two areas were evaluated in the HHRA. As noted in Section 6.1, data and modeling results from the Phase I offshore investigation were divided into two data groupings/areas for separate consideration in the risk assessments:

- Grouping NNS: The Northeast/Near-Shore Grouping includes all samples from Transects A, B, C, and D, as well as the following locations in Transects DE, E, and F: DE01, E01, E02, F01, F02, and F05.

- Grouping SWTM: The Southwest/Tin Mill Canal Effluent Grouping includes all of Transects G, H, I, and J, as well as the following locations in Transects DE, E, and F: DE02, E03, F03, F04, F06, and F07.

These groupings were delineated based on geography as well as the characteristics of the sediment, with locations in Grouping NNS having coarser sediments and/or less observable impacts (e.g., odor, sheen). Locations in Grouping SWTM are generally silty-to-clayey and show preliminary evidence of impacts from the Tin Mill Canal effluent.

It should be noted that these groupings do not represent clearly defined exposure areas, especially for expected exposures to surface water, fish tissue, and crab tissue. Rather, the groupings were selected to reflect a differentiation in risk assessment objectives.

In Grouping NNS, current inputs to the offshore area via groundwater/pore water and stormwater were the focus of the risk assessment. Therefore, only the Site-related COPCs for each transect presented in **Table 8-4** are considered in the NNS. **Table 8-4** presents a summary of the Site-related COPCs for sediment and pore water in each transect/location, for which data were used in the HHRA. The primary use anticipated for the HHRA results for this grouping is the evaluation of whether current impacts from the former steel mill are associated with unacceptable risk in this area.

In Grouping SWTM, all constituents analyzed are potentially related to historical discharges from the Tin Mill Canal that are causing current risk. Therefore, all available data from the Phase I offshore investigation in this area is used in the HHRA for this grouping. The primary use of risk assessment results for this grouping is delineation of areas that will be considered in remedial decision-making in the southern area that has been impacted by the Tin Mill Canal effluent.

In addition to the division of the Phase I area in groupings, the HHRA also evaluated two separate determinations of fish and crab tissue concentrations. One evaluation consisted of field-collected fish and crab tissue concentrations (EA 2011b). The second evaluation consisted of modeled fish and crab tissue concentrations. It is noted that no COPCs were determined for potential receptor direct contact with surface water and sediment in the NNS area, and no COPCs were determined for direct contact with surface water in the SWTM area. As a result, the evaluation of ingestion of fish and crab tissue play a distinctive role in the conclusions of the HHRA.

For the analysis of field-collected fish and crab tissue, the dataset and tissue concentrations were the same for both groupings. However, SVOCs and VOCs were modeled from literature-based BAFs. Therefore, for these chemicals, the sediment concentrations are an important factor in the HHRA risk results. The evaluation of field-collected fish and crab tissue provides a more realistic characterization of human exposure through fish ingestion, since these species range widely throughout the Bay and are not restricted to the Phase I area. Currently, the Phase I area adjacent to Sparrows Point is not expected to be frequently used for swimming or other water activities, and it is expected that people would visit other, more easily accessible areas available in close proximity to Sparrows Point (e.g., state parks, private docks, etc.). However, there are no controls against these activities and fishing has been observed in this area, as described in Section 6.5.1. The evaluation of field-collected tissue provides an estimate of a site-specific exposure that takes into account the mobility of aquatic organisms in the offshore areas by evaluating sample results from studies of field-collected crab and fish tissue. These results provide a long-term risk characterization of the people fishing/crabbing in the area under current conditions.

The modeled fish and crab tissue concentrations provide a theoretical maximum exposure that provides conservative indication of potential contribution from offshore sediment and surface water to these organisms, relying partially on site-specific bioaccumulation studies. These bioaccumulation studies assess the contribution of the site-specific sediment to risk associated

with fish and crab consumption. Literature-based bioaccumulation factors were utilized to predict fish tissue concentrations from the modeled surface water. This evaluates potential risk contributions specifically from the Phase I area, as if crab and fish reside solely in the Phase I area.

Table 10-12 presents a summary of the HHRA risk results for the NNS.

Table 10-12 Human Health Risk Assessment Summary of Results for the Northeast/Near-Shore Area

Receptor	Media	Carcinogenic Risks[1]	Non-Carcinogenic Hazards[2]	COPCs Contributing Significantly to Results
Field-Collected Tissue				
Adult Recreational User	Ingestion of Fish	Not applicable	0.07	Not applicable
	Ingestion of Crab	6.5×10^{-6}	0.06	Not applicable
	Cumulative Results	**7×10^{-6}**	**0.1**	
Adolescent Recreational User	Ingestion of Fish	Not applicable	0.09	Not applicable
	Ingestion of Crab	1.3×10^{-5}	0.08	Not applicable
	Cumulative Results	**1×10^{-5}**	**0.2**	
Child Recreational User	Ingestion of Fish	Not applicable	0.1	Not applicable
	Ingestion of Crab	5×10^{-6}	0.1	Not applicable
	Cumulative Results	**5×10^{-6}**	**0.2**	
Watermen	Ingestion of Fish	Not applicable	0.09	Not applicable
	Ingestion of Crab	9.9×10^{-6}	0.08	Not applicable
	Cumulative Results	**1×10^{-5}**	**0.2**	
Modeled Tissue				
Adult Recreational User	Ingestion of Fish	1.6×10^{-5}	0.4	PAHs
	Ingestion of Crab	1.2×10^{-5}	0.01	Not applicable
	Cumulative Results	**3×10^{-5}**	**0.4**	
Adolescent Recreational User	Ingestion of Fish	3.1×10^{-5}	0.5	Benzo(a)pyrene
	Ingestion of Crab	2.4×10^{-5}	0.02	PAHs
	Cumulative Results	**5×10^{-5}**	**0.5**	
Child Recreational User	Ingestion of Fish	1.1×10^{-5}	0.6	Benzo(a)pyrene
	Ingestion of Crab	8.9×10^{-6}	0.02	Not applicable
	Cumulative Results	**2×10^{-5}**	**0.6**	
Watermen	Ingestion of Fish	2.4×10^{-5}	0.4	Benzo(a)pyrene
	Ingestion of Crab	1.9×10^{-5}	0.02	PAHs
	Cumulative Results	**4×10^{-5}**	**0.4**	

(1) USEPA acceptable excess cancer risk range: 10^{-6} to 10^{-4}. MDE acceptable excess cancer risk range: 10^{-6} to 10^{-5}.
(2) USEPA acceptable hazard quotient: 1.0. MDE acceptable hazard quotient: 1.0.

The evaluation of both the field-collected tissue and modeled tissue evaluations did not indicate any non-cancer hazards above 1. This reveals there are no non-cancer concerns for the NNS Area. For the modeled tissue concentrations within the NNS Area, carcinogenic results for all receptors were above the MDE acceptable excess cancer risk range of 10^{-6} to 10^{-5}. However, based on the USEPA acceptable excess cancer risk range of 10^{-6} to 10^{-4}, all receptors carcinogenic results were within this range. **Tables 10-10.5 through 10-10.8** present a summary

of the significant contributors to the HHRA risk results. For the modeled tissue evaluation, the primary contributor to excess cancer risk results was benzo(a)pyrene in crab and fish tissue.

For the field-collected tissue evaluation, carcinogenic risks were within the USEPA acceptable excess cancer risk range of 10^{-6} to 10^{-4} (**Tables 10-10.1 through 10-10.4**). Additionally, carcinogenic risk results for all receptors for the field-collected evaluation were within the MDE acceptable excess cancer risk range of 10^{-6} to 10^{-5}. Carcinogenic risk results for the field-collected tissue evaluation were approximately five times lower than the risk results for the modeled tissue evaluation. This reveals that the modeled tissue evaluation most likely over-estimates risk results for the NNS Area.

Table 10-13 presents a summary of the HHRA risk results for the SWTM.

Table 10-13 Human Health Risk Assessment Summary of Results for the Southwest/Tin Mill Canal Area

Receptor	Media	Carcinogenic Risks[1]	Non-Carcinogenic Hazards[2]	COPCs Contributing Significantly to Results
Field-Collected Tissue				
Adult Recreational User	Dermal Contact with Sediment	5.5×10^{-8}	0.0002	Not applicable
	Ingestion of Fish	1.8×10^{-5}	0.1	Arsenic, Total PCBs
	Ingestion of Crab	3.7×10^{-5}	0.3	Total PCBs
	Cumulative Results	**6×10^{-5}**	**0.4**	
Adolescent Recreational User	Dermal Contact with Sediment	1.9×10^{-7}	0.0008	Not applicable
	Ingestion of Fish	1.2×10^{-5}	0.2	Arsenic, Total PCBs
	Ingestion of Crab	3.2×10^{-5}	0.4	Total PCBs, PAHs, Bis(2-ethylhexyl)phthalate
	Cumulative Results	**4×10^{-5}**	**0.6**	
Child Recreational User	Ingestion of Fish	4.4×10^{-6}	0.2	Not applicable
	Ingestion of Crab	1.2×10^{-5}	0.5	Total PCBs, PAHs, Bis(2-ethylhexyl)phthalate
	Cumulative Results	**2×10^{-5}**	**0.7**	
Watermen	Dermal Contact with Sediment	1.8×10^{-6}	0.006	Not applicable
	Ingestion of Fish	2.7×10^{-5}	0.1	Arsenic, Total PCBs
	Ingestion of Crab	5.6×10^{-5}	0.4	Arsenic, Bis(2-ethylhexyl)phthalate, Total PCBs, PAHs
	Cumulative Results	**9×10^{-5}**	**0.5**	

Receptor	Media	Carcinogenic Risks[1]	Non-Carcinogenic Hazards[2]	COPCs Contributing Significantly to Results
Modeled Tissue				
Adult Recreational User	Dermal Contact with Sediment	5.5×10^{-8}	0.0002	Not applicable
	Ingestion of Fish	1.1×10^{-5}	0.3	Benzo(a)pyrene
	Ingestion of Crab	1.5×10^{-3}	28	Arsenic, Aroclor 1248, Aroclor 1254, Aroclor 1260, PAHs, Bis(2-ethylhexyl)phthalate
	Cumulative Results	**2×10^{-3}**	**28**	
Adolescent Recreational User	Dermal Contact with Sediment	1.9×10^{-7}	0.0008	Not applicable
	Ingestion of Fish	2.3×10^{-5}	0.3	Benzo(a)pyrene
	Ingestion of Crab	1.1×10^{-3}	37	Arsenic, Aroclor 1248, Aroclor 1254, Aroclor 1260, PAHs, Bis(2-ethylhexyl)phthalate
	Cumulative Results	**1×10^{-3}**	**37**	
Child Recreational User	Ingestion of Fish	8.5×10^{-6}	0.4	Not applicable
	Ingestion of Crab	4.1×10^{-4}	46	Arsenic, Aroclor 1248, Aroclor 1254, Aroclor 1260, PAHs, Bis(2-ethylhexyl)phthalate
	Cumulative Results	**4×10^{-4}**	**47**	
Watermen	Dermal Contact with Sediment	1.8×10^{-6}	0.006	Not applicable
	Ingestion of Fish	1.7×10^{-5}	0.3	Benzo(a)pyrene
	Ingestion of Crab	2.3×10^{-3}	34	Arsenic, Aroclor 1248, Aroclor 1254, Aroclor 1260, PAHs, Bis(2-ethylhexyl)phthalate
	Cumulative Results	**2×10^{-3}**	**35**	

(1) USEPA acceptable excess cancer risk range: 10^{-6} to 10^{-4}. MDE acceptable excess cancer risk range:10^{-6} to 10^{-5}.
(2) USEPA acceptable hazard quotient: 1.0. MDE acceptable hazard quotient: 1.0.

For the SWTM Area, carcinogenic risk results for ingestion of crab and fish based on both modeled and field-collected tissue concentrations exceeded the MDE acceptable excess cancer risk range of 10^{-6} to 10^{-5}. However, based on the USEPA acceptable excess cancer risk range of 10^{-6} to 10^{-4}, only the ingestion of modeled crab tissue, not for fish tissue or for the more realistic field-collected tissue, exceeded the risk range. **Tables 10-10.9 through 10-10.16** present a summary of the significant contributors to the HHRA risk results.

Additionally, modeled crab tissue revealed Aroclor 1254 non-carcinogenic hazards above the acceptable level of 1 for all receptors evaluated in the HHRA (**Tables 10-10.13 through 10-10.16**). Field-collected crabs were not analyzed for Aroclors, only PCB congeners, because PCB

congener analysis is a more sensitive analytical method for tissue. Toxicity values for PCB congeners are only available for a cancer endpoint so a comparison of non-carcinogenic hazards is not available. However, a comparison of EPCs for the field-collected and modeled crab tissue (**Tables 10-3.9 and 10-3.11**) reveal modeled crab tissue concentrations of Aroclors two orders of magnitude higher than total PCB concentrations found in the field-collected crab tissue.

It is noted that MDE has a fish consumption advisory in place for the Patapsco River/Inner Harbor (including the offshore area of Sparrows Point) to account for PCBs (MDE 2014). The fish consumption advisory recommends a limited number of meals per month to avoid elevated exposures.

For the modeled tissue evaluation, carcinogenic risk results were elevated above the USEPA acceptable excess cancer risk range of 10^{-6} to 10^{-4} and the MDE acceptable excess cancer risk range of 10^{-6} to 10^{-5} for all receptors exposure to modeled crab tissue. Primary contributors to carcinogenic risks were Aroclor 1248, Aroclor 1254, and Aroclor 1260 in crab tissue based upon modeled uptake from sediment concentrations (**Tables 10-10.13 through 10-10.16**). In addition, PAHs were also primary contributors to carcinogenic risks for the modeled crab in the SWTM. For PAHs, carcinogenic risks were above the upper end of the USEPA acceptable excess cancer risk range of 10^{-4} for the adolescent recreational user and watermen. Carcinogenic risks for all receptors exposure to PAHs in modeled crab tissue were above the MDE acceptable excess cancer risk range of 10^{-6} to 10^{-5}. Field-collected crab tissue did not reveal PAHs above the MDE acceptable excess cancer risk range of 10^{-6} to 10^{-5}, and all carcinogenic risks were within the USEPA acceptable excess cancer risk range. Thus, the modeled crab tissue over-estimated carcinogenic risks due to PCBs and PAHs compared to the more realistic field-collected crab tissue, and by a large magnitude.

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TABLE 10-2.1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
PHASE I AREA OF THE SPARROWS POINT SITE
NORTHEAST/NEAR-SHORE - SURFACE SEDIMENT

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Surface Sediment
Exposure Point: Northeast/Near Shore Exposure Area

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration (2) Used for Screening	Background (3) Value	Screening (4) Toxicity Value		Potential (5) ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (6) Contaminant Deletion or Selection
INORGANICS																	
7440-43-9	CADMIUM	7.20E-01		4.80E+00		mg/kg	SD-D02	5/5	6.10E-02 - 8.10E-02	4.80E+00	NA	1.71E+03	N	NA	NA	No	BSL
7440-47-3	CHROMIUM	3.30E+01		7.50E+02		mg/kg	SD-B02	2/2	1.50E-01 - 3.65E-01	7.50E+02	NA	1.33E+05	C	NA	NA	No	BSL
7440-50-8	COPPER	5.50E+00		1.60E+02		mg/kg	SD-A03	13/13	1.20E-01 - 4.50E-01	1.60E+02	NA	2.73E+05	N	NA	NA	No	BSL
57-12-5	CYANIDE, TOTAL	1.80E-01	J	1.60E+00		mg/kg	DE01-SD	7/8	3.10E-01 - 3.90E-01	1.60E+00	NA	4.10E+03	N	NA	NA	No	BSL
7439-92-1	LEAD	1.50E+01		1.10E+02		mg/kg	SD-F01	8/8	6.10E-02 - 8.10E-02	1.10E+02	NA	NA		NA	NA	No	NSL
7439-97-6	MERCURY	7.90E-03	J	4.20E-01		mg/kg	SD-C03	3/3	2.30E-02 - 6.80E-02	4.20E-01	NA	4.78E+01	N	NA	NA	No	BSL
7440-02-0	NICKEL	2.20E+00		4.60E+01		mg/kg	SD-C03 / SD-A03	13/13	6.10E-02 - 2.30E-01	4.60E+01	NA	1.37E+05	N	NA	NA	No	BSL
7440-22-4	SILVER	2.60E-02	J	1.70E+00		mg/kg	SD-C03	5/5	6.50E-02 - 2.10E-01	1.70E+00	NA	1.37E+03	N	NA	NA	No	BSL
7440-66-6	ZINC	9.80E+01	J	1.55E+03	J	mg/kg	SD-B02	13/13	3.10E-01 - 1.10E+00	1.55E+03	NA	2.05E+06	N	NA	NA	No	BSL
POLYAROMATIC HYDROCARBONS																	
208-96-8	ACENAPHTHYLENE	8.50E-03	J	1.10E-01		mg/kg	F05-SD	2/8	1.70E-02 - 8.20E-02	1.10E-01	NA	3.15E+04	C	NA	NA	No	BSL
120-12-7	ANTHRACENE	6.20E-02		6.20E-02		mg/kg	F05-SD	1/8	1.70E-02 - 8.20E-02	6.20E-02	NA	1.58E+05	N	NA	NA	No	BSL
56-55-3	BENZO[A]ANTHRACENE	1.40E-02	J	3.20E-01		mg/kg	F05-SD	3/8	1.70E-02 - 8.20E-02	3.20E-01	NA	1.68E+01	C	NA	NA	No	BSL
50-32-8	BENZO[A]PYRENE	4.00E-01		4.00E-01		mg/kg	F05-SD	1/8	1.70E-02 - 8.20E-02	4.00E-01	NA	1.68E+00	C	NA	NA	No	BSL
205-99-2	BENZO[B]FLUORANTHENE	1.10E-02	J	3.70E-01		mg/kg	F05-SD	2/8	1.70E-02 - 8.20E-02	3.70E-01	NA	1.68E+01	C	NA	NA	No	BSL
191-24-2	BENZO[G,H,I]PERYLENE	5.00E-01		5.00E-01		mg/kg	F05-SD	1/8	1.70E-02 - 8.20E-02	5.00E-01	NA	1.58E+04	N	NA	NA	No	BSL
207-08-9	BENZO[K]FLUORANTHENE	1.60E-01		1.60E-01		mg/kg	F05-SD	1/8	1.70E-02 - 8.20E-02	1.60E-01	NA	1.68E+02	C	NA	NA	No	BSL
218-01-9	CHRYSENE	1.30E-02	J	2.80E-01		mg/kg	F05-SD	3/8	1.70E-02 - 8.20E-02	2.80E-01	NA	1.68E+03	C	NA	NA	No	BSL
53-70-3	DIBENZ(A,H)ANTHRACENE	4.50E-02		4.50E-02		mg/kg	F05-SD	1/8	1.70E-02 - 8.20E-02	4.50E-02	NA	1.68E+00	C	NA	NA	No	BSL
206-44-0	FLUORANTHENE	7.20E-03	J	1.40E+00		mg/kg	F05-SD	8/8	1.70E-02 - 8.20E-02	1.40E+00	NA	2.10E+04	N	NA	NA	No	BSL
193-39-5	INDENO[1,2,3-CD]PYRENE	3.10E-01		3.10E-01		mg/kg	F05-SD	1/8	1.70E-02 - 8.20E-02	3.10E-01	NA	1.68E+01	C	NA	NA	No	BSL
91-20-3	NAPHTHALENE	4.20E-03	J	3.70E-02		mg/kg	F05-SD	5/8	1.70E-02 - 8.20E-02	3.70E-02	NA	1.05E+04	C	NA	NA	No	BSL
85-01-8	PHENANTHRENE	3.70E-02		3.70E-02		mg/kg	F05-SD	1/8	1.70E-02 - 8.20E-02	3.70E-02	NA	1.58E+04	N	NA	NA	No	BSL
129-00-0	PYRENE	6.30E-03	J	7.50E-01		mg/kg	SD-F01	8/8	1.70E-02 - 8.20E-02	7.50E-01	NA	1.58E+04	N	NA	NA	No	BSL
SEMIVOLATILE ORGANIC COMPOUNDS																	
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	1.80E-02	J	1.60E+00		mg/kg	SD-F01	9/16	1.70E-01 - 3.50E+00	1.60E+00	NA	2.96E+03		NA	NA	No	BSL

Note: Chemicals of Potential Concern are bold with shading.

(1) Minimum/maximum detected concentration.
(2) Maximum concentration used as screening value.
(3) Background values are not included as part of the COPC selection process.
(4) Site-specific Screening Toxicity Values developed. Please see Appendix H for calculations.
(5) ARAR/TBC are not applicable because risk assessment utilizes federal risk-based stands for screening.
(6) Rationale Codes — Selection Reason: ASL = Above Screening Toxicity Level; Deletion Reason: BSL = Below Screening Toxicity Level; NSL = No Screening Toxicity Level

Definitions: ARAR = Applicable or Relevant and Appropriate Requirement; C = Carcinogenic; COPC = Chemical of Potential Concern; N = Non-Carcinogenic; NA = Not Applicable; mg/kg = milligrams per kilogram; TBC = To be considered

Data Qualifiers: J = Value is estimated.

TABLE 10-2.2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

PHASE I AREA OF THE SPARROWS POINT SITE

NORTHEAST/NEAR-SHORE - SURFACE WATER

Scenario Timeframe: Current/Future
Medium: Surface water
Exposure Medium: Surface water
Exposure Point: Northeast/Near Shore Exposure Area

CAS Number	Chemical	Units	SW EPC	Detection Frequency	Concentration (2) Used for Screening	Background (3) Value	Screening (4) Toxicity Value		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (5) Contaminant Deletion or Selection
INORGANICS												
7440-47-3	CHROMIUM	µg/L	6.71E-01	NA	6.71E-01	NA	1.87E+04	N	NA	NA	No	BSL
7440-50-8	COPPER	µg/L	6.41E-01	NA	6.41E-01	NA	7.69E+04	N	NA	NA	No	BSL
57-12-5	CYANIDE (TOTAL)	µg/L	2.52E+00	NA	2.52E+00	NA	1.15E+03	N	NA	NA	No	BSL
7439-92-1	LEAD	µg/L	4.40E-01	NA	4.40E-01	NA	1.50E+01		NA	NA	No	BSL
7439-97-6	MERCURY	µg/L	6.63E-01	NA	6.63E-01	NA	1.92E+02	N	NA	NA	No	BSL
7440-02-0	NICKEL	µg/L	3.77E+00	NA	3.77E+00	NA	7.69E+03	N	NA	NA	No	BSL
7440-66-6	ZINC	µg/L	1.25E+01	NA	1.25E+01	NA	9.61E+05	N	NA	NA	No	BSL
POLYAROMATIC HYDROCARBONS												
50-32-8	HMW PAHs	µg/L	5.10E-02	NA	5.10E-02	NA	NA		NA	NA	No	NSL
129-00-0	LMW PAHs	µg/L	3.12E-01	NA	3.12E-01	NA	2.87E+02	N	NA	NA	No	BSL
SEMIVOLATILE ORGANIC COMPOUNDS												
117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	µg/L	9.89E-02	NA	9.89E-02	NA	2.00E+03	N	NA	NA	No	BSL

Note: Chemicals of Potential Concern are bold with shading.

(1) Surface water concentrations were modeled as discussed in Section 6.1.

(2) The modeled maximum surface water concentration was used for screening.

(3) Background values are not included as part of the COPC selection process.

(4) Site-specific Screening Toxicity Values developed. Please see Appendix H for calculations.

(5) Rationale Codes

Definitions:

ARAR = Applicable or Relevant and Appropriate Requirement
C = Carcinogenic
COPC = Chemical of Potential Concern
N = Non-Carcinogenic
NA = Not Applicable
ug/L = micrograms per liter
TBC = To be considered

TABLE 10-2.3

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

PHASE I AREA OF THE SPARROWS POINT SITE

ALL AREAS - FIELD-COLLECTED CRABS

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Crabs
Exposure Point: Northeast/Near Shore Exposure Area

CAS Number	Chemical	Units	Detection Frequency	Sediment EPC Value	SEDBAF	Concentration (1) Used for Screening	Screening (2) Toxicity Value		COPC Flag	Rationale for (3) Contaminant Deletion or Selection
INORGANICS										
7440-43-9	**CADMIUM**	**mg/kg**	**5/ 5**	**NA**	**NA**	**1.58E-01**	**1.50E-01**	**N**	**Yes**	**ASL**
7440-47-3	CHROMIUM	mg/kg	3/5	NA	NA	2.39E-01	2.30E+02	N	No	BSL
7440-50-8	**COPPER**	**mg/kg**	**5/ 5**	**NA**	**NA**	**1.25E+01**	**6.20E+00**	**N**	**Yes**	**ASL**
7439-92-1	LEAD	mg/kg	5/ 5	NA	NA	1.71E-01	NA		No	NSL
7439-97-6	MERCURY	mg/kg	4/ 5	NA	NA	2.10E-02	4.60E-02	N	No	BSL
7440-02-0	NICKEL	mg/kg	5/ 5	NA	NA	1.95E-01	3.10E+00	N	No	BSL
7440-22-4	SILVER	mg/kg	5/ 5	NA	NA	3.61E-01	7.70E-01	N	No	BSL
7440-66-6	ZINC	mg/kg	5/ 5	NA	NA	4.59E+01	4.60E+01	N	No	BSL
POLYAROMATIC HYDROCARBONS										
83-32-9	ACENAPHTHENE	mg/kg	3/ 5	NA	NA	1.71E-02	9.30E+00	N	No	BSL
208-96-8	ACENAPHTHYLENE	mg/kg	2/ 5	NA	NA	1.49E-02	9.30E+00	N	No	BSL
120-12-7	ANTHRACENE	mg/kg	2/ 5	NA	NA	1.47E-02	4.60E+01	N	No	BSL
56-55-3	**BENZO(A)ANTHRACENE**	**mg/kg**	**1/ 5**	**NA**	**NA**	**2.57E-02**	**5.70E-03**	**C**	**Yes**	**ASL**
50-32-8	**BENZO(A)PYRENE**	**mg/kg**	**1/ 5**	**NA**	**NA**	**1.58E-02**	**5.70E-04**	**C**	**Yes**	**ASL**
205-99-2	**BENZO(B)FLUORANTHENE**	**mg/kg**	**2/ 5**	**NA**	**NA**	**3.15E-02**	**5.70E-03**	**C**	**Yes**	**ASL**
207-08-9	BENZO(K)FLUORANTHENE	mg/kg	1/ 5	NA	NA	1.49E-02	5.70E-02	C	No	BSL
218-01-9	CHRYSENE	mg/kg	1/ 5	NA	NA	1.47E-02	5.70E-01	C	No	BSL
206-44-0	FLUORANTHENE	mg/kg	3/5	NA	NA	8.69E-02	6.20E+00	N	No	BSL
86-73-7	FLUORENE	mg/kg	1/ 5	NA	NA	1.47E-02	6.20E+00	N	No	BSL
91-20-3	NAPHTHALENE	mg/kg	3/5	NA	NA	2.20E-02	3.10E+00	N	No	BSL
85-01-8	PHENANTHRENE	mg/kg	3/ 5	NA	NA	1.64E-02	4.60E+01	N	No	BSL
129-00-0	PYRENE	mg/kg	2/ 5	NA	NA	4.74E-02	4.60E+00	N	No	BSL
SEMI-VOLATILE ORGANIC COMPOUNDS										
117-81-7	**BIS(2-ETHYLHEXYL) PHTHALATE**	**mg/kg**	**NA**	**5.45E-01**	**4.00E+00**	**2.18E+00**	**3.00E-01**	**C**	**Yes**	**ASL**

Note: Chemicals of Potential Concern are bold with shading

(1) Actual crab tissue sample results for crab meat and mustard, except chemicals not analyzed in tissue. For bis(2-ethylhexyl)phthalate, the screening concentration is the Sediment EPC*SEDBAF as detailed in Section 10.1.

(2) USEPA Regional Screening Levels, USEPA, June 2015. For non-carcinogens, value shown is equal to 1/10 the fish tissue value. For carcinogens the value shown is equal to the fish tissue value.

(3) Rationale Codes
Selection Reason: ASL = Above Screening Toxicity Level
Deletion Reason: BSL = Below Screening Toxicity Level

Surrogates used: Anthracene for Phenanthrene, Acenaphthene for Acenaphthylene, Pyrene for Benzo[g,h,i]perylene.

Definitions:
C = Carcinogenic
COPC = Chemical of Potential Concern
EPC = Exposure Point Concentration
N = Non-Carcinogenic
NA = Not Applicable
SEDBAF = Sediment Bioaccumulation Factor
mg/kg = milligrams per kilogram

TABLE 10-2.4

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

PHASE I AREA OF THE SPARROWS POINT SITE

NORTHEAST/NEAR SHORE - FIELD-COLLECTED FINFISH

Scenario Timeframe: Current/Future
Medium: Surface water
Exposure Medium: Finfish
Exposure Point: Northeast/Near Shore Exposure Area

CAS Number	Chemical	SW EPC (mg/L)	Detection Frequency	SWBAF (mg/L to mg/kg dry weight)	Concentration (1) Used for Screening (mg/kg)	Screening (2) Toxicity Value (mg/kg)		COPC Flag	Rationale for (3) Contaminant Deletion or Selection
INORGANICS									
7440-47-3	CHROMIUM	NA	2/5	NA	7.20E-02	2.30E+02	N	No	BSL
7440-50-8	COPPER	NA	5/5	NA	4.50E+00	6.20E+00	N	No	BSL
7439-92-1	LEAD	NA	5/5	NA	2.60E-01	NA		No	NSL
7439-97-6	**MERCURY**	**NA**	**5/5**	**NA**	**5.60E-02**	**4.60E-02**	**N**	**Yes**	**ASL**
7440-02-0	NICKEL	NA	5/5	NA	6.20E-02	3.10E+00	N	No	BSL
7440-22-4	SILVER	NA	2/5	NA	4.20E-02	7.70E-01	N	No	BSL
7440-66-6	ZINC	NA	5/5	NA	1.36E+01	4.60E+01	N	No	BSL
POLYAROMATIC HYDROCARBONS									
83-32-9	ACENAPHTHENE	NA	1/5	NA	3.60E-03	9.30E+00	N	No	BSL
206-44-0	FLUORANTHENE	NA	1/5	NA	1.40E-02	6.20E+00	N	No	BSL
91-20-3	NAPHTHALENE	NA	2/5	NA	1.35E-02	3.10E+00	N	No	BSL
85-01-8	PHENANTHRENE	NA	2/5	NA	5.80E-03	4.60E+01	N	No	BSL
SEMIVOLATILE ORGANIC COMPOUNDS									
117-81-7	BIS(2-ETHYLHEXYL) PHTHLATE	3.17E-05	NA	6.85E+03	2.17E-01	3.00E-01	C	No	BSL

Note: Chemicals of Potential Concern are bold with shading.

(1) Modeled uptake or maximum fish tissue concentration used as screening value.

(2) USEPA Regional Screening Levels, USEPA, June 2015. For non-carcinogens, value shown is equal to 1/10 the fish tissue value. For carcinogens the value shown is equal to the fish tissue value.

(3) Rationale Codes

Selection Reason: ASL = Above Screening Toxicity Level

Deletion Reason: BSL = Below Screening Toxicity Level

NSL = No Screening Toxicity Level

Surrogates used: Anthracene for Phenanthrene.

Definitions:
C = Carcinogenic
COPC = Chemical of Potential Concern
N = Non-Carcinogenic
NA = Not Applicable
mg/kg = milligrams per kilogram
EPC = Exposure Point Concentration
SWBAF = Surface water Bioaccumulation Factor

TABLE 10-2.5
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
PHASE I AREA OF THE SPARROWS POINT SITE
NORTHEAST/NEAR SHORE - CRABS/UPTAKE

Scenario Timeframe: Future
Medium: Sediment
Exposure Medium: Crabs
Exposure Point: Northeast/Near Shore Exposure Area

CAS Number	Chemical	Units	Sediment EPC Value	SEDBAF (mg/kg dry wt.)	BAF Source	Concentration [1] Used for Screening	Screening [2] Toxicity Value		COPC Flag	Rationale for [3] Contaminant Deletion or Selection
INORGANICS										
7440-43-9	CADMIUM	mg/kg	4.38E+00	3.10E-02	95% UCLM from bioaccumulation tests - worm value	1.36E-01	1.50E-01	N	No	BSL
7440-47-3	CHROMIUM	mg/kg	7.50E+02	1.87E-02	95% UCLM from bioaccumulation tests - worm value	1.40E+01	2.30E+02	N	No	BSL
7440-50-8	COPPER	mg/kg	9.38E+01	3.10E-02	95% UCLM from bioaccumulation tests - worm value	2.91E+00	6.20E+00	N	No	BSL
7439-92-1	LEAD	mg/kg	7.41E+01	1.45E-02	95% UCLM from bioaccumulation tests - worm value	1.07E+00	NA		No	NSL
7439-97-6	MERCURY	mg/kg	4.20E-01	5.73E-02	95% UCLM from bioaccumulation tests - worm value	2.41E-02	4.60E-02	N	No	BSL
7440-02-0	NICKEL	mg/kg	3.79E+01	4.55E-02	95% UCLM from bioaccumulation tests - worm value	1.72E+00	3.10E+00	N	No	BSL
7440-22-4	SILVER	mg/kg	4.79E+00	8.09E-02	95% UCLM from bioaccumulation tests - worm value	3.88E-01	7.70E-01	N	No	BSL
7440-66-6	**ZINC**	**mg/kg**	**1.03E+03**	**9.78E-02**	**95% UCLM from bioaccumulation tests - worm value**	**1.01E+02**	**4.60E+01**	**N**	**Yes**	**ASL**
POLYAROMATIC HYDROCARBONS										
208-96-8	ACENAPHTHYLENE	mg/kg	1.10E-01	2.01E-01	95% UCLM from bioaccumulation tests - worm value	2.21E-02	9.30E+00	N	No	BSL
120-12-7	ANTHRACENE	mg/kg	6.20E-02	3.29E-01	95% UCLM from bioaccumulation tests - worm value	2.04E-02	4.60E+01	N	No	BSL
56-55-3	**BENZO[A]ANTHRACENE**	**mg/kg**	**3.20E-01**	**5.98E-01**	**95% UCLM from bioaccumulation tests - clam value**	**1.91E-01**	**5.70E-03**	**C**	**Yes**	**ASL**
50-32-8	**BENZO[A]PYRENE**	**mg/kg**	**4.00E-01**	**2.92E-01**	**95% UCLM from bioaccumulation tests - clam value**	**1.17E-01**	**5.70E-04**	**C**	**Yes**	**ASL**
205-99-2	**BENZO[B]FLUORANTHENE**	**mg/kg**	**3.70E-01**	**1.90E-01**	**95% UCLM from bioaccumulation tests - clam value**	**7.01E-02**	**5.70E-03**	**C**	**Yes**	**ASL**
191-24-2	BENZO[G,H,I]PERYLENE	mg/kg	5.00E-01	9.31E-02	95% UCLM from bioaccumulation tests - clam value	4.65E-02	4.60E+00	N	No	BSL
207-08-9	BENZO[K]FLUORANTHENE	mg/kg	1.60E-01	1.90E-01	95% UCLM for Benzo(b)fluoranthene from bioaccumulation tests - clam value	3.03E-02	5.70E-02	C	No	BSL
218-01-9	CHRYSENE	mg/kg	2.80E-01	5.82E-01	95% UCLM from bioaccumulation tests - clam value	1.63E-01	5.70E-01	C	No	BSL
53-70-3	**DIBENZ(A,H)ANTHRACENE**	**mg/kg**	**4.50E-02**	**7.11E-01**	**95% UCLM from bioaccumulation tests - worm value**	**3.20E-02**	**5.70E-04**	**C**	**Yes**	**ASL**
206-44-0	FLUORANTHENE	mg/kg	1.97E+00	1.24E+00	95% UCLM from bioaccumulation tests - worm value	2.44E+00	6.20E+00	N	No	BSL
193-39-5	**INDENO[1,2,3-CD]PYRENE**	**mg/kg**	**3.10E-01**	**2.26E-01**	**95% UCLM from bioaccumulation tests - worm value**	**7.02E-02**	**5.70E-03**	**C**	**Yes**	**ASL**
91-20-3	NAPHTHALENE	mg/kg	2.72E-02	6.99E-02	95% UCLM from bioaccumulation tests - worm value	1.90E-03	3.10E+00	N	No	BSL
85-01-8	PHENANTHRENE	mg/kg	3.70E-02	3.04E-01	95% UCLM from bioaccumulation tests - clam value	1.12E-02	3.10E+00	N	No	BSL
129-00-0	PYRENE	mg/kg	2.30E+00	1.38E+00	95% UCLM from bioaccumulation tests - clam value	3.17E+00	4.60E+00	N	No	BSL
SEMI-VOLATILE ORGANIC COMPOUNDS										
117-81-7	**BIS(2-ETHYLHEXYL) PHTHALATE**	**mg/kg**	**5.45E-01**	**4.00E+00**	**Default**	**2.18E+00**	**3.00E-01**	**C**	**Yes**	**ASL**

Note: Chemicals of Potential Concern are bold with shading.

(1) The screening concentration is the Sediment EPC*SEDBAF.

(2) USEPA Regional Screening Levels, USEPA, June 2015. For non-carcinogens, value shown is equal to 1/10 the fish tissue value. For carcinogens the value shown is equal to the fish tissue value.

(3) Rationale Codes
Selection Reason: ASL = Above Screening Toxicity Level
Deletion Reason: BSL = Below Screening Toxicity Level
NSL = No Screening Toxicity Level

Surrogates used: Anthracene for Phenanthrene, Acenaphthene for Acenaphthylene, Pyrene for Benzo[g,h,i]perylene.

Definitions:
C = Carcinogenic
COPC = Chemical of Potential Concern
EPC = Exposure Point Concentration
N = Non-Carcinogenic
SEDBAF = Sediment Bioaccumulation Factor
NA = Not Applicable
mg/kg = milligrams per kilogram

TABLE 10-2.6
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
PHASE I AREA OF THE SPARROWS POINT SITE
NORTHEAST/NEAR SHORE - FINFISH/UPTAKE

Scenario Timeframe: Future
Medium: Surface water
Exposure Medium: Finfish
Exposure Point: Northeast/Near Shore Exposure Area

CAS Number	Chemical	SW EPC (mg/L)	SWBAF (mg/L to mg/kg dry weight)	BAF Source	Concentration [1] Used for Screening (mg/kg)	Screening [2] Toxicity Value (mg/kg)		COPC Flag	Rationale for [3] Contaminant Deletion or Selection
INORGANICS									
7440-47-3	CHROMIUM	2.16E-04	8.00E+02	BCF from http://rais.ornl.gov/cgi-bin/tools/TOX_search	1.73E-01	2.30E+02	N	No	BSL
7440-50-8	COPPER	2.48E-04	1.86E+03	Based on fathead minnow in Table 5 - USEPA 2003	4.60E-01	6.20E+00	N	No	BSL
7439-92-1	LEAD	9.80E-05	4.50E+01	Based on bluegill in Table 5 - USEPA 1985b	4.41E-03	NA		No	NSL
7439-97-6	**MERCURY**	**1.54E-04**	**7.20E+03**	**Based on rainbow trout in Table 5 - USEPA 1985c**	**1.11E+00**	**4.60E-02**	**N**	**Yes**	**ASL**
7440-02-0	NICKEL	1.34E-03	9.60E+01	Based on rainbow trout/fathead minnow in Table 5 geometric mean - USEPA 1986	1.29E-01	3.10E+00	N	No	BSL
7440-66-6	ZINC	4.41E-03	2.52E+02	Based on mummichog in Table 5 geometric mean- USEPA 1987b	1.11E+00	4.60E+01	N	No	BSL
POLYAROMATIC HYDROCARBONS									
50-32-8	**HMW PAHs**	**1.15E-05**	**2.06E+04**	**BCF calculated via Regression from BCFBAF Program**	**2.37E-01**	**5.70E-04**	**C**	**Yes**	**ASL**
129-00-0	LMW PAHs	1.23E-04	3.08E+03	BCF calculated via Regression from BCFBAF Program	3.79E-01	4.60E+00	N	No	BSL
SEMIVOLATILE ORGANIC COMPOUNDS									
117-81-7	BIS(2-ETHYLHEXYL) PHTHLATE	3.17E-05	6.85E+03	BCF calculated via Regression from BCFBAF Program	2.17E-01	3.00E-01	C	No	BSL

Note: Chemicals of Potential Concern are bold with shading.

(1) The screening concentration is the Surface Water EPC*SWBAF.

(2) USEPA Regional Screening Levels, USEPA, June 2015. For non-carcinogens, value shown is equal to 1/10 the fish tissue value. For carcinogens the value shown is equal to the fish tissue value.

(3) Rationale Codes
Selection Reason: ASL = Above Screening Toxicity Level
Deletion Reason: BSL = Below Screening Toxicity Level
NSL = No Screening Toxicity Level

Surrogates used for BAFs: Benzo(a)pyrene for HMW PAHs, and Pyrene for LMW PAHs.

Definitions:
C = Carcinogenic
COPC = Chemical of Potential Concern
N = Non-Carcinogenic
NA = Not Applicable
mg/kg = milligrams per kilogram
EPC = Exposure Point Concentration
SWBAF = Surface water Bioaccumulation Factor

TABLE 10-2.7
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
PHASE I AREA OF THE SPARROWS POINT SITE
SOUTHWEST/TIN MILL CANAL EFFLUENT - SURFACE SEDIMENT

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Surface Sediment
Exposure Point: Southwest/Tin Mill Canal Exposure Area

CAS Number	Chemical	Minimum [1] Concentration	Minimum Qualifier	Maximum [1] Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value		Potential [5] ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [6] Contaminant Deletion or Selection
INORGANICS																	
7440-36-0	ANTIMONY	1.30E-01	J	1.00E+01	J	mg/kg	SD-H01-0002	28/29	1.40E-01 - 3.50E+00	1.00E+01	NA	4.10E+02	N	NA	NA	No	BSL
7440-38-2	**ARSENIC**	**9.60E+00**		**1.20E+02**		**mg/kg**	**SD-G06-0002**	**29/29**	**7.10E-02 - 2.50E-01**	**1.20E+02**	**NA**	**9.21E+01**	**C**	**NA**	**NA**	**Yes**	**ASL**
7440-41-7	BERYLLIUM	1.70E-01		1.60E+00	J	mg/kg	SD-F06-0002	29/29	7.10E-02 - 1.70E+00	1.60E+00	NA	9.56E+01	N	NA	NA	No	BSL
7440-43-9	CADMIUM	2.60E-01		1.10E+02	J	mg/kg	SD-H03-0002	29/29	7.10E-02 - 1.70E+00	1.10E+02	NA	1.71E+03	N	NA	NA	No	BSL
7440-47-3	CHROMIUM	2.20E+01		4.60E+03	J	mg/kg	SD-H03-0002	29/29	1.40E-01 - 3.50E+00	4.60E+03	NA	1.33E+05	C	NA	NA	No	BSL
7440-50-8	COPPER	1.30E+01		5.50E+02	J	mg/kg	SD-H03-0002	29/29	1.40E-01 - 3.50E+00	5.50E+02	NA	2.73E+05	N	NA	NA	No	BSL
57-12-5	CYANIDE, TOTAL	3.70E-01	J	3.50E+01		mg/kg	SD-H07-0002	28/29	3.60E-01 - 1.30E+00	3.50E+01	NA	4.10E+03	N	NA	NA	No	BSL
7439-92-1	LEAD	2.70E+01		1.10E+03		mg/kg	SD-G06-0002	29/29	7.10E-02 - 1.70E+00	1.10E+03	NA	NA	N	NA	NA	No	NSL
7439-97-6	MERCURY	5.40E-02		1.60E+00	J	mg/kg	SD-F07-0002	27/28	1.90E-02 - 8.40E-02	1.60E+00	NA	4.78E+01	N	NA	NA	No	BSL
7440-02-0	NICKEL	9.10E+00	J	2.10E+02	J	mg/kg	SD-H03-0002	29/29	7.10E-02 - 1.70E+00	2.10E+02	NA	1.37E+05	N	NA	NA	No	BSL
7782-49-2	SELENIUM	6.70E-01	J	1.70E+01	J	mg/kg	SD-I03-0002	24/29	3.50E-01 - 8.70E+00	1.70E+01	NA	3.41E+04	N	NA	NA	No	BSL
7440-22-4	SILVER	5.70E-02	J	8.10E+00	J	mg/kg	SD-G04-0002	29/29	7.10E-02 - 1.70E+00	8.10E+00	NA	1.37E+03	N	NA	NA	No	BSL
7440-28-0	THALLIUM	8.50E-02		9.80E-01	J	mg/kg	SD-F06-0002	29/29	7.10E-02 - 1.70E+00	9.80E-01	NA	6.83E+01	N	NA	NA	No	BSL
7440-66-6	ZINC	7.10E+01		1.70E+04	J	mg/kg	SD-H03-0002	29/29	3.50E-01 - 9.70E+00	1.70E+04	NA	2.05E+06	N	NA	NA	No	BSL
POLYAROMATIC HYDROCARBONS																	
83-32-9	ACENAPHTHENE	7.10E-03	J	3.10E+00	J	mg/kg	SD-H04-0002	21/29	1.50E-02 - 1.90E+00	3.10E+00	NA	3.15E+04	N	NA	NA	No	BSL
208-96-8	ACENAPHTHYLENE	1.40E-02	J	2.70E+00	J	mg/kg	SD-H04-0002	23/29	1.50E-02 - 1.90E+00	2.70E+00	NA	3.15E+04	C	NA	NA	No	BSL
120-12-7	ANTHRACENE	2.00E-02		4.10E+00		mg/kg	SD-H01-0002	22/29	1.50E-02 - 1.90E+00	4.10E+00	NA	1.58E+05	N	NA	NA	No	BSL
56-55-3	BENZO[A]ANTHRACENE	5.20E-02		6.00E+00		mg/kg	SD-H07-0002	25/29	1.50E-02 - 1.90E+00	6.00E+00	NA	1.68E+01	C	NA	NA	No	BSL
50-32-8	**BENZO[A]PYRENE**	**5.60E-02**		**4.95E+00**		**mg/kg**	**SD-H07-0002**	**22/29**	**1.50E-02 - 1.90E+00**	**4.95E+00**	**NA**	**1.68E+00**	**C**	**NA**	**NA**	**Yes**	**ASL**
205-99-2	BENZO[B]FLUORANTHENE	7.40E-02		5.80E+00		mg/kg	SD-H01-0002	23/29	1.50E-02 - 1.90E+00	5.80E+00	NA	1.68E+01	C	NA	NA	No	BSL
191-24-2	BENZO[G,H,I]PERYLENE	4.70E-02		4.30E+00		mg/kg	SD-H01-0002	22/29	1.50E-02 - 1.90E+00	4.30E+00	NA	1.58E+04	N	NA	NA	No	BSL
207-08-9	BENZO[K]FLUORANTHENE	1.80E-02		3.30E+00		mg/kg	SD-G01-0002	22/29	1.50E-02 - 1.90E+00	3.30E+00	NA	1.68E+02	C	NA	NA	No	BSL
218-01-9	CHRYSENE	4.90E-02		5.35E+00		mg/kg	SD-H07-0002	24/29	1.50E-02 - 1.90E+00	5.35E+00	NA	1.68E+03	C	NA	NA	No	BSL
53-70-3	DIBENZ(A,H)ANTHRACENE	1.40E-02	J	1.10E+00		mg/kg	SD-H07-0002	13/29	1.50E-02 - 1.90E+00	1.10E+00	NA	1.68E+00	C	NA	NA	No	BSL
206-44-0	FLUORANTHENE	7.50E-02		1.40E+01		mg/kg	SD-H01-0002	29/29	1.50E-02 - 1.90E+00	1.40E+01	NA	2.10E+04	N	NA	NA	No	BSL
86-73-7	FLUORENE	1.20E-02	J	4.30E+00	J	mg/kg	SD-H04-0002	23/29	1.50E-02 - 1.90E+00	4.30E+00	NA	2.10E+04	N	NA	NA	No	BSL
193-39-5	INDENO[1,2,3-CD]PYRENE	4.20E-02		3.45E+00		mg/kg	SD-H07-0002	21/29	1.50E-02 - 1.90E+00	3.45E+00	NA	1.68E+01	C	NA	NA	No	BSL
91-20-3	NAPHTHALENE	8.90E-02		9.10E+00	J	mg/kg	SD-F06-0002	29/29	1.50E-02 - 1.90E+00	9.10E+00	NA	1.05E+04	C	NA	NA	No	BSL
85-01-8	PHENANTHRENE	4.20E-02		1.55E+01	J	mg/kg	SD-H04-0002	23/29	1.50E-02 - 1.90E+00	1.55E+01	NA	1.58E+04	N	NA	NA	No	BSL
129-00-0	PYRENE	7.00E-02		1.03E+01	J	mg/kg	SD-H04-0002	29/29	1.50E-02 - 1.90E+00	1.03E+01	NA	1.58E+04	N	NA	NA	No	BSL
POLYCHLORINATED BIPHENYLS																	
12672-29-6	AROCLOR-1248	3.30E-04	J	9.00E+00	J	mg/kg	SD-G04-0002	28/28	6.00E-04 - 2.00E-01	9.00E+00	NA	1.48E+01	C	NA	NA	No	BSL
11097-69-1	AROCLOR-1254	5.50E-04	J	3.20E+00	J	mg/kg	SD-G04-0002	20/28	6.00E-04 - 2.00E-01	3.20E+00	NA	9.75E+00	N	NA	NA	No	BSL
11096-82-5	AROCLOR-1260	3.50E-04	J	2.00E+00	J	mg/kg	SD-H03-0002	23/28	6.00E-04 - 2.00E-01	2.00E+00	NA	1.48E+01	C	NA	NA	No	BSL
SEMIVOLATILE ORGANIC COMPOUNDS																	
105-67-9	2,4-DIMETHYLPHENOL	5.90E-02	J	5.90E-02	J	mg/kg	SD-I03-0002	1/28	7.20E-02 - 9.40E+00	5.90E-02	NA	1.37E+04		NA	NA	No	BSL
100-02-7	4-NITROPHENOL	3.60E+00	J	3.60E+00	J	mg/kg	SD-F07-0002	1/28	3.70E-01 - 4.90E+01	3.60E+00	NA	NA		NA	NA	No	NSL
65-85-0	BENZOIC ACID	7.90E-01	J	1.40E+00	J	mg/kg	SD-E03-0002	3/28	3.70E-01 - 4.90E+01	1.40E+00	NA	2.73E+06		NA	NA	No	BSL
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	1.80E-01	J	5.10E+01	J	mg/kg	SD-H04-0002	26/29	1.50E-01 - 1.90E+01	5.10E+01	NA	2.96E+03		NA	NA	No	BSL
84-74-2	DI-N-BUTYL PHTHALATE	7.70E-02	J	1.80E-01	J	mg/kg	SD-G05-0002	2/28	7.20E-02 - 9.40E+00	1.80E-01	NA	6.83E+04		NA	NA	No	BSL
108-95-2	PHENOL	5.80E-02		3.90E-01	J	mg/kg	SD-F07-0002	9/28	1.50E-02 - 1.90E+00	3.90E-01	NA	2.05E+05		NA	NA	No	BSL

TABLE 10-2.7
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
PHASE I AREA OF THE SPARROWS POINT SITE
SOUTHWEST/TIN MILL CANAL EFFLUENT - SURFACE SEDIMENT

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Surface Sediment
Exposure Point: Southwest/Tin Mill Canal Exposure Area

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration (2) Used for Screening	Background (3) Value	Screening (4) Toxicity Value	Potential (5) ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (6) Contaminant Deletion or Selection
VOLATILE ORGANIC COMPOUNDS																
95-50-1	1,2-DICHLOROBENZENE	4.25E-03	J / J	1.80E-01	J	mg/kg	SD-G02-0002	5/28	7.30E-03 - 2.60E-02	1.80E-01	NA	6.14E+04	NA	NA	No	NSL
541-73-1	1,3-DICHLOROBENZENE	2.40E-03	J	1.30E-02	J	mg/kg	SD-H03-0002	4/28	7.30E-03 - 2.60E-02	1.30E-02	NA	6.14E+04	NA	NA	No	NSL
106-46-7	1,4-DICHLOROBENZENE	2.80E-03	J	2.80E-02	J	mg/kg	SD-G02-0002	7/28	7.30E-03 - 2.60E-02	2.80E-02	NA	7.67E+03	NA	NA	No	NSL
71-43-2	BENZENE	2.60E-03	J	1.20E-02	J	mg/kg	SD-G02-0002	9/28	7.30E-03 - 2.60E-02	1.20E-02	NA	1.51E+05	NA	NA	No	BSL
108-90-7	CHLOROBENZENE	2.40E-03	J	2.50E-01		mg/kg	SD-H03	12/28	7.30E-03 - 2.60E-02	2.50E-01	NA	1.37E+04	NA	NA	No	NSL
100-41-4	ETHYLBENZENE	2.10E-03	J	8.90E-02	J	mg/kg	SD-G02-0002	9/28	7.30E-03 - 2.60E-02	8.90E-02	NA	1.26E+04	NA	NA	No	BSL
108-88-3	TOLUENE	1.30E-03	J	7.10E-02	J	mg/kg	SD-H03-0002	13/28	7.30E-03 - 2.60E-02	7.10E-02	NA	1.82E+05	NA	NA	No	BSL

Note: Chemicals of Potential Concern are bold with shading

(1) Minimum/maximum detected concentration.
(2) Maximum concentration used as screening value.
(3) Background values are not included as part of the COPC selection process.
(4) Site-specific Screening Toxicity Values developed. Please see Appendix H for calculations.
(5) ARAR/TBC are not applicable because risk assessment utilizes federal risk-based stands for screening.
(6) Rationale Codes — Selection Reason: ASL = Above Screening Toxicity Level; Deletion Reason: BSL = Below Screening Toxicity Level; NSL = No Screening Toxicity Level

Definitions:
ARAR = Applicable or Relevant and Appropriate Requirement
C = Carcinogenic
COPC = Chemical of Potential Concern
N = Non-Carcinogenic
NA = Not Applicable
mg/kg = milligrams per kilogram
TBC = To be considered

Data Qualifiers: J = Value is estimated.

Surrogates used: Anthracene for Phenanthrene, Naphthalene for Acenaphthylene, Pyrene for Benzo[g,h,i]perylene.

TABLE 10-2.8
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
PHASE I AREA OF THE SPARROWS POINT SITE
SOUTHWEST/TIN MILL CANAL EFFLUENT - SURFACE WATER

Scenario Timeframe: Current/Future
Medium: Surface water
Exposure Medium: Surface water
Exposure Point: Southwest/Tin Mill Canal Exposure Area

CAS Number	Chemical	Units	SW EPC	Detection Frequency	Concentration (2) Used for Screening	Background (3) Value	Screening (4) Toxicity Value		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (5) Contaminant Deletion or Selection
INORGANICS												
7440-36-0	ANTIMONY	µg/L	3.29E-01	NA	3.29E-01	NA	1.15E+02	N	NA	NA	No	BSL
7440-38-2	ARSENIC	µg/L	9.60E-01	NA	9.60E-01	NA	5.09E+01	C	NA	NA	No	BSL
7440-47-3	CHROMIUM	µg/L	9.63E-01	NA	9.63E-01	NA	1.87E+04	C	NA	NA	No	BSL
7440-50-8	COPPER	µg/L	9.69E-01	NA	9.69E-01	NA	7.69E+04	N	NA	NA	No	BSL
57-12-5	CYANIDE (TOTAL)	µg/L	3.87E+00	NA	3.87E+00	NA	1.15E+03	N	NA	NA	No	BSL
7439-92-1	LEAD	µg/L	5.37E-01	NA	5.37E-01	NA	1.50E+01		NA	NA	No	BSL
7439-97-6	MERCURY	µg/L	3.25E-01	NA	3.25E-01	NA	1.92E+02	N	NA	NA	No	BSL
7440-02-0	NICKEL	µg/L	5.80E+00	NA	5.80E+00	NA	7.69E+03	N	NA	NA	No	BSL
7440-66-6	ZINC	µg/L	1.93E+01	NA	1.93E+01	NA	9.61E+05	N	NA	NA	No	BSL
POLYAROMATIC HYDROCARBONS												
50-32-8	HMW PAHs	µg/L	2.32E-02	NA	2.32E-02	NA	NA		NA	NA	No	NSL
129-00-0	LMW PAHs	µg/L	4.72E-01	NA	4.72E-01	NA	2.87E+02	N	NA	NA	No	BSL
SEMIVOLATILE ORGANIC COMPOUNDS												
117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	µg/L	7.33E-02	NA	7.33E-02	NA	2.00E+03	N	NA	NA	No	BSL

Note: Chemicals of Potential Concern are bold with shading.

(1) Surface water concentrations were modeled as discussed in Section 6.1.
(2) The modeled maximum surface water concentration was used for screening.
(3) Background values are not included as part of the COPC selection process.
(4) Site-specific Screening Toxicity Values developed. Please see Appendix H for calculations.
(5) Rationale Codes

Definitions:
ARAR = Applicable or Relevant and Appropriate Requirement
C = Carcinogenic
COPC = Chemical of Potential Concern
N = Non-Carcinogenic
NA = Not Applicable
ug/L = micrograms per liter
mg/kg = milligrams per kilogram
TBC = To be considered

TABLE 10-2.9
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
PHASE I AREA OF THE SPARROWS POINT SITE
SOUTHWEST/TIN MILL CANAL EFFLUENT - FIELD-COLLECTED CRABS

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Crabs
Exposure Point: Southwest/Tin Mill Canal Exposure Area

CAS Number	Chemical	Units	Detection Frequency	Sediment EPC Value	SEDBAF (mg/kg dry wt.)	Concentration [1] Used for Screening	Screening [2] Toxicity Value		COPC Flag	Rationale for [3] Contaminant Deletion or Selection
INORGANICS										
7429-90-5	ALUMINUM	mg/kg	5/ 5	NA	NA	7.20E+00	1.50E+02	N	No	BSL
7440-36-0	ANTIMONY	mg/kg	5/ 5	NA	NA	3.91E-02	6.20E-02	N	No	BSL
7440-38-2	**ARSENIC**	**mg/kg**	**5/ 5**	**NA**	**NA**	**1.24E+00**	**2.80E-03**	**C**	**Yes**	**ASL**
7440-41-7	BERYLLIUM	mg/kg	0/ 5	NA	NA	4.69E-02	3.10E-01	N	No	BSL
7440-43-9	**CADMIUM**	**mg/kg**	**5/ 5**	**NA**	**NA**	**1.58E-01**	**1.50E-01**	**N**	**Yes**	**ASL**
7440-47-3	CHROMIUM	mg/kg	3/ 5	NA	NA	2.39E-01	2.30E+02	N	No	BSL
7440-48-4	**COBALT**	**mg/kg**	**5/ 5**	**NA**	**NA**	**1.38E-01**	**4.60E-02**	**N**	**Yes**	**ASL**
7440-50-8	**COPPER**	**mg/kg**	**5/ 5**	**NA**	**NA**	**1.25E+01**	**6.20E+00**	**N**	**Yes**	**ASL**
7439-89-6	IRON	mg/kg	5/ 5	NA	NA	5.01E+01	1.10E+02	N	No	BSL
7439-92-1	LEAD	mg/kg	5/ 5	NA	NA	1.71E-01	NA		No	NSL
7439-96-5	MANGANESE	mg/kg	5/ 5	NA	NA	1.10E+01	2.20E+01	N	No	BSL
7439-97-6	MERCURY	mg/kg	4/ 5	NA	NA	2.10E-02	4.60E-02	N	No	BSL
7440-02-0	NICKEL	mg/kg	5/ 5	NA	NA	1.95E-01	3.10E+00	N	No	BSL
7782-49-2	**SELENIUM**	**mg/kg**	**5/ 5**	**NA**	**NA**	**1.07E+00**	**7.70E-01**	**N**	**Yes**	**ASL**
7440-22-4	SILVER	mg/kg	5/ 5	NA	NA	3.61E-01	7.70E-01	N	No	BSL
7440-28-0	**THALLIUM**	**mg/kg**	**1/ 5**	**NA**	**NA**	**4.69E-02**	**1.50E-02**	**C**	**Yes**	**ASL**
7440-31-5	TIN	mg/kg	1/ 5	NA	NA	2.34E-01	9.30E+01	N	No	BSL
7440-66-6	ZINC	mg/kg	5/ 5	NA	NA	4.59E+01	4.60E+01	N	Yes	BSL
POLYAROMATIC HYDROCARBONS										
91-57-6	2-METHYLNAPHTHALENE	mg/kg	1/ 5	NA	NA	1.47E-02	6.20E-01	N	No	BSL
83-32-9	ACENAPHTHENE	mg/kg	3/ 5	NA	NA	1.71E-02	9.30E+00	N	No	BSL
208-96-8	ACENAPHTHYLENE	mg/kg	2/ 5	NA	NA	1.49E-02	9.30E+00	N	No	BSL
120-12-7	ANTHRACENE	mg/kg	2/ 5	NA	NA	1.47E-02	4.60E+01	N	No	BSL
56-55-3	**BENZO(A)ANTHRACENE**	**mg/kg**	**1/ 5**	**NA**	**NA**	**2.57E-02**	**5.70E-03**	**C**	**Yes**	**ASL**
50-32-8	**BENZO(A)PYRENE**	**mg/kg**	**1/ 5**	**NA**	**NA**	**1.58E-02**	**5.70E-04**	**C**	**Yes**	**ASL**
205-99-2	**BENZO(B)FLUORANTHENE**	**mg/kg**	**2/ 5**	**NA**	**NA**	**3.15E-02**	**5.70E-03**	**C**	**Yes**	**ASL**
207-08-9	BENZO(K)FLUORANTHENE	mg/kg	1/ 5	NA	NA	1.49E-02	5.70E-02	C	No	BSL
218-01-9	CHRYSENE	mg/kg	1/ 5	NA	NA	1.47E-02	5.70E-01	C	No	BSL
206-44-0	FLUORANTHENE	mg/kg	3/ 5	NA	NA	8.69E-02	6.20E+00	N	No	BSL
86-73-7	FLUORENE	mg/kg	1/ 5	NA	NA	1.47E-02	6.20E+00	N	No	BSL
91-20-3	NAPHTHALENE	mg/kg	3/ 5	NA	NA	2.20E-02	3.10E+00	N	No	BSL
85-01-8	PHENANTHRENE	mg/kg	3/ 5	NA	NA	1.64E-02	3.10E+00	N	No	BSL
129-00-0	PYRENE	mg/kg	2/ 5	NA	NA	4.74E-02	4.60E+00	N	No	BSL
POLYCHLORINATED BIPHENYLS										
TOTAL PCBS	**TOTAL PCBs (ND=0)**	**mg/kg**	**5/ 5**	**NA**	**NA**	**1.44E-01**	**2.10E-03**	**C**	**Yes**	**ASL**
TOTAL PCBS	**TOTAL PCBs (ND=DL)**	**mg/kg**	**5/ 5**	**NA**	**NA**	**2.10E-01**	**2.10E-03**	**C**	**Yes**	**ASL**
SEMI-VOLATILE ORGANIC COMPOUNDS										
105-67-9	2,4-DIMETHYLPHENOL	mg/kg	NA	5.90E-02	4.00E+00	2.36E-01	3.10E+00	N	No	BSL
100-02-7	4-NITROPHENOL	mg/kg	NA	3.60E+00	4.00E+00	1.44E+01	NA		No	BSL
65-85-0	BENZOIC ACID	mg/kg	NA	1.40E+00	4.00E+00	5.60E+00	6.20E+02	N	No	BSL
117-81-7	**BIS(2-ETHYLHEXYL) PHTHALATE**	**mg/kg**	**NA**	**1.84E+01**	**4.00E+00**	**7.38E+01**	**3.00E-01**	**C**	**Yes**	**ASL**
84-74-2	DI-N-BUTYL PHTHALATE	mg/kg	NA	1.80E-01	4.00E+00	7.20E-01	1.50E+01	N	No	BSL
108-95-2	PHENOL	mg/kg	NA	2.42E-01	4.00E+00	9.68E-01	4.60E+01	N	No	BSL

TABLE 10-2.9

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

PHASE I AREA OF THE SPARROWS POINT SITE

SOUTHWEST/TIN MILL CANAL EFFLUENT - FIELD-COLLECTED CRABS

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Crabs
Exposure Point: Southwest/Tin Mill Canal Exposure Area

CAS Number	Chemical	Units	Detection Frequency	Sediment EPC Value	SEDBAF (mg/kg dry wt.)	Concentration (1) Used for Screening	Screening (2) Toxicity Value		COPC Flag	Rationale for (3) Contaminant Deletion or Selection
VOLATILE ORGANIC COMPOUNDS										
95-50-1	1,2-DICHLOROBENZENE	mg/kg	NA	3.63E-02	4.67E-01	1.70E-02	1.40E+01	N	No	BSL
541-73-1	1,3-DICHLOROBENZENE	mg/kg	NA	8.42E-03	8.44E-02	7.10E-04	1.40E+01	N	No	BSL
106-46-7	1,4-DICHLOROBENZENE	mg/kg	NA	9.56E-03	5.68E-02	5.43E-04	7.70E-01	C	No	BSL
71-43-2	BENZENE	mg/kg	NA	7.05E-03	4.00E+00	2.82E-02	7.60E-02	C	No	BSL
108-90-7	CHLOROBENZENE	mg/kg	NA	2.38E-02	4.00E+00	9.52E-02	3.10E+00	N	No	BSL
100-41-4	ETHYLBENZENE	mg/kg	NA	1.95E-02	4.00E+00	7.80E-02	3.80E-01	C	No	BSL
108-88-3	TOLUENE	mg/kg	NA	1.79E-02	4.00E+00	7.16E-02	1.20E+01	N	No	BSL

Note: Chemicals of Potential Concern are bold with shading.

(1) Actual crab tissue sample results for crab meat and mustard, except chemicals not analyzed in tissue. For semivolatile organic compounds and volatile organic compounds, the screening concentration is the Sediment EPC*SEDBAF.

(2) USEPA Regional Screening Levels, USEPA, June 2015. For non-carcinogens, value shown is equal to 1/10 the fish tissue value. For carcinogens the value shown is equal to the fish tissue value.

(3) Rationale Codes

Selection Reason:
Deletion Reason:

ASL = Above Screening Toxicity Level
BSL = Below Screening Toxicity Level
NSL = No Screening Toxicity Level

Surrogates used: Anthracene for Phenanthrene, Acenaphthene for Acenaphthylene, Pyrene for Benzo[g,h,i]perylene 1,2-Dichlorobenzene for 1,3-Dichlorobenzene.

Definitions:

C = Carcinogenic
COPC = Chemical of Potential Concern
N = Non-Carcinogenic
NA = Not Applicable
mg/kg = milligrams per kilogram
EPC = Exposure Point Concentration
SEDBAF = Sediment Bioaccumulation Factor

TABLE 10-2.10

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

PHASE I AREA OF THE SPARROWS POINT SITE

SOUTHWEST/TIN MILL CANAL EFFLUENT - FIELD-COLLECTED FINFISH

Scenario Timeframe: Current/Future
Medium: Surface water
Exposure Medium: Finfish
Exposure Point: Southwest/Tin Mill Canal Exposure Area

CAS Number	Chemical	SW EPC (mg/L)	Detection Frequency	SWBAF (mg/L to mg/kg dry weight)	Concentration [1] Used for Screening (mg/kg)	Screening [2] Toxicity Value (mg/kg)		COPC Flag	Rationale for [3] Contaminant Deletion or Selection
INORGANICS									
7429-90-5	ALUMINUM	NA	5/5	NA	2.00E+00	1.50E+02	N	No	BSL
7440-36-0	ANTIMONY	NA	5/5	NA	1.40E-02	6.20E-02	N	No	BSL
7440-38-2	**ARSENIC**	**NA**	**5/5**	**NA**	**4.80E-01**	**2.80E-03**	**C**	**Yes**	**ASL**
7440-47-3	CHROMIUM	NA	2/5	NA	7.20E-02	2.30E+02	N	No	BSL
7440-48-4	COBALT	NA	5/5	NA	3.10E-02	4.60E-02	N	No	BSL
7440-50-8	COPPER	NA	5/5	NA	4.50E+00	6.20E+00	N	No	BSL
7439-89-6	IRON	NA	5/5	NA	7.80E+00	1.10E+02	N	No	BSL
7439-92-1	LEAD	NA	5/5	NA	2.60E-01	NA		No	NSL
7439-96-5	MANGANESE	NA	5/5	NA	4.00E+00	2.20E+01	N	No	BSL
7439-97-6	**MERCURY**	**NA**	**5/5**	**NA**	**5.60E-02**	**4.60E-02**	**N**	**Yes**	**ASL**
7440-02-0	NICKEL	NA	5/5	NA	6.20E-02	3.10E+00	N	No	BSL
7782-49-2	**SELENIUM**	**NA**	**5/5**	**NA**	**9.70E-01**	**7.70E-01**	**N**	**Yes**	**ASL**
7440-22-4	SILVER	NA	2/5	NA	4.20E-02	7.70E-01	N	No	BSL
7440-31-5	TIN	NA	3/5	NA	1.40E-01	9.30E+01	N	No	BSL
7440-66-6	ZINC	NA	5/5	NA	1.36E+01	4.60E+01	N	No	BSL
POLYAROMATIC HYDROCARBONS									
83-32-9	ACENAPHTHENE	NA	1/5	NA	3.60E-03	9.30E+00	N	No	BSL
206-44-0	FLUORANTHENE	NA	1/5	NA	1.40E-02	6.20E+00	N	No	BSL
91-20-3	NAPHTHALENE	NA	2/5	NA	1.35E-02	3.10E+00	N	No	BSL
85-01-8	PHENANTHRENE	NA	2/5	NA	5.80E-03	3.10E+00	N	No	BSL
POLYCHLORINATED BIPHENYLS									
TOTAL PCBs	**TOTAL PCBs (ND=0)**	**NA**	**5/5**	**NA**	**1.92E-01**	**2.10E-03**	**C**	**Yes**	**ASL**
TOTAL PCBs	**TOTAL PCBs (ND=DL)**	**NA**	**5/5**	**NA**	**2.12E-01**	**2.10E-03**	**C**	**Yes**	**ASL**
SEMIVOLATILE ORGANIC COMPOUNDS									
117-81-7	BIS(2-ETHYLHEXYL) PHTHLATE	2.57E-05	NA	6.85E+03	1.76E-01	3.00E-01	C	No	BSL

Note: Chemicals of Potential Concern are bold with shading

(1) Modeled uptake or maximum fish tissue concentration used as screening value.

(2) USEPA Regional Screening Levels, USEPA, June 2015. For non-carcinogens, value shown is equal to 1/10 the fish tissue value. For carcinogens the value shown is equal to the fish tissue value.

(3) Rationale Codes

Selection Reason: ASL = Above Screening Toxicity Level

Deletion Reason: BSL = Below Screening Toxicity Level

NSL = No Screening Toxicity Level

Surrogates used: Anthracene for Phenanthrene.

Definitions:

C = Carcinogenic

COPC = Chemical of Potential Concern

N = Non-Carcinogenic

NA = Not Applicable

mg/kg = milligrams per kilogran

EPC = Exposure Point Concentration

SWBAF = Surface water Bioaccumulation Factor

TABLE 10-2.11

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

PHASE I AREA OF THE SPARROWS POINT SITE

SOUTHWEST/TIN MILL CANAL EFFLUENT - CRABS/UPTAKE

Scenario Timeframe: Future
Medium: Crabs
Exposure Medium: Crabs
Exposure Point: Southwest/Tin Mill Canal Exposure Area

CAS Number	Chemical	Units	Sediment EPC Value	SEDBAF (mg/kg dry wt.)	BAF Source	Concentration [1] Used for Screening	Screening [2] Toxicity Value		COPC Flag	Rationale for [3] Contaminant Deletion or Selection
INORGANICS										
7440-36-0	**ANTIMONY**	**mg/kg**	**5.64E+00**	**1.26E-01**	**95% UCLM from bioaccumulation tests - clam value**	**7.09E-01**	**6.20E-02**	**N**	**Yes**	**ASL**
7440-38-2	**ARSENIC**	**mg/kg**	**4.79E+01**	**2.16E-01**	**95% UCLM from bioaccumulation tests - clam value**	**1.04E+01**	**2.80E-03**	**C**	**Yes**	**ASL**
7440-41-7	**BERYLLIUM**	**mg/kg**	**8.68E-01**	**4.00E+00**	**Default**	**3.47E+00**	**3.10E-01**	**N**	**Yes**	**ASL**
7440-43-9	**CADMIUM**	**mg/kg**	**3.04E+01**	**3.10E-02**	**95% UCLM from bioaccumulation tests - worm value**	**9.43E-01**	**1.50E-01**	**N**	**Yes**	**ASL**
7440-47-3	CHROMIUM	mg/kg	2.43E+03	1.87E-02	95% UCLM from bioaccumulation tests - worm value	4.55E+01	2.30E+02	N	No	BSL
7440-50-8	**COPPER**	**mg/kg**	**3.22E+02**	**3.10E-02**	**95% UCLM from bioaccumulation tests - worm value**	**9.98E+00**	**6.20E+00**	**N**	**Yes**	**ASL**
7439-92-1	LEAD	mg/kg	4.67E+02	1.45E-02	95% UCLM from bioaccumulation tests - worm value	6.77E+00	NA		No	NSL
7439-97-6	**MERCURY**	**mg/kg**	**8.27E-01**	**5.73E-02**	**95% UCLM from bioaccumulation tests - worm value**	**4.74E-02**	**4.60E-02**	**N**	**Yes**	**ASL**
7440-02-0	**NICKEL**	**mg/kg**	**1.11E+02**	**4.55E-02**	**95% UCLM from bioaccumulation tests - worm value**	**5.06E+00**	**3.10E+00**	**N**	**Yes**	**ASL**
7782-49-2	**SELENIUM**	**mg/kg**	**8.83E+00**	**2.10E-01**	**95% UCLM from bioaccumulation tests - worm value**	**1.85E+00**	**7.70E-01**	**N**	**Yes**	**ASL**
7440-22-4	SILVER	mg/kg	3.87E+00	8.09E-02	95% UCLM from bioaccumulation tests - worm value	3.13E-01	7.70E-01	N	No	BSL
7440-28-0	**THALLIUM**	**mg/kg**	**5.23E-01**	**5.56E-02**	**95% UCLM from bioaccumulation tests - clam value**	**2.91E-02**	**1.50E-02**	**C**	**Yes**	**ASL**
7440-66-6	**ZINC**	**mg/kg**	**6.68E+03**	**9.78E-02**	**95% UCLM from bioaccumulation tests - worm value**	**6.53E+02**	**4.60E+01**	**N**	**Yes**	**ASL**
POLYAROMATIC HYDROCARBONS										
83-32-9	ACENAPHTHENE	mg/kg	9.65E-01	3.39E-01	95% UCLM from bioaccumulation tests - worm value	3.27E-01	9.30E+00	N	No	BSL
208-96-8	ACENAPHTHYLENE	mg/kg	9.35E-01	2.01E-01	95% UCLM from bioaccumulation tests - worm value	1.88E-01	9.30E+00	N	No	BSL
120-12-7	ANTHRACENE	mg/kg	1.33E+00	3.29E-01	95% UCLM from bioaccumulation tests - worm value	4.39E-01	4.60E+01	N	No	BSL
56-55-3	**BENZO[A]ANTHRACENE**	**mg/kg**	**2.53E+00**	**5.98E-01**	**95% UCLM from bioaccumulation tests - clam value**	**1.51E+00**	**5.70E-03**	**C**	**Yes**	**ASL**
50-32-8	**BENZO[A]PYRENE**	**mg/kg**	**2.32E+00**	**2.92E-01**	**95% UCLM from bioaccumulation tests - clam value**	**6.79E-01**	**5.70E-04**	**C**	**Yes**	**ASL**
205-99-2	**BENZO[B]FLUORANTHENE**	**mg/kg**	**2.30E+00**	**1.90E-01**	**95% UCLM from bioaccumulation tests - clam value**	**4.35E-01**	**5.70E-03**	**C**	**Yes**	**ASL**
191-24-2	BENZO[G,H,I]PERYLENE	mg/kg	2.15E+00	9.31E-02	95% UCLM from bioaccumulation tests - clam value	2.00E-01	4.60E+00	N	No	BSL
207-08-9	**BENZO[K]FLUORANTHENE**	**mg/kg**	**1.19E+00**	**1.90E-01**	**95% UCLM for Benzo(b)fluoranthene from bioaccumulation tests - clam value**	**2.25E-01**	**5.70E-02**	**C**	**Yes**	**ASL**
218-01-9	**CHRYSENE**	**mg/kg**	**2.58E+00**	**5.82E-01**	**95% UCLM from bioaccumulation tests - clam value**	**1.50E+00**	**5.70E-01**	**C**	**Yes**	**ASL**
53-70-3	**DIBENZ(A,H)ANTHRACENE**	**mg/kg**	**4.59E-01**	**7.11E-01**	**95% UCLM from bioaccumulation tests - worm value**	**3.26E-01**	**5.70E-04**	**C**	**Yes**	**ASL**
206-44-0	**FLUORANTHENE**	**mg/kg**	**6.77E+00**	**1.24E+00**	**95% UCLM from bioaccumulation tests - worm value**	**8.39E+00**	**6.20E+00**	**N**	**Yes**	**ASL**
86-73-7	FLUORENE	mg/kg	1.72E+00	1.12E-01	bioaccumulation tests - worm valueB	1.92E-01	6.20E+00	N	No	BSL
193-39-5	**INDENO[1,2,3-CD]PYRENE**	**mg/kg**	**1.60E+00**	**2.26E-01**	**95% UCLM from bioaccumulation tests - worm value**	**3.62E-01**	**5.70E-03**	**C**	**Yes**	**ASL**
91-20-3	NAPHTHALENE	mg/kg	2.87E+00	6.99E-02	95% UCLM from bioaccumulation tests - worm value	2.00E-01	3.10E+00	N	No	BSL
85-01-8	PHENANTHRENE	mg/kg	6.81E+00	3.04E-01	95% UCLM from bioaccumulation tests - clam value	2.07E+00	3.10E+00	N	No	BSL
129-00-0	**PYRENE**	**mg/kg**	**4.72E+00**	**1.38E+00**	**95% UCLM from bioaccumulation tests - clam value**	**6.52E+00**	**4.60E+00**	**N**	**Yes**	**ASL**
POLYCHLORINATED BIPHENYLS										
12672-29-6	**AROCLOR-1248**	**mg/kg**	**3.58E+00**	**1.41E+01**	**Average of whole body freshwater BSAF for Total PCBs from EPA data set (2009)**	**5.05E+01**	**2.10E-03**	**C**	**Yes**	**ASL**
11097-69-1	**AROCLOR-1254**	**mg/kg**	**1.24E+00**	**1.41E+01**	**Average of whole body freshwater BSAF for Total PCBs from EPA data set (2009)**	**1.75E+01**	**2.10E-03**	**C**	**Yes**	**ASL**
11096-82-5	**AROCLOR-1260**	**mg/kg**	**6.57E-01**	**1.41E+01**	**Average of whole body freshwater BSAF for Total PCBs from EPA data set (2009)**	**9.27E+00**	**2.10E-03**	**C**	**Yes**	**ASL**

TABLE 10-2.11

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

PHASE I AREA OF THE SPARROWS POINT SITE

SOUTHWEST/TIN MILL CANAL EFFLUENT - CRABS/UPTAKE

Scenario Timeframe: Future
Medium: Crabs
Exposure Medium: Crabs
Exposure Point: Southwest/Tin Mill Canal Exposure Area

CAS Number	Chemical	Units	Sediment EPC Value	SEDBAF (mg/kg dry wt.)	BAF Source	Concentration (1) Used for Screening	Screening (2) Toxicity Value		COPC Flag	Rationale for (3) Contaminant Deletion or Selection
SEMI-VOLATILE ORGANIC COMPOUNDS										
105-67-9	2,4-DIMETHYLPHENOL	mg/kg	5.90E-02	4.00E+00	Average of whole body freshwater BSAF from EPA data set (2009)	2.36E-01	3.10E+00	N	No	BSL
100-02-7	4-NITROPHENOL	mg/kg	3.60E+00	4.00E+00	Average of whole body freshwater BSAF from EPA data set (2009)	1.44E+01	NA	NA	No	BSL
65-85-0	BENZOIC ACID	mg/kg	1.40E+00	4.00E+00	Average of whole body freshwater BSAF from EPA data set (2009)	5.60E+00	6.20E+02	N	No	BSL
117-81-7	**BIS(2-ETHYLHEXYL) PHTHALATE**	**mg/kg**	**1.84E+01**	**4.00E+00**	**Default**	**7.38E+01**	**3.00E-01**	**C**	**Yes**	**ASL**
84-74-2	DI-N-BUTYL PHTHALATE	mg/kg	1.80E-01	4.00E+00	Default	7.20E-01	1.50E+01	N	No	BSL
108-95-2	PHENOL	mg/kg	2.42E-01	4.00E+00	Default	9.68E-01	4.60E+01	N	No	BSL
VOLATILE ORGANIC COMPOUNDS										
95-50-1	1,2-DICHLOROBENZENE	mg/kg	3.63E-02	4.67E-01	BSAF from EPA data set (2009)	1.70E-02	1.40E+01	N	No	BSL
541-73-1	1,3-DICHLOROBENZENE	mg/kg	8.42E-03	8.44E-02	BSAF from EPA data set (2009)	7.10E-04	1.40E+01	N	No	BSL
106-46-7	1,4-DICHLOROBENZENE	mg/kg	9.56E-03	5.68E-02	BSAF from EPA data set (2009)	5.43E-04	7.70E-01	C	No	BSL
71-43-2	BENZENE	mg/kg	7.05E-03	4.00E+00	Default	2.82E-02	7.60E-02	C	No	BSL
108-90-7	CHLOROBENZENE	mg/kg	2.38E-02	4.00E+00	Default	9.52E-02	3.10E+00	N	No	BSL
100-41-4	ETHYLBENZENE	mg/kg	1.95E-02	4.00E+00	Default	7.80E-02	3.80E-01	C	No	BSL
108-88-3	TOLUENE	mg/kg	1.79E-02	4.00E+00	Default	7.16E-02	1.20E+01	N	No	BSL

Note: Chemicals of Potential Concern are bold with shading.

(1) The screening concentration is the Sediment EPC*SEDBAF.

(2) USEPA Regional Screening Levels, USEPA, June 2015. For non-carcinogens, value shown is equal to 1/10 the fish tissue value. For carcinogens the value shown is equal to the fish tissue value.

(3) Rationale Codes
Selection Reason: ASL = Above Screening Toxicity Level
Deletion Reason: BSL = Below Screening Toxicity Level
NSL = No Screening Toxicity Level

Surrogates used: Anthracene for Phenanthrene, Acenaphthene for Acenaphthylene, Pyrene for Benzo[g,h,i]perylene 1,2-Dichlorobenzene for 1,3-Dichlorobenzene.

Definitions:
C = Carcinogenic
COPC = Chemical of Potential Concern
EPC = Exposure Point Concentration
N = Non-Carcinogenic
SEDBAF = Sediment Bioaccumulation Factor
NA = Not Applicable
mg/kg = milligrams per kilogram

TABLE 10-2.12
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
PHASE I AREA OF THE SPARROWS POINT SITE
SOUTHWEST/TIN MILL CANAL EFFLUENT - FINFISH/UPTAKE

Scenario Timeframe: Future
Medium: Surface water
Exposure Medium: Finfish
Exposure Point: Phase I Area of the Sparrows Point Site

CAS Number	Chemical	SW EPC (mg/L)	SWBAF (mg/L to mg/kg dry weight)	BAF Source	Concentration [1] Used for Screening (mg/kg)	Screening [2] Toxicity Value (mg/kg)		COPC Flag	Rationale for [3] Contaminant Deletion or Selection
INORGANICS									
7440-36-0	ANTIMONY	1.20E-04	4.00E+00	Based on bluegill in Table 5 - USEPA 1980	4.80E-04	6.20E-02	N	No	BSL
7440-38-2	**ARSENIC**	**5.13E-04**	**1.60E+01**	**Based on bluegill in Table 5 - USEPA 1985a**	**8.21E-03**	**2.80E-03**	**C**	**Yes**	**ASL**
7440-47-3	CHROMIUM	2.57E-04	8.00E+02	BCF from http://rais.ornl.gov/cgi-bin/tools/TOX_search	2.05E-01	2.30E+02	N	No	BSL
7440-50-8	COPPER	2.99E-04	1.86E+03	Based on fathead minnow in Table 5 - USEPA 2003	5.55E-01	6.20E+00	N	No	BSL
7439-92-1	LEAD	7.99E-05	4.50E+01	Based on bluegill in Table 5 - USEPA 1985b	3.60E-03	NA		No	NSL
7439-97-6	**MERCURY**	**1.14E-04**	**7.20E+03**	**Based on rainbow trout in Table 5 - USEPA 1985c**	**8.19E-01**	**4.60E-02**	**N**	**Yes**	**ASL**
7440-02-0	NICKEL	1.68E-03	9.60E+01	Based on rainbow trout/fathead minnow in Table 5 geometric mean - USEPA 1986	1.61E-01	3.10E+00	N	No	BSL
7440-66-6	ZINC	5.56E-03	2.52E+02	Based on mummichog in Table 5 geometric mean- USEPA 1987b	1.40E+00	4.60E+01	N	No	BSL
POLYAROMATIC HYDROCARBONS									
50-32-8	**HMW PAHs**	**8.43E-06**	**2.06E+04**	**BCF calculated via Regression from BCFBAF Program**	**1.74E-01**	**5.70E-04**	**C**	**Yes**	**ASL**
129-00-0	LMW PAHs	1.30E-04	3.08E+03	BCF calculated via Regression from BCFBAF Program	4.01E-01	4.60E+00	N	No	BSL
SEMIVOLATILE ORGANIC COMPOUNDS									
117-81-7	BIS(2-ETHYLHEXYL) PHTHLATE	2.57E-05	6.85E+03	BCF calculated via Regression from BCFBAF Program	1.76E-01	3.00E-01	C	No	BSL

Note: Chemicals of Potential Concern are bold with shading.

(1) The screening concentration is the Surface Water EPC*SWBAF.

(2) USEPA Regional Screening Levels, USEPA, June 2015. For non-carcinogens, value shown is equal to 1/10 the fish tissue value. For carcinogens the value shown is equal to the fish tissue value.

(3) Rationale Codes
ASL = Above Screening Toxicity Level
BSL = Below Screening Toxicity Level
NSL = No Screening Toxicity Level

Surrogates used for BAFs: Benzo(a)pyrene for HMW PAHs, and Pyrene for LMW PAHs.

Definitions:
C = Carcinogenic
COPC = Chemical of Potential Concern
EPC = Exposure Point Concentration
N = Non-Carcinogenic
SWBAF = Surface water Bioaccumulation Factor
NA = Not Applicable
mg/kg = milligrams per kilogram

TABLE 10-3.1
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
PHASE I AREA OF THE SPARROWS POINT SITE
NORTHEAST/NEAR SHORE - SURFACE SEDIMENT

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Surface Sediment
Exposure Point: Northeast/Near Shore Exposure Area

Chemical of Potential Concern	Units	Mean Detected Concentration	95% UCLM	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
INORGANICS									
NO COPC	mg/kg	NA	NA	NA		mg/kg	NA	NA	Regional Guidance
POLYAROMATIC HYDROCARBONS									
NO COPC	mg/kg	NA	NA	NA		mg/kg	NA	NA	Regional Guidance
SEMIVOLATILE ORGANIC COMPOUNDS									
NO COPC	mg/kg	NA	NA	NA		mg/kg	NA	NA	Regional Guidance

NA = Not Applicable

TABLE 10-3.2
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
PHASE I AREA OF THE SPARROWS POINT SITE
NORTHEAST/NEAR SHORE - SURFACE WATER

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Northeast/Near Shore Exposure Area

Chemical of Potential Concern	Units	Mean Detected Concentration	95% UCLM	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
INORGANICS									
NO COPC	mg/L	NA	NA	NA		mg/L	NA	NA	NA
POLYAROMATIC HYDROCARBONS									
NO COPC	mg/L	NA	NA	NA		mg/L	NA	NA	NA
SEMIVOLATILE ORGANIC COMPOUNDS									
NO COPC	mg/L	NA	NA	NA		mg/L	NA	NA	NA

NA = Not Applicable

TABLE 10-3.3
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
PHASE I AREA OF THE SPARROWS POINT SITE
NORTHEAST/NEAR SHORE - CRABS

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Crabs
Exposure Point: Northeast/Near Shore Exposure Area

Chemical of Potential Concern	Units	Mean Detected Concentration	95% UCLM	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure	
							Medium EPC Value	Medium EPC Rationale
INORGANICS								
CADMIUM	mg/kg	1.18E-01	NA	1.58E-01		mg/kg	1.58E-01	CRAB COPC
COPPER	mg/kg	7.97E+00	NA	1.25E+01		mg/kg	1.25E+01	CRAB COPC
POLYAROMATIC HYDROCARBONS								
BENZO(A)ANTHRACENE	mg/kg	1.48E-02	NA	2.57E-02		mg/kg	2.57E-02	CRAB COPC
BENZO(A)PYRENE	mg/kg	1.20E-02	NA	1.58E-02		mg/kg	1.58E-02	CRAB COPC
BENZO(B)FLUORANTHENE	mg/kg	1.77E-02	NA	3.15E-02		mg/kg	3.15E-02	CRAB COPC
SEMI-VOLATILE ORGANIC COMPOUNDS								
BIS(2-ETHYLHEXYL) PHTHALATE*	mg/kg	NA	2.18E+00	NA		mg/kg	2.18E+00	CRAB COPC

Modeled crab concentrations reflect dry weight concentrations.

*Bioaccumulation factors (BAFs) are used to determine the concentrations of bis(2-ethylhexyl)phthalate in aquatic organisms exposed to sediment. All other chemicals are actual tissue concentrations.

NA = Not Applicable

95%UCLM = 95 percent upper confidence limit on the mean

EPC = exposure point concentration

mg/kg = milligrams per kilogram

TABLE 10-3.4
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
PHASE I AREA OF THE SPARROWS POINT SITE
NORTHEAST/NEAR SHORE - FINFISH

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Finfish
Exposure Point: Northeast/Near Shore Exposure Area

Chemical of Potential Concern	Units	Mean Detected Concentration	95% UCLM	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure	
							Medium EPC Value	Medium EPC Rationale
INORGANICS								
MERCURY	mg/kg	4.84E-02	NA	5.60E-02		mg/kg	5.60E-02	FISH COPC

NA = Not Applicable
95%UCLM = 95 percent upper confidence limit on the mean
EPC = exposure point concentration
mg/kg = milligrams per kilogram

TABLE 10-3.5
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
PHASE I AREA OF THE SPARROWS POINT SITE
NORTHEAST/NEAR SHORE - FINFISH/UPTAKE

Scenario Timeframe: Future
Medium: Surface Water
Exposure Medium: Finfish
Exposure Point: Northeast/Near Shore Exposure Area

Chemical of Potential Concern	Units	Mean Detected Concentration	95% UCLM	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure	
							Medium EPC Value	Medium EPC Rationale
INORGANICS								
MERCURY	mg/kg	NA	1.11E+00	NA		mg/kg	1.11E+00	FISH COPC
POLYAROMATIC HYDROCARBONS								
HMW PAHs	mg/kg	NA	2.37E-01	NA		mg/kg	2.37E-01	FISH COPC

Bioaccumulation factors (BAFs) are used to determine the concentrations of COPCs in aquatic organisms exposed to surface water.
NA = Not Applicable
95%UCLM = 95 percent upper confidence limit on the mean
EPC = exposure point concentration
mg/kg = milligrams per kilogram

TABLE 10-3.6
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
PHASE I AREA OF THE SPARROWS POINT SITE
NORTHEAST/NEAR SHORE - CRABS/UPTAKE

Scenario Timeframe: Future
Medium: Sediment
Exposure Medium: Crabs
Exposure Point: Northeast/Near Shore Exposure Area

Chemical of Potential Concern	Units	Mean Detected Concentration	95% UCLM	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure	
							Medium EPC Value	Medium EPC Rationale
INORGANICS								
ZINC	mg/kg	NA	1.01E+02	NA		mg/kg	1.01E+02	CRAB COPC
POLYAROMATIC HYDROCARBONS								
BENZO(A)ANTHRACENE	mg/kg	NA	1.91E-01	NA		mg/kg	1.91E-01	CRAB COPC
BENZO(A)PYRENE	mg/kg	NA	1.17E-01	NA		mg/kg	1.17E-01	CRAB COPC
BENZO(B)FLUORANTHENE	mg/kg	NA	7.01E-02	NA		mg/kg	7.01E-02	CRAB COPC
DIBENZ(A,H)ANTHRACENE	mg/kg	NA	3.20E-02	NA		mg/kg	3.20E-02	CRAB COPC
INDENO[1,2,3-CD]PYRENE	mg/kg	NA	7.02E-02	NA		mg/kg	7.02E-02	CRAB COPC
SEMI-VOLATILE ORGANIC COMPOUNDS								
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	NA	2.18E+00	NA		mg/kg	2.18E+00	CRAB COPC

Modeled crab concentrations reflect dry weight concentrations.

Bioaccumulation factors (BAFs) are used to determine the medium EPC value concentrations in aquatic organisms exposed to sediment.

NA = Not Applicable

95%UCLM = 95 percent upper confidence limit on the mean

EPC = exposure point concentration

mg/kg = milligrams per kilogram

TABLE 10-3.7
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
PHASE I AREA OF THE SPARROWS POINT SITE
SOUTHWEST/TIN MILL CANAL EFFLUENT - SURFACE SEDIMENT

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Surface Sediment
Exposure Point: Southwest/Tin Mill Canal Exposure Area

Chemical of Potential Concern	Units	Mean Detected Concentration	95% UCLM	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
INORGANICS									
ARSENIC	mg/kg	3.91E+01	6.01E+01	1.20E+02	J	mg/kg	6.01E+01	95%UCLM-CL	Regional Guidance
POLYAROMATIC HYDROCARBONS									
BENZO[A]PYRENE	mg/kg	2.31E+00	2.32E+00	4.95E+00	J	mg/kg	2.32E+00	95%UCLM-KMp	Regional Guidance

Note: Statistics calculated by the EPA program ProUCL.
95%UCLM-CL indicates that the 95 percent upper confidence limit on the mean is based on the Chebyshev test for lognormal distribution.
95%UCLM-KMp indicates that the 95 percent upper confidence limit on the mean is based on the non-parametric Kaplan-Meier (KM) percentile boostrap test.

TABLE 10-3.8
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
PHASE I AREA OF THE SPARROWS POINT SITE
SOUTHWEST/TIN MILL CANAL EFFLUENT - SURFACE WATER

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Southwest/Tin Mill Canal Exposure Area

Chemical of Potential Concern	Units	Mean Detected Concentration	95% UCLM	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
INORGANICS									
NO COPC	mg/L	NA	NA	NA		mg/L	NA	NA	NA
POLYAROMATIC HYDROCARBONS									
NO COPC	mg/L	NA	NA	NA		mg/L	NA	NA	NA
SEMI-VOLATILE ORGANIC COMPOUNDS									
NO COPC	mg/L	NA	NA	NA		mg/L	NA	NA	NA

NA = Not Applicable

TABLE 10-3.9
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
PHASE I AREA OF THE SPARROWS POINT SITE
SOUTHWEST/TIN MILL CANAL EFFLUENT - CRABS

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Crabs
Exposure Point: Southwest/Tin Mill Canal Exposure Area

Chemical of Potential Concern	Units	Mean Detected Concentration	95% UCLM	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure	
							Medium EPC Value	Medium EPC Rationale
INORGANICS								
ARSENIC	mg/kg	1.07E+00	NA	1.24E+00		mg/kg	1.24E+00	CRAB COPC
CADMIUM	mg/kg	1.18E-01	NA	1.58E-01		mg/kg	1.58E-01	CRAB COPC
COBALT	mg/kg	1.05E-01	NA	1.38E-01		mg/kg	1.38E-01	CRAB COPC
COPPER	mg/kg	7.97E+00	NA	1.25E+01		mg/kg	1.25E+01	CRAB COPC
SELENIUM	mg/kg	9.04E-01	NA	1.07E+00		mg/kg	1.07E+00	CRAB COPC
THALLIUM	mg/kg	3.94E-02	NA	4.69E-02		mg/kg	4.69E-02	CRAB COPC
POLYAROMATIC HYDROCARBONS								
BENZO(A)ANTHRACENE	mg/kg	1.48E-02	NA	2.57E-02		mg/kg	2.57E-02	CRAB COPC
BENZO(A)PYRENE	mg/kg	1.20E-02	NA	1.58E-02		mg/kg	1.58E-02	CRAB COPC
BENZO(B)FLUORANTHENE	mg/kg	1.77E-02	NA	3.15E-02		mg/kg	3.15E-02	CRAB COPC
POLYCHLORINATED BIPHENYLS								
TOTAL PCBs (ND=0)	mg/kg	1.11E-01	NA	1.44E-01		mg/kg	1.44E-01	CRAB COPC
TOTAL PCBs (ND=DL)	mg/kg	1.70E-01	NA	2.10E-01		mg/kg	2.10E-01	CRAB COPC
SEMI-VOLATILE ORGANIC COMPOUNDS								
BIS(2-ETHYLHEXYL) PHTHALATE*	mg/kg	NA	7.38E+01	NA		mg/kg	7.38E+01	CRAB COPC

Modeled crab concentrations reflect dry weight concentrations.

*Bioaccumulation factors (BAFs) are used to determine the concentrations of bis(2-ethylhexyl)phthalate in aquatic organisms exposed to sediment. All other chemicals are actual tissue concentrations.

NA = Not Applicable

95%UCLM = 95 percent upper confidence limit on the mean

EPC = exposure point concentration

mg/kg = milligrams per kilogram

TABLE 10-3.10
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
PHASE I AREA OF THE SPARROWS POINT SITE
SOUTHWEST/TIN MILL CANAL EFFLUENT - FINFISH

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Finfish
Exposure Point: Southwest/Tin Mill Canal Exposure Area

Chemical of Potential Concern	Units	Mean Detected Concentration	95% UCLM	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure	
							Medium EPC Value	Medium EPC Rationale
METALS								
ARSENIC	mg/kg	3.88E-01	NA	4.80E-01		mg/kg	4.80E-01	FISH COPC
MERCURY	mg/kg	4.84E-02	NA	5.60E-02		mg/kg	5.60E-02	FISH COPC
SELENIUM	mg/kg	8.46E-01	NA	9.70E-01		mg/kg	9.70E-01	FISH COPC
POLYCHLORINATED BIPHENYLS								
TOTAL PCBs (ND=0)	mg/kg	1.46E-01	NA	1.92E-01		mg/kg	1.92E-01	FISH COPC
TOTAL PCBs (ND=DL)	mg/kg	1.67E-01	NA	2.12E-01		mg/kg	2.12E-01	FISH COPC

NA = Not Applicable
95%UCLM = 95 percent upper confidence limit on the mean
EPC = exposure point concentration
mg/kg = milligrams per kilogram

TABLE 10-3.11
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
PHASE I AREA OF THE SPARROWS POINT SITE
SOUTHWEST/TIN MILL CANAL EFFLUENT - CRABS/UPTAKE

Scenario Timeframe: Future
Medium: Sediment
Exposure Medium: Crabs
Exposure Point: Southwest/Tin Mill Canal Exposure Area

Chemical of Potential Concern	Units	Mean Detected Concentration	95% UCLM	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure	
							Medium EPC Value	Medium EPC Rationale
INORGANICS								
ANTIMONY	mg/kg	NA	7.09E-01	NA		mg/kg	7.09E-01	CRAB COPC
ARSENIC	mg/kg	NA	1.04E+01	NA		mg/kg	1.04E+01	CRAB COPC
BERYLLIUM	mg/kg	NA	3.47E+00	NA		mg/kg	3.47E+00	CRAB COPC
CADMIUM	mg/kg	NA	9.43E-01	NA		mg/kg	9.43E-01	CRAB COPC
COPPER	mg/kg	NA	9.98E+00	NA		mg/kg	9.98E+00	CRAB COPC
MERCURY	mg/kg	NA	4.74E-02	NA		mg/kg	4.74E-02	CRAB COPC
NICKEL	mg/kg	NA	5.06E+00	NA		mg/kg	5.06E+00	CRAB COPC
SELENIUM	mg/kg	NA	1.85E+00	NA		mg/kg	1.85E+00	CRAB COPC
THALLIUM	mg/kg	NA	2.91E-02	NA		mg/kg	2.91E-02	CRAB COPC
ZINC	mg/kg	NA	6.53E+02	NA		mg/kg	6.53E+02	CRAB COPC
POLYAROMATIC HYDROCARBONS								
BENZO(A)ANTHRACENE	mg/kg	NA	1.51E+00	NA		mg/kg	1.51E+00	CRAB COPC
BENZO(A)PYRENE	mg/kg	NA	6.79E-01	NA		mg/kg	6.79E-01	CRAB COPC
BENZO(B)FLUORANTHENE	mg/kg	NA	4.35E-01	NA		mg/kg	4.35E-01	CRAB COPC
BENZO(K)FLUORANTHENE	mg/kg	NA	2.25E-01	NA		mg/kg	2.25E-01	CRAB COPC
CHRYSENE	mg/kg	NA	1.50E+00	NA		mg/kg	1.50E+00	CRAB COPC
DIBENZ(A,H)ANTHRACENE	mg/kg	NA	3.26E-01	NA		mg/kg	3.26E-01	CRAB COPC
FLUORANTHENE	mg/kg	NA	8.39E+00	NA		mg/kg	8.39E+00	CRAB COPC
INDENO[1,2,3-CD]PYRENE	mg/kg	NA	3.62E-01	NA		mg/kg	3.62E-01	CRAB COPC
PYRENE	mg/kg	NA	6.52E+00	NA		mg/kg	6.52E+00	CRAB COPC

TABLE 10-3.11
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
PHASE I AREA OF THE SPARROWS POINT SITE
SOUTHWEST/TIN MILL CANAL EFFLUENT - CRABS/UPTAKE

Scenario Timeframe: Future
Medium: Sediment
Exposure Medium: Crabs
Exposure Point: Southwest/Tin Mill Canal Exposure Area

Chemical of Potential Concern	Units	Mean Detected Concentration	95% UCLM	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure	
							Medium EPC Value	Medium EPC Rationale
POLYCHLORINATED BIPHENYLS								
AROCLOR-1248	mg/kg	NA	5.05E+01	NA		mg/kg	5.05E+01	CRAB COPC
AROCLOR-1254	mg/kg	NA	1.75E+01	NA		mg/kg	1.75E+01	CRAB COPC
AROCLOR-1260	mg/kg	NA	9.27E+00	NA		mg/kg	9.27E+00	CRAB COPC
SEMI-VOLATILE ORGANIC COMPOUNDS								
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	NA	7.38E+01	NA		mg/kg	7.38E+01	CRAB COPC

Modeled crab concentrations reflect dry weight concentrations.

Bioaccumulation factors (BAFs) are used to determine the medium EPC value concentrations in aquatic organisms exposed to sediment.

NA = Not Applicable

95%UCLM = 95 percent upper confidence limit on the mean

EPC = exposure point concentration

mg/kg = milligrams per kilogram

TABLE 10-3.12
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
PHASE I AREA OF THE SPARROWS POINT SITE
SOUTHWEST/TIN MILL CANAL EFFLUENT - FINFISH/UPTAKE

Scenario Timeframe: Future
Medium: Surface Water
Exposure Medium: Finfish
Exposure Point: Southwest/Tin Mill Canal Exposure Area

Chemical of Potential Concern	Units	Mean Detected Concentration	95% UCLM	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure	
							Medium EPC Value	Medium EPC Rationale
INORGANICS								
ARSENIC	mg/kg	NA	8.21E-03	NA		mg/kg	8.21E-03	FISH COPC
MERCURY	mg/kg	NA	8.19E-01	NA		mg/kg	8.19E-01	FISH COPC
POLYAROMATIC HYDROCARBONS								
HMW PAHs	mg/kg	NA	1.74E-01	NA		mg/kg	1.74E-01	FISH COPC

Bioaccumulation factors (BAFs) are used to determine the concentrations of COPCs in aquatic organisms exposed to surface water.
NA = Not Applicable
95%UCLM = 95 percent upper confidence limit on the mean
EPC = exposure point concentration
mg/kg = milligrams per kilogram

TABLE 10-4.1
VALUES USED FOR ADULT RECREATIONAL USER DAILY SEDIMENT INTAKE EQUATIONS
PHASE I OF SPARROWS POINT

Scenario Timeframe: Current
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Sparrows Point
Receptor Population: Recreational User
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	Intake Equation / Model Name
Dermal	CS	Chemical Concentration in Sediment	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	SA	Surface Area for Contact	cm^2/event	4,090	U.S. EPA 2011	CS x SA x AF x ABS x EF x ED x CF / (BW x AT)
	AF	Adherence Factor	mg/cm^2	0.07	U.S. EPA 2014 (2)	
	ABS	Dermal Absorption Fraction	Unitless	Chemical-Specific	Chemical-Specific	
	EF	Exposure Frequency	event/yr	4	BPJ (3)	
	ED-C	Exposure Duration - Cancer	yr	20	U.S. EPA 2014	
	BW	Body Weight	kg	80	U.S. EPA 2014	
	AT-NC	Averaging Time - Noncancer	days	7,300	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA 1989	

Note : BPJ = Best Professional Judgement

(1) Contact with sediment will be with the feet and lower legs. From Table 7-12 of 2011*Exposure Factors Handbook* , the mean lower legs are 2,710 cm^2 and the feet are 1,380 cm^2, with a total of 4,090 cm^2.

(2) The adherence factor is conservatively equal to the recommended factor for resident adult exposure to soil

(3) Swimming will occur only a limited basis, 4 days/yr. based upon previous RCRA assessment (ISG 2005)

CDI = chronic daily intake

TABLE 10-4.2
VALUES USED FOR ADOLESCENT RECREATIONAL USER DAILY SEDIMENT INTAKE EQUATIONS
PHASE I OF SPARROWS POINT

Scenario Timeframe: Current
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Sparrows Point
Receptor Population: Recreational User
Receptor Age: Adolescent

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	Intake Equation / Model Name
Dermal	CS	Chemical Concentration in Sediment	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	SA	Surface Area for Contact	cm^2/event	2,880	U.S. EPA 2011	CS x SA x AF x ABS x EF x ED x CF / (BW x AT)
	AF	Adherence Factor	mg/cm^2	0.2	U.S. EPA 2014 (2)	(5)
	ABS	Dermal Absorption Fraction	Unitless	Chemical-Specific	Chemical-Specific	
	EF	Exposure Frequency	event/yr	4	BPJ (3)	
	ED-C	Exposure Duration - Cancer	yr	10	BPJ (4)	
	BW	Body Weight	kg	45	U.S. EPA 2011	
	AT-NC	Averaging Time - Noncancer	days	3,650	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA 1989	

Note : BPJ = Best Professional Judgement

(1) Contact with sediment will be with the feet and lower legs. Surface areas are averaged for the age ranges of 6 to <11 years and 11 to <16 years of age assuming the 50th percentile. From Table 7-2 of 2011 *Exposure Factors Handbook* , the mean surface area for the lower legs (assuming SA is 50% of total leg area) are 1,990 cm^2 and the feet are 890 cm^2, with a total of 2,880 cm^2.

(2) The adherence factor is conservatively equal to the recommended factor for resident child exposure to soil.

(3) Swimming will occur only a limited basis, 4 days/yr. based upon previous RCRA assessment (ISG 2005).

(4) Exposure duration assumes an age range of 6 to 16 years.

(5) Slope Factor for chemicals identified as mutagenic in Table 10-6 are adjusted by a factor of 3.

CDI = chronic daily intake

TABLE 10-4.3
VALUES USED FOR WATERMAN DAILY SEDIMENT INTAKE EQUATIONS
PHASE I OF SPARROWS POINT

Scenario Timeframe: Current
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Sparrows Point
Receptor Population: Waterman
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	Intake Equation / Model Name
Dermal	CS	Chemical Concentration in Sediment	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	SA	Surface Area for Contact	cm^2/event	2,530	U.S. EPA 2011	CS x SA x AF x ABS x EF x ED x CF / (BW x AT)
	AF	Adherence Factor	mg/cm^2	0.3	U.S. EPA 2014 (2)	
	ABS	Dermal Absorption Fraction	Unitless	Chemical-Specific	Chemical-Specific	
	EF	Exposure Frequency	event/yr	39	BPJ (3)	
	ED-C	Exposure Duration - Cancer	yr	25	U.S. EPA 1991a	
	BW	Body Weight	kg	80	U.S. EPA 2014	
	AT-NC	Averaging Time - Noncancer	days	9,125	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA 1989	

Note : BPJ = Best Professional Judgement

(1) The watermen contact would be limited to the hands and forearms arms since contact to sediment is primarily while hauling fishing nets into boat. The forearm SA at 1,460 cm^2 and hands at 1,070 cm^2. From Table 7-2 and Table 7-12 of 2011 *Exposure Factors Handbook* , this results in an SA of 2,530 cm^2.

(2) The adherence factor is conservatively equal to the recommended factor for commercial/industrial worker exposure to soil.

(3) F ishing is expected to occur March through November, for a total of 9 months or 39 weeks. It is expected that a watermen would not fish exclusively in the Patapsco River near the Coke Point offshore environment. The watermen fishes near Coke Point 1 day/week for a total of 39 days/year.

CDI = chronic daily intake

TABLE 10-4.4
VALUES USED FOR ADULT RECREATIONAL USER DAILY FINFISH/CRAB INTAKE EQUATIONS
PHASE I OF SPARROWS POINT

Scenario Timeframe: Current
Medium: Surface Water/Sediment
Exposure Medium: Fish/Crab
Exposure Point: Sparrows Point
Receptor Population: Recreational User
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	Intake Equation / Model Name
Ingestion	CS	Chemical Concentration in Fish Tissue/Crab Meat	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	CR	Ingestion Rate	kg/meal	0.23	U.S. EPA 2000, MDE 2014 (1)	CS x CR x EF x ED / (BW x AT)
	EF	Exposure Frequency	meals/yr	16	BPJ (2)	
	ED	Exposure Duration	yr	20	U.S. EPA 1989	
	BW	Body Weight	kg	80	U.S. EPA 2014	
	AT-NC	Averaging time - Noncancer	days	7,300	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	

Note : BPJ = Best Professional Judgement
(1) The weight of cooked fish ingested by an adult is 8 ounces/meal or 0.23 kg/meal (wet weight).
(2) It is assumed that the recreational user will fish or catch crabs from the area for 2 days per week during warmer months, June to September (32 day). Fish and crab ingestion are each assumed at 16 meals/yr from the Sparrows Point Area.
CDI = chronic daily intake

TABLE 10-4.5
VALUES USED FOR ADOLESCENT RECREATIONAL USER DAILY FINFISH/CRAB INTAKE EQUATIONS
PHASE I OF SPARROWS POINT

Scenario Timeframe: Current
Medium: Surface Water/Sediment
Exposure Medium: Fish/Crab
Exposure Point: Sparrows Point
Receptor Population: Recreational User
Receptor Age: Adolescent

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	Intake Equation / Model Name
Ingestion	CS	Chemical Concentration in Fish Tissue/Crab Meat	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	CR	Ingestion Rate	kg/meal	0.17	U.S. EPA 2000, MDE 2014 (1)	CS x CR x EF x ED / (BW x AT)
	EF	Exposure Frequency	meals/yr	16	BPJ (2)	(3)
	ED	Exposure Duration	yr	10	BPJ	
	BW	Body Weight	kg	45	U.S. EPA 2011	
	AT-NC	Averaging time - Noncancer	days	3,650	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	

Note : BPJ = Best Professional Judgement
(1) The weight of cooked fish ingested by an adolescent is 6 ounces/meal or 0.17 kg/meal (wet weight).
(2) It is assumed that the recreational user will fish or catch crabs from the area for 2 days per week during warmer months, June to September (32 day). Fish and crab ingestion are each assumed at 16 meals/yr from the Sparrows Point Area.
(3) Slope Factor for chemicals identified as mutagenic in Table 10-6 are adjusted by a factor of 3.
CDI = chronic daily intake

TABLE 10-4.6
VALUES USED FOR CHILD RECREATIONAL USER DAILY FINFISH/CRAB INTAKE EQUATIONS
PHASE I OF SPARROWS POINT

Scenario Timeframe: Current
Medium: Surface Water/Sediment
Exposure Medium: Fish/Crab
Exposure Point: Sparrows Point
Receptor Population: Recreational User
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	Intake Equation / Model Name
Ingestion	CS	Chemical Concentration in Fish Tissue/Crab Meat	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	CR	Ingestion Rate	kg/meal	0.085	U.S. EPA 2000, MDE 2014 (1)	CS x CR x EF x ED / (BW x AT)
	EF	Exposure Frequency	meals/yr	16	BPJ (2)	(4)
	ED	Exposure Duration	yr	3	BPJ (3)	
	BW	Body Weight	kg	18	U.S. EPA 2011	
	AT-NC	Averaging time - Noncancer	days	1,095	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	

Note : BPJ = Best Professional Judgement
(1) The weight of cooked fish ingested by a child is 3 ounces/meal or 0.085 kg/meal (wet weight).
(2) It is assumed that the recreational user will fish or catch crabs from the area for 2 days per week during warmer months, June to September (32 day). Fish and crab ingestion are each assumed at 16 meals/yr from the Sparrows Point Area.
(3) Age range for child is assumed from 3 to 6 years. It is expected that children younger than 3 years will not eat catch from the Patapsco River.
(4) Slope Factor for chemicals identified as mutagenic in Table 10-6 are adjusted by a factor of 3.
CDI = chronic daily intake

TABLE 10-4.7
VALUES USED FOR WATERMAN DAILY FINFISH/CRAB INTAKE EQUATIONS
PHASE I OF SPARROWS POINT

Scenario Timeframe: Current
Medium: Surface Water/Sediment
Exposure Medium: Fish/Crab
Exposure Point: Sparrows Point
Receptor Population: Waterman
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	Intake Equation / Model Name
Ingestion	CS	Chemical Concentration in Fish Tissue/Crab Meat	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	CR	Ingestion Rate	kg/meal	0.23	U.S. EPA 2000, MDE 2014 (1)	CS x CR x EF x ED / (BW x AT)
	EF	Exposure Frequency	meals/yr	19.5	BPJ (2)	
	ED	Exposure Duration	yr	25	U.S. EPA 1991a	
	BW	Body Weight	kg	80	U.S. EPA 2014	
	AT-NC	Averaging time - Noncancer	days	9,125	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	

Note : BPJ = Best Professional Judgement
(1) The weight of cooked fish ingested by an adult is 8 ounces/meal or 0.23 kg/meal (wet weight).
(2) It is assumed that the waterman ingest fish or catch crabs from the Patapsco River each day they visit the area (39 days). Fish and crab ingestion are each assumed at equal meals/yr (19.5) based upon number of days within the Sparrows Point Area.
CDI = chronic daily intake

TABLE 10-5.1
NON-CANCER TOXICITY DATA - ORAL/DERMAL
PHASE I AREA OF SPARROWS POINT

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value (mg/kg-day)	Oral to Dermal Adjustment Factor (GI ABS) (1)	Adjusted Dermal RfD (2) (mg/kg bw-day)	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (3) (mm/dd/yy)
INORGANICS								
ANTIMONY	Chronic	4.00E-04	0.15	6.00E-05	Blood	1000/1	IRIS	9/10/2015
ARSENIC	Chronic	3.00E-04	1	3.00E-04	Skin	3/1	IRIS	9/10/2015
BERYLLIUM	Chronic	2.00E-03	0.007	2.86E-01	Intestines	300/1	IRIS	9/10/2015
CADMIUM	Chronic	1.00E-03	0.025	2.50E-05	Kidneys	10/1	IRIS	9/10/2015
COBALT	Chronic	3.00E-04	1	3.00E-04	Blood	10/1	PPTRV	7/20/2007
COPPER	Chronic	4.00E-02	1	4.00E-02	Gastrointestinal System	NA/NA	HEAST	1997
MERCURY	Chronic	1.00E-04	1	1.00E-04	Central Nervous System	10/1	IRIS	9/10/2015
NICKEL	Chronic	2.00E-02	1	2.00E-02	Body weight	300/1	IRIS	9/10/2015
SELENIUM	Chronic	5.00E-03	1	5.00E-03	NA	3/1	IRIS	9/10/2015
SILVER	Chronic	5.00E-03	0.04	2.00E-04	Skin	3/1	IRIS	9/10/2015
THALLIUM	Chronic	1.00E-05	1	1.00E-05	Hair	3000/1	PPRTV-X	9/17/2012
ZINC	Chronic	3.00E-01	1	3.00E-01	Blood	3/1	IRIS	9/10/2015
POLYAROMATIC HYDROCARBONS								
BENZO(A)ANTHRACENE	NA	NA	1	NA	NA	NA/NA	IRIS	9/10/2015
BENZO(B)FLUORANTHENE	NA	NA	1	NA	NA	NA/NA	IRIS	9/10/2015
BENZO(K)FLUORANTHENE	NA	NA	1	NA	NA	NA/NA	IRIS	9/10/2015
BENZO(A)PYRENE	NA	NA	1	NA	NA	NA/NA	IRIS	9/10/2015
CHRYSENE	NA	NA	1	NA	NA	NA/NA	IRIS	9/10/2015
DIBENZ(A,H)ANTHRACENE	NA	NA	1	NA	NA	NA/NA	IRIS	9/10/2015
FLUORANTHENE	Chronic	4.00E-02	1	4.00E-02	Liver	3000/1	IRIS	9/10/2015
INDENO(1,2,3-C,D)PYRENE	NA	NA	1	NA	NA	NA/NA	IRIS	9/10/2015
PYRENE	Chronic	3.00E-02	1	3.00E-02	Kidneys	3000/1	IRIS	9/10/2015
POLYCHLORINATED BIPHENYLS								
AROCLOR-1248	NA	NA	1	NA	NA	NA/NA	IRIS	9/10/2015
AROCLOR-1254	Chronic	2.00E-05	1	2.00E-05	Eyes and skin	300/1	IRIS	9/10/2015
AROCLOR-1260	NA	NA	1	NA	NA	NA/NA	IRIS	9/10/2015
TOTAL PCB's	NA	NA	1	NA	NA	NA/NA	IRIS	9/10/2015
SEMIVOLATILE ORGANIC COMPOUNDS								
BIS(2-ETHYLHEXYL)PHTHALATE	Chronic	2.00E-02	1	2.00E-02	Liver	1000/1	IRIS	9/10/2015

(1) Taken from USEPA 2004 Guidance.
(2) Not Applicable
(3) Dermal toxicological values adjusted from oral values using USEPA 2004 recommended chemical-specific gastrointestinal absorption factors (GI ABS). RfDs are multiplied by the GI ABS.
IRIS - Integrated Risk Information System. For IRIS values, the date IRIS was searched is provided.
HEAST - Health Effects Assessment Summary Tables. For HEAST values, the date of HEAST is provided.
PPRTV-X - Provisional Peer-Reviewed Toxicity Value, Screening level. For PPRTV values, the date of the issure paper is provided.

TABLE 10-5.2
CHEMICAL-SPECIFIC PARAMETERS
PHASE I AREA OF SPARROWS POINT

Chemical of Potential Concern	Absorption Factor	Reference	GI ABS	Reference	Permeability Constant (cm/hr)	Reference
INORGANICS						
ANTIMONY	0.01	U.S. EPA, 1995	0.15	U.S. EPA, 2004	1.00E-03	U.S. EPA, 2015
ARSENIC	0.03	U.S. EPA, 2004	1	U.S. EPA, 2004	1.00E-03	U.S. EPA, 2015
BERYLLIUM	0.01	U.S. EPA, 1995	0.007	U.S. EPA, 2004	1.00E-03	U.S. EPA 2004
CADMIUM	0.001	U.S. EPA, 2004	0.025	U.S. EPA, 2004	1.00E-03	U.S. EPA, 2015
COBALT	0.01	U.S. EPA, 1995	1	U.S. EPA, 2004	4.00E-04	U.S. EPA, 2015
COPPER	0.01	U.S. EPA, 1995	1	U.S. EPA, 2004	1.00E-03	U.S. EPA, 2015
MERCURY	0.01	U.S. EPA, 1995	1	U.S. EPA, 2004	1.00E-03	U.S. EPA, 2015
NICKEL	0.01	U.S. EPA, 1995	1	U.S. EPA, 2004	1.00E-03	U.S. EPA, 2015
SELENIUM	0.01	U.S. EPA, 1995	1	U.S. EPA, 2004	9.03E-04	U.S. EPA, 2015
THALLIUM	0.01	U.S. EPA, 1995	1	U.S. EPA, 2004	1.00E-03	U.S. EPA, 2015
ZINC	0.01	U.S. EPA, 1995	1	U.S. EPA, 2004	6.00E-04	U.S. EPA, 2015
POLYAROMATIC HYDROCARBONS						
BENZ(A)ANTHRACENE	0.13	U.S. EPA, 2004	1	U.S. EPA, 2004	NA	U.S. EPA, 2015
BENZO(B)FLUORANTHENE	0.13	U.S. EPA, 2004	1	U.S. EPA, 2004	NA	U.S. EPA, 2015
BENZO(K)FLUORANTHENE	0.13	U.S. EPA, 2004	1	U.S. EPA, 2004	NA	U.S. EPA, 2015
BENZO(A)PYRENE	0.13	U.S. EPA, 2004	1	U.S. EPA, 2004	NA	U.S. EPA, 2015
CHRYSENE	0.13	U.S. EPA, 2004	1	U.S. EPA, 2004	NA	U.S. EPA, 2015
DIBENZ(A,H)ANTHRACENE	0.13	U.S. EPA, 2004	1	U.S. EPA, 2004	NA	U.S. EPA, 2015
FLUORANTHENE	0.13	U.S. EPA, 2004	1	U.S. EPA, 2004	3.10E-01	U.S. EPA, 2015
INDENO(1,2,3-C,D)PYRENE	0.13	U.S. EPA, 2004	1	U.S. EPA, 2004	NA	U.S. EPA, 2015
PYRENE	0.13	U.S. EPA, 2004	1	U.S. EPA, 2004	2.01E-01	U.S. EPA, 2015
POLYCHLORINATED BIPHENYLS						
AROCLOR-1248	0.14	U.S. EPA, 2004	1	U.S. EPA, 2004	4.80E-01	U.S. EPA, 2015
AROCLOR-1254	0.14	U.S. EPA, 2004	1	U.S. EPA, 2004	7.50E-01	U.S. EPA, 2015
AROCLOR-1260	0.14	U.S. EPA, 2004	1	U.S. EPA, 2004	9.86E-01	U.S. EPA, 2015
TOTAL PCB's	0.14	U.S. EPA, 2004	1	U.S. EPA, 2004	5.50E-01	U.S. EPA, 2015
SEMIVOLATILE ORGANIC COMPOUNDS						
BIS(2-ETHYLHEXYL)PHTHALATE	0.1	U.S. EPA, 2004	1	U.S. EPA, 2004	1.10E+00	U.S. EPA, 2015

NA = Data not available.
GI ABS = Gastrointestional Absorption factors

U.S. EPA, 1995 = U.S. Environmental Protection Agency, 1995. *Assessing Dermal Exposure From Soil* . Region 3, Office of Superfund Programs. EPA/903-K-95-003. December.
U.S. EPA, 2004 = U.S. Environmental Protection Agency, 2004. *Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment).* Final Guidance.
U.S. EPA, 2015 = U.S. Environmental Protection Agency, 2015. *Regional Screening Levels (RSLs) Chemical-Specific Parameters Supporting Table* . November 2015. Available at: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm.

TABLE 10-6.1
CANCER TOXICITY DATA - ORAL/DERMAL
PHASE I AREA OF SPARROWS POINT

Chemical of Potential Concern	Oral Cancer Slope Factor	Oral Absorption Efficiency for Dermal (GI ABS)[1]	Absorbed Cancer Slope Factor for Dermal [2]	Units	Weight of Evidence/Cancer Guideline Description	Mutagenic Compound	Source	Date [3] (mm/dd/yy)
INORGANICS								
ANTIMONY	NA	0.15	NA	per (mg/kg-day)	NA		IRIS	9/10/2015
ARSENIC	1.5E+00	1	1.5E+00	per (mg/kg-day)	A		IRIS	9/10/2015
BERYLLIUM	NA	0.007	NA	per (mg/kg-day)	B1		IRIS	9/10/2015
CADMIUM	NA	0.025	NA	per (mg/kg-day)	NA		IRIS	9/10/2015
COBALT	NA	1	NA	per (mg/kg-day)	NA		PPTRV	9/10/2015
COPPER	NA	1	NA	per (mg/kg-day)	D		IRIS	9/10/2015
MERCURY	NA	1	NA	per (mg/kg-day)	C		IRIS	9/10/2015
NICKEL	NA	1	NA	per (mg/kg-day)	NA		IRIS	9/10/2015
SELENIUM	NA	1	NA	per (mg/kg-day)	D		IRIS	9/10/2015
THALLIUM	NA	1	NA	per (mg/kg-day)	NA		IRIS	9/10/2015
ZINC	NA	1	NA	per (mg/kg-day)	D		IRIS	9/10/2015
POLYAROMATIC HYDROCARBONS								
BENZ(A)ANTHRACENE	7.3E-01	1	7.3E-01	per (mg/kg-day)	B2	M	IRIS	9/10/2015
BENZO(B)FLUORANTHENE	7.3E-01	1	7.3E-01	per (mg/kg-day)	B2	M	IRIS	9/10/2015
BENZO(K)FLUORANTHENE	7.3E-02	1	7.3E-02	per (mg/kg-day)	B2	M	IRIS	9/10/2015
BENZO(A)PYRENE	7.3E+00	1	7.3E+00	per (mg/kg-day)	B2	M	IRIS	9/10/2015
CHRYSENE	7.3E-03	1	7.3E-03	per (mg/kg-day)	B2	M	IRIS	9/10/2015
DIBENZ(A,H)ANTHRACENE	7.3E+00	1	7.3E+00	per (mg/kg-day)	B2	M	IRIS	9/10/2015
FLUORANTHENE	NA	1	NA	per (mg/kg-day)	D		IRIS	9/10/2015
INDENO(1,2,3-C,D)PYRENE	7.3E-01	1	7.3E-01	per (mg/kg-day)	B2	M	IRIS	9/10/2015
PYRENE	NA	1	NA	per (mg/kg-day)	D		IRIS	9/10/2015
POLYCHLORINATED BIPHENYLS								
AROCLOR-1248	2.0E+00	1	2.0E+00	per (mg/kg-day)	B2		IRIS	9/10/2015
AROCLOR-1254	2.0E+00	1	2.0E+00	per (mg/kg-day)	B2		IRIS	9/10/2015
AROCLOR-1260	2.0E+00	1	2.0E+00	per (mg/kg-day)	B2		IRIS	9/10/2015
TOTAL PCB's	1.3E+05	1	1.3E+05	per (mg/kg-day)	NA		IRIS	9/10/2015
SEMIVOLATILE ORGANIC COMPOUNDS								
BIS(2-ETHYLHEXYL)PHTHALATE	1.4E-02	1	1.4E-02	per (mg/kg-day)	B2		IRIS	9/10/2015

NA = Not Applicable
M = Mutagenic
(1) Taken from USEPA 2004 Guidance.
(2) Dermal Toxicological values adjusted from oral values using USEPA 2004 recommended chemical-specific gastrointestinal absorption factors (GI ABS). CSFs are divided by the GI ABS.
(3) IRIS - Integrated Risk Information System. For IRIS values, the date IRIS was searched is provided.

Weight of Evidence: A - Human carcinogen
B1 - Probable human carcinogen - indicate that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

TABLE 10-7.1
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SPARROWS POINT NORTHEAST/NEAR-SHORE - FIELD COLLECTED TISSUE EVALUATION

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake*		CSF		Cancer Risk	Intake*		RfD		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Sediment	Sediment	Crabs	Ingestion	**INORGANICS**												
				CADMIUM	1.58E-01	(mg/kg)	5.70E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	1.99E-05	(mg/kg-day)	1.00E-03	(mg/kg-day)	2.0E-02
				COPPER	1.25E+01	(mg/kg)	4.49E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	1.57E-03	(mg/kg-day)	4.00E-02	(mg/kg-day)	3.9E-02
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)ANTHRACENE	2.57E-02	(mg/kg)	9.25E-07	(mg/kg-day)	7.30E-01	per (mg/kg-day)	6.8E-07	3.24E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(B)FLUORANTHENE	3.15E-02	(mg/kg)	1.13E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	8.3E-07	3.96E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(A)PYRENE	1.58E-02	(mg/kg)	5.70E-07	(mg/kg-day)	7.30E+00	per (mg/kg-day)	4.2E-06	2.00E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				SEMIVOLATILE ORGANIC COMPOUNDS												
				BIS(2-ETHYLHEXYL)PHTHALATE	2.18E+00	(mg/kg)	1.96E-05	(mg/kg-day)	1.40E-02	per (mg/kg-day)	2.7E-07	6.87E-05	(mg/kg-day)	2.00E-02	(mg/kg-day)	3.4E-03
			Exp. Route Total								**6.5E-06**					**6.3E-02**
		Exposure Point Total									**6.5E-06**					**6.3E-02**
	Exposure Medium Total										**6.5E-06**					**6.3E-02**
Sediment Total											**6.5E-06**					**6.3E-02**
Surface Water	Surface Water	Finfish	Ingestion	**INORGANICS**												
				MERCURY	5.60E-02	(mg/kg)	2.02E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	7.06E-06	(mg/kg-day)	1.00E-04	(mg/kg-day)	7.1E-02
			Exp. Route Total								**0.0E+00**					**7.1E-02**
		Exposure Point Total									**0.0E+00**					**7.1E-02**
	Exposure Medium Total										**0.0E+00**					**7.1E-02**
Surface Water Total											**0.0E+00**					**7.1E-02**
										Total of Receptor Risks Across All Media	**6.5E-06**				Total of Receptor Hazards Across All Media	**1.3E-01**

Note:
*Intakes for crab for modeled bis(2-ethylhexyl)phthalate are adjusted by 0.25 to account for wet weight as evaluated in the intake calculations.

EPC = Exposure Point Concentration
CSF = Cancer Slope Factor
RfD = Reference Dose

TABLE 10-7.2
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SPARROWS POINT NORTHEAST/NEAR-SHORE - FIELD COLLECTED TISSUE EVALUATION

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake*		CSF		Cancer Risk	Intake*		RfD		Hazard Quotient
					Value	Units	Value	Units	Value	Units		Value	Units	Value	Units	
Sediment	Sediment	Crabs	Ingestion	**INORGANICS**												
				CADMIUM	1.58E-01	(mg/kg)	3.74E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	2.62E-05	(mg/kg-day)	1.00E-03	(mg/kg-day)	2.6E-02
				COPPER	1.25E+01	(mg/kg)	2.95E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	2.07E-03	(mg/kg-day)	4.00E-02	(mg/kg-day)	5.2E-02
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)ANTHRACENE	2.57E-02	(mg/kg)	1.82E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	1.3E-06	4.25E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(B)FLUORANTHENE	3.15E-02	(mg/kg)	2.23E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	1.6E-06	5.21E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(A)PYRENE	1.58E-02	(mg/kg)	1.12E-06	(mg/kg-day)	7.30E+00	per (mg/kg-day)	8.2E-06	2.62E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				SEMIVOLATILE ORGANIC COMPOUNDS												
				BIS(2-ETHYLHEXYL)PHTHALATE	2.18E+00	(mg/kg)	1.29E-05	(mg/kg-day)	1.40E-02	per (mg/kg-day)	1.8E-07	9.03E-05	(mg/kg-day)	2.00E-02	(mg/kg-day)	4.5E-03
			Exp. Route Total								**1.3E-05**					**8.2E-02**
		Exposure Point Total									**1.3E-05**					**8.2E-02**
	Exposure Medium Total										**1.3E-05**					**8.2E-02**
Sediment Total											**1.3E-05**					**8.2E-02**
Surface Water	Surface Water	Finfish	Ingestion	**INORGANICS**												
				MERCURY	5.60E-02	(mg/kg)	1.32E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	9.27E-06	(mg/kg-day)	1.00E-04	(mg/kg-day)	9.3E-02
			Exp. Route Total								**0.0E+00**					**9.3E-02**
		Exposure Point Total									**0.0E+00**					**9.3E-02**
	Exposure Medium Total										**0.0E+00**					**9.3E-02**
Surface Water Total											**0.0E+00**					**9.3E-02**
										Total of Receptor Risks Across All Media	**1.3E-05**				Total of Receptor Hazards Across All Media	**1.8E-01**

Note:
*Intakes for crab for modeled bis(2-ethylhexyl)phthalate are adjusted by 0.25 to account for wet weight as evaluated in the intake calculations.
EPC = Exposure Point Concentration
CSF = Cancer Slope Factor
RfD = Reference Dose

TABLE 10-7.3
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SPARROWS POINT NORTHEAST/NEAR-SHORE - FIELD COLLECTED TISSUE EVALUATION

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake*		CSF		Cancer Risk	Intake*		RfD		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Sediment	Sediment	Crabs	Ingestion	**INORGANICS**												
				CADMIUM	1.58E-01	(mg/kg)	1.40E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	3.28E-05	(mg/kg-day)	1.00E-03	(mg/kg-day)	3.3E-02
				COPPER	1.25E+01	(mg/kg)	1.11E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	2.58E-03	(mg/kg-day)	4.00E-02	(mg/kg-day)	6.5E-02
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)ANTHRACENE	2.57E-02	(mg/kg)	6.84E-07	(mg/kg-day)	7.30E-01	per (mg/kg-day)	5.0E-07	5.32E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(B)FLUORANTHENE	3.15E-02	(mg/kg)	8.37E-07	(mg/kg-day)	7.30E-01	per (mg/kg-day)	6.1E-07	6.51E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(A)PYRENE	1.58E-02	(mg/kg)	4.21E-07	(mg/kg-day)	7.30E+00	per (mg/kg-day)	3.1E-06	3.28E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				SEMIVOLATILE ORGANIC COMPOUNDS												
				BIS(2-ETHYLHEXYL)PHTHALATE	2.18E+00	(mg/kg)	4.83E-06	(mg/kg-day)	1.40E-02	per (mg/kg-day)	6.8E-08	1.13E-04	(mg/kg-day)	2.00E-02	(mg/kg-day)	5.6E-03
			Exp. Route Total								**5.0E-06**					**1.0E-01**
		Exposure Point Total									**5.0E-06**					**1.0E-01**
	Exposure Medium Total										**5.0E-06**					**1.0E-01**
Sediment Total											**5.0E-06**					**1.0E-01**
Surface Water	Surface Water	Finfish	Ingestion	**INORGANICS**												
				MERCURY	5.60E-02	(mg/kg)	4.97E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	1.16E-05	(mg/kg-day)	1.00E-04	(mg/kg-day)	1.2E-01
			Exp. Route Total								**0.0E+00**					**1.2E-01**
		Exposure Point Total									**0.0E+00**					**1.2E-01**
	Exposure Medium Total										**0.0E+00**					**1.2E-01**
Surface Water Total											**0.0E+00**					**1.2E-01**
										Total of Receptor Risks Across All Media	**5.0E-06**				Total of Receptor Hazards Across All Media	**2.2E-01**

Note:
*Intakes for crab for modeled bis(2-ethylhexyl)phthalate are adjusted by 0.25 to account for wet weight as evaluated in the intake calculations.
EPC = Exposure Point Concentration
CSF = Cancer Slope Factor
RfD = Reference Dose

TABLE 10-7.4
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SPARROWS POINT NORTHEAST/NEAR-SHORE - FIELD COLLECTED TISSUE EVALUATION

Scenario Timeframe: Current
Receptor Population: Waterman
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake*		CSF		Cancer Risk	Intake*		RfD		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Sediment	Sediment	Crabs	Ingestion	**INORGANICS**												
				CADMIUM	1.58E-01	(mg/kg)	8.68E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	2.43E-05	(mg/kg-day)	1.00E-03	(mg/kg-day)	2.4E-02
				COPPER	1.25E+01	(mg/kg)	6.85E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	1.92E-03	(mg/kg-day)	4.00E-02	(mg/kg-day)	4.8E-02
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)ANTHRACENE	2.57E-02	(mg/kg)	1.41E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	1.0E-06	3.95E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(B)FLUORANTHENE	3.15E-02	(mg/kg)	1.73E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	1.3E-06	4.83E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(A)PYRENE	1.58E-02	(mg/kg)	8.69E-07	(mg/kg-day)	7.30E+00	per (mg/kg-day)	6.3E-06	2.43E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				SEMIVOLATILE ORGANIC COMPOUNDS												
				BIS(2-ETHYLHEXYL)PHTHALATE	2.18E+00	(mg/kg)	2.99E-05	(mg/kg-day)	1.40E-02	per (mg/kg-day)	4.2E-07	8.37E-05	(mg/kg-day)	2.00E-02	(mg/kg-day)	4.2E-03
			Exp. Route Total								**9.9E-06**					**7.6E-02**
		Exposure Point Total									**9.9E-06**					**7.6E-02**
	Exposure Medium Total										**9.9E-06**					**7.6E-02**
Sediment Total											**9.9E-06**					**7.6E-02**
Surface Water	Surface Water	Finfish	Ingestion	**INORGANICS**												
				MERCURY	5.60E-02	(mg/kg)	3.07E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	8.60E-06	(mg/kg-day)	1.00E-04	(mg/kg-day)	8.6E-02
			Exp. Route Total								**0.0E+00**					**8.6E-02**
		Exposure Point Total									**0.0E+00**					**8.6E-02**
	Exposure Medium Total										**0.0E+00**					**8.6E-02**
Surface Water Total											**0.0E+00**					**8.6E-02**
										Total of Receptor Risks Across All Media	**9.9E-06**				Total of Receptor Hazards Across All Media	**1.6E-01**

Note:
*Intakes for crab for modeled bis(2-ethylhexyl)phthalate are adjusted by 0.25 to account for wet weight as evaluated in the intake calculations.
EPC = Exposure Point Concentration
CSF = Cancer Slope Factor
RfD = Reference Dose

TABLE 10-7.5
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SPARROWS POINT NORTHEAST/NEAR-SHORE - UPTAKE EVALUATION

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake*		CSF		Cancer Risk	Intake*		RfD		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Sediment	Sediment	Crabs	Ingestion	**INORGANICS**												
				ZINC	1.01E+02	(mg/kg)	9.11E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	3.19E-03	(mg/kg-day)	3.00E-01	(mg/kg-day)	1.1E-02
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)ANTHRACENE	1.91E-01	(mg/kg)	1.72E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	1.3E-06	6.02E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(B)FLUORANTHENE	7.01E-02	(mg/kg)	6.31E-07	(mg/kg-day)	7.30E-01	per (mg/kg-day)	4.6E-07	2.21E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(A)PYRENE	1.17E-01	(mg/kg)	1.05E-06	(mg/kg-day)	7.30E+00	per (mg/kg-day)	7.7E-06	3.69E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				DIBENZ(A,H)ANTHRACENE	3.20E-02	(mg/kg)	2.88E-07	(mg/kg-day)	7.30E+00	per (mg/kg-day)	2.1E-06	1.01E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				INDENO(1,2,3-C,D)PYRENE	7.02E-02	(mg/kg)	6.32E-07	(mg/kg-day)	7.30E-01	per (mg/kg-day)	4.6E-07	2.21E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				SEMIVOLATILE ORGANIC COMPOUNDS												
				BIS(2-ETHYLHEXYL)PHTHALATE	2.18E+00	(mg/kg)	1.96E-05	(mg/kg-day)	1.40E-02	per (mg/kg-day)	2.7E-07	6.87E-05	(mg/kg-day)	2.00E-02	(mg/kg-day)	3.4E-03
			Exp. Route Total								**1.2E-05**					**1.4E-02**
		Exposure Point Total									**1.2E-05**					**1.4E-02**
	Exposure Medium Total										**1.2E-05**					**1.4E-02**
Sediment Total											**1.2E-05**					**1.4E-02**
Surface Water	Surface Water	Finfish	Ingestion	**INORGANICS**												
				MERCURY	1.11E+00	(mg/kg)	9.99E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	3.50E-05	(mg/kg-day)	1.00E-04	(mg/kg-day)	3.5E-01
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)PYRENE	2.37E-01	(mg/kg)	2.13E-06	(mg/kg-day)	7.30E+00	per (mg/kg-day)	1.6E-05	7.46E-06	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**1.6E-05**					**3.5E-01**
		Exposure Point Total									**1.6E-05**					**3.5E-01**
	Exposure Medium Total										**1.6E-05**					**3.5E-01**
Surface Water Total											**1.6E-05**					**3.5E-01**
										Total of Receptor Risks Across All Media	**2.8E-05**				Total of Receptor Hazards Across All Media	**3.6E-01**

Note:
*Intakes for modeled fish and crab concentrations are adjusted by 0.25 to account for wet weight as evaluated in the intake calculations.

EPC = Exposure Point Concentration
CSF = Cancer Slope Factor
RfD = Reference Dose

TABLE 10-7.6
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SPARROWS POINT NORTHEAST/NEAR-SHORE - UPTAKE EVALUATION

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake*		CSF		Cancer Risk	Intake*		RfD		Hazard Quotient
					Value	Units	Value	Units	Value	Units		Value	Units	Value	Units	
Sediment	Sediment	Crabs	Ingestion	**INORGANICS**												
				ZINC	1.01E+02	(mg/kg)	5.99E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	4.19E-03	(mg/kg-day)	3.00E-01	(mg/kg-day)	1.4E-02
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)ANTHRACENE	1.91E-01	(mg/kg)	3.39E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	2.5E-06	7.91E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(B)FLUORANTHENE	7.01E-02	(mg/kg)	1.24E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	9.1E-07	2.90E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(A)PYRENE	1.17E-01	(mg/kg)	2.08E-06	(mg/kg-day)	7.30E+00	per (mg/kg-day)	1.5E-05	4.84E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				DIBENZ(A,H)ANTHRACENE	3.20E-02	(mg/kg)	5.68E-07	(mg/kg-day)	7.30E+00	per (mg/kg-day)	4.1E-06	1.32E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				INDENO(1,2,3-C,D)PYRENE	7.02E-02	(mg/kg)	1.25E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	9.1E-07	2.91E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				SEMIVOLATILE ORGANIC COMPOUNDS												
				BIS(2-ETHYLHEXYL)PHTHALATE	2.18E+00	(mg/kg)	1.29E-05	(mg/kg-day)	1.40E-02	per (mg/kg-day)	1.8E-07	9.03E-05	(mg/kg-day)	2.00E-02	(mg/kg-day)	4.5E-03
			Exp. Route Total								**2.4E-05**					**1.8E-02**
		Exposure Point Total									**2.4E-05**					**1.8E-02**
	Exposure Medium Total										**2.4E-05**					**1.8E-02**
Sediment Total											**2.4E-05**					**1.8E-02**
Surface Water	Surface Water	Finfish	Ingestion	**INORGANICS**												
				MERCURY	1.11E+00	(mg/kg)	6.56E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	4.60E-05	(mg/kg-day)	1.00E-04	(mg/kg-day)	4.6E-01
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)PYRENE	2.37E-01	(mg/kg)	4.20E-06	(mg/kg-day)	7.30E+00	per (mg/kg-day)	3.1E-05	9.80E-06	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**3.1E-05**					**4.6E-01**
		Exposure Point Total									**3.1E-05**					**4.6E-01**
	Exposure Medium Total										**3.1E-05**					**4.6E-01**
Surface Water Total											**3.1E-05**					**4.6E-01**
										Total of Receptor Risks Across All Media	**5.4E-05**				Total of Receptor Hazards Across All Media	**4.8E-01**

Note:
*Intakes for modeled fish and crab concentrations are adjusted by 0.25 to account for wet weight as evaluated in the intake calculations.
EPC = Exposure Point Concentration
CSF = Cancer Slope Factor
RfD = Reference Dose

TABLE 10-7.7
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SPARROWS POINT NORTHEAST/NEAR-SHORE - UPTAKE EVALUATION

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake*		CSF		Cancer Risk	Intake*		RfD		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Sediment	Sediment	Crabs	Ingestion	**INORGANICS**												
				ZINC	1.01E+02	(mg/kg)	2.24E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	5.24E-03	(mg/kg-day)	3.00E-01	(mg/kg-day)	1.7E-02
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)ANTHRACENE	1.91E-01	(mg/kg)	1.27E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	9.3E-07	9.88E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(B)FLUORANTHENE	7.01E-02	(mg/kg)	4.66E-07	(mg/kg-day)	7.30E-01	per (mg/kg-day)	3.4E-07	3.63E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(A)PYRENE	1.17E-01	(mg/kg)	7.78E-07	(mg/kg-day)	7.30E+00	per (mg/kg-day)	5.7E-06	6.05E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				DIBENZ(A,H)ANTHRACENE	3.20E-02	(mg/kg)	2.13E-07	(mg/kg-day)	7.30E+00	per (mg/kg-day)	1.6E-06	1.66E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				INDENO(1,2,3-C,D)PYRENE	7.02E-02	(mg/kg)	4.67E-07	(mg/kg-day)	7.30E-01	per (mg/kg-day)	3.4E-07	3.63E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				SEMIVOLATILE ORGANIC COMPOUNDS												
				BIS(2-ETHYLHEXYL)PHTHALATE	2.18E+00	(mg/kg)	4.83E-06	(mg/kg-day)	1.40E-02	per (mg/kg-day)	6.8E-08	1.13E-04	(mg/kg-day)	2.00E-02	(mg/kg-day)	5.6E-03
			Exp. Route Total								**8.9E-06**					**2.3E-02**
		Exposure Point Total									**8.9E-06**					**2.3E-02**
	Exposure Medium Total										**8.9E-06**					**2.3E-02**
Sediment Total											**8.9E-06**					**2.3E-02**
Surface Water	Surface Water	Finfish	Ingestion	**INORGANICS**												
				MERCURY	1.11E+00	(mg/kg)	2.46E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	5.74E-05	(mg/kg-day)	1.00E-04	(mg/kg-day)	5.7E-01
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)PYRENE	2.37E-01	(mg/kg)	1.58E-06	(mg/kg-day)	7.30E+00	per (mg/kg-day)	1.1E-05	1.23E-05	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**1.1E-05**					**5.7E-01**
		Exposure Point Total									**1.1E-05**					**5.7E-01**
	Exposure Medium Total										**1.1E-05**					**5.7E-01**
Surface Water Total											**1.1E-05**					**5.7E-01**
										Total of Receptor Risks Across All Media	**2.0E-05**				Total of Receptor Hazards Across All Media	**6.0E-01**

Note:
*Intakes for modeled fish and crab concentrations are adjusted by 0.25 to account for wet weight as evaluated in the intake calculations.
EPC = Exposure Point Concentration
CSF = Cancer Slope Factor
RfD = Reference Dose

TABLE 10-7.8
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SPARROWS POINT NORTHEAST/NEAR-SHORE - UPTAKE EVALUATION

Scenario Timeframe: Current
Receptor Population: Waterman
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake*		CSF		Cancer Risk	Intake*		RfD		Hazard Quotient
					Value	Units	Value	Units	Value	Units		Value	Units	Value	Units	
Sediment	Sediment	Crabs	Ingestion	**INORGANICS**												
				ZINC	1.01E+02	(mg/kg)	1.39E-03	(mg/kg-day)	NA	per (mg/kg-day)	--	3.89E-03	(mg/kg-day)	3.00E-01	(mg/kg-day)	1.3E-02
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)ANTHRACENE	1.91E-01	(mg/kg)	2.62E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	1.9E-06	7.33E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(B)FLUORANTHENE	7.01E-02	(mg/kg)	9.61E-07	(mg/kg-day)	7.30E-01	per (mg/kg-day)	7.0E-07	2.69E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(A)PYRENE	1.17E-01	(mg/kg)	1.60E-06	(mg/kg-day)	7.30E+00	per (mg/kg-day)	1.2E-05	4.49E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				DIBENZ(A,H)ANTHRACENE	3.20E-02	(mg/kg)	4.39E-07	(mg/kg-day)	7.30E+00	per (mg/kg-day)	3.2E-06	1.23E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				INDENO(1,2,3-C,D)PYRENE	7.02E-02	(mg/kg)	9.63E-07	(mg/kg-day)	7.30E-01	per (mg/kg-day)	7.0E-07	2.70E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				SEMIVOLATILE ORGANIC COMPOUNDS												
				BIS(2-ETHYLHEXYL)PHTHALATE	2.18E+00	(mg/kg)	2.99E-05	(mg/kg-day)	1.40E-02	per (mg/kg-day)	4.2E-07	8.37E-05	(mg/kg-day)	2.00E-02	(mg/kg-day)	4.2E-03
			Exp. Route Total								**1.9E-05**					**1.7E-02**
		Exposure Point Total									**1.9E-05**					**1.7E-02**
	Exposure Medium Total										**1.9E-05**					**1.7E-02**
Sediment Total											**1.9E-05**					**1.7E-02**
Surface Water	Surface Water	Finfish	Ingestion	**INORGANICS**												
				MERCURY	1.11E+00	(mg/kg)	1.52E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	4.26E-05	(mg/kg-day)	1.00E-04	(mg/kg-day)	4.3E-01
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)PYRENE	2.37E-01	(mg/kg)	3.25E-06	(mg/kg-day)	7.30E+00	per (mg/kg-day)	2.4E-05	9.09E-06	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**2.4E-05**					**4.3E-01**
		Exposure Point Total									**2.4E-05**					**4.3E-01**
	Exposure Medium Total										**2.4E-05**					**4.3E-01**
Surface Water Total											**2.4E-05**					**4.3E-01**
										Total of Receptor Risks Across All Medi	**4.2E-05**				Total of Receptor Hazards Across All Medi	**4.4E-01**

Note:
*Intakes for modeled fish and crab concentrations are adjusted by 0.25 to account for wet weight as evaluated in the intake calculations.
EPC = Exposure Point Concentration
CSF = Cancer Slope Factor
RfD = Reference Dose

TABLE 10-7.9
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - FIELD COLLECTED TISSUE EVALUATION

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC*		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake*		CSF		Cancer Risk	Intake*		RfD		Hazard Quotient
					Value	Units	Value	Units	Value	Units		Value	Units	Value	Units	
Sediment	Sediment	Sparrows Point	Dermal	**INORGANICS**												
				ARSENIC	6.01E+01	(mg/kg)	2.02E-08	(mg/kg-day)	1.50E+00	per (mg/kg-day)	3.0E-08	7.07E-08	(mg/kg-day)	3.00E-04	(mg/kg-day)	2.4E-04
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)PYRENE	2.32E+00	(mg/kg)	3.38E-09	(mg/kg-day)	7.30E+00	per (mg/kg-day)	2.5E-08	1.18E-08	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**5.5E-08**					**2.4E-04**
		Exposure Point Total									**5.5E-08**					**2.4E-04**
		Crabs	Ingestion	**INORGANICS**												
				ARSENIC	1.29E-01	(mg/kg)	4.64E-06	(mg/kg-day)	1.50E+00	per (mg/kg-day)	7.0E-06	1.63E-05	(mg/kg-day)	3.00E-04	(mg/kg-day)	5.4E-02
				CADMIUM	1.58E-01	(mg/kg)	5.69E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	1.99E-05	(mg/kg-day)	1.00E-03	(mg/kg-day)	2.0E-02
				COBALT	1.38E-01	(mg/kg)	4.97E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	1.74E-05	(mg/kg-day)	3.00E-04	(mg/kg-day)	5.8E-02
				COPPER	1.25E+01	(mg/kg)	4.50E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	1.58E-03	(mg/kg-day)	4.00E-02	(mg/kg-day)	3.9E-02
				SELENIUM	1.07E+00	(mg/kg)	3.85E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	1.35E-04	(mg/kg-day)	5.00E-03	(mg/kg-day)	2.7E-02
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)ANTHRACENE	2.57E-02	(mg/kg)	9.25E-07	(mg/kg-day)	7.30E-01	per (mg/kg-day)	6.8E-07	3.24E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(B)FLUORANTHENE	3.15E-02	(mg/kg)	1.13E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	8.3E-07	3.97E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(A)PYRENE	1.58E-02	(mg/kg)	5.69E-07	(mg/kg-day)	7.30E+00	per (mg/kg-day)	4.2E-06	1.99E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				POLYCHLORINATED BIPHENYLS												
				TOTAL PCB's	2.10E-01	(mg/kg)	7.56E-06	(mg/kg-day)	2.00E+00	per (mg/kg-day)	1.5E-05	2.65E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				SEMIVOLATILE ORGANIC COMPOUNDS												
				BIS(2-ETHYLHEXYL)PHTHALATE	7.38E+01	(mg/kg)	6.64E-04	(mg/kg-day)	1.40E-02	per (mg/kg-day)	9.3E-06	2.33E-03	(mg/kg-day)	2.00E-02	(mg/kg-day)	1.2E-01
			Exp. Route Total								**3.7E-05**					**3.1E-01**
		Exposure Point Total									**3.7E-05**					**3.1E-01**
	Exposure Medium Total										**3.7E-05**					**3.1E-01**
Sediment Total											**3.7E-05**					**3.1E-01**
Surface Water	Surface Water	Finfish	Ingestion	**INORGANICS**												
				ARSENIC	4.99E-02	(mg/kg)	1.80E-06	(mg/kg-day)	1.50E+00	per (mg/kg-day)	2.7E-06	6.29E-06	(mg/kg-day)	3.00E-04	(mg/kg-day)	2.1E-02
				MERCURY	5.60E-02	(mg/kg)	2.02E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	7.06E-06	(mg/kg-day)	1.00E-04	(mg/kg-day)	7.1E-02
				SELENIUM	9.70E-01	(mg/kg)	3.49E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	1.22E-04	(mg/kg-day)	5.00E-03	(mg/kg-day)	2.4E-02
				POLYCHLORINATED BIPHENYLS												
				TOTAL PCB's	2.12E-01	(mg/kg)	7.63E-06	(mg/kg-day)	2.00E+00	per (mg/kg-day)	1.5E-05	2.67E-05	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**1.8E-05**					**1.2E-01**
		Exposure Point Total									**1.8E-05**					**1.2E-01**
	Exposure Medium Total										**1.8E-05**					**1.2E-01**
Surface Water Total											**1.8E-05**					**1.2E-01**
										Total of Receptor Risks Across All Media	**5.5E-05**			Total of Receptor Hazards Across All Media		**4.3E-01**

Note:
Arsenic in crab and finfish is adjusted by 0.104 (10.4%) to account for the upper bound of expected inorganic arsenic in fish and crab.
*Intakes for modeled crab concentrations for bis(2-ethylhexyl)phthalate are adjusted by 0.25 to account for wet weight as evaluated in the intake calculations.
EPC = Exposure Point Concentration
CSF = Cancer Slope Factor
RfD = Reference Dose

TABLE 10-7.10
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - FIELD COLLECTED TISSUE EVALUATION

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC*		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake*		CSF		Cancer Risk	Intake*		RfD		Hazard Quotient
					Value	Units	Value	Units	Value	Units		Value	Units	Value	Units	
Sediment	Sediment	Sparrows Point	Dermal	**INORGANICS**												
				ARSENIC	6.01E+01	(mg/kg)	3.61E-08	(mg/kg-day)	1.50E+00	per (mg/kg-day)	5.4E-08	2.53E-07	(mg/kg-day)	3.00E-04	(mg/kg-day)	8.4E-04
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)PYRENE	2.32E+00	(mg/kg)	1.81E-08	(mg/kg-day)	7.30E+00	per (mg/kg-day)	1.3E-07	4.23E-08	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**1.9E-07**					**8.4E-04**
		Exposure Point Total									**1.9E-07**					**8.4E-04**
		Crabs	Ingestion	**INORGANICS**												
				ARSENIC	1.29E-01	(mg/kg)	3.05E-06	(mg/kg-day)	1.50E+00	per (mg/kg-day)	4.6E-06	2.14E-05	(mg/kg-day)	3.00E-04	(mg/kg-day)	7.1E-02
				CADMIUM	1.58E-01	(mg/kg)	3.74E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	2.62E-05	(mg/kg-day)	1.00E-03	(mg/kg-day)	2.6E-02
				COBALT	1.38E-01	(mg/kg)	3.26E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	2.29E-05	(mg/kg-day)	3.00E-04	(mg/kg-day)	7.6E-02
				COPPER	1.25E+01	(mg/kg)	2.96E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	2.07E-03	(mg/kg-day)	4.00E-02	(mg/kg-day)	5.2E-02
				SELENIUM	1.07E+00	(mg/kg)	2.53E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	1.77E-04	(mg/kg-day)	5.00E-03	(mg/kg-day)	3.5E-02
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)ANTHRACENE	2.57E-02	(mg/kg)	1.82E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	1.3E-06	4.26E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(B)FLUORANTHENE	3.15E-02	(mg/kg)	2.24E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	1.6E-06	5.22E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(A)PYRENE	1.58E-02	(mg/kg)	1.12E-06	(mg/kg-day)	7.30E+00	per (mg/kg-day)	8.2E-06	2.62E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				POLYCHLORINATED BIPHENYLS												
				TOTAL PCB's	2.10E-01	(mg/kg)	4.97E-06	(mg/kg-day)	2.00E+00	per (mg/kg-day)	9.9E-06	3.48E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				SEMIVOLATILE ORGANIC COMPOUNDS												
				BIS(2-ETHYLHEXYL)PHTHALATE	7.38E+01	(mg/kg)	4.36E-04	(mg/kg-day)	1.40E-02	per (mg/kg-day)	6.1E-06	3.06E-03	(mg/kg-day)	2.00E-02	(mg/kg-day)	1.5E-01
			Exp. Route Total								**3.2E-05**					**4.1E-01**
		Exposure Point Total									**3.2E-05**					**4.1E-01**
	Exposure Medium Total										**3.2E-05**					**4.1E-01**
Sediment Total											**3.2E-05**					**4.1E-01**
Surface Water	Surface Water	Finfish	Ingestion	**INORGANICS**												
				ARSENIC	4.99E-02	(mg/kg)	1.18E-06	(mg/kg-day)	1.50E+00	per (mg/kg-day)	1.8E-06	8.27E-06	(mg/kg-day)	3.00E-04	(mg/kg-day)	2.8E-02
				MERCURY	5.60E-02	(mg/kg)	1.32E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	9.27E-06	(mg/kg-day)	1.00E-04	(mg/kg-day)	9.3E-02
				SELENIUM	9.70E-01	(mg/kg)	2.29E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	1.61E-04	(mg/kg-day)	5.00E-03	(mg/kg-day)	3.2E-02
				POLYCHLORINATED BIPHENYLS												
				TOTAL PCB's	2.12E-01	(mg/kg)	5.02E-06	(mg/kg-day)	2.00E+00	per (mg/kg-day)	1.0E-05	3.51E-05	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**1.2E-05**					**1.5E-01**
		Exposure Point Total									**1.2E-05**					**1.5E-01**
	Exposure Medium Total										**1.2E-05**					**1.5E-01**
Surface Water Total											**1.2E-05**					**1.5E-01**
										Total of Receptor Risks Across All Media	**4.4E-05**			Total of Receptor Hazards Across All Media		**5.7E-01**

Note:
Arsenic in crab and finfish is adjusted by 0.104 (10.4%) to account for the upper bound of expected inorganic arsenic in fish and crab.
*Intakes for modeled crab concentrations for bis(2-ethylhexyl)phthalate are adjusted by 0.25 to account for wet weight as evaluated in the intake calculations.
EPC = Exposure Point Concentration
CSF = Cancer Slope Factor
RfD = Reference Dose

TABLE 10-7.11
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - FIELD COLLECTED TISSUE EVALUATION

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC*		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake*		CSF		Cancer Risk	Intake*		RfD		Hazard Quotient
					Value	Units	Value	Units	Value	Units		Value	Units	Value	Units	
Sediment	Sediment	Crabs	Ingestion	**INORGANICS**												
				ARSENIC	1.29E-01	(mg/kg)	1.14E-06	(mg/kg-day)	1.50E+00	per (mg/kg-day)	1.7E-06	2.67E-05	(mg/kg-day)	3.00E-04	(mg/kg-day)	8.9E-02
				CADMIUM	1.58E-01	(mg/kg)	1.40E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	3.27E-05	(mg/kg-day)	1.00E-03	(mg/kg-day)	3.3E-02
				COBALT	1.38E-01	(mg/kg)	1.22E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	2.86E-05	(mg/kg-day)	3.00E-04	(mg/kg-day)	9.5E-02
				COPPER	1.25E+01	(mg/kg)	1.11E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	2.59E-03	(mg/kg-day)	4.00E-02	(mg/kg-day)	6.5E-02
				SELENIUM	1.07E+00	(mg/kg)	9.49E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	2.21E-04	(mg/kg-day)	5.00E-03	(mg/kg-day)	4.4E-02
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)ANTHRACENE	2.57E-02	(mg/kg)	6.84E-07	(mg/kg-day)	7.30E-01	per (mg/kg-day)	5.0E-07	5.32E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(B)FLUORANTHENE	3.15E-02	(mg/kg)	8.38E-07	(mg/kg-day)	7.30E-01	per (mg/kg-day)	6.1E-07	6.52E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(A)PYRENE	1.58E-02	(mg/kg)	4.21E-07	(mg/kg-day)	7.30E+00	per (mg/kg-day)	3.1E-06	3.27E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				POLYCHLORINATED BIPHENYLS												
				TOTAL PCB's	2.10E-01	(mg/kg)	1.86E-06	(mg/kg-day)	2.00E+00	per (mg/kg-day)	3.7E-06	4.35E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				SEMIVOLATILE ORGANIC COMPOUNDS												
				BIS(2-ETHYLHEXYL)PHTHALATE	7.38E+01	(mg/kg)	1.64E-04	(mg/kg-day)	1.40E-02	per (mg/kg-day)	2.3E-06	3.82E-03	(mg/kg-day)	2.00E-02	(mg/kg-day)	1.9E-01
			Exp. Route Total								**1.2E-05**					**5.2E-01**
		Exposure Point Total									**1.2E-05**					**5.2E-01**
	Exposure Medium Total										**1.2E-05**					**5.2E-01**
Sediment Total											**1.2E-05**					**5.2E-01**
Surface Water	Surface Water	Finfish	Ingestion	**INORGANICS**												
				ARSENIC	4.99E-02	(mg/kg)	4.43E-07	(mg/kg-day)	1.50E+00	per (mg/kg-day)	6.6E-07	1.03E-05	(mg/kg-day)	3.00E-04	(mg/kg-day)	3.4E-02
				MERCURY	5.60E-02	(mg/kg)	4.97E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	1.16E-05	(mg/kg-day)	1.00E-04	(mg/kg-day)	1.2E-01
				SELENIUM	9.70E-01	(mg/kg)	8.61E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	2.01E-04	(mg/kg-day)	5.00E-03	(mg/kg-day)	4.0E-02
				POLYCHLORINATED BIPHENYLS												
				TOTAL PCB's	2.12E-01	(mg/kg)	1.88E-06	(mg/kg-day)	2.00E+00	per (mg/kg-day)	3.8E-06	4.39E-05	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**4.4E-06**					**1.9E-01**
		Exposure Point Total									**4.4E-06**					**1.9E-01**
	Exposure Medium Total										**4.4E-06**					**1.9E-01**
Surface Water Total											**4.4E-06**					**1.9E-01**
										Total of Receptor Risks Across All Media	**1.6E-05**				Total of Receptor Hazards Across All Media	**7.1E-01**

Note:
Arsenic in crab and finfish is adjusted by 0.104 (10.4%) to account for the upper bound of expected inorganic arsenic in fish and crab.
*Intakes for modeled crab concentrations for bis(2-ethylhexyl)phthalate are adjusted by 0.25 to account for wet weight as evaluated in the intake calculations.
EPC = Exposure Point Concentration
CSF = Cancer Slope Factor
RfD = Reference Dose

TABLE 10-7.12
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - FIELD COLLECTED TISSUE EVALUATION

Scenario Timeframe: Current
Receptor Population: Waterman
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC*		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake*		CSF		Cancer Risk	Intake*		RfD		Hazard Quotient
					Value	Units	Value	Units	Value	Units		Value	Units	Value	Units	
Sediment	Sediment	Sparrows Point	Dermal	**INORGANICS**												
				ARSENIC	6.01E+01	(mg/kg)	6.52E-07	(mg/kg-day)	1.50E+00	per (mg/kg-day)	9.8E-07	1.83E-06	(mg/kg-day)	3.00E-04	(mg/kg-day)	6.1E-03
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)PYRENE	2.32E+00	(mg/kg)	1.09E-07	(mg/kg-day)	7.30E+00	per (mg/kg-day)	8.0E-07	3.06E-07	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**1.8E-06**					**6.1E-03**
		Exposure Point Total									**1.8E-06**					**6.1E-03**
		Crabs	Ingestion	**INORGANICS**												
				ARSENIC	1.29E-01	(mg/kg)	7.07E-06	(mg/kg-day)	1.50E+00	per (mg/kg-day)	1.1E-05	1.98E-05	(mg/kg-day)	3.00E-04	(mg/kg-day)	6.6E-02
				CADMIUM	1.58E-01	(mg/kg)	8.67E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	2.43E-05	(mg/kg-day)	1.00E-03	(mg/kg-day)	2.4E-02
				COBALT	1.38E-01	(mg/kg)	7.57E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	2.12E-05	(mg/kg-day)	3.00E-04	(mg/kg-day)	7.1E-02
				COPPER	1.25E+01	(mg/kg)	6.86E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	1.92E-03	(mg/kg-day)	4.00E-02	(mg/kg-day)	4.8E-02
				SELENIUM	1.07E+00	(mg/kg)	5.87E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	1.64E-04	(mg/kg-day)	5.00E-03	(mg/kg-day)	3.3E-02
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)ANTHRACENE	2.57E-02	(mg/kg)	1.41E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	1.0E-06	3.95E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(B)FLUORANTHENE	3.15E-02	(mg/kg)	1.73E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	1.3E-06	4.84E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(A)PYRENE	1.58E-02	(mg/kg)	8.67E-07	(mg/kg-day)	7.30E+00	per (mg/kg-day)	6.3E-06	2.43E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				POLYCHLORINATED BIPHENYLS												
				TOTAL PCB's	2.10E-01	(mg/kg)	1.15E-05	(mg/kg-day)	2.00E+00	per (mg/kg-day)	2.3E-05	3.23E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				SEMIVOLATILE ORGANIC COMPOUNDS												
				BIS(2-ETHYLHEXYL)PHTHALATE	7.38E+01	(mg/kg)	1.01E-03	(mg/kg-day)	1.40E-02	per (mg/kg-day)	1.4E-05	2.83E-03	(mg/kg-day)	2.00E-02	(mg/kg-day)	1.4E-01
			Exp. Route Total								**5.6E-05**					**3.8E-01**
		Exposure Point Total									**5.6E-05**					**3.8E-01**
	Exposure Medium Total										**5.8E-05**					**3.9E-01**
Sediment Total											**5.8E-05**					**3.9E-01**
Surface Water	Surface Water	Finfish	Ingestion	**INORGANICS**												
				ARSENIC	4.99E-02	(mg/kg)	2.74E-06	(mg/kg-day)	1.50E+00	per (mg/kg-day)	4.1E-06	7.67E-06	(mg/kg-day)	3.00E-04	(mg/kg-day)	2.6E-02
				MERCURY	5.60E-02	(mg/kg)	3.07E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	8.60E-06	(mg/kg-day)	1.00E-04	(mg/kg-day)	8.6E-02
				SELENIUM	9.70E-01	(mg/kg)	5.32E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	1.49E-04	(mg/kg-day)	5.00E-03	(mg/kg-day)	3.0E-02
				POLYCHLORINATED BIPHENYLS												
				TOTAL PCB's	2.12E-01	(mg/kg)	1.16E-05	(mg/kg-day)	2.00E+00	per (mg/kg-day)	2.3E-05	3.26E-05	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**2.7E-05**					**1.4E-01**
		Exposure Point Total									**2.7E-05**					**1.4E-01**
	Exposure Medium Total										**2.7E-05**					**1.4E-01**
Surface Water Total											**2.7E-05**					**1.4E-01**
										Total of Receptor Risks Across All Media	**8.6E-05**				Total of Receptor Hazards Across All Media		**5.3E-01**

Note:
Arsenic in crab and finfish is adjusted by 0.104 (10.4%) to account for the upper bound of expected inorganic arsenic in fish and crab.
*Intakes for modeled crab concentrations for bis(2-ethylhexyl)phthalate are adjusted by 0.25 to account for wet weight as evaluated in the intake calculations.
EPC = Exposure Point Concentration
CSF = Cancer Slope Factor
RfD = Reference Dose

TABLE 10-7.13
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - UPTAKE EVALUATION

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC*		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake*		CSF		Cancer Risk	Intake*		RfD		Hazard Quotient
					Value	Units	Value	Units	Value	Units		Value	Units	Value	Units	
Sediment	Sediment	Sparrows Point	Dermal[1]	**INORGANICS**												
				ARSENIC	6.01E+01	(mg/kg)	2.02E-08	(mg/kg-day)	1.50E+00	per (mg/kg-day)	3.0E-08	7.07E-08	(mg/kg-day)	3.00E-04	(mg/kg-day)	2.4E-04
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)PYRENE	2.32E+00	(mg/kg)	3.38E-09	(mg/kg-day)	7.30E+00	per (mg/kg-day)	2.5E-08	1.18E-08	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**5.5E-08**					**2.4E-04**
		Exposure Point Total									**5.5E-08**					**2.4E-04**
		Crabs	Ingestion	**INORGANICS**												
				ANTIMONY	7.09E-01	(mg/kg)	6.38E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	2.23E-05	(mg/kg-day)	4.00E-04	(mg/kg-day)	5.6E-02
				ARSENIC	1.08E+00	(mg/kg)	9.74E-06	(mg/kg-day)	1.50E+00	per (mg/kg-day)	1.5E-05	3.41E-05	(mg/kg-day)	3.00E-04	(mg/kg-day)	1.1E-01
				BERYLLIUM	3.47E+00	(mg/kg)	3.13E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	1.09E-04	(mg/kg-day)	2.00E-03	(mg/kg-day)	5.5E-02
				CADMIUM	9.43E-01	(mg/kg)	8.49E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	2.97E-05	(mg/kg-day)	1.00E-03	(mg/kg-day)	3.0E-02
				COPPER	9.98E+00	(mg/kg)	8.98E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	3.14E-04	(mg/kg-day)	4.00E-02	(mg/kg-day)	7.9E-03
				MERCURY	4.74E-02	(mg/kg)	4.27E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	1.49E-06	(mg/kg-day)	2.00E-02	(mg/kg-day)	7.5E-05
				NICKEL	5.06E+00	(mg/kg)	4.55E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	1.59E-04	(mg/kg-day)	5.00E-03	(mg/kg-day)	3.2E-02
				SELENIUM	1.85E+00	(mg/kg)	1.67E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	5.83E-05	(mg/kg-day)	5.00E-03	(mg/kg-day)	1.2E-02
				ZINC	6.53E+02	(mg/kg)	5.88E-03	(mg/kg-day)	NA	per (mg/kg-day)	--	2.06E-02	(mg/kg-day)	3.00E-01	(mg/kg-day)	6.9E-02
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)ANTHRACENE	1.51E+00	(mg/kg)	1.36E-05	(mg/kg-day)	7.30E-01	per (mg/kg-day)	9.9E-06	4.76E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(B)FLUORANTHENE	4.35E-01	(mg/kg)	3.92E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	2.9E-06	1.37E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(K)FLUORANTHENE	2.25E-01	(mg/kg)	2.03E-06	(mg/kg-day)	7.30E-02	per (mg/kg-day)	1.5E-07	7.10E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(A)PYRENE	6.79E-01	(mg/kg)	6.11E-06	(mg/kg-day)	7.30E+00	per (mg/kg-day)	4.5E-05	2.14E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				CHRYSENE	1.50E+00	(mg/kg)	1.35E-05	(mg/kg-day)	7.30E-03	per (mg/kg-day)	9.9E-08	4.73E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				DIBENZ(A,H)ANTHRACENE	3.26E-01	(mg/kg)	2.93E-06	(mg/kg-day)	7.30E+00	per (mg/kg-day)	2.1E-05	1.03E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				FLUORANTHENE	8.39E+00	(mg/kg)	7.55E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	2.64E-04	(mg/kg-day)	4.00E-02	(mg/kg-day)	6.6E-03
				INDENO(1,2,3-C,D)PYRENE	3.62E-01	(mg/kg)	3.26E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	2.4E-06	1.14E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				PYRENE	6.52E+00	(mg/kg)	5.87E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	2.05E-04	(mg/kg-day)	3.00E-02	(mg/kg-day)	6.8E-03
				POLYCHLORINATED BIPHENYLS												
				AROCLOR-1248	5.05E+01	(mg/kg)	4.55E-04	(mg/kg-day)	2.00E+00	per (mg/kg-day)	9.1E-04	1.59E-03	(mg/kg-day)	NA	(mg/kg-day)	--
				AROCLOR-1254	1.75E+01	(mg/kg)	1.58E-04	(mg/kg-day)	2.00E+00	per (mg/kg-day)	3.2E-04	5.51E-04	(mg/kg-day)	2.00E-05	(mg/kg-day)	2.8E+01
				AROCLOR-1260	9.27E+00	(mg/kg)	8.34E-05	(mg/kg-day)	2.00E+00	per (mg/kg-day)	1.7E-04	2.92E-04	(mg/kg-day)	NA	(mg/kg-day)	--
				SEMIVOLATILE ORGANIC COMPOUNDS												
				BIS(2-ETHYLHEXYL)PHTHALATE	7.38E+01	(mg/kg)	6.64E-04	(mg/kg-day)	1.40E-02	per (mg/kg-day)	9.3E-06	2.33E-03	(mg/kg-day)	2.00E-02	(mg/kg-day)	1.2E-01
			Exp. Route Total								**1.5E-03**					**2.8E+01**
		Exposure Point Total									**1.5E-03**					**2.8E+01**
	Exposure Medium Total										**1.5E-03**					**2.8E+01**
Sediment Total											**1.5E-03**					**2.8E+01**
Surface Water	Surface Water	Finfish	Ingestion	**INORGANICS**												
				ARSENIC	8.54E-04	(mg/kg)	7.69E-09	(mg/kg-day)	1.50E+00	per (mg/kg-day)	1.2E-08	2.69E-08	(mg/kg-day)	3.00E-04	(mg/kg-day)	9.0E-05
				MERCURY	8.19E-01	(mg/kg)	7.37E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	2.58E-05	(mg/kg-day)	1.00E-04	(mg/kg-day)	2.6E-01
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)PYRENE	1.74E-01	(mg/kg)	1.57E-06	(mg/kg-day)	7.30E+00	per (mg/kg-day)	1.1E-05	5.48E-06	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**1.1E-05**					**2.6E-01**
		Exposure Point Total									**1.1E-05**					**2.6E-01**
	Exposure Medium Total										**1.1E-05**					**2.6E-01**
Surface Water Total											**1.1E-05**					**2.6E-01**
										Total of Receptor Risks Across All Media	**1.5E-03**				Total of Receptor Hazards Across All Media		**2.8E+01**

Note:
Arsenic in crab and finfish is adjusted by 0.104 (10.4%) to account for the upper bound of expected inorganic arsenic in fish and crab.
*Intakes for modeled fish and crab concentrations are adjusted by 0.25 to account for wet weight as evaluated in the intake calculations.
EPC = Exposure Point Concentration
CSF = Cancer Slope Factor
RfD = Reference Dose

TABLE 10-7.14
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - UPTAKE EVALUATION

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC*		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake*		CSF		Cancer Risk	Intake*		RfD		Hazard Quotient
					Value	Units	Value	Units	Value	Units		Value	Units	Value	Units	
Sediment	Sediment	Sparrows Point	Dermal	**INORGANICS**												
				ARSENIC	6.01E+01	(mg/kg)	3.61E-08	(mg/kg-day)	1.50E+00	per (mg/kg-day)	5.4E-08	2.53E-07	(mg/kg-day)	3.00E-04	(mg/kg-day)	8.4E-04
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)PYRENE	2.32E+00	(mg/kg)	1.81E-08	(mg/kg-day)	7.30E+00	per (mg/kg-day)	1.3E-07	4.23E-08	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**1.9E-07**					**8.4E-04**
		Exposure Point Total									**1.9E-07**					**8.4E-04**
		Crabs	Ingestion	**INORGANICS**												
				ANTIMONY	7.09E-01	(mg/kg)	4.19E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	2.94E-05	(mg/kg-day)	4.00E-04	(mg/kg-day)	7.3E-02
				ARSENIC	1.08E+00	(mg/kg)	6.40E-06	(mg/kg-day)	1.50E+00	per (mg/kg-day)	9.6E-06	4.48E-05	(mg/kg-day)	3.00E-04	(mg/kg-day)	1.5E-01
				BERYLLIUM	3.47E+00	(mg/kg)	2.05E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	1.44E-04	(mg/kg-day)	2.00E-03	(mg/kg-day)	7.2E-02
				CADMIUM	9.43E-01	(mg/kg)	5.58E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	3.90E-05	(mg/kg-day)	1.00E-03	(mg/kg-day)	3.9E-02
				COPPER	9.98E+00	(mg/kg)	5.90E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	4.13E-04	(mg/kg-day)	4.00E-02	(mg/kg-day)	1.0E-02
				MERCURY	4.74E-02	(mg/kg)	2.80E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	1.96E-06	(mg/kg-day)	2.00E-02	(mg/kg-day)	9.8E-05
				NICKEL	5.06E+00	(mg/kg)	2.99E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	2.09E-04	(mg/kg-day)	5.00E-03	(mg/kg-day)	4.2E-02
				SELENIUM	1.85E+00	(mg/kg)	1.09E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	7.66E-05	(mg/kg-day)	5.00E-03	(mg/kg-day)	1.5E-02
				ZINC	6.53E+02	(mg/kg)	3.86E-03	(mg/kg-day)	NA	per (mg/kg-day)	--	2.70E-02	(mg/kg-day)	3.00E-01	(mg/kg-day)	9.0E-02
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)ANTHRACENE	1.51E+00	(mg/kg)	2.68E-05	(mg/kg-day)	7.30E-01	per (mg/kg-day)	2.0E-05	6.25E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(B)FLUORANTHENE	4.35E-01	(mg/kg)	7.72E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	5.6E-06	1.80E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(K)FLUORANTHENE	2.25E-01	(mg/kg)	4.00E-06	(mg/kg-day)	7.30E-02	per (mg/kg-day)	2.9E-07	9.33E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(A)PYRENE	6.79E-01	(mg/kg)	1.20E-05	(mg/kg-day)	7.30E+00	per (mg/kg-day)	8.8E-05	2.81E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				CHRYSENE	1.50E+00	(mg/kg)	2.66E-05	(mg/kg-day)	7.30E-03	per (mg/kg-day)	1.9E-07	6.21E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				DIBENZ(A,H)ANTHRACENE	3.26E-01	(mg/kg)	5.78E-06	(mg/kg-day)	7.30E+00	per (mg/kg-day)	4.2E-05	1.35E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				FLUORANTHENE	8.39E+00	(mg/kg)	4.96E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	3.47E-04	(mg/kg-day)	4.00E-02	(mg/kg-day)	8.7E-03
				INDENO(1,2,3-C,D)PYRENE	3.62E-01	(mg/kg)	6.42E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	4.7E-06	1.50E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				PYRENE	6.52E+00	(mg/kg)	3.86E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	2.70E-04	(mg/kg-day)	3.00E-02	(mg/kg-day)	9.0E-03
				POLYCHLORINATED BIPHENYLS												
				AROCLOR-1248	5.05E+01	(mg/kg)	2.99E-04	(mg/kg-day)	2.00E+00	per (mg/kg-day)	6.0E-04	2.09E-03	(mg/kg-day)	NA	(mg/kg-day)	--
				AROCLOR-1254	1.75E+01	(mg/kg)	1.04E-04	(mg/kg-day)	2.00E+00	per (mg/kg-day)	2.1E-04	7.25E-04	(mg/kg-day)	2.00E-05	(mg/kg-day)	3.6E+01
				AROCLOR-1260	9.27E+00	(mg/kg)	5.48E-05	(mg/kg-day)	2.00E+00	per (mg/kg-day)	1.1E-04	3.84E-04	(mg/kg-day)	NA	(mg/kg-day)	--
				SEMIVOLATILE ORGANIC COMPOUNDS												
				BIS(2-ETHYLHEXYL)PHTHALATE	7.38E+01	(mg/kg)	4.36E-04	(mg/kg-day)	1.40E-02	per (mg/kg-day)	6.1E-06	3.06E-03	(mg/kg-day)	2.00E-02	(mg/kg-day)	1.5E-01
			Exp. Route Total								**1.1E-03**					**3.7E+01**
		Exposure Point Total									**1.1E-03**					**3.7E+01**
	Exposure Medium Total										**1.1E-03**					**3.7E+01**
Sediment Total											**1.1E-03**					**3.7E+01**
Surface Water	Surface Water	Finfish	Ingestion	**INORGANICS**												
				ARSENIC	8.54E-04	(mg/kg)	5.05E-09	(mg/kg-day)	1.50E+00	per (mg/kg-day)	7.6E-09	3.53E-08	(mg/kg-day)	3.00E-04	(mg/kg-day)	1.2E-04
				MERCURY	8.19E-01	(mg/kg)	4.84E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	3.39E-05	(mg/kg-day)	1.00E-04	(mg/kg-day)	3.4E-01
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)PYRENE	1.74E-01	(mg/kg)	3.09E-06	(mg/kg-day)	7.30E+00	per (mg/kg-day)	2.3E-05	7.20E-06	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**2.3E-05**					**3.4E-01**
		Exposure Point Total									**2.3E-05**					**3.4E-01**
	Exposure Medium Total										**2.3E-05**					**3.4E-01**
Surface Water Total											**2.3E-05**					**3.4E-01**
										Total of Receptor Risks Across All Media	**1.1E-03**				Total of Receptor Hazards Across All Media		**3.7E+01**

Note:
Arsenic in crab and finfish is adjusted by 0.104 (10.4%) to account for the upper bound of expected inorganic arsenic in fish and crab.
*Intakes for modeled fish and crab concentrations are adjusted by 0.25 to account for wet weight as evaluated in the intake calculations.
EPC = Exposure Point Concentration
CSF = Cancer Slope Factor
RfD = Reference Dose

TABLE 10-7.15
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - UPTAKE EVALUATION

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC*		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake*		CSF		Cancer Risk	Intake*		RfD		Hazard Quotient
					Value	Units	Value	Units	Value	Units		Value	Units	Value	Units	
Sediment	Sediment	Crabs	Ingestion	**INORGANICS**												
				ANTIMONY	7.09E-01	(mg/kg)	1.57E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	3.67E-05	(mg/kg-day)	4.00E-04	(mg/kg-day)	9.2E-02
				ARSENIC	1.08E+00	(mg/kg)	2.40E-06	(mg/kg-day)	1.50E+00	per (mg/kg-day)	3.6E-06	5.60E-05	(mg/kg-day)	3.00E-04	(mg/kg-day)	1.9E-01
				BERYLLIUM	3.47E+00	(mg/kg)	7.70E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	1.80E-04	(mg/kg-day)	2.00E-03	(mg/kg-day)	9.0E-02
				CADMIUM	9.43E-01	(mg/kg)	2.09E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	4.88E-05	(mg/kg-day)	1.00E-03	(mg/kg-day)	4.9E-02
				COPPER	9.98E+00	(mg/kg)	2.21E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	5.16E-04	(mg/kg-day)	4.00E-02	(mg/kg-day)	1.3E-02
				MERCURY	4.74E-02	(mg/kg)	1.05E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	2.45E-06	(mg/kg-day)	2.00E-02	(mg/kg-day)	1.2E-04
				NICKEL	5.06E+00	(mg/kg)	1.12E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	2.62E-04	(mg/kg-day)	5.00E-03	(mg/kg-day)	5.2E-02
				SELENIUM	1.85E+00	(mg/kg)	4.10E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	9.57E-05	(mg/kg-day)	5.00E-03	(mg/kg-day)	1.9E-02
				ZINC	6.53E+02	(mg/kg)	1.45E-03	(mg/kg-day)	NA	per (mg/kg-day)	--	3.38E-02	(mg/kg-day)	3.00E-01	(mg/kg-day)	1.1E-01
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)ANTHRACENE	1.51E+00	(mg/kg)	1.00E-05	(mg/kg-day)	7.30E-01	per (mg/kg-day)	7.3E-06	7.81E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(B)FLUORANTHENE	4.35E-01	(mg/kg)	2.89E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	2.1E-06	2.25E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(K)FLUORANTHENE	2.25E-01	(mg/kg)	1.50E-06	(mg/kg-day)	7.30E-02	per (mg/kg-day)	1.1E-07	1.17E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(A)PYRENE	6.79E-01	(mg/kg)	4.52E-06	(mg/kg-day)	7.30E+00	per (mg/kg-day)	3.3E-05	3.51E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				CHRYSENE	1.50E+00	(mg/kg)	9.98E-06	(mg/kg-day)	7.30E-03	per (mg/kg-day)	7.3E-08	7.76E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				DIBENZ(A,H)ANTHRACENE	3.26E-01	(mg/kg)	2.17E-06	(mg/kg-day)	7.30E+00	per (mg/kg-day)	1.6E-05	1.69E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				FLUORANTHENE	8.39E+00	(mg/kg)	1.86E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	4.34E-04	(mg/kg-day)	4.00E-02	(mg/kg-day)	1.1E-02
				INDENO(1,2,3-C,D)PYRENE	3.62E-01	(mg/kg)	2.41E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	1.8E-06	1.87E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				PYRENE	6.52E+00	(mg/kg)	1.45E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	3.37E-04	(mg/kg-day)	3.00E-02	(mg/kg-day)	1.1E-02
				POLYCHLORINATED BIPHENYLS												
				AROCLOR-1248	5.05E+01	(mg/kg)	1.12E-04	(mg/kg-day)	2.00E+00	per (mg/kg-day)	2.2E-04	2.61E-03	(mg/kg-day)	NA	(mg/kg-day)	--
				AROCLOR-1254	1.75E+01	(mg/kg)	3.88E-05	(mg/kg-day)	2.00E+00	per (mg/kg-day)	7.8E-05	9.06E-04	(mg/kg-day)	2.00E-05	(mg/kg-day)	4.5E+01
				AROCLOR-1260	9.27E+00	(mg/kg)	2.06E-05	(mg/kg-day)	2.00E+00	per (mg/kg-day)	4.1E-05	4.80E-04	(mg/kg-day)	NA	(mg/kg-day)	--
				SEMIVOLATILE ORGANIC COMPOUNDS												
				BIS(2-ETHYLHEXYL)PHTHALATE	7.38E+01	(mg/kg)	1.64E-04	(mg/kg-day)	1.40E-02	per (mg/kg-day)	2.3E-06	3.82E-03	(mg/kg-day)	2.00E-02	(mg/kg-day)	1.9E-01
			Exp. Route Total								**4.1E-04**					**4.6E+01**
		Exposure Point Total									**4.1E-04**					**4.6E+01**
	Exposure Medium Total										**4.1E-04**					**4.6E+01**
Sediment Total											**4.1E-04**					**4.6E+01**
Surface Water	Surface Water	Finfish	Ingestion	**INORGANICS**												
				ARSENIC	8.54E-04	(mg/kg)	1.89E-09	(mg/kg-day)	1.50E+00	per (mg/kg-day)	2.8E-09	4.42E-08	(mg/kg-day)	3.00E-04	(mg/kg-day)	1.5E-04
				MERCURY	8.19E-01	(mg/kg)	1.82E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	4.24E-05	(mg/kg-day)	1.00E-04	(mg/kg-day)	4.2E-01
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)PYRENE	1.74E-01	(mg/kg)	1.16E-06	(mg/kg-day)	7.30E+00	per (mg/kg-day)	8.5E-06	9.00E-06	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**8.5E-06**					**4.2E-01**
		Exposure Point Total									**8.5E-06**					**4.2E-01**
	Exposure Medium Total										**8.5E-06**					**4.2E-01**
Surface Water Total											**8.5E-06**					**4.2E-01**
										Total of Receptor Risks Across All Media	**4.2E-04**			Total of Receptor Hazards Across All Media		**4.7E+01**

Note:
Arsenic in crab and finfish is adjusted by 0.104 (10.4%) to account for the upper bound of expected inorganic arsenic in fish and crab.
*Intakes for modeled fish and crab concentrations are adjusted by 0.25 to account for wet weight as evaluated in the intake calculations.
EPC = Exposure Point Concentration
CSF = Cancer Slope Factor
RfD = Reference Dose

TABLE 10-7.16
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - UPTAKE EVALUATION

Scenario Timeframe: Current
Receptor Population: Waterman
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC*		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake*		CSF		Cancer Risk	Intake*		RfD		Hazard Quotient
					Value	Units	Value	Units	Value	Units		Value	Units	Value	Units	
Sediment	Sediment	Sparrows Point	Dermal	**INORGANICS**												
				ARSENIC	6.01E+01	(mg/kg)	6.52E-07	(mg/kg-day)	1.50E+00	per (mg/kg-day)	9.8E-07	1.83E-06	(mg/kg-day)	3.00E-04	(mg/kg-day)	6.1E-03
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)PYRENE	2.32E+00	(mg/kg)	1.09E-07	(mg/kg-day)	7.30E+00	per (mg/kg-day)	8.0E-07	3.06E-07	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**1.8E-06**					**6.1E-03**
		Exposure Point Total									**1.8E-06**					**6.1E-03**
		Crabs	Ingestion	**INORGANICS**												
				ANTIMONY	7.09E-01	(mg/kg)	9.72E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	2.72E-05	(mg/kg-day)	4.00E-04	(mg/kg-day)	6.8E-02
				ARSENIC	1.08E+00	(mg/kg)	1.48E-05	(mg/kg-day)	1.50E+00	per (mg/kg-day)	2.2E-05	4.15E-05	(mg/kg-day)	3.00E-04	(mg/kg-day)	1.4E-01
				BERYLLIUM	3.47E+00	(mg/kg)	4.76E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	1.33E-04	(mg/kg-day)	2.00E-03	(mg/kg-day)	6.7E-02
				CADMIUM	9.43E-01	(mg/kg)	1.29E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	3.62E-05	(mg/kg-day)	1.00E-03	(mg/kg-day)	3.6E-02
				COPPER	9.98E+00	(mg/kg)	1.37E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	3.83E-04	(mg/kg-day)	4.00E-02	(mg/kg-day)	9.6E-03
				MERCURY	4.74E-02	(mg/kg)	6.50E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	1.82E-06	(mg/kg-day)	2.00E-02	(mg/kg-day)	9.1E-05
				NICKEL	5.06E+00	(mg/kg)	6.94E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	1.94E-04	(mg/kg-day)	5.00E-03	(mg/kg-day)	3.9E-02
				SELENIUM	1.85E+00	(mg/kg)	2.54E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	7.10E-05	(mg/kg-day)	5.00E-03	(mg/kg-day)	1.4E-02
				ZINC	6.53E+02	(mg/kg)	8.96E-03	(mg/kg-day)	NA	per (mg/kg-day)	--	2.51E-02	(mg/kg-day)	3.00E-01	(mg/kg-day)	8.4E-02
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)ANTHRACENE	1.51E+00	(mg/kg)	2.07E-05	(mg/kg-day)	7.30E-01	per (mg/kg-day)	1.5E-05	5.80E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(B)FLUORANTHENE	4.35E-01	(mg/kg)	5.97E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	4.4E-06	1.67E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(K)FLUORANTHENE	2.25E-01	(mg/kg)	3.09E-06	(mg/kg-day)	7.30E-02	per (mg/kg-day)	2.3E-07	8.65E-06	(mg/kg-day)	NA	(mg/kg-day)	--
				BENZO(A)PYRENE	6.79E-01	(mg/kg)	9.31E-06	(mg/kg-day)	7.30E+00	per (mg/kg-day)	6.8E-05	2.61E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				CHRYSENE	1.50E+00	(mg/kg)	2.06E-05	(mg/kg-day)	7.30E-03	per (mg/kg-day)	1.5E-07	5.76E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				DIBENZ(A,H)ANTHRACENE	3.26E-01	(mg/kg)	4.47E-06	(mg/kg-day)	7.30E+00	per (mg/kg-day)	3.3E-05	1.25E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				FLUORANTHENE	8.39E+00	(mg/kg)	1.15E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	3.22E-04	(mg/kg-day)	4.00E-02	(mg/kg-day)	8.1E-03
				INDENO(1,2,3-C,D)PYRENE	3.62E-01	(mg/kg)	4.96E-06	(mg/kg-day)	7.30E-01	per (mg/kg-day)	3.6E-06	1.39E-05	(mg/kg-day)	NA	(mg/kg-day)	--
				PYRENE	6.52E+00	(mg/kg)	8.94E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	2.50E-04	(mg/kg-day)	3.00E-02	(mg/kg-day)	8.3E-03
				POLYCHLORINATED BIPHENYLS												
				AROCLOR-1248	5.05E+01	(mg/kg)	6.93E-04	(mg/kg-day)	2.00E+00	per (mg/kg-day)	1.4E-03	1.94E-03	(mg/kg-day)	NA	(mg/kg-day)	--
				AROCLOR-1254	1.75E+01	(mg/kg)	2.40E-04	(mg/kg-day)	2.00E+00	per (mg/kg-day)	4.8E-04	6.72E-04	(mg/kg-day)	2.00E-05	(mg/kg-day)	3.4E+01
				AROCLOR-1260	9.27E+00	(mg/kg)	1.27E-04	(mg/kg-day)	2.00E+00	per (mg/kg-day)	2.5E-04	3.56E-04	(mg/kg-day)	NA	(mg/kg-day)	--
				SEMIVOLATILE ORGANIC COMPOUNDS												
				BIS(2-ETHYLHEXYL)PHTHALATE	7.38E+01	(mg/kg)	1.01E-03	(mg/kg-day)	1.40E-02	per (mg/kg-day)	1.4E-05	2.83E-03	(mg/kg-day)	2.00E-02	(mg/kg-day)	1.4E-01
			Exp. Route Total								**2.3E-03**					**3.4E+01**
		Exposure Point Total									**2.3E-03**					**3.4E+01**
	Exposure Medium Total										**2.3E-03**					**3.4E+01**
Sediment Total											**2.3E-03**					**3.4E+01**
Surface Water	Surface Water	Finfish	Ingestion	**INORGANICS**												
				ARSENIC	8.54E-04	(mg/kg)	1.17E-08	(mg/kg-day)	1.50E+00	per (mg/kg-day)	1.8E-08	3.28E-08	(mg/kg-day)	3.00E-04	(mg/kg-day)	1.1E-04
				MERCURY	8.19E-01	(mg/kg)	1.12E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	3.14E-05	(mg/kg-day)	1.00E-04	(mg/kg-day)	3.1E-01
				POLYAROMATIC HYDROCARBONS												
				BENZO(A)PYRENE	1.74E-01	(mg/kg)	2.39E-06	(mg/kg-day)	7.30E+00	per (mg/kg-day)	1.7E-05	6.68E-06	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**1.7E-05**					**3.1E-01**
		Exposure Point Total									**1.7E-05**					**3.1E-01**
	Exposure Medium Total										**1.7E-05**					**3.1E-01**
Surface Water Total											**1.7E-05**					**3.1E-01**
										Total of Receptor Risks Across All Media	**2.3E-03**			Total of Receptor Hazards Across All Media		**3.5E+01**

Note:
Arsenic in crab and finfish is adjusted by 0.104 (10.4%) to account for the upper bound of expected inorganic arsenic in fish and crab.
*Intakes for modeled fish and crab concentrations are adjusted by 0.25 to account for wet weight as evaluated in the intake calculations.
EPC = Exposure Point Concentration
CSF = Cancer Slope Factor
RfD = Reference Dose

TABLE 10-9.1

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT NORTHEAST/NEAR-SHORE - FIELD COLLECTED TISSUE EVALUATION

Location: Northeast/Near Shore Exposure Area
Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Northeast/ Near Shore	**INORGANICS**					**INORGANICS**					
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	7.1E-02	--	--	7.1E-02
			(Total for Finfish)	---	---	---	---	(Total for Finfish)		7.1E-02	---	---	7.1E-02
			Total Risk Across Surface Water				**0.0E+00**			**Total Hazard Index Across Surface Water**			**7.1E-02**
Sediment	Crabs	Northeast/ Near Shore	**INORGANICS**					**INORGANICS**					
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	2.0E-02	--	--	2.0E-02
			COPPER	--	--	--	NA	COPPER	Gastrointestinal System	3.9E-02	--	--	3.9E-02
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	6.8E-07	--	--	6.8E-07	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	8.3E-07	--	--	8.3E-07	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	4.2E-06	--	--	4.2E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	2.7E-07	--	--	2.7E-07	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	3.4E-03	--	--	3.4E-03
			(Total for Crabs)	6.5E-06	---	---	6.5E-06	(Total for Crabs)		6.3E-02	---	---	6.3E-02
			Total Risk Across Sediment				**6.5E-06**			**Total Hazard Index Across Sediment**			**6.3E-02**
			Total Risk Across All Media and All Exposure Routes				**7E-06**			**Total Hazard Index Across All Media and All Exposure Routes**			**0.1**

TABLE 10-9.2

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT NORTHEAST/NEAR-SHORE - FIELD COLLECTED TISSUE EVALUATION

Location: Northeast/Near Shore Exposure Area
Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Northeast/ Near Shore	**INORGANICS**					**INORGANICS**					
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	9.3E-02	--	--	9.3E-02
			(Total for Finfish)	---	---	---	---	(Total for Finfish)		9.3E-02	---	---	9.3E-02
			Total Risk Across Surface Water				**0.0E+00**			**Total Hazard Index Across Surface Water**			**9.3E-02**
Sediment	Crabs	Northeast/ Near Shore	**INORGANICS**					**INORGANICS**					
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	2.6E-02	--	--	2.6E-02
			COPPER	--	--	--	NA	COPPER	Gastrointestinal System	5.2E-02	--	--	5.2E-02
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	1.3E-06	--	--	1.3E-06	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	1.6E-06	--	--	1.6E-06	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	8.2E-06	--	--	8.2E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	1.8E-07	--	--	1.8E-07	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	4.5E-03	--	--	4.5E-03
			(Total for Crabs)	1.3E-05	---	---	1.3E-05	(Total for Crabs)		8.2E-02	---	---	8.2E-02
			Total Risk Across Sediment				**1.3E-05**			**Total Hazard Index Across Sediment**			**8.2E-02**
			Total Risk Across All Media and All Exposure Routes				**1E-05**			**Total Hazard Index Across All Media and All Exposure Routes**			**0.2**

TABLE 10-9.3

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT NORTHEAST/NEAR-SHORE - FIELD COLLECTED TISSUE EVALUATION

Location: Northeast/Near Shore Exposure Area

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Northeast/ Near Shore	**INORGANICS**					**INORGANICS**					
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	1.2E-01	--	--	1.2E-01
			(Total for Finfish)	---	---	---	---		(Total for Finfish)	1.2E-01	---	---	1.2E-01
						Total Risk Across Surface Water	**0.0E+00**					**Total Hazard Index Across Surface Water**	**1.2E-01**
Sediment	Crabs	Northeast/ Near Shore	**INORGANICS**					**INORGANICS**					
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	3.3E-02	--	--	3.3E-02
			COPPER	--	--	--	NA	COPPER	Gastrointestinal System	6.5E-02	--	--	6.5E-02
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	5.0E-07	--	--	5.0E-07	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	6.1E-07	--	--	6.1E-07	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	3.1E-06	--	--	3.1E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	6.8E-08	--	--	6.8E-08	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	5.6E-03	--	--	5.6E-03
			(Total for Crabs)	5.0E-06	---	---	5.0E-06		(Total for Crabs)	1.0E-01	---	---	1.0E-01
						Total Risk Across Sediment	**5.0E-06**					**Total Hazard Index Across Sediment**	**1.0E-01**
						Total Risk Across All Media and All Exposure Routes	**5E-06**					**Total Hazard Index Across All Media and All Exposure Routes**	**0.2**

TABLE 10-9.4

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT NORTHEAST/NEAR-SHORE - FIELD COLLECTED TISSUE EVALUATION

Location: Northeast/Near Shore Exposure Area

Scenario Timeframe: Current
Receptor Population: Watermen
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Northeast/ Near Shore	**INORGANICS**					**INORGANICS**					
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	8.6E-02	--	--	8.6E-02
			(Total for Finfish)	---	---	---	---		(Total for Finfish)	8.6E-02	---	---	8.6E-02
						Total Risk Across Surface Water	**0.0E+00**					**Total Hazard Index Across Surface Water**	**8.6E-02**
Sediment	Crabs	Northeast/ Near Shore	**INORGANICS**					**INORGANICS**					
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	2.4E-02	--	--	2.4E-02
			COPPER	--	--	--	NA	COPPER	Gastrointestinal System	4.8E-02	--	--	4.8E-02
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	1.0E-06	--	--	1.0E-06	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	1.3E-06	--	--	1.3E-06	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	6.3E-06	--	--	6.3E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	4.2E-07	--	--	4.2E-07	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	4.2E-03	--	--	4.2E-03
			(Total for Crabs)	9.9E-06	---	---	9.9E-06		(Total for Crabs)	7.6E-02	---	---	7.6E-02
						Total Risk Across Sediment	**9.9E-06**					**Total Hazard Index Across Sediment**	**7.6E-02**
						Total Risk Across All Media and All Exposure Routes	**1E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**0.2**

TABLE 10-9.5

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT NORTHEAST/NEAR-SHORE - UPTAKE EVALUATION

Location: Northeast/Near Shore Exposure Area

Scenario Timeframe: Current

Receptor Population: Recreational User

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Northeast/ Near Shore	**INORGANICS**					**INORGANICS**					
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	3.5E-01	--	--	3.5E-01
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	1.6E-05	--	--	1.6E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Finfish)	1.6E-05	---	---	1.6E-05		(Total for Finfish)	3.5E-01	---	---	3.5E-01
						Total Risk Across Surface Water	**1.6E-05**					**Total Hazard Index Across Surface Water**	**3.5E-01**
Sediment	Crabs	Northeast/ Near Shore	**INORGANICS**					**INORGANICS**					
			ZINC	--	--	--	NA	ZINC	Blood	1.1E-02	--	--	1.1E-02
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	1.3E-06	--	--	1.3E-06	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	4.6E-07	--	--	4.6E-07	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	7.7E-06	--	--	7.7E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			DIBENZ(A,H)ANTHRACENE	2.1E-06	--	--	2.1E-06	DIBENZ(A,H)ANTHRACENE	NA	--	--	--	NA
			INDENO(1,2,3-C,D)PYRENE	4.6E-07	--	--	4.6E-07	INDENO(1,2,3-C,D)PYRENE	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	2.7E-07	--	--	2.7E-07	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	3.4E-03	--	--	3.4E-03
			(Total for Crabs)	1.2E-05	---	---	1.2E-05		(Total for Crabs)	1.4E-02	---	---	1.4E-02
						Total Risk Across Sediment	**1.2E-05**					**Total Hazard Index Across Sediment**	**1.4E-02**
						Total Risk Across All Media and All Exposure Routes	**3E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**0.4**

TABLE 10-9.6

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT NORTHEAST/NEAR-SHORE - UPTAKE EVALUATION

Location: Northeast/Near Shore Exposure Area
Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Northeast/ Near Shore	**INORGANICS**					**INORGANICS**					
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	4.6E-01	--	--	4.6E-01
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	3.1E-05	--	--	3.1E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Finfish)	3.1E-05	---	---	3.1E-05		(Total for Finfish)	4.6E-01	---	---	4.6E-01
						Total Risk Across Surface Water	**3.1E-05**					**Total Hazard Index Across Surface Water**	**4.6E-01**
Sediment	Crabs	Northeast/ Near Shore	**INORGANICS**					**INORGANICS**					
			ZINC	--	--	--	NA	ZINC	Blood	1.4E-02	--	--	1.4E-02
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	2.5E-06	--	--	2.5E-06	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	9.1E-07	--	--	9.1E-07	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	1.5E-05	--	--	1.5E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			DIBENZ(A,H)ANTHRACENE	4.1E-06	--	--	4.1E-06	DIBENZ(A,H)ANTHRACENE	NA	--	--	--	NA
			INDENO(1,2,3-C,D)PYRENE	9.1E-07	--	--	9.1E-07	INDENO(1,2,3-C,D)PYRENE	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	1.8E-07	--	--	1.8E-07	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	4.5E-03	--	--	4.5E-03
			(Total for Crabs)	2.4E-05	---	---	2.4E-05		(Total for Crabs)	1.8E-02	---	---	1.8E-02
						Total Risk Across Sediment	**2.4E-05**					**Total Hazard Index Across Sediment**	**1.8E-02**
						Total Risk Across All Media and All Exposure Routes	**5E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**0.5**

TABLE 10-9.7

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT NORTHEAST/NEAR-SHORE - UPTAKE EVALUATION

Location: Northeast/Near Shore Exposure Area

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Northeast/ Near Shore	**INORGANICS**					**INORGANICS**					
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	5.7E-01	--	--	5.7E-01
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	1.1E-05	--	--	1.1E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Finfish)	1.1E-05	---	---	1.1E-05	(Total for Finfish)		5.7E-01	---	---	5.7E-01
						Total Risk Across Surface Water	**1.1E-05**					**Total Hazard Index Across Surface Water**	**5.7E-01**
Sediment	Crabs	Northeast/ Near Shore	**INORGANICS**					**INORGANICS**					
			ZINC	--	--	--	NA	ZINC	Blood	1.7E-02	--	--	1.7E-02
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	9.3E-07	--	--	9.3E-07	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	3.4E-07	--	--	3.4E-07	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	5.7E-06	--	--	5.7E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			DIBENZ(A,H)ANTHRACENE	1.6E-06	--	--	1.6E-06	DIBENZ(A,H)ANTHRACENE	NA	--	--	--	NA
			INDENO(1,2,3-C,D)PYRENE	3.4E-07	--	--	3.4E-07	INDENO(1,2,3-C,D)PYRENE	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	6.8E-08	--	--	6.8E-08	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	5.6E-03	--	--	5.6E-03
			(Total for Crabs)	8.9E-06	---	---	8.9E-06	(Total for Crabs)		2.3E-02	---	---	2.3E-02
						Total Risk Across Sediment	**8.9E-06**					**Total Hazard Index Across Sediment**	**2.3E-02**
						Total Risk Across All Media and All Exposure Routes	**2E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**0.6**

TABLE 10-9.8

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT NORTHEAST/NEAR-SHORE - UPTAKE EVALUATION

Location: Northeast/Near Shore Exposure Area

Scenario Timeframe: Current
Receptor Population: Watermen
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Northeast/ Near Shore	**INORGANICS**					**INORGANICS**					
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	4.3E-01	--	--	4.3E-01
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	2.4E-05	--	--	2.4E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Finfish)	2.4E-05	---	---	2.4E-05	(Total for Finfish)		4.3E-01	---	---	4.3E-01
			Total Risk Across Surface Water				**2.4E-05**			**Total Hazard Index Across Surface Water**			**4.3E-01**
Sediment	Crabs	Northeast/ Near Shore	**INORGANICS**					**INORGANICS**					
			ZINC	--	--	--	NA	ZINC	Blood	1.3E-02	--	--	1.3E-02
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	1.9E-06	--	--	1.9E-06	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	7.0E-07	--	--	7.0E-07	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	1.2E-05	--	--	1.2E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			DIBENZ(A,H)ANTHRACENE	3.2E-06	--	--	3.2E-06	DIBENZ(A,H)ANTHRACENE	NA	--	--	--	NA
			INDENO(1,2,3-C,D)PYRENE	7.0E-07	--	--	7.0E-07	INDENO(1,2,3-C,D)PYRENE	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	4.2E-07	--	--	4.2E-07	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	4.2E-03	--	--	4.2E-03
			(Total for Crabs)	1.9E-05	---	---	1.9E-05	(Total for Crabs)		1.7E-02	---	---	1.7E-02
			Total Risk Across Sediment				**1.9E-05**			**Total Hazard Index Across Sediment**			**1.7E-02**
			Total Risk Across All Media and All Exposure Routes				**4E-05**			**Total Hazard Index Across All Media and All Exposure Routes**			**0.4**

TABLE 10-9.9

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - FIELD COLLECTED TISSUE EVALUATION

Location: Southwest/Tin Mill Canal Exposure Area
Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Southwest/	**INORGANICS**					**INORGANICS**					
		Tin Mill	ARSENIC	2.7E-06	--	--	2.7E-06	ARSENIC	Skin	2.1E-02	--	--	2.1E-02
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	7.1E-02	--	--	7.1E-02
			SELENIUM	--	--	--	NA	SELENIUM	NA	2.4E-02	--	--	2.4E-02
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			TOTAL PCB's	1.5E-05	--	--	1.5E-05	TOTAL PCB's	NA	--	--	--	NA
			(Total for Finfish)	1.8E-05	---	---	1.8E-05		(Total for Finfish)	1.2E-01	---	---	1.2E-01
						Total Risk Across Surface Water	**1.8E-05**					**Total Hazard Index Across Surface Water**	**1.2E-01**
Sediment	Sediment	Southwest/	**INORGANICS**					**INORGANICS**					
		Tin Mill	ARSENIC	--	3.0E-08	--	3.0E-08	ARSENIC	Skin	--	2.4E-04	--	2.4E-04
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	--	2.5E-08	--	2.5E-08	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total)	---	5.5E-08	---	5.5E-08		(Total)	---	2.4E-04	---	2.4E-04
Sediment	Crabs	Southwest/	**INORGANICS**					**INORGANICS**					
		Tin Mill	ARSENIC	7.0E-06	--	--	7.0E-06	ARSENIC	Skin	5.4E-02	--	--	5.4E-02
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	2.0E-02	--	--	2.0E-02
			COBALT	--	--	--	NA	COBALT	Blood	5.8E-02	--	--	5.8E-02
			COPPER	--	--	--	NA	COPPER	Gastrointestinal System	3.9E-02	--	--	3.9E-02
			SELENIUM	--	--	--	NA	SELENIUM	NA	2.7E-02	--	--	2.7E-02
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	6.8E-07	--	--	6.8E-07	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	8.3E-07	--	--	8.3E-07	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	4.2E-06	--	--	4.2E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			TOTAL PCB's	1.5E-05	--	--	1.5E-05	TOTAL PCB's	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	9.3E-06	--	--	9.3E-06	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	1.2E-01	--	--	1.2E-01
			(Total for Crabs)	3.7E-05	---	---	3.7E-05		(Total for Crabs)	3.1E-01	---	---	3.1E-01
						Total Risk Across Sediment	**3.7E-05**					**Total Hazard Index Across Sediment**	**3.1E-01**
						Total Risk Across All Media and All Exposure Routes	**6E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**0.4**

TABLE 10-9.10

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - FIELD COLLECTED TISSUE EVALUATION

Location: Southwest/Tin Mill Canal Exposure Area
Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Southwest/	**INORGANICS**					**INORGANICS**					
		Tin Mill	ARSENIC	1.8E-06	--	--	1.8E-06	ARSENIC	Skin	2.8E-02	--	--	2.8E-02
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	9.3E-02	--	--	9.3E-02
			SELENIUM	--	--	--	NA	SELENIUM	NA	3.2E-02	--	--	3.2E-02
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			TOTAL PCB's	1.0E-05	--	--	1.0E-05	TOTAL PCB's	NA	--	--	--	NA
			(Total for Finfish)	1.2E-05	---	---	1.2E-05		(Total for Finfish)	1.5E-01	---	---	1.5E-01
						Total Risk Across Surface Water	**1.2E-05**					**Total Hazard Index Across Surface Water**	**1.5E-01**
Sediment	Sediment	Sparrows Point	**INORGANICS**					**INORGANICS**					
			ARSENIC	--	5.4E-08	--	5.4E-08	ARSENIC	Skin	--	8.4E-04	--	8.4E-04
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	--	1.3E-07	--	1.3E-07	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total)	---	1.9E-07	---	1.9E-07		(Total)	---	8.4E-04	---	8.4E-04
Sediment	Crabs	Southwest/	**INORGANICS**					**INORGANICS**					
		Tin Mill	ARSENIC	4.6E-06	--	--	4.6E-06	ARSENIC	Skin	7.1E-02	--	--	7.1E-02
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	2.6E-02	--	--	2.6E-02
			COBALT	--	--	--	NA	COBALT	Blood	7.6E-02	--	--	7.6E-02
			COPPER	--	--	--	NA	COPPER	Gastrointestinal System	5.2E-02	--	--	5.2E-02
			SELENIUM	--	--	--	NA	SELENIUM	NA	3.5E-02	--	--	3.5E-02
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	1.3E-06	--	--	1.3E-06	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	1.6E-06	--	--	1.6E-06	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	8.2E-06	--	--	8.2E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			TOTAL PCB's	9.9E-06	--	--	9.9E-06	TOTAL PCB's	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	6.1E-06	--	--	6.1E-06	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	1.5E-01	--	--	1.5E-01
			(Total for Crabs)	3.2E-05	---	---	3.2E-05		(Total for Crabs)	4.1E-01	---	---	4.1E-01
						Total Risk Across Sediment	**3.2E-05**					**Total Hazard Index Across Sediment**	**4.1E-01**
						Total Risk Across All Media and All Exposure Routes	**4E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**0.6**

TABLE 10-9.11

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - FIELD COLLECTED TISSUE EVALUATION

Location: Southwest/Tin Mill Canal Exposure Area

Scenario Timeframe: Current

Receptor Population: Recreational User

Receptor Age: Chilc

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Southwest/	**INORGANICS**					**INORGANICS**					
		Tin Mill	ARSENIC	6.6E-07	--	--	6.6E-07	ARSENIC	Skin	3.4E-02	--	--	3.4E-02
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	1.2E-01	--	--	1.2E-01
			SELENIUM	--	--	--	NA	SELENIUM	NA	4.0E-02	--	--	4.0E-02
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			TOTAL PCB's	3.8E-06	--	--	3.8E-06	TOTAL PCB's	NA	--	--	--	NA
			(Total for Finfish)	4.4E-06	---	---	4.4E-06		(Total for Finfish)	1.9E-01	---	---	1.9E-01
						Total Risk Across Surface Water	**4.4E-06**			**Total Hazard Index Across Surface Water**			**1.9E-01**
Sediment	Crabs	Southwest/	**INORGANICS**					**INORGANICS**					
		Tin Mill	ARSENIC	1.7E-06	--	--	1.7E-06	ARSENIC	Skin	8.9E-02	--	--	8.9E-02
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	3.3E-02	--	--	3.3E-02
			COBALT	--	--	--	NA	COBALT	Blood	9.5E-02	--	--	9.5E-02
			COPPER	--	--	--	NA	COPPER	Gastrointestinal System	6.5E-02	--	--	6.5E-02
			SELENIUM	--	--	--	NA	SELENIUM	NA	4.4E-02	--	--	4.4E-02
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	5.0E-07	--	--	5.0E-07	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	6.1E-07	--	--	6.1E-07	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	3.1E-06	--	--	3.1E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			TOTAL PCB's	3.7E-06	--	--	3.7E-06	TOTAL PCB's	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	2.3E-06	--	--	2.3E-06	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	1.9E-01	--	--	1.9E-01
			(Total for Crabs)	1.2E-05	---	---	1.2E-05		(Total for Crabs)	5.2E-01	---	---	5.2E-01
						Total Risk Across Sediment	**1.2E-05**					**Total Hazard Index Across Sediment**	**5.2E-01**
						Total Risk Across All Media and All Exposure Routes	**2E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**0.7**

TABLE 10-9.12

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - FIELD COLLECTED TISSUE EVALUATION

Location: Southwest/Tin Mill Canal Exposure Area
Scenario Timeframe: Current
Receptor Population: Watermen
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Southwest/	**INORGANICS**					**INORGANICS**					
		Tin Mill	ARSENIC	4.1E-06	--	--	4.1E-06	ARSENIC	Skin	2.6E-02	--	--	2.6E-02
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	8.6E-02	--	--	8.6E-02
			SELENIUM	--	--	--	NA	SELENIUM	NA	3.0E-02	--	--	3.0E-02
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			TOTAL PCB's	2.3E-05	--	--	2.3E-05	TOTAL PCB's	NA	--	--	--	NA
			(Total for Finfish)	2.7E-05	---	---	2.7E-05		(Total for Finfish)	1.4E-01	---	---	1.4E-01
						Total Risk Across Surface Water	**2.7E-05**					**Total Hazard Index Across Surface Water**	**1.4E-01**
Sediment	Sediment	Sparrows Point	**INORGANICS**					**INORGANICS**					
			ARSENIC	--	9.8E-07	--	9.8E-07	ARSENIC	Skin	--	6.1E-03	--	6.1E-03
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	--	8.0E-07	--	8.0E-07	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total)	---	1.8E-06	---	1.8E-06		(Total)	---	6.1E-03	---	6.1E-03
Sediment	Crabs	Southwest/	**INORGANICS**					**INORGANICS**					
		Tin Mill	ARSENIC	1.1E-05	--	--	1.1E-05	ARSENIC	Skin	6.6E-02	--	--	6.6E-02
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	2.4E-02	--	--	2.4E-02
			COBALT	--	--	--	NA	COBALT	Blood	7.1E-02	--	--	7.1E-02
			COPPER	--	--	--	NA	COPPER	Gastrointestinal System	4.8E-02	--	--	4.8E-02
			SELENIUM	--	--	--	NA	SELENIUM	NA	3.3E-02	--	--	3.3E-02
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	1.0E-06	--	--	1.0E-06	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	1.3E-06	--	--	1.3E-06	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	6.3E-06	--	--	6.3E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			TOTAL PCB's	2.3E-05	--	--	2.3E-05	TOTAL PCB's	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	1.4E-05	--	--	1.4E-05	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	1.4E-01	--	--	1.4E-01
			(Total for Crabs)	5.6E-05	---	---	5.6E-05		(Total for Crabs)	3.8E-01	---	---	3.8E-01
						Total Risk Across Sediment	**5.8E-05**					**Total Hazard Index Across Sediment**	**3.9E-01**
						Total Risk Across All Media and All Exposure Routes	**9E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**0.5**

TABLE 10-9.13

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - UPTAKE EVALUATION

Location: Southwest/Tin Mill Canal Exposure Area

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			ARSENIC	1.2E-08	--	--	1.2E-08	ARSENIC	Skin	9.0E-05	--	--	9.0E-05
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	2.6E-01	--	--	2.6E-01
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	1.1E-05	--	--	1.1E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Finfish)	1.1E-05	---	---	1.1E-05	(Total for Finfish)		2.6E-01	---	---	2.6E-01
						Total Risk Across Surface Water	**1.1E-05**			**Total Hazard Index Across Surface Water**			**2.6E-01**
Sediment	Sediment	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			ARSENIC	--	3.0E-08	--	3.0E-08	ARSENIC	Skin	--	2.4E-04	--	2.4E-04
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	--	2.5E-08	--	2.5E-08	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total)	---	5.5E-08	---	5.5E-08		(Total)	---	2.4E-04	---	2.4E-04
Sediment	Crabs	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			ANTIMONY	--	--	--	NA	ANTIMONY	Blood	5.6E-02	--	--	5.6E-02
			ARSENIC	1.5E-05	--	--	1.5E-05	ARSENIC	Skin	1.1E-01	--	--	1.1E-01
			BERYLLIUM	--	--	--	NA	BERYLLIUM	Intestines	5.5E-02	--	--	5.5E-02
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	3.0E-02	--	--	3.0E-02
			COPPER	--	--	--	NA	COPPER	Gastrointestinal System	7.9E-03	--	--	7.9E-03
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	7.5E-05	--	--	7.5E-05
			NICKEL	--	--	--	NA	NICKEL	Body weight	3.2E-02	--	--	3.2E-02
			SELENIUM	--	--	--	NA	SELENIUM	NA	1.2E-02	--	--	1.2E-02
			ZINC	--	--	--	NA	ZINC	Blood	6.9E-02	--	--	6.9E-02
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	9.9E-06	--	--	9.9E-06	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	2.9E-06	--	--	2.9E-06	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(K)FLUORANTHENE	1.5E-07	--	--	1.5E-07	BENZO(K)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	4.5E-05	--	--	4.5E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			CHRYSENE	9.9E-08	--	--	9.9E-08	CHRYSENE	NA	--	--	--	NA
			DIBENZ(A,H)ANTHRACENE	2.1E-05	--	--	2.1E-05	DIBENZ(A,H)ANTHRACENE	NA	--	--	--	NA
			FLUORANTHENE	--	--	--	NA	FLUORANTHENE	Liver	6.6E-03	--	--	6.6E-03
			INDENO(1,2,3-C,D)PYRENE	2.4E-06	--	--	2.4E-06	INDENO(1,2,3-C,D)PYRENE	NA	--	--	--	NA
			PYRENE	--	--	--	NA	PYRENE	Kidneys	6.8E-03	--	--	6.8E-03
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			AROCLOR-1248	9.1E-04	--	--	9.1E-04	AROCLOR-1248	NA	--	--	--	NA
			AROCLOR-1254	3.2E-04	--	--	3.2E-04	AROCLOR-1254	Eyes and skin	2.8E+01	--	--	2.8E+01
			AROCLOR-1260	1.7E-04	--	--	1.7E-04	AROCLOR-1260	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	9.3E-06	--	--	9.3E-06	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	1.2E-01	--	--	1.2E-01
			(Total for Crabs)	1.5E-03	---	---	1.5E-03		(Total for Crabs)	2.8E+01	---	---	2.8E+01

TABLE 10-9.13

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - UPTAKE EVALUATION

Location: Southwest/Tin Mill Canal Exposure Area

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
						Total Risk Across Sediment	**1.5E-03**					**Total Hazard Index Across Sediment**	**2.8E+01**
						Total Risk Across All Media and All Exposure Routes	**2E-03**					**Total Hazard Index Across All Media and All Exposure Routes**	**28**

TABLE 10-9.14

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - UPTAKE EVALUATION

Location: Southwest/Tin Mill Canal Exposure Area
Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			ARSENIC	7.6E-09	--	--	7.6E-09	ARSENIC	Skin	1.2E-04	--	--	1.2E-04
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	3.4E-01	--	--	3.4E-01
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	2.3E-05	--	--	2.3E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Finfish)	2.3E-05	---	---	2.3E-05	(Total for Finfish)		3.4E-01	---	---	3.4E-01
			Total Risk Across Surface Water				**2.3E-05**		**Total Hazard Index Across Surface Water**				**3.4E-01**
Sediment	Sediment	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			ARSENIC	--	5.4E-08	--	5.4E-08	ARSENIC	Skin	--	8.4E-04	--	8.4E-04
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	--	1.3E-07	--	1.3E-07	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total)	---	1.9E-07	---	1.9E-07		(Total)	---	8.4E-04	---	8.4E-04
	Crabs	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			ANTIMONY	--	--	--	NA	ANTIMONY	Blood	7.3E-02	--	--	7.3E-02
			ARSENIC	9.6E-06	--	--	9.6E-06	ARSENIC	Skin	1.5E-01	--	--	1.5E-01
			BERYLLIUM	--	--	--	NA	BERYLLIUM	Intestines	7.2E-02	--	--	7.2E-02
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	3.9E-02	--	--	3.9E-02
			COPPER	--	--	--	NA	COPPER	Gastrointestinal System	1.0E-02	--	--	1.0E-02
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	9.8E-05	--	--	9.8E-05
			NICKEL	--	--	--	NA	NICKEL	Body weight	4.2E-02	--	--	4.2E-02
			SELENIUM	--	--	--	NA	SELENIUM	NA	1.5E-02	--	--	1.5E-02
			ZINC	--	--	--	NA	ZINC	Blood	9.0E-02	--	--	9.0E-02
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	2.0E-05	--	--	2.0E-05	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	5.6E-06	--	--	5.6E-06	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(K)FLUORANTHENE	2.9E-07	--	--	2.9E-07	BENZO(K)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	8.8E-05	--	--	8.8E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			CHRYSENE	1.9E-07	--	--	1.9E-07	CHRYSENE	NA	--	--	--	NA
			DIBENZ(A,H)ANTHRACENE	4.2E-05	--	--	4.2E-05	DIBENZ(A,H)ANTHRACENE	NA	--	--	--	NA
			FLUORANTHENE	--	--	--	NA	FLUORANTHENE	Liver	8.7E-03	--	--	8.7E-03
			INDENO(1,2,3-C,D)PYRENE	4.7E-06	--	--	4.7E-06	INDENO(1,2,3-C,D)PYRENE	NA	--	--	--	NA
			PYRENE	--	--	--	NA	PYRENE	Kidneys	9.0E-03	--	--	9.0E-03
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			AROCLOR-1248	6.0E-04	--	--	6.0E-04	AROCLOR-1248	NA	--	--	--	NA
			AROCLOR-1254	2.1E-04	--	--	2.1E-04	AROCLOR-1254	Eyes and skin	3.6E+01	--	--	3.6E+01
			AROCLOR-1260	1.1E-04	--	--	1.1E-04	AROCLOR-1260	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	6.1E-06	--	--	6.1E-06	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	1.5E-01	--	--	1.5E-01
			(Total for Crabs)	1.1E-03	---	---	1.1E-03		(Total for Crabs)	3.7E+01	---	---	3.7E+01

TABLE 10-9.14

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - UPTAKE EVALUATION

Location: Southwest/Tin Mill Canal Exposure Area

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
						Total Risk Across Sediment	**1.1E-03**					**Total Hazard Index Across Sediment**	**3.7E+01**
						Total Risk Across All Media and All Exposure Routes	**1E-03**					**Total Hazard Index Across All Media and All Exposure Routes**	**37**

TABLE 10-9.15

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - UPTAKE EVALUATION

Location: Southwest/Tin Mill Canal Exposure Area

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			ARSENIC	2.8E-09	--	--	2.8E-09	ARSENIC	Skin	1.5E-04	--	--	1.5E-04
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	4.2E-01	--	--	4.2E-01
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	8.5E-06	--	--	8.5E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Finfish)	8.5E-06	---	---	8.5E-06	(Total for Finfish)		4.2E-01	---	---	4.2E-01
			Total Risk Across Surface Water				**8.5E-06**			**Total Hazard Index Across Surface Water**			**4.2E-01**
Sediment	Crabs	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			ANTIMONY	--	--	--	NA	ANTIMONY	Blood	9.2E-02	--	--	9.2E-02
			ARSENIC	3.6E-06	--	--	3.6E-06	ARSENIC	Skin	1.9E-01	--	--	1.9E-01
			BERYLLIUM	--	--	--	NA	BERYLLIUM	Intestines	9.0E-02	--	--	9.0E-02
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	4.9E-02	--	--	4.9E-02
			COPPER	--	--	--	NA	COPPER	Gastrointestinal System	1.3E-02	--	--	1.3E-02
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	1.2E-04	--	--	1.2E-04
			NICKEL	--	--	--	NA	NICKEL	Body weight	5.2E-02	--	--	5.2E-02
			SELENIUM	--	--	--	NA	SELENIUM	NA	1.9E-02	--	--	1.9E-02
			ZINC	--	--	--	NA	ZINC	Blood	1.1E-01	--	--	1.1E-01
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	7.3E-06	--	--	7.3E-06	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	2.1E-06	--	--	2.1E-06	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(K)FLUORANTHENE	1.1E-07	--	--	1.1E-07	BENZO(K)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	3.3E-05	--	--	3.3E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			CHRYSENE	7.3E-08	--	--	7.3E-08	CHRYSENE	NA	--	--	--	NA
			DIBENZ(A,H)ANTHRACENE	1.6E-05	--	--	1.6E-05	DIBENZ(A,H)ANTHRACENE	NA	--	--	--	NA
			FLUORANTHENE	--	--	--	NA	FLUORANTHENE	Liver	1.1E-02	--	--	1.1E-02
			INDENO(1,2,3-C,D)PYRENE	1.8E-06	--	--	1.8E-06	INDENO(1,2,3-C,D)PYRENE	NA	--	--	--	NA
			PYRENE	--	--	--	NA	PYRENE	Kidneys	1.1E-02	--	--	1.1E-02
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			AROCLOR-1248	2.2E-04	--	--	2.2E-04	AROCLOR-1248	NA	--	--	--	NA
			AROCLOR-1254	7.8E-05	--	--	7.8E-05	AROCLOR-1254	Eyes and skin	4.5E+01	--	--	4.5E+01
			AROCLOR-1260	4.1E-05	--	--	4.1E-05	AROCLOR-1260	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	2.3E-06	--	--	2.3E-06	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	1.9E-01	--	--	1.9E-01
			(Total for Crabs)	4.1E-04	---	---	4.1E-04	(Total for Crabs)		4.6E+01	---	---	4.6E+01
			Total Risk Across Sediment				**4.1E-04**			**Total Hazard Index Across Sediment**			**4.6E+01**
			Total Risk Across All Media and All Exposure Routes				**4E-04**			**Total Hazard Index Across All Media and All Exposure Routes**			**47**

TABLE 10-9.16

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - UPTAKE EVALUATION

Location: Southwest/Tin Mill Canal Exposure
Area Scenario Timeframe: Current
Receptor Population: Watermen
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			ARSENIC	1.8E-08	--	--	1.8E-08	ARSENIC	Skin	1.1E-04	--	--	1.1E-04
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	3.1E-01	--	--	3.1E-01
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	1.7E-05	--	--	1.7E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Finfish)	1.7E-05	---	---	1.7E-05		(Total for Finfish)	3.1E-01	---	---	3.1E-01
						Total Risk Across Surface Water	**1.7E-05**					**Total Hazard Index Across Surface Water**	**3.1E-01**
Sediment	Sediment	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			ARSENIC	--	9.8E-07	--	9.8E-07	ARSENIC	Skin	--	6.1E-03	--	6.1E-03
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	--	8.0E-07	--	8.0E-07	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total)	---	1.8E-06	---	1.8E-06		(Total)	---	6.1E-03	---	6.1E-03
	Crabs	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			ANTIMONY	--	--	--	NA	ANTIMONY	Blood	6.8E-02	--	--	6.8E-02
			ARSENIC	2.2E-05	--	--	2.2E-05	ARSENIC	Skin	1.4E-01	--	--	1.4E-01
			BERYLLIUM	--	--	--	NA	BERYLLIUM	Intestines	6.7E-02	--	--	6.7E-02
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	3.6E-02	--	--	3.6E-02
			COPPER	--	--	--	NA	COPPER	Gastrointestinal System	9.6E-03	--	--	9.6E-03
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	9.1E-05	--	--	9.1E-05
			NICKEL	--	--	--	NA	NICKEL	Body weight	3.9E-02	--	--	3.9E-02
			SELENIUM	--	--	--	NA	SELENIUM	NA	1.4E-02	--	--	1.4E-02
			ZINC	--	--	--	NA	ZINC	Blood	8.4E-02	--	--	8.4E-02
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	1.5E-05	--	--	1.5E-05	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	4.4E-06	--	--	4.4E-06	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(K)FLUORANTHENE	2.3E-07	--	--	2.3E-07	BENZO(K)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	6.8E-05	--	--	6.8E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			CHRYSENE	1.5E-07	--	--	1.5E-07	CHRYSENE	NA	--	--	--	NA
			DIBENZ(A,H)ANTHRACENE	3.3E-05	--	--	3.3E-05	DIBENZ(A,H)ANTHRACENE	NA	--	--	--	NA
			FLUORANTHENE	--	--	--	NA	FLUORANTHENE	Liver	8.1E-03	--	--	8.1E-03
			INDENO(1,2,3-C,D)PYRENE	3.6E-06	--	--	3.6E-06	INDENO(1,2,3-C,D)PYRENE	NA	--	--	--	NA
			PYRENE	--	--	--	NA	PYRENE	Kidneys	8.3E-03	--	--	8.3E-03
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			AROCLOR-1248	1.4E-03	--	--	1.4E-03	AROCLOR-1248	NA	--	--	--	NA
			AROCLOR-1254	4.8E-04	--	--	4.8E-04	AROCLOR-1254	Eyes and skin	3.4E+01	--	--	3.4E+01
			AROCLOR-1260	2.5E-04	--	--	2.5E-04	AROCLOR-1260	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	1.4E-05	--	--	1.4E-05	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	1.4E-01	--	--	1.4E-01
			(Total for Crabs)	2.3E-03	---	---	2.3E-03		(Total for Crabs)	3.4E+01	---	---	3.4E+01
						Total Risk Across Sediment	**2.3E-03**					**Total Hazard Index Across Sediment**	**3.4E+01**
						Total Risk Across All Media and All Exposure Routes	**2E-03**					**Total Hazard Index Across All Media and All Exposure Routes**	**35**

TABLE 10-10.1

SIGNFICANT CONTRIBUTORS TO RISK

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT NORTHEAST/NEAR-SHORE - FIELD COLLECTED TISSUE EVALUATION

Location: Northeast/Near Shore Exposure Area

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Total Risk Across Surface Water							**0.0E+00**			**Total Hazard Index Across Surface Water**			**0.0E+00**
Sediment	Crabs	Northeast/ Near Shore	**POLYAROMATIC HYDROCARBONS**					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	4.2E-06	--	--	4.2E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Crabs)	4.8E-06	---	---	4.8E-06	(Total for Crabs)		---	---	---	---
Total Risk Across Sediment							**4.8E-06**			**Total Hazard Index Across Sediment**			**0.0E+00**
Total Risk Across All Media and All Exposure Routes							**5E-06**			**Total Hazard Index Across All Media and All Exposure Routes**			**0.0**

TABLE 10-10.2

SIGNFICANT CONTRIBUTORS TO RISK

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT NORTHEAST/NEAR-SHORE - FIELD COLLECTED TISSUE EVALUATION

Location: Northeast/Near Shore Exposure Area

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Total Risk Across Surface Water							**0.0E+00**			**Total Hazard Index Across Surface Water**			**0.0E+00**
Sediment	Crabs	Northeast/ Near Shore	**POLYAROMATIC HYDROCARBONS**					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	1.3E-06	--	--	1.3E-06	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	1.6E-06	--	--	1.6E-06	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	8.2E-06	--	--	8.2E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Crabs)	1.2E-05	---	---	1.2E-05	(Total for Crabs)		---	---	---	---
Total Risk Across Sediment							**1.2E-05**			**Total Hazard Index Across Sediment**			**0.0E+00**
Total Risk Across All Media and All Exposure Routes							**1E-05**			**Total Hazard Index Across All Media and All Exposure Routes**			**0.0**

TABLE 10-10.3

SIGNFICANT CONTRIBUTORS TO RISK

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT NORTHEAST/NEAR-SHORE - FIELD COLLECTED TISSUE EVALUATION

Location: Northeast/Near Shore Exposure Area

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Total Risk Across Surface Water							**0.0E+00**			**Total Hazard Index Across Surface Water**			**0.0E+00**
Sediment	Crabs	Northeast/ Near Shore	**INORGANICS**					**INORGANICS**					
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	3.1E-06	--	--	3.1E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Crabs)	3.8E-06	---	---	3.8E-06	(Total for Crabs)		---	---	---	---
Total Risk Across Sediment							**3.8E-06**			**Total Hazard Index Across Sediment**			**0.0E+00**
Total Risk Across All Media and All Exposure Routes							**4E-06**			**Total Hazard Index Across All Media and All Exposure Routes**			**0.0**

Total Hazard Index Across For Central Nervous System **0.0**

TABLE 10-10.4

SIGNFICANT CONTRIBUTORS TO RISK

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT NORTHEAST/NEAR-SHORE - FIELD COLLECTED TISSUE EVALUATION

Location: Northeast/Near Shore Exposure Area

Scenario Timeframe: Current
Receptor Population: Watermen
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Sediment	Crabs	Northeast/ Near Shore	**POLYAROMATIC HYDROCARBONS**					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	1.0E-06	--	--	1.0E-06	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	1.3E-06	--	--	1.3E-06	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	6.3E-06	--	--	6.3E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Crabs)	9.5E-06	---	---	9.5E-06	(Total for Crabs)		---	---	---	---
						Total Risk Across Sediment	**9.5E-06**					**Total Hazard Index Across Sediment**	**0.0E+00**
						Total Risk Across All Media and All Exposure Routes	**1E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**0.0**

TABLE 10-10.5

SIGNIFICANT CONTRIBUTORS TO RISK

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT NORTHEAST/NEAR-SHORE - UPTAKE EVALUATION

Location: Northeast/Near Shore Exposure Area

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Northeast/ Near Shore	**POLYAROMATIC HYDROCARBONS**					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	1.6E-05	--	--	1.6E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Finfish)	1.6E-05	---	---	1.6E-05		(Total for Finfish)	---	---	---	---
						Total Risk Across Surface Water	**1.6E-05**					**Total Hazard Index Across Surface Water**	**0.0E+00**
Sediment	Crabs	Northeast/ Near Shore	**INORGANICS**					**INORGANICS**					
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	1.3E-06	--	--	1.3E-06	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(A)PYRENE	7.7E-06	--	--	7.7E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			DIBENZ(A,H)ANTHRACENE	2.1E-06	--	--	2.1E-06	DIBENZ(A,H)ANTHRACENE	NA	--	--	--	NA
			(Total for Crabs)	1.1E-05	---	---	1.1E-05		(Total for Crabs)	---	---	---	---
						Total Risk Across Sediment	**1.1E-05**					**Total Hazard Index Across Sediment**	**0.0E+00**
						Total Risk Across All Media and All Exposure Routes	**3E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**0.0**

TABLE 10-10.6

SIGNIFICANT CONTRIBUTORS TO RISK

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT NORTHEAST/NEAR-SHORE - UPTAKE EVALUATION

Location: Northeast/Near Shore Exposure Area

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Northeast/ Near Shore	**POLYAROMATIC HYDROCARBONS**					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	3.1E-05	--	--	3.1E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Finfish)	3.1E-05	---	---	3.1E-05	(Total for Finfish)		---	---	---	---
						Total Risk Across Surface Water	**3.1E-05**					**Total Hazard Index Across Surface Water**	**0.0E+00**
Sediment	Crabs	Northeast/ Near Shore	**POLYAROMATIC HYDROCARBONS**					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	2.5E-06	--	--	2.5E-06	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(A)PYRENE	1.5E-05	--	--	1.5E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			DIBENZ(A,H)ANTHRACENE	4.1E-06	--	--	4.1E-06	DIBENZ(A,H)ANTHRACENE	NA	--	--	--	NA
			(Total for Crabs)	2.2E-05	---	---	2.2E-05	(Total for Crabs)		---	---	---	---
						Total Risk Across Sediment	**2.2E-05**					**Total Hazard Index Across Sediment**	**0.0E+00**
						Total Risk Across All Media and All Exposure Routes	**5E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**0.0**

TABLE 10-10.7

SIGNIFICANT CONTRIBUTORS TO RISK

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT NORTHEAST/NEAR-SHORE - UPTAKE EVALUATION

Location: Northeast/Near Shore Exposure Area

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Northeast/ Near Shore	**POLYAROMATIC HYDROCARBONS**					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	1.1E-05	--	--	1.1E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Finfish)	1.1E-05	---	---	1.1E-05	(Total for Finfish)		---	---	---	---
						Total Risk Across Surface Water	**1.1E-05**					**Total Hazard Index Across Surface Water**	**0.0E+00**
Sediment	Crabs	Northeast/ Near Shore	**INORGANICS**					**INORGANICS**					
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	5.7E-06	--	--	5.7E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			DIBENZ(A,H)ANTHRACENE	1.6E-06	--	--	1.6E-06	DIBENZ(A,H)ANTHRACENE	NA	--	--	--	NA
			(Total for Crabs)	7.2E-06	---	---	7.2E-06	(Total for Crabs)		---	---	---	---
						Total Risk Across Sediment	**7.2E-06**					**Total Hazard Index Across Sediment**	**0.0E+00**
						Total Risk Across All Media and All Exposure Routes	**2E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**0**

TABLE 10-10.8

SIGNIFICANT CONTRIBUTORS TO RISK

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT NORTHEAST/NEAR-SHORE - UPTAKE EVALUATION

Location: Northeast/Near Shore Exposure Area

Scenario Timeframe: Current
Receptor Population: Watermen
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Northeast/ Near Shore	**POLYAROMATIC HYDROCARBONS**					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	2.4E-05	--	--	2.4E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Finfish)	2.4E-05	---	---	2.4E-05	(Total for Finfish)		---	---	---	---
						Total Risk Across Surface Water	**2.4E-05**					**Total Hazard Index Across Surface Water**	**0.0E+00**
Sediment	Crabs	Northeast/ Near Shore	**INORGANICS**					**INORGANICS**					
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	1.9E-06	--	--	1.9E-06	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(A)PYRENE	1.2E-05	--	--	1.2E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			DIBENZ(A,H)ANTHRACENE	3.2E-06	--	--	3.2E-06	DIBENZ(A,H)ANTHRACENE	NA	--	--	--	NA
			(Total for Crabs)	1.7E-05	---	---	1.7E-05	(Total for Crabs)		---	---	---	---
						Total Risk Across Sediment	**1.7E-05**					**Total Hazard Index Across Sediment**	**0.0E+00**
						Total Risk Across All Media and All Exposure Routes	**4E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**0.0**

TABLE 10-10.9

SIGNIFICANT CONTRIBUTORS TO RISK

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - FIELD COLLECTED TISSUE EVALUATION

Location: Southwest/Tin Mill Canal Exposure Area

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			ARSENIC	2.7E-06	--	--	2.7E-06	ARSENIC	Skin	--	--	--	NA
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			TOTAL PCB's	1.5E-05	--	--	1.5E-05	TOTAL PCB's	NA	--	--	--	NA
			(Total for Finfish)	1.8E-05	---	---	1.8E-05	(Total for Finfish)		---	---	---	---
			Total Risk Across Surface Water				**1.8E-05**			**Total Hazard Index Across Surface Water**			**0.0E+00**
Sediment	Crabs	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			ARSENIC	7.0E-06	--	--	7.0E-06	ARSENIC	Skin	--	--	--	NA
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	4.2E-06	--	--	4.2E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			TOTAL PCB's	1.5E-05	--	--	1.5E-05	TOTAL PCB's	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	9.3E-06	--	--	9.3E-06	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	--	--	--	NA
			(Total for Crabs)	3.6E-05	---	---	3.6E-05	(Total for Crabs)		---	---	---	---
			Total Risk Across Sediment				**3.6E-05**			**Total Hazard Index Across Sediment**			**0.0E+00**
			Total Risk Across All Media and All Exposure Routes				**5E-05**			**Total Hazard Index Across All Media and All Exposure Routes**			**0.0**

TABLE 10-10.10

SIGNIFICANT CONTRIBUTORS TO RISK

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - FIELD COLLECTED TISSUE EVALUATION

Location: Southwest/Tin Mill Canal Exposure Area
Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			ARSENIC	1.8E-06	--	--	1.8E-06	ARSENIC	Skin	--	--	--	NA
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			TOTAL PCB's	1.0E-05	--	--	1.0E-05	TOTAL PCB's	NA	--	--	--	NA
			(Total for Finfish)	1.2E-05	---	---	1.2E-05	(Total for Finfish)		---	---	---	---
						Total Risk Across Surface Water	**1.2E-05**					**Total Hazard Index Across Surface Water**	**0.0E+00**
Sediment	Crabs	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			ARSENIC	4.6E-06	--	--	4.6E-06	ARSENIC	Skin	--	--	--	NA
			COPPER	--	--	--	NA	COPPER	Gastrointestinal System	--	--	--	NA
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	1.3E-06	--	--	1.3E-06	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	1.6E-06	--	--	1.6E-06	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	8.2E-06	--	--	8.2E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			TOTAL PCB's	9.9E-06	--	--	9.9E-06	TOTAL PCB's	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	6.1E-06	--	--	6.1E-06	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	--	--	--	NA
			(Total for Crabs)	3.2E-05	---	---	3.2E-05	(Total for Crabs)		---	---	---	---
						Total Risk Across Sediment	**3.2E-05**					**Total Hazard Index Across Sediment**	**0.0E+00**
						Total Risk Across All Media and All Exposure Routes	**4E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**0.0**

TABLE 10-10.11

SIGNIFICANT CONTRIBUTORS TO RISK

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - FIELD COLLECTED TISSUE EVALUATION

Location: Southwest/Tin Mill Canal Exposure Area
Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Southwest/ Tin Mill	**POLYCHLORINATED BIPHENYLS**					**POLYCHLORINATED BIPHENYLS**					
			TOTAL PCB's	3.8E-06	--	--	3.8E-06	TOTAL PCB's	NA	--	--	--	NA
			(Total for Finfish)	3.8E-06	---	---	3.8E-06	(Total for Finfish)		---	---	---	---
			Total Risk Across Surface Water				**3.8E-06**			**Total Hazard Index Across Surface Water**			**0.0E+00**
Sediment	Crabs	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			ARSENIC	1.7E-06	--	--	1.7E-06	ARSENIC	Skin	--	--	--	NA
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	3.1E-06	--	--	3.1E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			TOTAL PCB's	3.7E-06	--	--	3.7E-06	TOTAL PCB's	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	2.3E-06	--	--	2.3E-06	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	--	--	--	NA
			(Total for Crabs)	1.1E-05	---	---	1.1E-05	(Total for Crabs)		---	---	---	---
			Total Risk Across Sediment				**1.1E-05**					**Total Hazard Index Across Sediment**	**0.0E+00**
			Total Risk Across All Media and All Exposure Routes				**1E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**0.0**

TABLE 10-10.12

SIGNIFICANT CONTRIBUTORS TO RISK

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - FIELD COLLECTED TISSUE EVALUATION

Location: Southwest/Tin Mill Canal Exposure Area
Scenario Timeframe: Current
Receptor Population: Watermen
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Southwest/	**INORGANICS**					**INORGANICS**					
		Tin Mill	ARSENIC	4.1E-06	--	--	4.1E-06	ARSENIC	Skin	--	--	--	NA
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			TOTAL PCB's	2.3E-05	--	--	2.3E-05	TOTAL PCB's	NA	--	--	--	NA
			(Total for Finfish)	2.7E-05	---	---	2.7E-05	(Total for Finfish)		---	---	---	---
						Total Risk Across Surface Water	**2.7E-05**					**Total Hazard Index Across Surface Water**	**0.0E+00**
Sediment	Crabs	Southwest/	**INORGANICS**					**INORGANICS**					
		Tin Mill	ARSENIC	1.1E-05	--	--	1.1E-05	ARSENIC	Skin	--	--	--	NA
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	1.0E-06	--	--	1.0E-06	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	1.3E-06	--	--	1.3E-06	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	6.3E-06	--	--	6.3E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			TOTAL PCB's	2.3E-05	--	--	2.3E-05	TOTAL PCB's	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	1.4E-05	--	--	1.4E-05	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	--	--	--	NA
			(Total for Crabs)	5.6E-05	---	---	5.6E-05	(Total for Crabs)		---	---	---	---
						Total Risk Across Sediment	**5.6E-05**					**Total Hazard Index Across Sediment**	**0.0E+00**
						Total Risk Across All Media and All Exposure Routes	**8E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**0.0**

TABLE 10-10.13

SIGNIFICANT CONTRIBUTORS TO RISK

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - UPTAKE EVALUATION

Location: Southwest/Tin Mill Canal Exposure Area

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	2.6E-01	--	--	2.6E-01
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	1.1E-05	--	--	1.1E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Finfish)	1.1E-05	---	---	1.1E-05		(Total for Finfish)	2.6E-01	---	---	2.6E-01
						Total Risk Across Surface Water	**1.1E-05**					**Total Hazard Index Across Surface Water**	**2.6E-01**
Sediment	Crabs	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			ARSENIC	1.5E-05	--	--	1.5E-05	ARSENIC	Skin	1.1E-01	--	--	1.1E-01
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	9.9E-06	--	--	9.9E-06	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	2.9E-06	--	--	2.9E-06	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	4.5E-05	--	--	4.5E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			DIBENZ(A,H)ANTHRACENE	2.1E-05	--	--	2.1E-05	DIBENZ(A,H)ANTHRACENE	NA	--	--	--	NA
			INDENO(1,2,3-C,D)PYRENE	2.4E-06	--	--	2.4E-06	INDENO(1,2,3-C,D)PYRENE	NA	--	--	--	NA
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			AROCLOR-1248	9.1E-04	--	--	9.1E-04	AROCLOR-1248	NA	--	--	--	NA
			AROCLOR-1254	3.2E-04	--	--	3.2E-04	AROCLOR-1254	Eyes and skin	2.8E+01	--	--	2.8E+01
			AROCLOR-1260	1.7E-04	--	--	1.7E-04	AROCLOR-1260	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	9.3E-06	--	--	9.3E-06	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	1.2E-01	--	--	1.2E-01
			(Total for Crabs)	1.5E-03	---	---	1.5E-03		(Total for Crabs)	2.8E+01	---	---	2.8E+01
						Total Risk Across Sediment	**1.5E-03**					**Total Hazard Index Across Sediment**	**2.8E+01**
						Total Risk Across All Media and All Exposure Routes	**2E-03**					**Total Hazard Index Across All Media and All Exposure Routes**	**28**

Total Hazard Index Across For Central Nervous System	**0.3**
Total Hazard Index Across For Liver	**0.1**
Total Hazard Index Across For Skin	**28**
Total Hazard Index Across For Eyes	**28**

TABLE 10-10.14

SIGNIFICANT CONTRIBUTORS TO RISK

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - UPTAKE EVALUATION

Location: Southwest/Tin Mill Canal Exposure Area
Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	3.4E-01	--	--	3.4E-01
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	2.3E-05	--	--	2.3E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Finfish)	2.3E-05	---	---	2.3E-05		(Total for Finfish)	3.4E-01	---	---	3.4E-01
						Total Risk Across Surface Water	**2.3E-05**					**Total Hazard Index Across Surface Water**	**3.4E-01**
Sediment	Crabs	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			ARSENIC	9.6E-06	--	--	9.6E-06	ARSENIC	Skin	1.5E-01	--	--	1.5E-01
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	2.0E-05	--	--	2.0E-05	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	5.6E-06	--	--	5.6E-06	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	8.8E-05	--	--	8.8E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			DIBENZ(A,H)ANTHRACENE	4.2E-05	--	--	4.2E-05	DIBENZ(A,H)ANTHRACENE	NA	--	--	--	NA
			INDENO(1,2,3-C,D)PYRENE	4.7E-06	--	--	4.7E-06	INDENO(1,2,3-C,D)PYRENE	NA	--	--	--	NA
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			AROCLOR-1248	6.0E-04	--	--	6.0E-04	AROCLOR-1248	NA	--	--	--	NA
			AROCLOR-1254	2.1E-04	--	--	2.1E-04	AROCLOR-1254	Eyes and skin	3.6E+01	--	--	3.6E+01
			AROCLOR-1260	1.1E-04	--	--	1.1E-04	AROCLOR-1260	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	6.1E-06	--	--	6.1E-06	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	1.5E-01	--	--	1.5E-01
			(Total for Crabs)	1.1E-03	---	---	1.1E-03		(Total for Crabs)	3.7E+01	---	---	3.7E+01
						Total Risk Across Sediment	**1.1E-03**					**Total Hazard Index Across Sediment**	**3.7E+01**
						Total Risk Across All Media and All Exposure Routes	**1E-03**					**Total Hazard Index Across All Media and All Exposure Routes**	**37**

Total Hazard Index Across For Central Nervous System	**0.3**
Total Hazard Index Across For Liver	**0.2**
Total Hazard Index Across For Skin	**36**
Total Hazard Index Across For Eyes	**36**

TABLE 10-10.15

SIGNIFICANT CONTRIBUTORS TO RISK

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - UPTAKE EVALUATION

Location: Southwest/Tin Mill Canal Exposure Area

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	4.2E-01	--	--	4.2E-01
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	8.5E-06	--	--	8.5E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Finfish)	8.5E-06	---	---	8.5E-06	(Total for Finfish)		4.2E-01	---	---	4.2E-01
			Total Risk Across Surface Water				**8.5E-06**			**Total Hazard Index Across Surface Water**			**4.2E-01**
Sediment	Crabs	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			ARSENIC	3.6E-06	--	--	3.6E-06	ARSENIC	Skin	1.9E-01	--	--	1.9E-01
			ZINC	--	--	--	NA	ZINC	Blood	1.1E-01	--	--	1.1E-01
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	7.3E-06	--	--	7.3E-06	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	2.1E-06	--	--	2.1E-06	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	3.3E-05	--	--	3.3E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			DIBENZ(A,H)ANTHRACENE	1.6E-05	--	--	1.6E-05	DIBENZ(A,H)ANTHRACENE	NA	--	--	--	NA
			INDENO(1,2,3-C,D)PYRENE	1.8E-06	--	--	1.8E-06	INDENO(1,2,3-C,D)PYRENE	NA	--	--	--	NA
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			AROCLOR-1248	2.2E-04	--	--	2.2E-04	AROCLOR-1248	NA	--	--	--	NA
			AROCLOR-1254	7.8E-05	--	--	7.8E-05	AROCLOR-1254	Eyes and skin	4.5E+01	--	--	4.5E+01
			AROCLOR-1260	4.1E-05	--	--	4.1E-05	AROCLOR-1260	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	--	--	--	NA	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	1.9E-01	--	--	1.9E-01
			(Total for Crabs)	4.1E-04	---	---	4.1E-04	(Total for Crabs)		4.6E+01	---	---	4.6E+01
			Total Risk Across Sediment				**4.1E-04**			**Total Hazard Index Across Sediment**			**4.6E+01**
			Total Risk Across All Media and All Exposure Routes				**4E-04**			**Total Hazard Index Across All Media and All Exposure Routes**			**46**

Total Hazard Index Across For Blood	**0.1**
Total Hazard Index Across For Central Nervous System	**0.4**
Total Hazard Index Across For Liver	**0.2**
Total Hazard Index Across For Skin	**45**
Total Hazard Index Across For Eyes	**45**

TABLE 10-10.16

SIGNIFICANT CONTRIBUTORS TO RISK

REASONABLE MAXIMUM EXPOSURE

SPARROWS POINT SOUTHWEST/TIN MILL CANAL EFFLUENT - UPTAKE EVALUATION

Location: Southwest/Tin Mill Canal Exposure Area
Scenario Timeframe: Current
Receptor Population: Watermen
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Finfish	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	3.1E-01	--	--	3.1E-01
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)PYRENE	1.7E-05	--	--	1.7E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Finfish)	1.7E-05	---	---	1.7E-05		(Total for Finfish)	3.1E-01	---	---	3.1E-01
			Total Risk Across Surface Water				**1.7E-05**		**Total Hazard Index Across Surface Water**				**3.1E-01**
Sediment	Crabs	Southwest/ Tin Mill	**INORGANICS**					**INORGANICS**					
			ARSENIC	2.2E-05	--	--	2.2E-05	ARSENIC	Skin	1.4E-01	--	--	1.4E-01
			POLYAROMATIC HYDROCARBONS					**POLYAROMATIC HYDROCARBONS**					
			BENZO(A)ANTHRACENE	1.5E-05	--	--	1.5E-05	BENZO(A)ANTHRACENE	NA	--	--	--	NA
			BENZO(B)FLUORANTHENE	4.4E-06	--	--	4.4E-06	BENZO(B)FLUORANTHENE	NA	--	--	--	NA
			BENZO(A)PYRENE	6.8E-05	--	--	6.8E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			DIBENZ(A,H)ANTHRACENE	3.3E-05	--	--	3.3E-05	DIBENZ(A,H)ANTHRACENE	NA	--	--	--	NA
			INDENO(1,2,3-C,D)PYRENE	3.6E-06	--	--	3.6E-06	INDENO(1,2,3-C,D)PYRENE	NA	--	--	--	NA
			POLYCHLORINATED BIPHENYLS					**POLYCHLORINATED BIPHENYLS**					
			AROCLOR-1248	1.4E-03	--	--	1.4E-03	AROCLOR-1248	NA	--	--	--	NA
			AROCLOR-1254	4.8E-04	--	--	4.8E-04	AROCLOR-1254	Eyes and skin	3.4E+01	--	--	3.4E+01
			AROCLOR-1260	2.5E-04	--	--	2.5E-04	AROCLOR-1260	NA	--	--	--	NA
			SEMIVOLATILE ORGANIC COMPOUNDS					**SEMIVOLATILE ORGANIC COMPOUNDS**					
			BIS(2-ETHYLHEXYL)PHTHALATE	1.4E-05	--	--	1.4E-05	BIS(2-ETHYLHEXYL)PHTHALATE	Liver	1.4E-01	--	--	1.4E-01
			(Total for Crabs)	2.3E-03	---	---	2.3E-03		(Total for Crabs)	3.4E+01	---	---	3.4E+01
			Total Risk Across Sediment				**2.3E-03**		**Total Hazard Index Across Sediment**				**3.4E+01**
			Total Risk Across All Media and All Exposure Routes				**2E-03**		**Total Hazard Index Across All Media and All Exposure Routes**				**34**

Total Hazard Index Across For Central Nervous System	**0.3**
Total Hazard Index Across For Liver	**0.1**
Total Hazard Index Across For Skin	**34**
Total Hazard Index Across For Eyes	**34**

TABLE 10-11.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

PHASE I AREA OF THE SPARROWS POINT SITE

NORTHEAST/NEAR-SHORE - FINFISH/UPTAKE - STORM CONDITIONS

Scenario Timeframe: Future
Medium: Surface water
Exposure Medium: Finfish
Exposure Point: Northeast/Near Shore Exposure Area

CAS Number	Chemical	SW EPC (mg/L)	SWBAF (mg/L to mg/kg dry weight)	Concentration [1] Used for Screening (mg/kg)	Screening [2] Toxicity Value (mg/kg)		COPC Flag	Rationale for [3] Contaminant Deletion or Selection
INORGANICS								
7440-47-3	CHROMIUM	5.20E-04	8.00E+02	4.16E-01	2.30E+02	N	No	BSL
7440-50-8	COPPER	6.40E-04	1.86E+03	1.19E+00	6.20E+00	N	No	BSL
57-12-5	CYANIDE (TOTAL)	1.97E-03	4.00E+00	7.88E-03	9.30E-02	N	No	BSL
7439-92-1	LEAD	1.00E-04	4.50E+01	4.50E-03	NA		No	NSL
7439-97-6	**MERCURY**	**1.60E-04**	**7.20E+03**	**1.15E+00**	**4.60E-02**	**N**	**Yes**	**ASL**
7440-02-0	NICKEL	1.66E-03	9.60E+01	1.59E-01	3.10E+00	N	No	BSL
7440-66-6	ZINC	8.95E-03	2.52E+02	2.26E+00	4.60E+01	N	No	BSL
POLYAROMATIC HYDROCARBONS								
50-32-8	**HMW PAHs**	**1.15E-05**	**2.06E+04**	**2.37E-01**	**5.70E-04**	**C**	**Yes**	**ASL**
129-00-0	LMW PAHs	1.30E-04	3.08E+03	4.01E-01	4.60E+00	N	No	BSL
SEMIVOLATILE ORGANIC COMPOUNDS								
117-81-7	**BIS(2-ETHYLHEXYL) PHTHLATE**	**8.00E-05**	**6.85E+03**	**5.48E-01**	**3.00E-01**	**C**	**Yes**	**ASL**

Note: Chemicals of Potential Concern are bold with shading.

(1) The screening concentration is the Surface Water EPC*SWBAF.

(2) USEPA Regional Screening Levels, USEPA, June 2015. For non-carcinogens, value shown is equal to 1/10 the fish tissue value. For carcinogens the value shown is equal to the fish tissue value.

(3) Rationale Codes

Selection Reason: ASL = Above Screening Toxicity Level
Deletion Reason: BSL = Below Screening Toxicity Level
NSL = No Screening Toxicity Level

Surrogates used: Benzo(a)pyrene for HMW PAHs, and Pyrene for LMW PAHs.

Definitions:
C = Carcinogenic
COPC = Chemical of Potential Concern
N = Non-Carcinogenic
NA = Not Applicable
mg/kg = milligrams per kilogram
EPC = Exposure Point Concentration
SWBAF = Surface water Bioaccumulation Factor

TABLE 10-11.2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

PHASE I AREA OF THE SPARROWS POINT SITE

SOUTHWEST/TIN MILL CANAL EFFLUENT - FINFISH/UPTAKE - STORM CONDITIONS

Scenario Timeframe: Future
Medium: Surface water
Exposure Medium: Finfish
Exposure Point: Phase I Area of the Sparrows Point Site

CAS Number	Chemical	SW EPC (mg/L)	SWBAF (mg/L to mg/kg dry weight)	Concentration [1] Used for Screening (mg/kg)	Screening [2] Toxicity Value (mg/kg)		COPC Flag	Rationale for [3] Contaminant Deletion or Selection
INORGANICS								
7440-36-0	ANTIMONY	1.90E-04	4.00E+00	7.60E-04	6.20E-02	N	No	BSL
7440-38-2	**ARSENIC**	**5.50E-04**	**1.60E+01**	**8.80E-03**	**2.80E-03**	**C**	**Yes**	**ASL**
7440-47-3	CHROMIUM	3.20E-04	8.00E+02	2.56E-01	2.30E+02	N	No	BSL
7440-50-8	COPPER	3.40E-04	1.86E+03	6.31E-01	6.20E+00	N	No	BSL
57-12-5	CYANIDE (TOTAL)	1.42E-03	4.00E+00	5.68E-03	9.30E-02	N	No	BSL
7439-92-1	LEAD	9.00E-05	4.50E+01	4.05E-03	NA		No	NSL
7439-97-6	**MERCURY**	**1.20E-04**	**7.20E+03**	**8.64E-01**	**4.60E-02**	**N**	**Yes**	**ASL**
7440-02-0	NICKEL	1.80E-03	9.60E+01	1.73E-01	3.10E+00	N	No	BSL
7440-66-6	ZINC	6.03E-03	2.52E+02	1.52E+00	4.60E+01	N	No	BSL
POLYAROMATIC HYDROCARBONS								
50-32-8	**HMW PAHs**	**1.00E-05**	**2.06E+04**	**2.06E-01**	**5.70E-04**	**C**	**Yes**	**ASL**
129-00-0	LMW PAHs	1.40E-04	3.08E+03	4.31E-01	4.60E+00	N	No	BSL
SEMIVOLATILE ORGANIC COMPOUNDS								
117-81-7	BIS(2-ETHYLHEXYL) PHTHLATE	4.00E-05	6.85E+03	2.74E-01	3.00E-01	C	No	BSL

Note: Chemicals of Potential Concern are bold with shading.

(1) The screening concentration is the Surface Water EPC*SWBAF.
value.

(3) Rationale Codes

ASL = Above Screening Toxicity Level
BSL = Below Screening Toxicity Level
NSL = No Screening Toxicity Level

Surrogates used: Benzo(a)pyrene for HMW PAHs, and Pyrene for LMW PAHs.

Definitions:

C = Carcinogenic
COPC = Chemical of Potential Concern
EPC = Exposure Point Concentration
N = Non-Carcinogenic
NA = Not Applicable
SWBAF = Surface water Bioaccumulation Factor
mg/kg = milligrams per kilogram

11. CONCLUSIONS AND RECOMMENDATIONS

The Offshore Investigation for the Phase I area included collection of sediment, pore water, and stormwater samples to support delineation of offshore impacts to Bear Creek from the Sparrows Point Facility. A primary objective of the investigation was to identify current Site-related impacts to the offshore environment. Accordingly, the pore water and stormwater data were used to model current Site-related impacts to surface water in the near-shore environment. An additional objective was identified after the results of the first round of sampling indicated substantial contamination in the southern portion of the Phase I area, likely associated with historical discharges from the Tin Mill Canal. Therefore, in addition to current impacts along the shoreline in the northern portion of the Phase I area, the offshore investigation also sought to delineate these historical impacts which appear to be associated with the Tin Mill Canal. The objectives of the investigation also included conducting human health and ecological risk assessments, as well as providing information that will be considered in remedial decision-making for the offshore area.

Human health and ecological risk assessments evaluated the potential cumulative risks for human and ecological receptors from exposure to surface water, sediment, and fish and crab tissue, within the Phase I area of Sparrows Point. The Phase I area was divided into two areas/groupings for the risk assessment, based on geography as well as the characteristics of and impacts to the sediment, with locations in the Northwest/Near-Shore grouping having coarser sediments and/or less observable impacts (e.g., odor, sheen). Locations in the Southwest/Tin Mill Canal Effluent grouping are generally silty-to-clayey and show preliminary evidence of impacts from the Canal effluent.

In northerly Grouping NNS, the investigation and risk assessments focused on current inputs of Site-related COPCs to the offshore area via groundwater/pore water and stormwater. The lines of evidence considered in the ERA suggest that Site-related COPCs in the Northeast/Near-Shore grouping area are not present in concentrations that pose a risk to wildlife; however, Site-related COPCs in sediment, as well as cyanide in surface water during storm events, may pose risks to aquatic and benthic organisms. The results of the HHRA indicate that there are no human health concerns for exposures to Site-related COPCs in the NNS area compared to the federal 10^{-4} to 10^{-6} acceptable excess cancer risk range. The Northeast/Near-Shore grouping did reveal potential carcinogenic risks above the MDE acceptable excess cancer risk range of 10^{-6} to 10^{-5} for modeled PAH concentrations via fish and crab ingestion, but no excess risk for ingestion of field-collected tissue.

In southerly Grouping SWTM, all constituents analyzed are potentially related to historical discharges from the Tin Mill Canal. Therefore, all available sediment data and modeled surface water concentrations for this grouping were used in the ERA and HHRA. The ERA concluded that wildlife that consume aquatic and benthic organisms are potentially at risk from selenium and total PCBs in sediment in this portion of the Phase I area. Aquatic and benthic organisms in this area are potentially at risk from COPCs in sediment and from cyanide in surface water only

during storm events. In addition to risks from chemical toxicity, there is also the potential for risk from oil and grease, which may cause physical impacts associated with coating gills, increasing biological oxygen demand, and fouling organisms. The results of the HHRA for the SWTM area indicate potential human health concerns primarily for ingestion of crabs containing PCBs and/or PAHs.

The SWTM grouping did reveal potential carcinogenic risks above the USEPA acceptable excess cancer risk range of 10^{-6} to 10^{-4} and above the MDE acceptable excess cancer risk range of 10^{-6} to 10^{-5} from modeled concentrations via fish and crab ingestion, while the field-collected tissue revealed carcinogenic risks above the MDE acceptable excess cancer risk range for receptors evaluated in the HHRA (**Tables 10-10.9 through 10-10.16**). Modeled Aroclor concentrations in crab revealed carcinogenic risks above 10^{-6} to 10^{-4}, while assessment of field-collected tissue revealed carcinogenic risks above 10^{-6} to 10^{-5}, based upon measured concentrations of total PCB congeners and arsenic and modeled concentrations of bis(2-ethylhexyl)phthalate.

Additionally, modeled crab tissue revealed Aroclor 1254 non-carcinogenic hazards above the acceptable level of 1 for all receptors evaluated in the HHRA (**Tables 10-10.13 through 10-10.16**). Field-collected crabs were not analyzed for Aroclors, only PCB congeners. Toxicity values for PCB congeners are only available for a cancer endpoint so a comparison of non-carcinogenic hazards is not available. However, a comparison of EPCs for the field-collected and modeled crab tissue **(Tables 10-3.9 and 10-3.11**) reveal modeled crab tissue concentrations of Aroclors two orders of magnitude higher than total PCB concentrations found in the field-collected crab tissue.

12. REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR). 2006. *Toxicological Profile for Cyanide. U.S. Department of Health and Human Services, Public Health Service. July.*

Baker, J., et al. 1997. *Spatial Mapping of Sedimentary Contaminants in the Baltimore Harbor/Patapsco River/Back River System*. Submitted to the Maryland Department of the Environment. 4 August.

Bechtel Jacobs Company LLC. 1998. *Biota Sediment Accumulation Factors for Invertebrates: Review and Recommendations for the Oak Ridge Reservation (BJC/OR-112)*. Prepared for the U.S. Department of Energy Office of Environmental Management. August.

Buchman, M.F. 2008. *NOAA Screening Quick Reference Tables*. NOAA OR&R Report 08-1. Office of Response and Restoration Division, National Oceanic and Atmospheric Administration, Seattle, Washington. 34 pages.

California Office of Environmental Health Hazard Assessment (OEHHA). 2000. *Technical Support Document for Exposure Assessment and Stochastic Analysis. Appendix H: Fish Bioconcentration Factors*. September.

CH2M Hill. 2001. *Site Wide Investigation: Groundwater Study Report, Bethlehem Steel Corporation, Sparrows Point Division*. Prepared by CH2M-Hill, Herndon Virginia for Bethlehem Steel Corporation, Sparrows Point Division, Maryland. December.

———. 2002. *Site-Wide Investigation Release Site Characterization Stud*y. Prepared by CH2M-Hill, Herndon Virginia for Bethlehem Steel Corporation, Sparrows Point Division, Maryland. June.

Computer Sciences Corporation. 2008. *Biota-Sediment Accumulation Factor Data*. Version 1.0. Prepared for United States Environmental Protection Agency.

Di Toro D.M., J.A. McGrath, and D.J. Hansen. 2000. Technical basis for narcotic chemicals and polycyclic aromatic hydrocarbon criteria. *Environ. Toxicol. Chem.* 19:1951–1970.

Domenico, P.A. and F.W. Schwartz. 1990. *Physical and Chemical Hydrogeology*, John Wiley & Sons, New York, 824 p.

EA Engineering, Science, and Technology, Inc. (EA). 2003. *Reconnaissance Study of Sparrows Point as a Containment Site for Placement of Harbor Dredged Material: Environmental Conditions*. Prepared for the Maryland Port Administration. December.

———. 2009. *Site Assessment for the Proposed Coke Point Dredged Material Containment Facility at Sparrows Point*. Prepared for the Maryland Port Administration. November.

———. 2010. *Additional Offshore Delineation for the Proposed Coke Point Dredged Material Containment Facility at Sparrows Point*. Prepared for the Maryland Port Administration. August.

———. 2011a. *Risk Assessment of Offshore Areas Adjacent to the Proposed Coke Point Dredged Material Containment Facility at Sparrows Point*. Prepared for the Maryland Port Administration. May.

———. 2011b. *Laboratory Bioaccumulation and Field-Collected Tissue Study in Support of the Risk Assessment of the Offshore Areas Adjacent to the Proposed Coke Point Dredged Material Containment Facility at Sparrows Point*. January.

———. 2014. *Work Plan for Offshore Investigation of the Phase I Area of the Sparrows Point Site*. September.

———. 2015. *Technical Memorandum: Round 1 Sediment Investigation and Plan for Round 2 Investigation, Sparrows Point Phase I Area*. January.

EnviroAnalytics Group. 2013. *Coke Point and Greys Landfills Semi-Annual Groundwater Monitoring Report, 1st Half 2013*. Prepared for Sparrows Point LLC. June.

———. 2014a. *Interim Measures 2013 Annual Report, Former Sludge Bin Storage Area, Rod and Wire Mill Area*. Prepared for Sparrows Point LLC. January.

———. 2014b. *Coke Point and Greys Landfills Semi-Annual Groundwater Monitoring Report, 2nd Half 2013*. Prepared for Sparrows Point LLC. February.

Environmental Engineering & Contracting, Inc. (EEC). 2013. *Interim Measures 2012 Annual Report, Former Sludge Bin Storage Area, Rod & Wire Mill*. Prepared for Sparrows Point LLC. January.

International Steel Group (ISG). 2005. Form 10-K, Annual Report for the Fiscal Year Ended December 31, 2004, filed by International Steel Group Inc. with the U.S. Securities and Exchange Commission, March 15, 2005.

Jones, D.S., G.W. Suter II, and R.N. Hull. 1997. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1997 Revision*. ES/ER/TM-95/R4. Prepared for U.S. Department of Energy, Office of Environmental Management. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

KCI Technologies (KCI). 2010. *Greys Landfill 2009 Groundwater Monitoring Report*. Prepared for Severstal Sparrows Point. January.

———. 2011. *Greys Landfill June 2011 Groundwater Monitoring Report*. Prepared for RG Steel Sparrows Point, LLC. June

Klosterhaus, S., et al. 2007. *Toxicity Identification and Evaluation and Long-Term Contaminant Trends in the Baltimore Harbor*. Submitted to the Maryland Department of the Environment. February.

Long, E.R. and L.G. Morgan. 1991. *The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program.* NOAA Technical Memorandum NOS OMA 52. Second printing. Seattle, Washington. August.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. *Environmental Management* 19(1):81–97.

MacDonald, D.D. 1994. *Approach to the assessment of sediment quality in Florida coastal waters.* Report prepared for Florida Department of Environmental Protection. Tallahassee, Florida.

MacDonald, D.D., R.S. Carr, F.D. Calder, E.R. Long, and C.G. Ingersoll. 1996. Development and evaluation of sediment quality guidelines for Florida coastal waters. *Ecotoxicology* 5(4):253–278.

MacDonald D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. *Archives of Environmental Contamination and Toxicology* 39:20–31.

Maryland Department of the Environment. 2014. *Maryland Fish Consumption Advisories, Statewide Fresh Water, Estuarine and Marine Waters*. April.

Maryland Department of Natural Resources. 2013. Maryland Submerged Aquatic Vegetation . http://geodata.md.gov/imap/rest/services/Biota/MD_SubmergedAquaticVegetation/MapServer

Oak Ridge National Laboratory. 2009. *Risk Assessment Information System, Toxicity and Physical Properties – Chemicals*. Online Database (http://rais.ornl.gov/). Accessed February 2009.

Persaud, D., R. Jaagumagi, and A. Hayton. 1993. *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario*. ISBN 0-7729-9248-7. Ontario Ministry of the Environment, Ottawa, Ontario. 23p.

Prince, R. 2011. *Data Evaluation and Screening Level Human Health and Ecological Risk Assessment for Bear Creek Sediment.* Land and Chemicals Division, USEPA Region III. October.

RG Steel and Silver, D.J. 2014. Environmental Trust Agreement by and between RG Steel Sparrows Point, LLC and Daniel J. Silver, trustee. January.

Rust Environment and Infrastructure (Rust). 1998. *Description of Current Conditions, Bethlehem Steel Corporation, Sparrows Point, Maryland*. Prepared by Rust Environment and Infrastructure, Harrisburg and Philadelphia Offices. January.

Sample, B.E., D.M. Opresko, and G.W. Suter II. 1996. *Toxicological Benchmarks for Wildlife*: *1996 Revision.* ES/ER/TM-86/R3. Risk Assessment Program, Health Sciences Research Division, Oak Ridge National Laboratory, Tennessee. Prepared for the United States Department of Energy, Office of Environmental Management. June.

Stammerjohn, S.,E. Smith, W.R. Boynton, and W.M. Kemp. 1991. *Potential impacts from marinas and boats in Baltimore Harbor.* Chesapeake Research Consortium Inc. Publication No. 139. Solomons, Maryland.

Suter II, G.W., and C.L. Tsao. 1996. T*oxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision*. ES/ER/TM-96/R2. Risk Assessment Program, Health Sciences Research Division, Oak Ridge National Laboratory.

United States Environmental Protection Agency (USEPA). 1976. Quality Criteria for Water. Washington DC: EPA. P. 113.

———. 1980. *Ambient Aquatic Life Water Quality Criteria for Antimony*. USEPA Office of Research and Development Environmental Research Laboratories. October.

———. 1985a. *Ambient Aquatic Life Water Quality Criteria for Arsenic − 1984*. USEPA Office of Research and Development Environmental Research Laboratories. January.

———. 1985b. *Ambient Aquatic Life Water Quality Criteria for Lead − 1984*. USEPA Office of Research and Development Environmental Research Laboratories. January.

———. 1985c. *Ambient Aquatic Life Water Quality Criteria for Mercury − 1984*. USEPA Office of Research and Development Environmental Research Laboratories. January.

———. 1986. *Ambient Aquatic Life Water Quality Criteria for Nickel − 1986*. USEPA Office of Research and Development Environmental Research Laboratories. September.

———. 1987a. *Ambient Aquatic Life Water Quality Criteria for Selenium − 1987*. USEPA Office of Research and Development Environmental Research Laboratories. September.

———. 1987b. *Ambient Aquatic Life Water Quality Criteria for Zinc − 1987*. USEPA Office of Research and Development Environmental Research Laboratories. February.

———. 1989. *Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part A).* Interim Final. EPA/540/1/-89-002. USEPA Office of Emergency and Remedial Response, Washington, D.C. December.

———. 1990. *National Oil and Hazardous Substances Pollution Contingency Plan* (40 CFR Part 300).

———. 1991. *Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual Supplemental Guidance, "Standard Default Exposure Factors."* Interim Final. PB91-921314. OSWER Directive 9285.6-03. USEPA Office of Emergency and Remedial Response, Toxics Integration Branch, Washington, D.C. 25 March.

———. 1992. *Guidelines for Data Usability in Risk Assessment (Part A)*. EPA/540/R-92/003. Office of Research and Development.

———. 1993. *Wildlife Exposure Factors Handbook*. Volumes I and II. EPA/600/R-93/187. USEPA Office of Research and Development, Washington, D.C. December.

———. 1995. *Assessing Dermal Exposure from Soil*. Region 3, Office of Superfund Programs. EPA/903-K-95-003. December.

———. 1996. Ecotox thresholds. *Eco Update* 3(2):1–12. EPA 540/F-95/038. USEPA Office of Solid Waste and Emergency Response.

———. 1997a. *Ecological Risk Assessment Guidance for Superfund. Process for Designing and Conducting Ecological Risk Assessments*. Interim Final. USEPA Environmental Response Team Office of Emergency and Remedial Response, Edison, New Jersey.

———. 1997b. *Exposure Factors Handbook: Volumes I, II, and III*. EPA/600/P-95/002Fa.

———. 1997c. *Health Effects Assessment Summary Tables (HEAST*). Office of Emergency and Remedial Response. PB97-921199INX. July.

———. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities*. Peer review draft. USEPA Office of Solid Waste.

———. 2000a. *Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment – Status and Needs*. EPA/823/R-00/001. USEPA Office of Water, Office of Solid Waste, Washington D.C.

———. 2000b. *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volume 2 Risk Assessment and Fish Consumption Limits.* Third edition. EPA 823-B-00-008. USEPA Office of Water.

———. 2002. *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part D: Standardized Planning, Reporting, and Review of Superfund Risk Assessments).* Publication 9285.7-47. Office of Emergency and Remedial Response.

———. 2003a. *Guidance for Developing Ecological Soil Screening Levels.* OSWER Directive 9285.7-55. EPA Office of Solid Waste and Emergency Response.

———. 2003b. *Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures*. EPA-600-R-02-013. Office of Research and Development. Washington, DC 20460.

———. 2003c. *Human Health Toxicity Values in Superfund Risk Assessments*. OSWER Directive 9285.7-53. Office of Solid Waste and Emergency Response.

———. 2004. *Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part E: Supplemental Guidance for Dermal Risk Assessment).* EPA/540/R/99/005, OSWER Directive 9285.7-02EP. Office of Superfund Remediation and Technology Innovation.

———. 2005a. *Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Metal Mixtures (Cadmium, Copper, Lead, Nickel, Silver, and Zinc).* EPA-600-R-02-011. Office of Research and Development. Washington, DC 20460. January.

———. 2005b. Ecological Soil Screening Levels for Cadmium. USEPA Office of Solid Waste and Emergency Response (OSWER). OSWER Directive 9285.7-65.

———. 2005c. Ecological Soil Screening Levels for Chromium. USEPA Office of Solid Waste and Emergency Response (OSWER). OSWER Directive 9285.7-66.

———. 2005d. Ecological Soil Screening Levels for Cobalt. USEPA Office of Solid Waste and Emergency Response (OSWER). OSWER Directive 9285.7-67.

———. 2005e. Ecological Soil Screening Levels for Lead. USEPA Office of Solid Waste and Emergency Response (OSWER). OSWER Directive 9285.7-70.

———. 2005f. Ecological Soil Screening Levels for Vanadium. USEPA Office of Solid Waste and Emergency Response (OSWER). OSWER Directive 9285.7-75.

———. 2005g. *Guidelines for Carcinogen Risk Assessment*. Risk Assessment Forum. EPA/630/P-03/001F. March.

———. 2005h. *Supplemental Guidance for Assessing Susceptibility From Early-Life Exposure to Carcinogens*. Risk Assessment Forum. EPA/630/R-03/003F. March.

———. 2007. *Ecological Soil Screening Levels for Polycyclic Aromatic Hydrocarbons*. OSWER Directive 9285.7-78. EPA Office of Solid Waste and Emergency Response.

———. 2007a. Ecological Soil Screening Levels for Copper. USEPA Office of Solid Waste and Emergency Response (OSWER). OSWER Directive 9285.7-68.

———. 2007b. Ecological Soil Screening Levels for DDT and Metabolites. USEPA Office of Solid Waste and Emergency Response (OSWER). OSWER Directive 9285.7-57.

———. 2007c. Ecological Soil Screening Levels for Dieldrin. USEPA Office of Solid Waste and Emergency Response (OSWER). OSWER Directive 9285.7-56.

———. 2007d. Ecological Soil Screening Levels for Manganese. USEPA Office of Solid Waste and Emergency Response (OSWER). OSWER Directive 9285.7-71.

———. 2007e. Ecological Soil Screening Levels for Nickel. USEPA Office of Solid Waste and Emergency Response (OSWER). OSWER Directive 9285.7-76.

———. 2007f. Ecological Soil Screening Levels for Selenium. USEPA Office of Solid Waste and Emergency Response (OSWER). OSWER Directive 9285.7-72.

———. 2007g. Ecological Soil Screening Levels for Zinc. USEPA Office of Solid Waste and Emergency Response (OSWER). OSWER Directive 9285.7-73.

———. 2009. *National Recommended Water Quality Criteria*. EPA Office of Science and Technology, Office of Water.

———. 2011. *Exposure Factors Handbook: 2011 Edition*. EPA/600/R-090/052F.

———. 2012a. EPI Suite™. http://www.epa.gov/tsca-screening-tools/epi-suitetm-estimation-program-interface. November.

———. 2012b. *Provision Peer-Reviewed Toxicity Values for Thallium and Compounds*. Superfund Health Risk Technical Support Center, National Center for Environmental Assessment. October 25.

———. 2013. *ProUCL Version 5.0.00*. Software developed by EPA. Obtained on the Internet at http://www.epa.gov/ nerlesd1/tsc/software.htm. Las Vegas Technical Support Center for Monitoring and Site Characterization.

———. 2014a. *Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors*. OSWER Directive 9200.1-120. Office of Solid Waste and Emergency Response.

———. 2014b. *Regional Screening Levels for Chemical Contaminants at Superfund Sites*. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm.

———. 2015a. *Regional Screening Levels for Chemical Contaminants at Superfund Sites*. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm. June.

———. 2015b. *Regional Screening Levels (RSLs) Resident Fish Table*. http://www.epa.gov/reg3hwmd/risk/human/index.htm. June.

———. 2015c. *Integrated Risk Information System database maintained on the Internet*: http://www.epa.gov/iris. EPA Environmental Criteria and Assessment Office.

U.S. Environmental Protection Agency (USEPA) Region III. 2006. Region III Biological Technical Assistance Group Screening Benchmarks. Draft.

United States Environmental Protection Agency (USEPA) and United States Army Corps of Engineers (USACE). 1991. *Evaluation of Dredged Material Proposed for Ocean Disposal, Testing Manual.* EPA 503/8-91/001. USEPA Office of Water. February.

———. 1998. *Evaluation of Dredged Material Proposed For Discharge in Waters of the U.S. – Testing Manual: Inland Testing Manual.* EPA-823-B-98-004. USEPA Office of Water, Washington, D.C., and USACE Operations, Construction, and Readiness Division, Washington, D.C. February.

U.S. Army Corp of Engineers (USACE). 2009. BSAF Database. USACE Engineer Research and Development Center. Accessed at http://el.erdc.usace.army.mil/bsaf/index.cfm

URS. 2005. *Site Wide Investigation, Report of Nature and Extent of Releases to Groundwater from the Special Study Areas, International Steel Group, ISG Sparrows Point, Inc. Facility, Sparrows Point, Maryland*. Prepared for ISG Sparrows Point, Inc. January.

———. 2006. Response to EPA Comments (4) and (5) dated December 15, 2005. Prepared by URS, under contract to ISG Sparrows Point LLC. Attachment to letter by Robert Abate, ISG Sparrows Point LLC to Andrew Fan, U.S. Environmental Protection Agency, Region III, and Richard Johnson, Maryland Department of Environment, December 6, 2006, 17 pp.

———. 2009a. *Screening Level Ecological Risk Assessment for On-Site Areas*. Prepared for Severstal Sparrows Point, LLC. April.

———. 2010. *Draft Baseline Ecological Risk Assessment for On-Site Areas*. Prepared for Severstal Sparrows Point, LLC. August.

———. 2011. *Interim Measures 2010 Annual Report, Former Sludge Bin Storage Area, Rod & Wire Mill*. Prepared for Severstal Sparrows Point, LLC. January.

———. 2012. *Interim Measures 2011 Annual Report, Former Sludge Bin Storage Area, Rod & Wire Mill*. Prepared for RG Steel Sparrows Point, LLC. January.

Van den Berg, M., L. Birnbaum, A.T.C. Bosveld, B. Brunström, P. Cook, M. Feeley, J.P. Giesy, A. Hanberg, R. Hasegawa, S.W. Kennedy, T. Kubiak, J.C. Larsen, F.X.R. van Leeuwen, A.K.D. Liem, C. Nolt, R.E. Peterson, L. Poellinger, S. Safe, D. Schrenk, D. Tillitt, M. Tysklind, M. Younes, F. Waern, and T. Zacharewski. 1998. Toxic equivalency factors (TEFs) for PCBs, PCDDs, PCDFs for humans and wildlife. *Environmental Health Perspectives* 106(12):775–792.

Weidou, A. 1981. Distribution and Binding of Cadmium in the Blue Crab, Implication in Human Health. Doctoral dissertation, New York University. Institute of Environmental Medicine.