BASELINE ECOLOGICAL RISK ASSESSMENT FOR ON-SITE AREAS

DRAFT

SEVERSTAL SPARROWS POINT FACILITY

SPARROWS POINT, MARYLAND

Prepared for

Severstal Sparrows Point, LLC
Sparrows Point, Maryland

August 2010

URS Corporation
335 Commerce Drive
Suite 300
Fort Washington, PA 19034

URS

TABLE OF CONTENTS

TABLE OF CONTENTS

Tables

Figures

Appendices

Acronyms

AOC	Area of Concern
AUF	area use factor
BAF	bioaccumulation factor
BEHP	bis(2-ethylhexyl)phthalate
BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
BSAF	biota sediment accumulation factor
BW	body weight
CL1B	County Lands 1B Parcel
CL2	County Lands 2 Parcel
COPC	constituent of potential concern
COPI	chemical of potential interest
C_p	concentration of constituent predicted in prey
C_s	concentration of constituent in soil/sediment
CSM	conceptual site model
DF	dietary fraction
Eco-SSL	Ecological Soil Screening Level
EDD	estimated daily dose
EPC	exposure point concentration
ESG	Equilibrium Partitioning Sediment Guidelines
f_{oc}	fraction of organic carbon
g	gram
HMW	high molecular weight
HQ	hazard quotient
IR	ingestion rate
K_d	distribution coefficient
kg	kilogram
K_p	soil-water partitioning coefficient
LMW	low molecular weight
LOAEL	lowest observable adverse effects level
MDE	Maryland Department of the Environment

MDNR	Maryland Department of Natural Resources
mg	milligram
msl	mean sea level
NOAEL	no observable adverse effects level
NPDES	National Pollutant Discharge Elimination System
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEC	probable effects concentration
PEL	probable effects level
RCRA	Resource Conservation and Recovery Act
ROC	receptor of concern
RME	reasonable maximum estimate
RTE	rare, threatened, or endangered
SLERA	Screening Level Ecological Risk Assessment
SMDP	scientific/management decision point
SSA	Special Study Area
SVOC	semi-volatile organic compound
SWI	site-wide investigation
SWMU	Solid Waste Management Unit
TRV	toxicity reference value
UCL_{95}	95 percent upper confidence limit of the mean concentration
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VOC	volatile organic compound

Background

A Baseline Ecological Risk Assessment for On-Site Areas (BERA) was conducted for the Severstal Sparrows Point Facility (the Site), located in Sparrows Point, Baltimore County, Maryland. The BERA characterized risks for valued wildlife receptors from exposure to surface soil and on-site sediment and/or surface water to support future decisions regarding the need for and potential extent of on-site remediation. This tier of the ecological risk assessment process follows a *Screening Level Ecological Risk Assessment for On-Site Areas* (URS 2009a) and a *Supplemental Report, County Lands Parcel 1B Ponds* (URS 2009b) (collectively, the SLERA) that were originally submitted as draft reports to the United States Environmental Protection Agency (USEPA) in April 2008 and January 2009, respectively. Comments on the draft SLERA reports were received from EPA on February 25, 2009. The SLERA reports were subsequently revised and re-submitted to USEPA in April and May 2009. USEPA completed review of the revised reports and determined that the clarifying responses were acceptable with some additional exceptions that were outlined in correspondence dated July 9, 2009. Final responses and associated revisions on the SLERA were completed and submitted to EPA in August 2009 (Severstal 2009).

The majority of the Site consists of industrial areas that contain buildings, slag, asphalt, or are otherwise anthropogenically disturbed, and are generally devoid of resources necessary for supporting wildlife (Rust Engineering & Infrastructure 1998). Limited areas of the Site are vegetated and are capable of supporting transient individuals and small wildlife populations. The scope of the SLERA, as defined by the *Ecological Risk Assessment Work Plan for On-Site Areas* (URS, 2007) approved by EPA, focused on areas that have been determined to: 1) provide habitat capable of supporting limited wildlife populations and communities typical of those inhabiting industrial sites or areas adjacent to industrial sites, and 2) be potentially impacted by historical operations or practices in Resource Conservation and Recovery Act (RCRA)-related Solid Waste Management Units and Areas of Concern.

Screening level risk characterization performed as part of the SLERA indicated a need for further ecological risk evaluation in the Humphrey Impoundment Special Study Area (SSA), County Lands 1B (CL1B) Parcel (including two ponds), Mud Reservoir, Former East Pond (Solid Waste Management Unit [SWMU] 29), and a head pond formerly connected to a historical conveyance ditch south of the Greys Landfill SSA (Knobby's Ditch). Specifically, the screening-level direct contact and food chain exposure risk characterization resulted in no-effect hazard quotients (HQs) greater than one for the following constituents of potential concern (COPCs): 15 metals, cyanide, nine individual polycyclic aromatic hydrocarbons (PAHs), total high molecular weight (HMW) PAHs, total low molecular weight (LMW) PAHs, Aroclor 1260, and bis(2-ethylhexyl)phthalate (BEHP). These COPCs were carried forward for further evaluation in the BERA. Thallium was also retained for further evaluation in the BERA given the lack of direct contact soil toxicity values for this metal. Similarly, beryllium was retained in the sediment evaluation of the CL1B Ponds due to the absence of screening-level sediment direct contact benchmark.

The objective of the BERA was to provide a more realistic and focused assessment of potential exposures and risks resulting from the SLERA process that could be potentially incurred by Site-related ecological receptors associated with on-Site surface soil, sediment, and surface water exposure pathways. Based on the Site characterization and data screening, the following exposure pathways are complete or potentially complete and were evaluated in the BERA:

- Terrestrial receptor exposure to surface soils;
- Terrestrial receptor exposure to terrestrial prey (plants, soil invertebrates, small mammals);
- Aquatic exposure to on-site sediment;
- Aquatic exposure to on-site surface water; and
- Aquatic exposure to benthic and pelagic prey (benthic invertebrates, fish).

On-site ecological receptors may be exposed to COPCs through the following exposure routes:

- Direct contact with COPCs from surface soil;
- Incidental ingestion of COPCs in surface soil;
- Direct contact with COPCs in sediment and surface water; and
- Ingestion of potentially impacted terrestrial and aquatic biota.

Exposure Assessment Approach

In the BERA, exposure estimates were refined through the application of more realistic estimates of exposure concentrations relative to exposure estimates used in the SLERA, which conservatively assumed lifetime exposure to the maximum concentration. Receptors foraging randomly throughout an exposure area are more realistically subject to COPC concentrations representing the central tendency of the exposure dataset. For datasets containing five or more samples, the upper-bound central tendency estimate (the 95 percent upper confidence limit of the mean concentration [UCL_{95}]) was calculated. This value was calculated for Humphrey Impoundment, CL1B Parcel, and Mud Reservoir soils, given that these datasets were sufficiently robust to calculate UCL_{95} concentrations. These UCL_{95} concentrations were used as the exposure point concentrations (EPCs) for ecological receptors in these areas. Because the datasets for the Former East Pond soils and CL1B Large Pond sediment were comprised of a smaller number of samples, the geometric mean concentration was used as the EPC for these areas. Maximum concentrations were used as EPCs for CL1B Small Pond and Knobby's Ditch Head Pond media.

The direct contact exposure evaluation included the comparison of the EPC to direct contact toxicity reference values (TRVs). The TRVs used to evaluate risks to communities of soil invertebrates, benthic macroinvertebrates, and finfish were selected from published, peer-reviewed data. These TRVs are intended to define the concentration of constituents in ecological media of concern above which effects on fauna inhabiting media of concern are likely to be observed. Results of these direct contact evaluations provide insight on possible COPC-related effects to community-level receptors; however, potential risks to valued higher-order wildlife receptors are appropriate as the bases for making remedial decisions at the Site.

Wildlife ingestion pathways were evaluated by considering the trophic transfer of constituents from Site soil, sediment, and surface water through the food chain to the selected receptors of concern. Wildlife guilds and representative receptors from each guild were identified during the SLERA Problem Formulation and were carried forward for further evaluation in the BERA. These guilds/receptors include the following:

- Avian omnivore – American robin (*Turdus migratorius*);
- Avian herbivore – mourning dove (*Zenaida macroura*);
- Avian carnivore – red-tailed hawk (*Buteo jamaicensis*);
- Mammalian herbivore – meadow vole (*Microtus pennsylvanicus*);
- Mammalian invertivore – short-tailed shrew (*Blarina brevicauda*); and
- Mammalian carnivore – red fox (*Vulpes vulpes*).

To quantify the food chain exposure and risks for on-site aquatic pathways, the following receptors were evaluated:

- Avian piscivore – great blue heron (*Ardea herodias*); and
- Mammalian invertivore – raccoon (*Procyon lotor*).

Wildlife dose modeling in this BERA follows USEPA ecological risk assessment guidance (USEPA 1997) for quantifying exposures and risks and incorporates more realistic site-specific parameters and assumptions regarding exposure (e.g., UCL_{95} COPC concentrations where available) to reduce uncertainties associated with Site COPCs, receptors, and the potential interactions between chemical stressors and biota. Food web models were used to calculate estimated daily doses (EDDs) of COPCs that selected receptor groups incur through exposure to surface soil, sediment, or surface water in each area of the Site. The food web model considered the primary routes of exposure to wildlife receptors as the direct ingestion of food items (plants, invertebrates, fish) and the incidental ingestion of soil or sediment. Concentrations of chemicals in prey were expressed as a function of chemical concentrations in soil, sediment, or surface water using bioaccumulation factors (BAFs) or biota sediment accumulation factors (BSAFs) for prey items. Bioaccumulation was estimated using regression models, where available, that take into account changes in COPC uptake rates with changes in COPC concentration.

In the BERA, species-specific forage ranges were compared to an areal estimate of the exposure area to estimate the contribution of the Site to the overall energetic requirements of the respective receptor (i.e., the area use factor [AUF]). This factor was generally calculated as the ratio of the size of the study area to the home range of each receptor. Application of an AUF is appropriate in the BERA since it incorporates a more realistic assumption regarding wildlife use that reduces the uncertainty in the exposure estimate, while retaining the conservative nature of the exposure model.

EDDs calculated during wildlife dose modeling represent the amount of a chemical that an individual member of a receptor population would ingest if the population foraged solely within the area used to develop exposure point concentrations. In keeping with common risk assessment practice, EDDs were compared to No Observable Adverse Effects Level (NOAEL) and Lowest Observable Adverse Effects Level (LOAEL) wildlife TRVs to assess the potential for adverse effects to wildlife within a concentration range. Wildlife TRVs in the BERA were selected from appropriate toxicity studies in the peer-reviewed primary literature. Preference was given to chronic studies that provided effects data for reproduction and growth endpoints, as acute studies and mortality/survival endpoints do not provide the sensitivity required to adequately evaluate risk in non-laboratory (natural) systems. Risks from comparisons of wildlife doses to lowest-effect levels (i.e., LOAELs) provide the most appropriate basis for remedial

decisions, given the conservativeness of NOAELs and uncertainty in extrapolating no-effect concentrations to field settings.

Risk Characterization Results

The food chain risk evaluation resulted in conservative NOAEL-based HQs greater than one for six metals in Humphrey Impoundment, four metals and total HMW PAHs in CL1B Parcel soils, four metals in Mud Reservoir, and three metals in the Former East Pond. LOAEL-based HQs greater than one were calculated for four metals in Humphrey Impoundment and two metals in the Former East Pond.

No unacceptable food chain risks were found for semi-aquatic receptors potentially utilizing the Large Pond or Small Pond in the CL1B Parcel. Avian wildlife TRVs were not available for antimony and tin; therefore, risks to wildlife from exposure to these constituents are uncertain and were evaluated qualitatively. The Knobby's Ditch Head Pond did not require an evaluation of wildlife risks in the BERA. As described in the SLERA, food chain risks posed to semi-aquatic birds and mammals in this pond were determined to be *de minimis*.

Risks based on the direct contact and wildlife food chain exposure evaluations for each area of concern are summarized below.

Humphrey Impoundment

- Exposure to UCL_{95} concentrations of cadmium, chromium, lead, nickel, selenium, and zinc in surficial soils resulted in elevated food chain risk estimates for populations of certain terrestrial wildlife receptors. Wildlife risks were highest for American robin and short-tailed shrew exposure to chromium (LOAEL HQs = 14.1 and 6.8, respectively). LOAEL-based HQs exceeding 1 for cadmium, lead, nickel, selenium, and zinc were generally low, and did not exceed 4.2. Both the American robin and short-tailed shrew have small home ranges, potentially resulting in 100% area use of Humphrey Impoundment. Given the poor conditions of the habitat in Humphrey Impoundment (very dense *Phragmites*), it is unlikely that populations of these receptors are established in this SSA, so actual exposure and risk are likely to be negligible.
- No unacceptable risks are posed to populations of wide-ranging receptors (red-tailed hawk, mourning dove, red fox) that may occasionally visit Humphrey Impoundment.
- Direct contact risks associated with exposure to UCL_{95} concentrations of COPCs to soil-dwelling invertebrate communities exceed the level at which adverse effects may occur for chromium, copper, cyanide, tin, and zinc. Chromium and zinc collectively contributed 87% of the direct contact risk to soil invertebrates.

County Lands 1B Parcel

<u>Uplands</u>

- Food chain exposure to UCL_{95} concentrations of COPCs in surficial soils does not pose a risk to terrestrial wildlife receptor populations.
- Direct contact risks associated with exposure to UCL_{95} concentrations of COPCs to soil-dwelling invertebrate communities exceed the level at which adverse effects may occur for

copper, zinc, and total HMW PAHs. The HQ for total HMW PAHs was slightly greater than 1, suggesting that this group of compounds poses a low potential risk to the community.

- Large Pond
- Food chain exposure to geometric mean concentrations of COPCs in sediments does not pose a risk to semi-aquatic wildlife receptor populations.
- Direct contact risks associated with exposure to geometric mean sediment concentrations of chromium and zinc may pose a marginal risk to the benthic macroinvertebrate community.
- Direct contact with surface water does not pose a risk to fish or water-column biota.

Small Pond

- Food chain exposure to maximum concentrations of COPCs in sediments does not pose a risk to semi-aquatic wildlife receptor populations.
- Direct contact risks associated with exposure to maximum sediment concentrations of COPCs by the benthic invertebrate community exceed the level at which adverse effects may occur for cadmium, copper, cyanide, and zinc. The risk posed from potential exposure to copper is considered low (HQ=1.9).
- Direct contact risks associated with exposure to maximum surface water concentrations of dissolved cadmium and dissolved zinc by water-column receptors exceed the level at which adverse effects may occur. The risk posed to dissolved zinc is considered to be low, given the relatively low HQ (1.5) and the application of the maximum surface water concentration for the assessment of the Small Pond.

Mud Reservoir

- Food chain exposure to UCL_{95} concentrations of COPCs in surficial soils does not pose a risk to terrestrial wildlife receptor populations.
- Direct contact risks associated with exposure to UCL_{95} concentrations of copper and zinc may pose a marginal risk to soil-dwelling invertebrate communities.

Former East Pond

- No unacceptable risks are posed to populations of wide-ranging receptors that may occasionally visit the Former East Pond.
- Exposure to the geometric mean concentration of cadmium in surficial soils results in elevated food chain risk estimates for receptors with small home ranges (American robin, short-tailed shrew). Other COPCs do not pose a risk to wildlife receptors. Given the poor conditions of the habitat in the Former East Pond (predominantly dense *Phragmites*), it is unlikely that populations of these receptors are established in this SWMU, so actual exposure and risk are likely negligible.
- Direct contact risks associated with geometric mean concentrations of zinc to soil-dwelling invertebrate communities exceed the level at which adverse effects may occur. Zinc was the only COPc to produce an HQ exceeding 1.

Knobby's Ditch Head Pond

- Food chain exposure to maximum concentrations of COPCs in sediments does not pose a risk to semi-aquatic wildlife receptor populations.
- Direct contact risks associated with exposure to maximum sediment concentrations of copper, cyanide, and zinc may pose a marginal risk to the benthic invertebrate community. Concentrations of total PAHs in sediment may pose a small risk to the benthic invertebrate community.
- Direct contact with surface water does not pose a risk to fish or water-column biota.

Conclusions

The concentrations of COPCs, primarily metals, in some areas are sufficiently elevated that community-level receptors (soil invertebrates, benthic invertebrates) are potentially at risk. For soil invertebrates, elevated risks are attributable primarily to chromium (Humphrey Impoundment), copper (CL1B Parcel), and zinc (Humphrey Impoundment, CL1B Parcel, and Former East Pond). For benthic macroinvertebrates inhabiting the on-site ponds, elevated risks are posed mainly to the community in the CL1B Small Pond from potential exposure to cadmium, cyanide, and zinc in sediment. Dissolved cadmium may also pose a risk to water-column invertebrates in the CL1B Small Pond. While invertebrate communities are subject to potentially unacceptable direct contact risk (to some COPCs), certain wildlife populations, with the exception of two areas, are not at risk.. Calculated numerical risk estimates for valued wildlife receptors suggest that exposure to some metals in surface soils in Humphrey Impoundment and the Former East Pond pose a risk to some terrestrial wildlife species in these areas. Cadmium and chromium contribute the majority of the risk to certain wildlife species in Humphrey Impoundment. Zinc is the only COPC in the Former East Pond to produce a LOAEL-based HQ in excess of 1 (for American robin and short-tailed shrew). Wildlife risks in the CL1B Parcel (including the two small ponds), Mud Reservoir, and Knobby's Ditch Head Pond are negligible; therefore, remediation based on ecological concerns in these areas is not necessary.

The numerical risk estimates in Humphrey Impoundment and the Former East Pond shows that the unacceptable risks apply only to wildlife with small home ranges that could potentially reside or forage 100 percent of the time within the area of concern (e.g., American robin, short-tailed shrew, meadow vole). Cadmium and chromium contribute the majority of the risk to certain wildlife species in Humphrey Impoundment. Zinc is the only COPC in the Former East Pond to produce a LOAEL-based HQ in excess of 1 (for American robin and short-tailed shrew). Wide-ranging wildlife species (e.g, red fox, red-tailed hawk, mourning dove) are not at risk from exposure to COPCs in on-site ecological media of concern. This conclusion should be considered in assessing the need for corrective measures at the Site, particularly given the poor quality of the habitat in these areas (very dense *Phragmites*) and the more suitable nesting and foraging opportunities available for wildlife in other, higher-quality habitat areas (e.g., the numerous County Lands Parcels).

A Baseline Ecological Risk Assessment for On-Site Areas (BERA) was conducted for the Severstal Sparrows Point Facility (the Site), located in Sparrows Point, Baltimore County, Maryland (**Figure 1**). This tier of the ecological risk assessment process follows a Screening Level Ecological Risk Assessment (SLERA) Report and a SLERA Supplemental Report that were originally submitted to the United States Environmental Protection Agency (USEPA) in April 2008 and January 2009, respectively. Comments on the draft SLERA reports were received from EPA on February 25, 2009. The SLERA reports were subsequently revised and re-submitted to USEPA in April and May 2009. USEPA completed review of the revised reports and determined that the clarifying responses were acceptable with some additional exceptions that were outlined in correspondence dated July 9, 2009. Final responses and associated revisions on the SLERA were completed by Severstal and submitted to EPA in August 2009 (Severstal 2009).

The overall objective of the BERA is to provide a more realistic and focused assessment of potential exposures and risks incurred by Site-related ecological receptors associated with on-Site surface soil, sediment, and surface water exposure pathways in ecological areas of concern that were identified as a result of screening level risk characterization performed as part of the SLERA. A need for further ecological risk evaluation was identified for the following areas: Humphrey Impoundment Special Study Area (SSA), County Lands 1B (CL1B) Parcel (including two ponds), Mud Reservoir, Former East Pond (Solid Waste Management Unit [SWMU] 29), and a head pond formerly connected to a historical conveyance ditch south of the Greys Landfill SSA (Knobby's Ditch). The findings of the BERA provide information that will be useful for future risk management decisions for on-site areas.

1.1 BACKGROUND

Site-wide investigation (SWI) tasks have been performed for the Site since 1997. Investigations were conducted in accordance with the 1997 Consent Decree, executed between the Bethlehem Steel Corporation and the USEPA and the State of Maryland, Maryland Department of the Environment (MDE).

Major submittals completed to date as part of the SWI include:

- Description of Current Conditions, January 1998 (Rust Engineering & Infrastructure 1998);
- SWI Work Plan – Groundwater Study, June 2000 (CH2M Hill 2000);
- SWI Groundwater Study Report, July 2001 (CH2M Hill 2001);
- SWI Release Site Characterization Study, June 2002 (CH2M Hill 2002a);
- SWI/Work Plan to Evaluate the Nature and Extent of Releases to Groundwater from the Special Study Areas for BSC, Sparrows Point Division, Maryland, July 2002 (CH2M Hill 2002b);
- Addendum to SWI Work Plan to Evaluate the Nature and Extent of Releases to Groundwater from the Special Study Areas for BSC, Sparrows Point Division, Maryland, September 2002 (SAIC 2002);

- Site-Wide Investigation: Report of Nature & Extent of Releases to Groundwater From the Special Study Areas, International Steel Group, ISG Sparrows Point, Inc. Facility, Sparrows Point, Maryland, January 2005 (URS 2005a);
- CA725 Facility Investigation and Human Health Risk Evaluation Findings, ISG Sparrows Point, June 2005 (URS 2005b);
- Ecological Risk Assessment Strategy Document; ISG Sparrows Point Facility (URS 2006);
- Final Ecological Risk Assessment Work Plan for On-Site Areas (URS 2007);
- Screening Level Ecological Risk Assessment for On-Site Areas, Final (URS 2009a); and
- Supplemental Report, County Lands Parcel 1B Ponds, Final (URS 2009b).

This BERA was performed in general accordance with the USEPA-approved Ecological Risk Assessment Work Plan for On-Site Areas dated January 4, 2007 (URS 2007) and presents the risk assessment results for on-site surface soils, surface water, and freshwater sediment in accordance with the general guidelines for a baseline ecological risk assessment, per USEPA's *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (USEPA 1997). Specifically, this BERA follows Steps 3 through 8 of the ecological risk assessment process, including problem formulation, risk characterization, and risk management.

1.2 PURPOSE AND OBJECTIVES

The overall objective of the ecological risk assessment process is to identify and characterize current and potential threats to the environment from the release of a hazardous substance (USEPA 1997). USEPA's *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (USEPA 1997) advocates a tiered approach for assessing ecological risk, and progresses from very conservative "screening-level" methodologies to a more rigorous, realistic assessment. The SLERA was designed to include all chemicals that exceeded conservative screening-level benchmarks. The BERA is based on the findings of the SLERA, but presents a more focused approach, refined to more realistically estimate ecological risks associated with chemicals that are the most likely to pose potential effects to wildlife and community-level organisms.

The BERA for the on-site areas of Severstal's Sparrows Point facility includes a characterization of the ecological features of the Site, constituents of potential concern (COPCs), a conceptual site model (CSM) that describes the linkages between selected receptors of concern (ROCs) and COPCs, a refined exposure assessment and ecotoxicological effects characterization, and a presentation of numerical direct contact and food-chain risks resulting from the combination of the exposure and toxicity assessments.

The specific objective of the BERA includes the characterization of risks to valued wildlife receptors from exposure to surface soil and on-site sediment and surface water. It is intended to support future decisions regarding the need for and potential extent of on-site remediation. As discussed in the *Ecological Risk Assessment Strategy Document* (URS 2006), and *Ecological Risk Assessment Work Plan for On-Site Areas* (URS 2007) reviewed and approved by the USEPA, the BERA focuses on the areas that: 1) provide habitat capable of supporting limited

wildlife populations and communities typical of those inhabiting industrial sites or areas adjacent to industrial sites, and 2) be potentially impacted by historical operations or practices in Resource Conservation and Recovery Act (RCRA)-related Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs). The ecological areas of concern for the BERA are as follows:

- Humphrey Impoundment;
- CL1B Parcel, including two small ponds;
- Mud Reservoir;
- Former East Pond; and
- Knobby's Ditch Head Pond.

The on-site ecological areas of concern were identified in the *Ecological Risk Assessment Strategy Document* (URS 2006), sampled according to the methodologies presented in the *Ecological Risk Assessment Work Plan for On-Site Areas* (URS 2007), and evaluated for screening-level exposures and risks in the *Screening Level Ecological Risk Assessment for On-Site Areas* (URS 2009a) and *Supplemental Report, County Lands Parcel 1B Ponds* (URS 2009b).

It should be noted that the SLERA evaluated potential migration pathways of Site-related chemical stressors to water bodies surrounding the Site, including screening assessments of groundwater from Site-wide perimeter monitoring wells and sediment in the portion of a tidal ditch (Knobby's Ditch) remaining following remedial construction activities at Grey Landfill. Given that the remnant portion of Knobby's Ditch currently does not contain suitable on-site aquatic habitat, and potential offsite impacts from current groundwater and stormwater migration from RCRA-related AOCs and SWMUs are the focus of a separate, offsite investigation, offsite groundwater and the ditch are not included in the On-Site BERA.

The site characterization section of the BERA presents a description of the Sparrows Point Site and the physical setting, with an emphasis on the terrestrial and on-site aquatic areas of ecological concern.

2.1 SITE DESCRIPTION

The Site encompasses approximately 3,100 acres within the Coastal Plain Physiographic Province (Coastal Plain). The Coastal Plain is a region of relatively low elevation and subdued topography, comprised of a wedge of unconsolidated sediments that thickens eastward (URS 2005a). An aerial photograph of the Site is provided as **Figure 2**. The facility is located at the mouth of the heavily industrialized and urbanized Baltimore Harbor/Patapsco River region, on a peninsula that is bordered by the tidal waters of Jones Creek and Old Road Bay to the east, the Patapsco River to the south, and Bear Creek to the west (**Figure 3**). These off-Site water bodies directly or indirectly drain into the Chesapeake Bay. A land connection to the northeast links the peninsula with the adjacent community of Edgemere.

Since 1889, the Site has been used in the production and finishing of steel. Iron and steel production operations and processes at the Site included raw material handling and coke, sinter, iron, steel, semi-finished product, and finished product preparation (Rust Engineering & Infrastructure 1998). In 1970, Sparrows Point was the largest steel facility in the United States, producing hot and cold rolled sheet, coated materials, pipe, plate, and rod and wire. Currently, the plant is a specialized producer of hot and cold rolled sheet, coated products, and tin mill products. It operates "L" blast furnace, the third largest in the United States, and one of the most modern cold mills in North America, commissioned in 2000.

2.2 PHYSICAL SETTING

2.2.1 Topography and Surface Drainage

The current ground surface at the Site is relatively flat. All major topographic features such as buildings, landfills, and material stockpiles are man-made. Throughout most of the peninsula, the elevation of the ground surface is between 10 and 20 feet above mean sea level (msl), with a site-wide average elevation of 15 feet above msl (USGS 1969). Land reclamation and fill placement have occurred over much of the Site, particularly in the southern portion of the peninsula, along shorelines, and in areas that historically contained stream channels and tidal waters. The thickest deposits occur in the historic stream channels and tidal waters (URS 2005a). Slag, a by-product of iron- and steel-making, was the primary source of fill used to expand and develop the Sparrows Point facility.

Surface water runoff is diverted and collected by a network of culverts, underground piping, and drainage ditches within the process areas of the facility. The storm water is then discharged to Bear Creek, Jones Creek and Old Road Bay, and the Patapsco River under existing NPDES permits. Since approximately 1970, storm water runoff from the central portion of the Site has discharged into the Tin Mill Canal, where it is then pumped into the Waste Water Treatment Plant for treatment prior to discharge. Runoff is minimized in slag-covered portions of the Site, as the porous slag entrains the majority of rainfall.

2.2.2 Soils

The Site is largely industrial, with most areas covered by buildings, asphalt, slag or other fill material. Slag is a byproduct of iron- and steel-making and has been historically used for fill on the Site. Rust Engineering & Infrastructure (1998) reviewed the results of two previous studies conducted to evaluate filling and land reclamation operations at the Site: USEPA (1985) and Wilson and Mendelson (1993). The review found that by 1998, much of the Site was reclaimed and/or slag filled. The southern portion of the Site includes several anthropogenic landforms, including byproduct material stockpiles and raw material stockpiles. Observations of the surface soils during various Site surveys and investigations conducted from 2005 to 2007 generally indicate that the soil quality at the Site is poor as a result of filling with rubble and coarse, nutrient-poor material, and intensive industrial operations and earth-moving activities that have occurred over many years. The thin veneer of topsoil overlying the slag fill provides enough substrate to support the growth of opportunistic vegetation in limited areas of the Site.

2.2.3 Hydrogeology

The *Site Wide Investigation, Report of Nature & Extent of Releases to Groundwater from the Special Study Areas* (URS 2005a) identified flow direction and groundwater quality from a network of monitoring wells established primarily within and near the five Special Study Areas (SSAs) indicated in **Figure 3** and also at various Site-wide locations. The SSAs, as designated in the 1997 Consent Decree, include the Tin Mill Canal/Finishing Mills, Greys Landfill, Humphrey Impoundment, Coke Point Landfill, and Coke Oven Area. Three distinct groundwater zones (shallow, intermediate, and lower) have been identified within the uppermost 100 ± feet of unconsolidated strata, based on the hydrogeological investigations of the Site. Shallow groundwater is found within the upper unconfined slag unit and exhibits radial flows in the Greys Landfill, Coke Oven Area, and Coke Point Landfill SSAs. Shallow groundwater also flows toward the Tin Mill Canal from the Humphrey Impoundment and Finishing Mills SSAs. The intermediate groundwater zone exhibits flow patterns that are influenced less by surface topographic conditions and predominant flow direction is toward the surrounding surface water. The lower groundwater zone is influenced more by regional groundwater conditions in the area.

2.2.4 Ecological Habitats

This section provides a summary description of the ecological conditions at the Site. The BERA focuses on areas where there is co-occurrence of viable habitat and potential impacts from RCRA-related SWMUs, AOCs or other areas as defined in the *Description of Current Conditions* Report (Rust Engineering & Infrastructure 1998). Existing information on the Site conditions and characterization of ecological habitats and resources is based on a review of the *Description of Current Conditions* Report and numerous observations taken during ecological reconnaissances, focused ecological surveys, and intensive sampling of surface soils, sediment, and surface water in the ecological areas of concern. The chronology of these surveys/investigations is provided below:

- A Site-wide reconnaissance-level survey conducted in May 2005;
- A focused survey of ecologically habitable areas conducted in May 2006;
- A follow-on habitat survey of ecological areas of concern conducted in April 2007;

- A reconnaissance of the Site (with USEPA) conducted in April 2007;
- Ecological risk assessment sampling activities conducted in June/July and December 2007;
- A vegetation and habitat survey conducted in September 2007; and
- A biological survey of the CL1B Ponds and Knobby's Ditch Head Pond conducted in May 2010.

The majority of the Site consists of industrial areas that contain buildings, slag, asphalt, or are otherwise anthropogenically disturbed, and are generally devoid of resources necessary for supporting wildlife (Rust Engineering & Infrastructure 1998). Limited areas of the Site are vegetated and are capable of supporting transient individuals and small wildlife populations.

General descriptions of the on-Site terrestrial and aquatic areas of ecological concern are provided in the following subsections, and are the focus of this BERA. A photographic log of the areas of study for the BERA is provided in **Appendix A**. Important to note is that the Tin Mill Canal/Finishing Mills, Greys Landfill, Coke Oven Area and Coke Point Landfill SSAs are not areas of ecological concern and do not require investigation as part of the on-site ecological risk assessment process. These areas were determined to be devoid of resources necessary for supporting wildlife, and are continuously anthropogenically disturbed. Therefore, they are not evaluated further in the BERA.

Terrestrial Characterization

Little natural environment exists at the Site (Rust Engineering & Infrastructure 1998). Both inactive and active industrialized portions of the Site are devoid or nearly devoid of vegetation. Flora that does occur in these areas is generally restricted to low-growing, opportunistic vegetation that does not provide adequate cover or browse for sustaining populations of wildlife. The majority of areas containing vegetated habitat are not in proximity to SWMUs and AOCs. Historical observations of wildlife have generally been restricted to transient mammals and birds (Rust Engineering & Infrastructure 1998). Wildlife observations of areas containing wooded habitat (County Lands Parcels) in 2006 and 2007 indicated the presence of gray squirrel (*Sciurus carolinensis*), red fox (*Vulpes vulpes*), and a variety of woodland birds typical of wooded suburban areas in the mid-Atlantic region.

The areas of focus for the Sparrows Point BERA are those that provide suitable habitat and potentially have been influenced by constituents attributable to Site operations or practices. Based on the results of the habitat surveys conducted in 2005, 2006 and 2007, the areas described below (and identified in **Figure 3**) were noted to contain potential habitat for terrestrial wildlife, and are the focus of this BERA.

- Humphrey Impoundment SSA – This SSA is present in the interior portion of the Site and contains very dense vegetation consisting almost exclusively of common reed (*Phragmites australis*). Observations of this area in 2005 and 2006 indicated fairly diverse and abundant overstory vegetation comprised predominantly of opportunistic species along the periphery of this SSA. Dense herbaceous flora comprised primarily of honeysuckle (*Lonicera* sp.) also borders the monotypic expanse of *Phragmites*. The Humphrey Impoundment SSA contains potential habitat for small mammals and some

species of upland birds. The heavy growth of *Phragmites* is likely highly limiting to the establishment of diverse communities of mammals and birds.

- County Lands 1B (CL1B) Parcel – Located in the northwestern portion of the Site, the southeastern end of this area was used as a disposal area for open hearth slurry from the Humphrey Creek Wastewater Treatment Plant between 1968 and 1978 (Rust Engineering & Infrastructure 1998). The Parcel is characterized by deciduous overstory vegetation and mixed herbaceous/scrub meadow. Observations of the southeastern portion of the CL1B Parcel in 2006, 2007, and 2010 indicated the presence of a wooded community of second-growth trees and a moderate to dense herbaceous shrub layer. Based on the presence of multiple layers of vegetation (canopy, understory, and ground cover) and the proximity of this area to adjacent open space areas to the north of the Site, the CL1B Parcel is capable of supporting avian and small and large mammalian communities.
- Mud Reservoir – Mud Reservoir is a diamond-shaped area of mixed open/wooded land located in the County Lands 2 (CL2) Parcel in the northwestern portion of the Site. Much of the CL2 is developed and includes the former Pipe Mill and Cold Mill complexes. The Mud Reservoir received mud and clays from the former Humphrey Impoundment. The majority of the non-wooded portion of the Mud Reservoir is composed of dense expanses of common reed with interspersed poison ivy (*Rhus radicans*). The remaining portion of the open area consists of a horseshoe-shaped, non-vegetated zone of soil that borders the woodlands to the east, north, and west. The wooded community is characterized by a diverse canopy layer and a woody and herbaceous understory. Trees include red oak (*Quercus rubra*), box elder (*Acer negundo*), black willow (*Salix nigra*), Norway maple (*Acer platanoides*), white birch (*Betula payrifera*), and bigtooth aspen (*Populus grandidentata*).

- Former East Pond (SWMU 29) – This area is located in the northern portion of the Former Rod and Wire Mill, and historically received excess filtrate from the dewatering of zinc processing sludges. Currently, the SWMU consists mainly of a narrow, heavily vegetated band of *Phragmites* with interspersed poison ivy. A small portion of the Former East Pond is sparsely vegetated and consists of fine-grained soil. This SWMU is small, isolated, and surrounded by paved and unpaved roads and the remains of former industrial activity (Rod and Wire Mill). The vegetated portion of the Former East Pond contains habitat for supporting a limited wildlife community; however, habitat quality in this area is considered marginal given the very dense growth of *Phragmites* that likely limits use of this area by wildlife.

On-Site Aquatic Characterization

Habitat surveys conducted in 2005, 2006, 2007, and 2010 included inspections of on-Site surface water features and their potential to support aquatic communities and wildlife. Surface water bodies included in the ERA process for the Sparrows Point Site are small man-made ponds that were previously used as either retention basins or as potential disposal sites for solid wastes and dredged materials. Descriptions of these surface water features are provided below:

- Knobby's Ditch Head Pond – This small pond located south of Greys Landfill was formerly connected to Knobby's Ditch, and receives stormwater from U.S. Route 695 and Site areas adjacent to this highway (**Appendix A**). The ¾-acre pond is surrounded

by roads and industrial activity and is isolated from Greys Landfill, but may have been influenced by operations conducted there in the past.[1] The banks of this pond are steep in slope and bordered primarily by *Phragmites* and false indigo (*Amorpha fruticosa*). Observations of the physical characteristics of this pond in May 2010 indicated turbid water and black, sulfidic sediments. Maximum water depth is approximately 7 feet; the average depth is between 4 and 5 feet. Eastern banded killifish (*Fundulus diaphanus*) were observed at the water surface. Fish traps collected numerous redear sunfish (*Lepomis microlophus*) along vegetated margins. A single muskrat (*Ondatra zibethicus*) and several frogs were also observed. Benthic invertebrates collected via sweep-netting of surficial sediment yielded small squaregill mayfly (Caenidae) nymphs, small minnow mayfly nymphs (Baetidae), and midge (Chironomidae) larvae. The steep slopes of this pond below its surface likely limit foraging opportunities for some semi-aquatic wildlife taxa (e.g., piscivorous birds).

- CL1B Large Pond – This ½-acre pond is located in the densely wooded, south-central portion of the CL1B Parcel and has a maximum depth of 3.5 feet (**Appendix A**). The CL1B Large Pond is surrounded by steeply sloping, heavily vegetated banks. Common reed and other nuisance vegetation (e.g., poison ivy, Japanese honeysuckle) are present in association with the margins of the pond. It is likely that this pond becomes very shallow in the peak of summer and may freeze to near-bottom in the winter. Sediment in the pond was dark and yielded a sulfidic odor, and consisted of muck, silt, fine-grained organic material, leaves, and coarse woody debris. Turbidity of the water was high and was likely the result of high productivity of pelagic algae. Minimal submerged aquatic vegetation was observed.

  Numerous eastern mosquitofish (*Gambusia holbrooki*) were observed during the May 2010 characterization of the on-site ponds. Mosquitofish have a high tolerance of elevated water temperatures and low oxygen conditions, allowing it to thrive in habitats unsuitable for many other fish species. No other fish species were following the application of a variety of field techniques. Benthic macroinvertebrates collected from jabs of the nearshore substrate with sweep nets yielded few individuals. Benthic invertebrate taxa consisted of a small squaregill mayfly (Caenidae) nymph, a skimmer dragonfly (Libellulidae) nymph, and several ramshorn snails (Planorbidae). Neustonic invertebrates observed include whirligig beetles (*Dineutus* sp.) and water striders (Gerridae). A small painted turtle (*Chrysemys picta*), a snapping turtle (*Chelydra serpentina*), and frogs were also observed in the CL1B Large Pond. No mammals or birds have been observed using this pond; however, the presence of small surface-oriented fish and amphibians provides a forage source for carnivorous semi-aquatic wildlife.

- CL1B Small Pond – This small (0.1-acre) surface water feature is located approximately 250 feet west of the CL1B Large Pond. This pond is in a heavily wooded area with a hard bottom consisting mainly of sand and gravel overlain with silt, fine organic matter, and some coarse woody debris (**Appendix A**). Like the CL1B Large Pond, the margins of this pond are associated with nuisance vegetation such as common reed, poison ivy,

[1] A newer retention pond now receives stormwater runoff from Greys Landfill.

and Japanese honeysuckle. In May 2010, water clarity was high and maximum water depth approximated 4 feet, with an average depth of roughly 3 feet.

No fish were observed in the CL1B Small Pond, and sampling using fish traps yielded no fish. It is unlikely that this pond is capable of supporting fish communities. In December 2007, only 1-1.5 feet of water were observed in the CL1B Small Pond, and it is possible that this feature may desiccate entirely during drought periods. A snapping turtle was observed resting on the bottom of this pond in May 2010. Benthic macroinvertebrates collected via sweep net grabs included skimmer dragonfly nymphs, a small minnow mayfly nymph, a spreadwing damselfly (Lestidae) nymph, midge larvae, sinistral pond snails (Physidae), and a water scavenger beetle (Hydrophilidae).

A fragment of a former surface water conveyance known as Knobby's Ditch is present south of Greys Landfill. At one time, the ditch contained marginal habitat for benthic invertebrates and semi-aquatic mammals. As a result of activities undertaken in the last few years to provide improvements to the operating conditions of Greys Landfill, the majority (1,400 feet) of Knobby's Ditch has been filled to divert stormwater drainage from the Landfill to a stormwater management basin. During storm events, the ditch receives overflow water from Knobby's Ditch Head Pond, located approximately 2,000 feet to the east. The remaining approximate 300-foot section of Knobby's Ditch does not provide suitable habitat for fishes or benthic invertebrates, nor does it provide foraging opportunities for wildlife.

The primary objectives of the *Screening Level Ecological Risk Assessment for On-Site Areas* (URS 2009a) and the *Supplemental Report, County Lands Parcel 1B Ponds* (collectively, the SLERA) were to describe potential ecological risks associated with on-Site surface soil, surface water, and sediment exposure pathways and determine the need for further ecological risk evaluation. The SLERA was intended to provide a screening-level assessment of the potential exposures and risks posed to community-level and wildlife receptors that may be present at the Site based on conservative assumptions regarding exposure and toxicity. The overall approach, results, and conclusions of the SLERA are discussed in the following sections.

3.1 SLERA APPROACH AND RESULTS

In the SLERA, direct contact and wildlife risks were evaluated for the Humphrey Impoundment, CL1B Parcel, Mud Reservoir, the Former East Pond, and the Knobby's Ditch Head Pond using conservative ecological screening values and wildlife exposure assumptions, including application of the maximum exposure concentration to estimate average daily doses of COPCs Based on the site characterization and data screening in the SLERA, complete exposure pathways were identified and the following ROCs were selected for quantitative and/or qualitative (terrestrial plants) risk evaluation:

- Soil invertebrate community;
- Terrestrial plant community;
- Omnivorous, herbivorous, and carnivorous birds; and
- Invertivorous, herbivorous, and carnivorous mammals.

To quantify the exposures and risks for on-Site aquatic pathways, the following ROCs were evaluated:

- Benthic invertebrate community;
- Finfish community;
- Piscivorous birds; and
- Invertivorous mammals.

The following approaches were used in the SLERA to estimate exposure and evaluate ecological effects:

- Utilize soil, sediment, and surface water ecotoxicity values to address the direct contact pathway to community-level receptors (soil invertebrates, benthic invertebrates, finfish) for COPCs identified in the data screening;
- Conduct a qualitative survey and evaluation of the terrestrial plant community in ecological areas of concern and in areas not influenced by Site operations ("reference" areas). The SLERA concluded that it is unlikely that Site-related constituents have caused adverse effects, and the plant communities present are most likely a result of the levels of physical disturbance in the areas of concern;

- Utilize food chain models to calculate an estimated daily dose (EDD) for COPCs in surface soil (for terrestrial receptors) and sediment and surface water (for semi-aquatic receptors); and
- Compare food chain dose concentrations to no-effect and lowest-effect toxicity reference values (TRVs).

The screening-level risk characterization of the direct contact and food chain exposure evaluations recommended the following COPCs for further evaluation in the BERA:

- Humphrey Impoundment: antimony, barium, cadmium, chromium, copper, cyanide, lead, nickel, selenium, thallium, tin, vanadium, zinc, and total high molecular weight (HMW) polycyclic aromatic hydrocarbons (PAHs).
- CL1B Parcel (uplands): antimony, cadmium, chromium, copper, cyanide, lead, selenium, thallium, vanadium, zinc, total low molecular weight (LMW) PAHs, and total HMW PAHs.
- Mud Reservoir: antimony, barium, cadmium, chromium, copper, lead, selenium, tin, vanadium, and zinc.
- Former East Pond: barium, cadmium, chromium, copper, lead, vanadium, and zinc.
- CL1B Large Pond: arsenic, chromium, copper, cyanide, lead, nickel, selenium, silver, tin, vanadium, and zinc.
- CL1B Small Pond: arsenic, barium, cadmium, chromium, copper, cyanide, lead, mercury, nickel, selenium, silver, tin, and zinc.
- Knobby's Ditch Head Pond: cadmium, chromium, copper, cyanide, lead, nickel, tin, vanadium, zinc, benzo(a)anthracene, benzo(a)pyrene, benzo(ghi)perylene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene, Aroclor 1260, and BEHP. Sulfide was identified as a direct contact COPC in the SLERA. However, its presence in sediments likely limits the bioavailability of divalent cationic metals through the formation of insoluble metal-sulfide complexes (DiToro et al. 1990; Ankley 1996). Sulfides occur naturally and may result from the bacterial breakdown of organic matter in pond sediments. Consequently, the BERA direct contact evaluation focuses on metals and PAH compounds that are more likely to drive direct contact risks.

Given that no screening-level sediment direct contact value could be identified for beryllium and tin in the SLERA, these metals were conservatively retained as a COPC for the direct contact evaluation in the BERA. Similarly, total cyanide and thallium could not be quantitatively evaluated in the SLERA due to lack of soil screening values for direct contact endpoints. The constituents were retained and evaluated in the BERA soil direct contact evaluation for the applicable areas of concern.

The SLERA determined that no surface water risks were posed to water-column receptors in the Knobby's Ditch Head Pond and the CL1B Large Pond. Hence, the surface water direct contact is not evaluated further for these areas in the BERA. Similarly, food chain risks in the SLERA were determined to be negligible for wildlife receptors potentially foraging in the Knobby's Ditch Head Pond; therefore, the food chain ingestion pathway was not assessed further in the BERA. The terrestrial plant community was evaluated qualitatively through focused vegetation

surveys in the areas of concern and in reference areas not impacted by Site operations (i.e., Country Lands 3A and 3B Parcels). The SLERA determined that it was unlikely that Site-related constituents have caused adverse effects to the plant communities, and the communities present are most likely a result of the levels of physical disturbance in these areas.

3.2 SCIENTIFIC MANAGEMENT DECISION POINT

A scientific/management decision point (SMDP) is a determination made at the completion of each of several steps in the risk assessment process regarding whether there is sufficient information necessary to make the risk decision at that step. For the on-Site areas, the SLERA concluded that the information collected and presented indicates a potential for ecological effects to occur from possible exposure to Site-related constituents in surface soils, on-site sediment, and on-site surface water. Consequently, the SLERA recommended that risks to the constituents identified above be evaluated further in a BERA.

Problem formulation is the systematic planning process that identifies the factors to be addressed in a BERA. The Problem Formulation (Step 3 of the ERA process) is designed to focus the approach of the BERA, built on the results of the SLERA, but refined to more accurately estimate direct contact and food-chain risks to receptors representing the assessment endpoints. This step of the ERA process consists of several activities, including:

- Refinement of the preliminary list of chemicals of potential concern (COPCs) at the Site, as identified during the SLERA (URS 2009a, 2009b) and indicated in **Table 3-1**[2];
- Development of management goals that provide an explicit statement of the desired condition of the valued entity being protected;
- Refinement of the information relating to the fate and transport of COPCs, potential exposure pathways, and the information on receptors potentially at risk; and
- Identification of assessment endpoints and measurement endpoints to focus the exposure and risk evaluation on the valued entity.

The product of the problem formulation for the Sparrows Point BERA is the development of a refined Site-specific CSM for the on-site areas of ecological concern.

4.1 BERA DATA SET

The BERA includes surface soil, sediment, and surface water data collected during the SLERA process. The methodologies and procedures used to collect these data are addressed in detail in the *Screening Level Ecological Risk Assessment for On-Site Areas* (URS 2009a) and *Supplemental Report, County Lands Parcel 1B Ponds* (URS 2009b). The sampling approach was intended to provide broad spatial coverage in each area of concern, and focused primarily on vegetated areas most suitable to wildlife habitability in these areas.

In general, surface soil samples obtained from the 0-0.5 feet below ground surface (bgs) depth interval were collected at locations anticipated to be potentially used by avian and mammalian wildlife. The following presents the number of soil samples and the locations where samples were collected in each ecological area of concern:

- Humphrey Impoundment – 18 samples (**Figure 4**);
- CL1B Parcel – 19 samples (**Figure 5**);
- Mud Reservoir – 12 samples (**Figure 6**); and
- Former East Pond – 3 samples (**Figure 7**).

Co-located sediment and surface water samples were collected in each of the following areas:

- Knobby's Ditch Head Pond – 2 samples (**Figure 8**);
- CL1B Large Pond – 3 samples (**Figure 9**); and
- CL1B Small Pond – 2 samples (**Figure 9**).

[2] All COPCs identified at the conclusion of the SLERA were evaluated quantitatively in the BERA to ensure sufficient conservatism in the assessment of baseline ecological risks.

On-Site soil, sediment, surface water, and groundwater samples were analyzed for the list of chemicals of potential interest (COPIs), an abbreviated Appendix IX list of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and inorganics established for the Site. Both total and dissolved metals analyses were performed for surface water samples.

The analytical results from the sampling effort are included in **Appendix B**. All data were reviewed and validated by a qualified data quality assurance chemist. Based on the analytical data quality review, all soil, sediment, and surface water data collected were considered acceptable for their intended use in the SLERA and BERA, with the exception of rejections of acid extractable compounds from one of the CL1B Large Pond surface water samples. These rejections are based on extraction holding time exceedances, and do not impact the conclusions of the BERA.

4.2 RISK MANAGEMENT GOAL

As defined by USEPA (2001), "a *risk management goal* is a general statement of the desired condition or direction of preference for the entity to be protected."

The following risk management goal is proposed for the Sparrows Point Site:

> "Maintenance (or provision) of soil, sediment, and water quality and habitat conditions capable of supporting a 'functioning ecosystem' for the terrestrial and semi-aquatic animal populations likely to be inhabiting or utilizing soil habitats and/or surface water features in this type of environmental setting (i.e., in close proximity to intense industrialized activities)."

The proposed assessment endpoints presented in Section 4.4 were developed based upon this risk management goal.

4.3 CONCEPTUAL SITE MODEL

The CSM identifies potentially complete exposure pathways and contains the necessary links (via complete exposure pathways) from the chemical sources to the appropriate assessment endpoints. Potential environmental stressors at the Site include organic and inorganic constituents that may either be associated with Site practices and operations or as natural components of Site media. The CSM for the Sparrows Point Site assume that former and current operations were the primary source of chemical releases to soil (or surface water features), and that naturally occurring sources (e.g., via the atmosphere) have made minimal contributions to the chemical loading to on-site areas. This conclusion is based primarily on the relatively isolated peninsular setting, the geology of the Site (e.g., predominance of man-made slag), and the long history of industrialized operations at the Site. Sources of constituents for each area of concern are discussed in Section 2.2.4. **Figure 10** illustrates the CSM developed to identify potentially complete exposure pathways for the terrestrial areas and on-site aquatic features.

4.3.1 Contaminant Fate and Transport

Release and Transport Mechanisms

Constituents released to soils from sources can be transported to adjacent areas by overland runoff and into shallow groundwater by percolation. Some of these constituents (e.g., metals) may persist in exposure media. Other constituents (e.g., VOCs) are not expected to be persistent in surface soils, sediment, or surface water.

For this BERA, potential fate and transport processes of constituents include:

- Desorption and/or erosion from soils and transport in surface runoff to adjacent areas, including on-site surface water features. In general, stormwater runoff from the ecological study areas is generally anticipated to be minimal due to the general lack of topographic relief, the high density of vegetation, and the high proportion of porous fill and slag in these areas.
- Adsorption to sediment from surface water in the on-Site surface water features; and
- Suspension and windblown transport of constituents from industrial areas, parking lots, and roads adsorbed to particles in ambient air;
- Dissolution and leaching into groundwater underlying the Site;
- Migration of COPCs in groundwater to sediment and surface water in the on-site ponds, and attenuation by dilution/dispersion, sorption, and biodegradation;
- Trophic transfer of bioaccumulative constituents that are incorporated in the terrestrial and on-site aquatic food chains.

The potential for constituents to be released and transported from the sources to points of contact with ecological receptors depends on their physicochemical properties, concentrations, and their spatial distribution. Surface water runoff and groundwater infiltration are of particular importance to soluble species of contaminants and less important to hydrophobic organic compounds.

Routes of Entry

The potential routes of entry for ecological receptors are:

- Direct contact (terrestrial): dermal absorption in soil invertebrates
- Direct contact (aquatic): dermal and/or gill absorption in benthic invertebrates and fishes;
- Ingestion by soil invertebrates, benthic invertebrates, fishes, and terrestrial and semi-aquatic wildlife; and
- Inhalation by wildlife.

Adequate ecotoxicity information is available in the scientific literature to address ecological risks associated with the dermal contact (for community receptors such as earthworms) and ingestion routes of entry. Complete exposure pathways that include these routes are evaluated in this BERA. Available scientific information is not adequate to evaluate complete exposure pathways for wildlife inhalation and dermal exposure. These pathways were not considered in

the BERA because they typically have a negligible contribution to the overall exposure for wildlife receptors (Sample et al. 1997; USEPA 2000a).

4.3.2 Toxicology of COPCs

Select toxicity profiles are included in the BERA to address constituents that are persistent, bioaccumulative, and potentially toxic. These profiles are provided for chemicals that were identified in the conclusion of the SLERA as COPCs for birds and mammals. The purpose of this selection process was to focus the risk assessment on those chemicals which, in the future, may play an important role in the risk management decision-making process at the Site. The majority of the information presented in the sections below is adapted from Agency for Toxic Substances and Disease Registry toxicological profiles (ATSDR 1992, 2003, 2004, 2005a, 2005b, 2005c, 2007, 2008a, 2008b). Other literature sources are cited as shown.

Antimony

Antimony is a metalloid with four oxidation states: Sb^{3-}, metallic Sb, Sb^{3+}, and Sb^{5+}. The Sb^{3+} form is the most common and stable form of this element. Antimony ore is found within the Earth's crust and is mined for production of antimony metal, alloys, and antimony oxide for use in the textiles, plastics, and metals industries. There are numerous naturally-occurring and man-made antimony compounds, complexes, and alloys.

Antimony enters the environment through mining and processing of the ores. In addition, small amounts are released from incinerators and power plants that burn coal as fuel. Most antimony released from anthropogenic activities ends up in soils or sediments, strongly attached to iron-, manganese-, or aluminum-containing particles. However, some antimony is not bonded as tightly, and therefore, may be taken up by plants and animals. Weathering of soils and rocks transports antimony into surface water bodies, along with domestic waste water discharges, and industrial waste water seepage and runoff. Antimony may be released from saline sediments if they are oxidized and the pH becomes very low. Data concerning the forms of antimony in the environment (valence state, compound, adsorption, coprecipitation, particle size) are likely to be site-specific and are limited, in general.

Animals are likely to be exposed to antimony via ingestion of water or food containing the metal, or by dermal contact with antimony-impacted soil and water. However, antimony does not bioaccumulate in fish and aquatic organisms (USEPA 1980). Additionally, antimony uptake from soil is minor (Ainsworth 1988) and although it does concentrate in the organs of small mammals, it does not biomagnify from lower to higher trophic levels in the food chain.

Cadmium

Cadmium is a naturally-occurring metal found with zinc, lead, and copper ores in the Earth's crust. While pure cadmium is a silver-white solid, cadmium chloride and cadmium sulfate are water-soluble compounds. In the environment, it exists in only one oxidation state (Cd^{2+}). This metal is mostly extracted as a by-product during processing of other metals and is used for batteries, pigments, coatings/platings, stabilizers for plastics, nonferrous alloys, and photovoltaic devices. Cadmium is released into the environment during mining and refining, manufacture and application of phosphate fertilizers, burning of fossil fuels by power plants, and incineration and disposal of waste, as well as natural phenomena like volcanic eruptions and forest fires. It enters the air as vapors or attached to particles, in soil it generally binds to organic matter, and in water

cadmium exists as the hydrated ion or as ionic complexes with other inorganic or organic substances. Depending on soil pH and organic carbon content, cadmium may be mobile, but is usually immobile and therefore, may be taken up by plants. In water, soluble forms will migrate, but insoluble forms will be deposited and absorbed in sediments.

Dermal absorption of cadmium is not significant, and although inhalation can be an important route of exposure, it is not considered to be a major concern. Cadmium in food and water enters the body through the digestive tract. Cadmium bioaccumulates in aquatic and terrestrial organisms in all levels of the food chain. In higher organisms, cadmium mostly accumulates in the liver and kidneys (not in muscle tissue). Due to low muscle concentration and low intestinal absorption, biomagnification through the food chain is not likely to be significant (Sprague 1986).

Chromium

Chromium is a naturally occurring element found in rocks, soil, in volcanic dust and gases, and in plants and animals. The most common forms are metallic chromium, trivalent (Cr^{3+}), and hexavalent (Cr^{6+}). Trivalent chromium occurs naturally in the environment and is an essential nutrient required by the human body to promote the action of insulin in body tissues so that sugar, protein, and fat can be used by the body. Chromium enters the air, water, and soil mostly in the Cr^{3+} and Cr^{6+} forms as a result of natural processes and human activities. Emissions from coal and oil combustion and steel production can increase Cr^{3+} levels in air, surficial soils, and sediments. Most of the chromium in soil does not dissolve easily in water and can attach strongly to the soil. A very small amount of the chromium in soil, however, will dissolve in water and can leach to groundwater. The movement of chromium in soil depends on the type and condition of the soil and other environmental factors.

Trivalent chromium is poorly absorbed by plants and animals and is routinely used as a non-absorbable marker for intestinal transport studies, both in invertebrates and in higher organisms. Most chromium in sediment is strongly bound to organic matter and is often not bioavailable. Invertebrates and fish are not particularly sensitive to chromium. Birds and mammals are exposed to chromium mainly through the diet, but uptake is limited given that Cr^{3+} is not transported across the gut epithelium to an appreciable extent (i.e., 0.4 to 2.1 percent). Chromium that is biologically incorporated into food is more readily absorbable and accounts for the amount required as a micronutrient by the body.

Copper

Copper is a common element that is also a micronutrient for all living organisms. Cu normally occurs as a sulfide salt in ancient marine sedimentary rocks, but is also common in soils weathered from these rocks. Copper is bioavailable only in its monovalent (Cu^{+}; unstable) and stable divalent (Cu^{2+}) state. The solubility of Cu salts is enhanced by acidic conditions and Cu may be leached from soils to groundwater and transported to surface water under acidic conditions. Copper also forms tight bonds with organic matter, which reduces transport and availability to biota.

Soluble copper can cause toxicity to soil invertebrates such as earthworms. Copper is toxic to both benthic invertebrates and fish when it is bioavailable. The intrinsic toxicity of copper is often ameliorated by binding to organic matter and by calcium in moderately hard to hard water. Birds and mammals are exposed to copper primarily through the diet and secondarily through

incidental ingestion of soil during feeding. Because copper is an essential micronutrient, the amount of copper that is taken up is regulated by the body and generally large concentrations of copper are required to cause toxicity. The liver and kidney are the main targets of excess copper.

Lead

Lead is a natural element that is persistent in water and soil. It occurs naturally as a sulfide in the ore, galena. It is a soft, bluish-white, silvery gray, malleable metal that may dissolve in water under certain conditions, particularly at low pH. The solubility of lead salts in water varies from insoluble to soluble depending on the type of salt formed. While lead is not generally bioaccumulative, it is persistent and toxic and was commonly used in conjunction with arsenic as a plant growth regulator and as a household insecticide. Lead in its bioavailable form is present as a divalent cation (Pb^{2+}). Divalent Pb forms salts with different anions that are sensitive to pH and begin to precipitate out of solution at about 7.0. This is particularly true of phosphate and carbonate lead salts. In the anaerobic conditions typically found in sediments, Pb forms a very tight bond with sulfide (galena), which reduces lead bioavailability for uptake or toxicity to organisms. Dissolved Pb may leach into the groundwater and be transported to surface waters.

Soluble Pb can cause toxicity to soil invertebrates such as earthworms at high enough concentrations. Except in acidified water bodies, lead precipitates from solution and contributes relatively little to uptake. Furthermore, lead is poorly absorbed across the gut of fish and invertebrates. Birds and mammals are mainly exposed to lead through the diet. Lead from soils is poorly absorbed across the gut and concentrations in food do not generally exceed those in the soil. Once lead is absorbed into the body, it is distributed to three major compartments: blood, soft tissue, and bone. The largest compartment is the bone, which contains about 95 percent of the total body lead burden in adults and about 73 percent in young. Blood lead is in equilibrium with lead in bone and soft tissue and may be mobilized in birds during egg production. Lead may cause effects in the gastrointestinal tract, hematopoietic system, cardiovascular system, central and peripheral nervous systems, kidneys, immune system, and reproductive system.

Nickel

Nickel is a transition metal that exists in five oxidations states. However, only Ni^{2+} is important under normal environmental conditions. Nickel is used in alloys, for example in stainless steel and metals used for coins. Nickel enters the environment through natural discharges like volcanic eruptions and windblown dust as well as anthropogenic activities such as burning fuel oil, metal refining and alloy production, incineration, and coal combustion. Atmospheric nickel is deposited on soils, sediments, and water bodies. In terrestrial and aquatic systems, adsorption, precipitation, coprecipitation, and complexation impacts nickel partitioning between soluble and particulate solid phases. The hexahydrate ion form of nickel is found in surface water and groundwater, which is poorly absorbed by most organisms. Organisms can obtain nickel in the body via inhalation of nickel particles which are absorbed from the respiratory tract, ingestion and subsequent absorption from the gastrointestinal tract, and dermal penetration.

Although some studies have found that nickel is accumulated from the soil by terrestrial plants, other data indicate bioaccumulation does not occur. In general, nickel is not significantly bioaccumulated by aquatic organisms; the bioavailability of nickel in sediment is partly determined by the amount of acid volatile sulfide in the sediment. Additionally, nickel does not biomagnify through the aquatic or terrestrial food chain. Evidence suggests that nickel

concentrations in organisms of higher trophic levels are actually less than concentrations in lower organisms.

Selenium

Selenium is a naturally occurring non-metal element and an essential nutrient for humans and animals. Selenium exists in four important, stable oxidation states: Se^{2-}, metallic Se, Se^{4+}, and Se^{6+}. It has similar chemical properties and forms similar compounds as sulfur. Although selenium is widely distributed in rocks and soils, elemental selenium is obtained mostly as a byproduct of copper refining. Selenium and its compounds are used in the electronics, glass, pharmaceutical, medical, and other industries. These compounds are released to the environment in air, soil, and water. Atmospheric selenium is removed by wet and dry deposition. The fate of selenium in the environment depends largely on the acidity and interactions with oxygen. It is not very bioavailable from anoxic, acidic soils, and elemental selenium does not dissolve in water. The salts of selenic and selenious acids are the most common forms of selenium in surface water.

Generally, elemental selenium is stable in soils and is found at low levels in water because it co-precipitates with sediments. Plants readily take up soluble selenates. Aquatic organisms may accumulate selenium and possibly bioconcentrate this element up the food chain. Selenium has been found in the feathers of semi-aquatic birds and livers of moose, indicating that selenium is bioaccumulated in higher organisms.

Tin

Tin is a naturally occurring element with two oxidation states: Sb^{2+} (stannous) and Sb^{4+} (stannic). It forms both inorganic and organic compounds (organotin); industrially-important organotin compounds contain Sb^{4+}. Tin metal is used to line cans and is present in brass, bronze, and pewter. Inorganic tin is used in toothpaste, soaps, food additives, and dyes; organotin compounds are found in plastics, pesticides, and wood preservatives. Tin metal and inorganic tin is found naturally in the environment, but organotin is anthropogenic. All organotin compounds are manufactured, with the exception of a few methylated forms (Eisler 1989). Tin enters the environment from natural processes like wind storms and man-made sources like smelting. However, once in the environment, it is relatively immobile because it binds to soils and sediments. While tin metal and inorganic forms are not degraded, organotin can be broken down by sunlight or bacteria to inorganic tin compounds.

Tin is found naturally in the air, water, and soil, and therefore, it is found in plants and animals. Inorganic tin is not well absorbed via inhalation, ingestion, or dermal exposure, but organotin compounds are more readily absorbed through the inhalation and oral routes. Inorganic tin is bioconcentrated from the water and sediment into aquatic plants, invertebrates, and fish. It does not appear the tin biomagnifies up through the aquatic food chain, and little data is available to assess the potential for tin to bioaccumulate. Inorganic tin and its salts are generally not toxic due to their poor absorption, relative insolubility of their oxides, and rapid elimination from the body (Eisler 1989; Howe and Watts 2005).

Zinc

In its bioavailable form, zinc exists as the cation Zn^{2+}. Zinc is used primarily in galvanized metals and metal alloys, but zinc compounds also have wide commercial applications including as rodenticide, zinc phosphide. While zinc is not generally bioaccumulative, it is persistent and

may be toxic. Bioavailable zinc (Zn^{2+}) forms salts with anions such as nitrate, carbonate, phosphate, and sulfate. Like lead, zinc carbonate and phosphate precipitate from solution in circumneutral pH conditions and, under anaerobic conditions, zinc combines with sulfide to form a relatively insoluble salt. Under acidic conditions, zinc solubilizes and may leach into groundwater and be transported to surface waters.

Zinc is an essential micronutrient for both plants and animals, and both plants and animals regulate zinc uptake. Zinc deficiency is more common than toxicity, and deficiency leads to reproductive failure and reduced growth rates. Soil invertebrates may be intoxicated in soils containing high concentrations of zinc, particularly if the soils have also been acidified by acid deposition. Under "normal" conditions, zinc is an essential micronutrient that is regulated by these organisms. Since zinc forms solid salts with carbonate and phosphate that precipitate from solution at circumneutral pH, most zinc is acquired through the diet in aquatic systems. In acidic conditions, zinc may also be acquired from the water column. Birds and mammals acquire zinc mainly through the diet. Gastrointestinal absorption of zinc is variable and depends on the chemical compound as well as on zinc levels in the body and dietary concentrations of other nutrients. Chronic oral exposures to zinc may result in anemia and pancreatitis. The adverse effects of zinc in birds may be due to the competition for calcium binding sites in the eggshell gland. These effects likely do not occur in the wild where soils contain high levels of calcium.

Polycyclic Aromatic Hydrocarbons

PAHs are a diverse class of organic compounds that include about one hundred individual substances containing two or more fused benzene, or aromatic, rings. Low molecular weight (LMW) PAHs have fewer than four rings, while high molecular weight (HMW) PAHs have four or more rings. The LMW PAHs include acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, 2-methylnaphthalene, and phenanthrene. The HMW PAHs include benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, fluoranthene, and pyrene.

PAHs are usually present in the environment in complex mixtures of hundreds or even thousands of related compounds. They may originate from three sources: fossil fuels (petrogenic PAHs), burning of organic matter (pyrogenic PAHs) and transformation of natural organic precursors by diagenic processes (biogenic PAHs). LMW PAHs are relatively water-soluble and may be leached from surface soils to groundwater and surface waters; HMW PAHs are water insoluble and are barely leached from soils. Both LMW and HMW PAHs are readily broken-down by sunlight and metabolized by microorganisms to more water-soluble and less toxic forms such as phenolics. After a certain period of time, PAHs also become much less bioavailable and may be irreversibly bound in the organic matter of soils and sediments.

While in the water column either in association with colloidal material or suspended particulates, the fate of PAHs tends to be governed by physical hydrodynamic factors, (e.g. advective transport). While in the water column, PAHs may be transported to other areas, biodegrade, evaporate, photochemically degrade or may be consumed by water column biota. USEPA (2003) has recently provided guidance for evaluating the effects of mixtures of PAHs in sediment on benthic organisms. It is based upon equilibrium partitioning (i.e., estimating the bioavailability of PAHs in sediment pore water using equilibrium theory) and a common narcotic mode of action for mixtures of PAHs and other nonionic organic chemicals.

However, USEPA (2003) acknowledges that this approach could potentially overestimate the bioavailable fraction of PAHs in sediment pore water if there are PAHs in the sediment

associated with soot, coke, slag, tar and coal as they often are in urban environments. As recent research into the bioavailability of PAHs in sediment has demonstrated, PAHs associated with these forms of pyrogenic carbonaceous material have very low bioavailability (Accardi-Dey and Gschwend 2003; Burgess 2004; Ghosh et al. 2003; Rust et al. 2004). Other authors have shown that the longer PAHs are in contact with organic carbon even from ordinary detritus, the less bioavailable they become.

4.3.3 Ecological Exposure Pathways

As presented in the CSM (**Figure 10**), there are several possible routes by which ecological receptors can be linked to Site-related chemical stressors. Once in soil, constituents may remain there or migrate to surface water and sediment through overland erosion and runoff, or be taken up by biota through ingestion. This BERA focuses on surface soil, on-site sediment, and on-site surface water, and the potential risks associated with ecological exposure to these media. As such, potential exposure media include surficial soil and sediment, surface water, terrestrial prey items, and aquatic prey items. Based on the observations taken during the 2005, 2006, 2007, and 2010 ecological surveys and the 2007 sampling program, and the presence of Site-related constituents in ecological areas of concern, the following complete exposure pathways are identified for evaluation in the BERA:

- Terrestrial receptor exposure to surface soils;
- Terrestrial receptor exposure to terrestrial food/prey (plants, soil invertebrates, small mammals);
- Aquatic exposure to on-Site sediment;
- Aquatic exposure to on-Site surface water; and
- Aquatic exposure to benthic and pelagic prey (benthic invertebrates, fish).

For the Sparrows Point BERA, ecological receptors may be exposed to COPCs through the following exposure routes:

- Direct contact with COPCs from surface soil;
- Direct contact with COPCs in sediment and surface water;
- Incidental ingestion of COPCs in surface soil;
- Incidental ingestion of COPCs in sediment;
- Ingestion of surface water;
- Ingestion of potentially impacted terrestrial plants and prey; and
- Ingestion of potentially impacted aquatic plants and prey.

With the exception of direct contact for soil invertebrates living within the soil medium, dermal contact and inhalation are considered minor pathways for terrestrial receptors. The ingestion of surface soils by wildlife during foraging and grooming can be an important exposure route for constituents in soils; therefore, the incidental ingestion pathway is evaluated in the BERA. Ingestion of surface water typically contributes a negligible quantity to the total risk incurred by wildlife; hence, this pathway was not evaluated further in this BERA.

4.3.4 Receptors of Concern

Ecological receptors for the Site were selected to represent communities and species in the major consumer trophic levels. As described in the *Final Ecological Risk Assessment Work Plan for On-Site Areas* (URS 2007), many of the terrestrial areas at the Site have been replaced by industrial facilities or have been modified or fragmented so that they do not provide suitable habitat or sustainable ecological function. As a result, these habitats support limited populations of ecological receptors. For example, terrestrial plant communities and soil invertebrate communities are not highly valued receptor groups for the Sparrows Point Site. Soil quality at the Site is generally poor as a result of filling with rubble and coarse, nutrient-poor material, and intensive industrial operations and earth-moving activities that have occurred over many years. Such activities generally result in depauperate soil invertebrate communities. As a result, wildlife populations that forage on soil invertebrates and diverse plant species are likewise limited, and must be adaptable to continuously disturbed, highly industrialized conditions. The on-site aquatic areas of concern are also either within or proximal to disturbed areas (e.g., large highways and wide railroad corridor in the CL1B Parcel, large highway and intensive earthmoving in Greys Landfill). Wildlife visiting these small aquatic areas must also be adaptable to disturbance.

4.3.5 Protected Species

During the 2005, 2006, 2007, and 2010 ecological surveys and the 2007 sampling program, no rare, threatened, or endangered (RTE) plant or animal species were observed on the Site. For the SLERA, the Maryland Department of Natural Resources (MDNR) and the United States Fish and Wildlife Service (USFWS) were contacted to provide records of any State or Federal RTE plants or animals occurring within the Sparrows Point Site boundary. The responses from both agencies indicated that there were no State or Federal records of RTE species within the project boundary.

Given that it has been more than one year since these agency determinations, updated requests were submitted to the MDNR and USFWS regarding the potential presence of listed species. These request letters provided in **Appendix C**. To date, only the USFWS has provided a response (no records of listed species); this response letter has been included in **Appendix C**. The response letter from MDNR is pending, and a copy will be provided once it is received.

4.4 ASSESSMENT AND MEASUREMENT ENDPOINTS

4.4.1 Assessment Endpoints

Assessment endpoints are defined as explicit expressions of environmental values that are to be protected (USEPA 1998), and are measured as potential effects on ecological receptors. Measurement endpoints are based on the evaluation of existing data for exposure media and comparison with ecotoxicity screening values. Selection of assessment endpoints for the ecological evaluation is based on:

- Identification of COPCs;
- The mode of toxicity of COPCs to various receptors; and

- The presence of sensitive or highly susceptible ecological receptors and exposure pathways (USEPA 1997).

The interpretation of available Site-specific chemical and biological information combined with an understanding of the structure and function of the on-site terrestrial and aquatic ecosystems at the Sparrows Point Site were used to identify specific assessment endpoints for the BERA. The assessment endpoints selected represent the protection of populations and communities, since the loss of one or a few individuals is unlikely to compromise the healthy function of an ecological community unless the individual is threatened or endangered and is regularly present (USEPA 1992). Consequently, if listed species are not present or not expected to be present at the Site (see Section 4.3.5), the fundamental unit for the BERA is the population rather than the individual.

The BERA assessment endpoints, receptors representing the assessment endpoints, and associated risk questions are described in the following subsections.

Assessment Endpoint #1: Viability and Function of the Soil Invertebrate Community

Soil invertebrates were selected as an assessment endpoint because they have an important role in energy flow and materials cycling, their potential for exposure to contaminants, and their role as a food source for higher trophic level organisms. This assessment endpoint evaluates whether the estimated exposure to Site-related constituents from direct contact with COPCs in surface soils is adequate to support the growth and reproduction of soil invertebrates that is representative of the natural variability experienced by soil invertebrate communities in other disturbed terrestrial habitats. Earthworms were selected as the receptor taxon to evaluate the soil invertebrate community since they play a vital role in nutrient cycling in surficial soils and are a food source for many invertivorous wildlife species.

Risk Question: Are concentrations of Site-related constituents in surface soil sufficient to cause adverse alterations to the functioning of the soil invertebrate community?

Selected Receptor: Earthworms

Assessment Endpoint #2: Viability and Function of the Herbivorous Terrestrial Avian Community

Herbivorous birds were selected as an assessment endpoint based on their role in the transfer of energy from plant tissue to animal tissue. They forage primarily on vegetation and, in turn, may provide an important food source for higher trophic levels. This assessment endpoint evaluates whether the estimated exposure to COPCs from incidental soil ingestion and diet is adequate to support the growth and reproduction of herbivorous birds that is representative of the natural variability experienced by herbivorous bird communities in other disturbed terrestrial habitats.

Risk Question: Are dietary exposure levels of Site-related constituents in surface soil sufficient to cause adverse alterations to the herbivorous terrestrial avian community?

Selected Receptor: Mourning dove (*Zenaida macroura*)

Assessment Endpoint #3: Viability and Function of the Omnivorous Terrestrial Avian Community

Omnivorous terrestrial birds were selected as an assessment endpoint because they represent an energy and nutrient pathway between soil invertebrates and plants that may be in direct contact with potentially contaminated surface soil. This assessment endpoint evaluates whether the

estimated exposure to COPCs from incidental soil ingestion and diet is adequate to support the growth and reproduction of omnivorous birds that is representative of natural variability experienced by omnivorous avian communities in other disturbed terrestrial habitats.

Risk Question: Are dietary exposure levels of Site-related constituents in surface soil sufficient to cause adverse alterations to the omnivorous avian community?

Selected Receptor: American robin (*Turdus migratorius*)

Assessment Endpoint #4: Viability and Function of the Carnivorous Terrestrial Avian Community

Carnivorous birds have been selected as an assessment endpoint because they feed primarily on animal tissue. They are typically the highest trophic level in the food chain and would thus be potentially vulnerable to chemical constituents that bioaccumulate. This assessment endpoint evaluates whether the estimated exposure to COPCs from incidental soil ingestion and diet is adequate to support the growth and reproduction of carnivorous birds that is representative of the natural variability experienced by carnivorous bird communities in other disturbed terrestrial habitats.

Risk Question: Are dietary exposure levels of Site-related constituents sufficient to cause adverse alterations to the carnivorous avian community?

Selected Receptor: Red-tailed hawk (*Buteo jamaicensis*)

Assessment Endpoint #5: Viability and Function of the Herbivorous Terrestrial Mammal Community

Herbivorous mammals were selected as an assessment endpoint because they have an important role in energy transfer from plant tissue to animal tissue. They forage primarily on vegetation and, in turn, provide an important food source carnivorous birds and mammals. This assessment endpoint evaluates whether the estimated exposure to COPCs from incidental soil ingestion and diet is adequate to support the growth and reproduction of herbivorous mammals that is representative of the natural variability experienced by herbivorous mammal communities in other disturbed terrestrial habitats.

Risk Question: Are dietary exposure levels of Site-related constituents sufficient to cause adverse alterations to the herbivorous mammal community?

Selected Receptor: Meadow vole (*Microtus pennsylvanicus*)

Assessment Endpoint #6: Viability and Function of the Invertivorous Terrestrial Mammal Community

Invertivorous mammals have been selected as an assessment endpoint because they feed primarily on invertebrates in close association with Site soils. They typically have a high trophic status in the food chain and would thus be potentially vulnerable to any bioaccumulative constituents. This assessment endpoint evaluates whether the estimated exposure to COPCs from incidental soil ingestion and diet is adequate to support the growth and reproduction of invertivorous mammals that is representative of the natural variability experienced by invertivorous mammal communities in other disturbed terrestrial habitats.

Risk Question: Are dietary exposure levels of Site-related constituents sufficient to cause adverse alterations to the invertivorous mammal community?

Selected Receptor: Short-tailed shrew (*Blarina brevicauda*)

Assessment Endpoint #7: Viability and Function of the Carnivorous Terrestrial Mammal Community

Carnivorous mammals were selected as an assessment endpoint because they consume animal tissue and have a high standing in the terrestrial food chain. This trophic guild is thus potentially vulnerable to chemicals that bioaccumulate. This assessment endpoint evaluates whether the estimated exposure to COPCs from incidental soil ingestion and diet is adequate to support the growth and reproduction that is representative of the natural variability experienced by carnivorous mammal communities in other disturbed terrestrial habitats.

Risk Question: Are dietary exposure levels of Site-related constituents sufficient to cause adverse alterations to the carnivorous mammal community?

Selected Receptor: Red fox (*Vulpes vulpes*)

Assessment Endpoint #8: Viability and Function of the Benthic Macroinvertebrate Community

The benthic macroinvertebrate community was selected as an assessment endpoint due to its role in aquatic energy flow and materials cycling, its potential for exposure to chemicals in sediment, and its role as a food source for higher trophic level organisms. This assessment endpoint evaluates whether sediment quality in the isolated surface water features of concern are adequate to support benthic invertebrate community function and diversity that is representative of the natural variability experienced by benthic communities in other lentic habitats in disturbed environments.

Risk Question: Are concentrations of Site-related constituents in sediment in the CL1B Large Pond, CL1B Small Pond, and Knobby's Ditch Head Pond sufficient cause adverse alterations to the functioning of the benthic macroinvertebrate community?

Selected Receptor: Benthic macroinvertebrate community

Assessment Endpoint #9: Viability and Function of the Finfish Community

The fish community was selected as an assessment endpoint because of its significant role in aquatic energy flow and nutrient cycling, its potential for exposure to chemicals in surface water, and its role as a food source to piscivorous wildlife. This assessment endpoint evaluates whether sediment quality in the isolated surface water features of concern are adequate to support fish community function and diversity that is representative of the natural variability experienced by fish communities in other lentic habitats in disturbed environments.

Risk Question: Are concentrations of Site-related constituents in the surface waters of the CL1B Large Pond, CL1B Small Pond, and Knobby's Ditch Head Pond sufficient to cause adverse alterations to the functioning of the fish community?

Selected Receptor: Fish community

Assessment Endpoint #10: Viability and Function of the Piscivorous Semi-Aquatic Avian Community

Piscivorous semi-aquatic birds were selected as an assessment endpoint because they feed primarily on fish tissue, and therefore are typically the highest trophic level in the aquatic food chain. This foraging guild is thus potentially vulnerable to constituents that bioaccumulate. This

assessment endpoint evaluates whether the estimated exposure to COPCs from diet is adequate to support the growth and reproduction of piscivorous semi-aquatic birds that is representative of the natural variability experienced by piscivorous semi-aquatic bird communities in other lentic habitats in disturbed environments.

Risk Question: Are dietary exposure levels of Site-related constituents in sediment and surface water in the CL1B Large Pond, CL1B Small Pond, and Knobby's Ditch Head Pond sufficient to cause adverse alterations to the piscivorous semi-aquatic avian community?

Selected Receptor: Great blue heron (*Ardea herodias*)

Assessment Endpoint #11: Viability and Function of the Invertivorous Semi-Aquatic Mammal Community

Invertivorous semi-aquatic mammals were selected as an assessment endpoint because they play an important role in energy transfer from the aquatic to the terrestrial ecosystem. Consumers of aquatic invertebrates may, in turn, provide a food source for higher trophic levels. This assessment endpoint evaluates whether the estimated exposure to COPCs from incidental sediment ingestion and diet is adequate to support the growth and reproduction of invertivorous semi-aquatic mammals that is representative of the natural variability experienced by invertivorous semi-aquatic mammal communities in other lentic habitats in disturbed environments.

Risk Question: Are dietary exposure levels of Site-related constituents in sediment and surface water in the CL1B Large Pond, CL1B Small Pond, and Knobby's Ditch Head Pond sufficient to cause adverse alterations to the invertivorous semi-aquatic mammal community?

Selected Receptor: Raccoon (*Procyon lotor*)

4.4.2 Measurement Endpoints

A measurement endpoint is a measurable ecological characteristic that is related to the assessment endpoint and is a measure of biological effects such as mortality, reproduction, and growth (USEPA 1997). These endpoints are based on the evaluation of existing analytical data for exposure media and comparison with TRVs, as well as observations of the habitat quality of the areas of ecological concern. It is assumed in this BERA that if detected chemical concentrations do not exceed TRVs, the receptor populations will be protected (i.e., there is no risk).

Each of the assessment endpoints may have one or more measures of effect to provide multiple bases for evaluation (i.e., lines of evidence). The primary line of evidence for this BERA is comparison of estimated or measured exposure levels of the COPC with ecological effects levels. The measures of effect are direct contact soil TRVs used to evaluate exposure through routes other than ingestion (e.g., absorption, immersion). For exposures incurred through the food chain, wildlife TRVs corresponding to NOAELs and LOAELs are used as measures of effect.

This step characterizes risk by comparing direct contact TRVs for direct contact exposure pathways and wildlife TRVs for food chain exposure pathways to upper-bound central tendency concentrations and doses of COPCs carried forward from the SLERA to this BERA. The 95 percent upper confidence limit of the mean concentration (UCL_{95}) is generally regarded as an appropriately conservative estimator of the upper-bound, central tendency EPC that receptors foraging randomly throughout an exposure area would be expected to encounter.

Where available, peer-reviewed direct contact TRVs are used to evaluate the ecological effects of exposure for invertebrates and fish. For birds and mammals, assumptions in the BERA include the use of the UCL_{95} or other central tendency estimate as the EPC, regression-based estimates of bioaccumulation, incorporation of receptor home ranges to the calculation of exposure, and peer-reviewed ecotoxicity information.

Discussions of these assumptions are provided in the following sections.

5.1 EXPOSURE POINT CONCENTRATIONS

For datasets containing five or more samples, a reasonable upper-bound estimate of the central tendency concentration is calculated using USEPA software, ProUCL 4.00.04, as the recommended UCL_{95} concentration (USEPA 2009). For areas with less than five samples with non-detects, a reliable UCL_{95} cannot be calculated, and therefore the geometric mean concentration is used to represent the EPC, where appropriate (USEPA 2009).

UCL_{95} concentrations were calculated for soil data samples from Humphrey Impoundment, CL1B Parcel, and Mud Reservoir. For the Former East Pond and CL1B Large Pond, geometric mean concentrations were used as EPCs. Maximum sample concentrations were applied to the exposure and risk calculations for the CL1B Small Pond and Knobby's Ditch Head Pond. Since the toxicity profiles indicate that risks are additive for individual HMW PAHs and LMW PAHs, the concentrations of the individual PAHs for these groups of constituents were summed in the risk evaluation. Individual PAHs that were not detected in a sample were included in the sum by using one-half the reporting limit.

The derivation of UCL_{95} concentrations for COPCs are provided in **Appendix D**, and summarized in **Tables 5-1** and **5-2**.

5.2 DIRECT CONTACT EXPOSURE

The direct contact exposure evaluation includes the comparison of EPC concentrations of detected COPCs to direct contact TRVs. Analysis of risks to soil invertebrate, benthic macroinvertebrate, and finfish communities from metals, PAHs, and other COPCs was based on published, peer-reviewed data. In some cases, TRVs were not available. These COPCs are therefore treated as uncertainties for the direct contact exposure pathway.

5.3 FOOD CHAIN EXPOSURE

Wildlife ingestion pathways were evaluated by considering the trophic transfer of constituents from Site soil, sediment or surface water through the food chain to the selected ROCs. Wildlife dose modeling in the BERA incorporates refined assumptions regarding exposure (e.g., realistic EPCs and area use estimates) to reduce the uncertainty associated with estimating wildlife

exposure. Simplified food web models were used to calculate EDDs of constituents that selected receptor groups experience through exposure to surface soil, sediment, or surface water in each area of the Site. The EDDs for wildlife receptors are calculated using: (1) UCL_{95}, geometric mean, or maximum prey and media concentrations, as appropriate, and (2) receptor-specific exposure parameters (**Table 5-3**). The EDD represents the amount of a chemical that an individual member of a receptor population would ingest if the population foraged solely within the area of concern. These values are then compared to the NOAEL and LOAEL TRVs to assess the potential for adverse effects.

The simplified food web model considers the primary routes of exposure to wildlife receptors as the direct ingestion of prey and the incidental ingestion of media. Concentrations of chemicals in prey are expressed as a function of soil, sediment, or surface water EPCs and bioaccumulation factors (BAFs) or biota sediment accumulation factors (BSAFs) for prey items. The following sections provide descriptions of the each of the BERA elements associated with the development of exposures and risks to selected wildlife receptors, including dose model equations, area use factors (AUFs), and bioaccumulation (e.g., BAFs and BSAFs).

5.3.1 Food Chain Dose Model

This section describes a simplified food web model, developed to calculate EDDs from chemical concentrations in sediment or soil. The total estimated daily dose (EDD_{total}) experienced by each selected receptor is the sum of the doses obtained from the two primary routes of exposure:

$$EDD_{total} = EDD_{diet} + EDD_{substrate}$$

In the model, the total dose from each route of exposure is calculated individually as follows:

Dietary Dose

$$EDD_{diet} = \frac{IR_{diet} \times \sum (BAF \times C_s \times DF_i) \times AUF}{BW}$$

where:

EDD_{diet}	= Dose of constituent obtained from the diet (milligram [mg] constituent/kilogram [kg] receptor body weight-day)
IR_{diet}	= Ingestion rate of food (kg food ingested per day, dry weight)
BAF	= Bioaccumulation factor, specific to prey type and constituent (kg substrate/kg food, dry weight)
C_s	= Concentration of constituent in soil or sediment (mg constituent/kg soil or sediment, dry weight)
DF_i	= Dietary fraction of food item *i* (proportion of food type in the diet)
AUF	= Area use factor includes, when appropriate, seasonal and area use rates
BW	= Body weight of the receptor, wet weight (kg)

Substrate Dose

$$EDD_{substrate} = \frac{IR_s \times C_s \times AUF}{BW}$$

$EDD_{substrate}$ = Dose of constituent obtained from incidental ingestion of soil or sediment (mg constituent/kg receptor body weight-day)

IR_s = Incidental ingestion rate of soil or sediment (kg soil ingested per day, dry weight)

C_s = Concentration of constituent in soil or sediment (mg constituent/kg soil or sediment, dry weight)

AUF = Area use factor includes, when appropriate, seasonal and area use rates

BW = Body weight of the receptor, wet weight (kg)

Food ingestion rates for selected wildlife receptors were based on allometric regression analyses of feeding rates versus body mass for over 170 species of mammals and birds (Nagy 2001). The allometric equations for estimating IR_{food} from Nagy (2001) are as follows:

1) American robin (omnivore) - $IR_{food} = 0.67(g\ BW)^{0.627}$
2) Red-tailed hawk (carnivore) - $IR_{food} = 0.849(g\ BW)^{0.663}$
3) Mourning dove (granivore) - $IR_{food} = 0.088(g\ BW)^{0.891}$
4) Red fox (carnivore) - $IR_{food} = 0.153(g\ BW)^{0.834}$
5) Short-tailed shrew (invertivore) - $IR_{food} = 0.373(g\ BW)^{0.622}$
6) Meadow vole (herbivore) - $IR_{food} = 0.859(g\ BW)^{0.628}$
7) Raccoon (invertivore) - $IR_{food} = 0.432(g\ BW)^{0.678}$
8) Great blue heron (carnivore) - $IR_{food} = 0.849(g\ BW)^{0.663}$

To avoid introducing unnecessary uncertainty into the model by converting parameters from dry weight to wet weight based on approximate moisture contents of dietary items, model parameters for food ingestion rates, substrate ingestion rates, and bioaccumulation rates are all expressed on a dry weight basis.

Receptor EDDs are calculated based on two exposure assumptions:

- Receptors consume and assimilate only the bioavailable portion of the EPC of COPCs detected in prey and media.
- Species-specific forage ranges were compared to the Site area to estimate the contribution of the Site to the overall energetic requirements of the respective receptor (i.e., the AUF).

5.3.2 Area Use Factors

The AUF accounts for the proportion of time that an organism spends in an area of concern during the time period of possible exposure. This factor is generally calculated as the ratio of the size of

the study area to the home range of each receptor, but may also include considerations of temporal use of the study area (i.e., seasonality). The use of an AUF is appropriate since it incorporates a more realistic assumption that reduces the overall uncertainty of the risk assessment, while retaining the conservative nature of the exposure model. Calculated AUFs for each receptor, in each area of concern, are presented in **Table 5-4**.

5.3.3 Bioaccumulation Factors

BAFs provide quantitative indicators of the tendency for a chemical to partition into biological organisms relative to the concentrations present in environmental exposure media. Site-specific measurements of tissue concentrations are the best data to reduce uncertainty in estimating exposure point concentrations in dietary components. However, the collection of tissue for all dietary components is not practical in most ecological risk assessments. Therefore, BAFs or models must be applied and a level of uncertainty in estimated concentrations must be accepted. BAFs represent observed or predicted ratios between chemical concentrations in prey and sediment or soil:

$$C_p = BAF \times C_s$$

where:

C_p = Chemical concentration predicted in prey (mg chemical/kg prey, dry weight);

BAF = Bioaccumulation factor, specific to prey type and chemical (kg sediment as dry weight/kg plant, invertebrate, or fish as dry weight); and

C_s = EPC in sediment or soil (mg chemical/kg soil or sediment as dry weight).

Per the *Final Ecological Risk Assessment Work Plan for On-Site Areas* (URS 2007) and the USEPA Region III BTAG guidance, food chain ingestion modeling was conducted on all COPCs identified as "important bioaccumulative constituents" (USEPA 2000b). For chromium, the USEPA (2000b) identifies hexavalent chromium only (Cr^{6+}) as bioaccumulative, and not the more common trivalent chromium (Cr^{3+}). However, to maintain sufficient conservatism in the BERA, chromium was retained for wildlife food chain analysis in the BERA. Similarly, although only tributyltin appears on the USEPA (2000b) list (and not inorganic tin), tin was retained in the food chain exposure and risk characterization.

Terrestrial BAFs

Exposure point concentrations in dietary items for terrestrial receptors are estimated using terrestrial BAFs. BAFs provide quantitative indicators of the tendency for a chemical to partition into terrestrial organisms relative to the concentrations present in terrestrial exposure media. BAFs used to calculate maximum concentrations of chemicals in terrestrial food items (terrestrial plants and soil invertebrates) were derived from the literature as indicated below.

Terrestrial Plants

The concentrations of selected metals in terrestrial plants are estimated using the recommended applications of terrestrial plant bioaccumulation models developed by Efroymson et al. (2001)

using data compiled in Bechtel-Jacobs (1998a). Single-variable regression models are the recommended application for general estimates of cadmium, copper, lead, nickel, selenium, and zinc concentrations in plants (Efroymson et al. 2001). For antimony, a regression derived from measured data was used to estimate uptake (USEPA, 2005a). The uptake factor for vegetated portions of food crops reported in Baes et al. (1984) is used as the BAF for tin. The concentration of chromium in terrestrial plants is estimated using the median uptake factors provided in Bechtel-Jacobs (1998a). Regression model equations and input variables developed in Efroymson et al. (2001) are presented in the notes for **Tables 5-5** through **5-8**.

The concentrations of total HMW PAHs in terrestrial plants are estimated using the recommended applications of terrestrial plant bioaccumulation models developed by USEPA (2007f). The regression model equation and input variables used to estimate PAH concentrations in plants are presented in the notes for **Tables 5-5** and **5-6**.

Soil Invertebrates

The concentrations of selected metals in soil invertebrates are estimated using the recommended applications of earthworm bioaccumulation models developed by Sample et al. (1999) and Neuhauser et al. (1995). Simple regression models are used to estimate soil invertebrate concentrations of cadmium, copper, lead, selenium, and zinc; regression model equations and input variables are presented in the notes for **Tables 5-5** through **5-8**. Bioaccumulation of chromium from soil to soil invertebrates was estimated using the mean uptake factor reported in Sample et al. (1998a). The soil invertebrate BAF for nickel was extracted from Beyer and Stafford (1993). A soil-invertebrate uptake factor for antimony and tin could not be identified in the literature. For these constituents, the ingestion-beef uptake factors from Baes et al. (1984) were used to estimate bioaccumulation.

The concentrations of total HMW PAHs in soil invertebrates are estimated using the uptake factor of 2.6, as provided in USEPA (2007f).

Small Mammals

The concentrations of selected metals in small mammals are estimated using the recommended applications of small mammal bioaccumulation models developed by Sample et al. (1998b). General regression models are used to estimate concentrations of cadmium, chromium, copper, lead, nickel, selenium, and zinc in small mammals (**Tables 5-5** through **5-8**). The small mammal concentrations of antimony and tin are estimated using the uptake factors developed by Baes et al. (1984). The BAF from soil to small mammals for these metals is calculated as the product of the soil-plant concentration factor and the ingestion-beef transfer coefficient. This approach is similar to the approach used to estimate metal concentrations in small mammals for the development of ecological soil screening levels (USEPA 2007a).

The USEPA (2007f) has concluded that following ingestion of PAHs by birds and mammals, these compounds are rapidly metabolized and eliminated. Consequently, bioaccumulation of PAHs in small mammals (and birds) is anticipated to be negligible.

Aquatic BSAFs

Exposure point concentrations in aquatic prey are estimated using BSAFs for benthic organisms. BSAFs provide quantitative indicators of the tendency for a chemical to partition into sediment-associated organisms relative to the concentrations present in sediment. BSAFs used to calculate

maximum COPC concentrations of chemicals in benthic organisms are derived from the literature as indicated below.

Benthic Invertebrates

Concentrations of selected metals in benthic invertebrates are estimated using the recommended applications of invertebrate bioaccumulation models developed by Bechtel-Jacobs (1998b) (**Tables 5-9** and **5-10**). Concentrations of copper and zinc are estimated as the 95 percent upper prediction limit (95_{UPL}) of regression models developed for those metals. The 90^{th} percentile BSAFs reported in Bechtel-Jacobs (1998b) were used to estimate concentrations of cadmium and chromium in depurated invertebrates. A BSAF for selenium was extracted from data reported in Hamilton and Buhl (2003a and 2003b).

Fish

When available, BSAFs reported in Song and Breslin (1999) were used to estimate bioaccumulation of metals in fish tissue based on a study of metal uptake in the opossum shrimp (*Mysis relicta*). A BSAF for selenium was not available from Song and Breslin (1999); therefore, the invertebrate BSAF for this constituent was used as a surrogate for bioaccumulation in fish (**Tables 5-9** and **5-10**).

5.4 EFFECTS CHARACTERIZATION

5.4.1 Soil Invertebrates

The direct contact exposure evaluation includes the comparison of EPCs of detected COPCs in surface soil to direct contact ecotoxicity values for soil invertebrates. The derivation of soil direct contact TRVs involved a comprehensive review of the available toxicological data for earthworms which, as discussed in Section 4.4.1, are considered the valued entity for representing the soil invertebrate community and for which a considerable toxicological database has been amassed. Ecotoxicity values were based generally on no-effect and/or lowest-effect levels, and were derived from chronic studies that focused on sensitive endpoints pertaining to healthy community function (i.e., reproduction and growth). If more than one effect concentration was available, the geometric mean concentration from all studies was calculated and used for comparison to EPC concentrations to assess soil invertebrate risks.

Table 5-11 presents the derivations of soil invertebrate direct contact TRVs for all soil COPCs.

5.4.2 Benthic Invertebrates

For evaluating potential risk to the benthic invertebrate community, the "consensus-based" freshwater sediment quality probable effects concentration (PEC) was used (MacDonald et al. 2000). These effects guidelines are widely accepted throughout the United States for use in ecological sediment evaluations, and generally correspond to sediment concentrations above which effects are likely to be observed. Because of the industrialized/urban setting where there are multiple potential sources of low-level PAHs and metals (Site operations, road runoff, fuel combustion), and considering the poor habitat value of the terrestrial areas of concern, it is believed that the appropriate sediment guideline to use for the Sparrows Point Site is the less

conservative PEC rather than the threshold effect concentration (TEC), a conservative value typically applied in the initial screening step to identify COPCs.

MacDonald et al. (2000) PECs were not available for barium, beryllium, cyanide, selenium, silver, tin, and vanadium. Consequently, other literature-derived sources were reviewed in order to extract an appropriate sediment quality effects benchmark. For barium, selenium, vanadium, and tin, sediment direct contact benchmarks were derived from the product of the soil-water partitioning coefficient (K_p) and the chemical-specific water quality benchmark. The K_p for metals can be estimated through the product of the distribution coefficient (K_d) and the site-specific fraction of organic carbon (f_{oc}). K_d values were extracted from USEPA (1996).

For BEHP, a probable effects level (PEL) calculated by the Florida Department of Environmental Protection was used to assess direct contact exposure of BEHP to benthic organisms (MacDonald 1994). The PEL is derived as the geometric mean of the 50th percentile of the effects data and 85th percentile of the no-effects data from coastal and estuarine sediments, respectively.

Since PAHs can occur in sediments as a mixture of several analytes, an evaluation of total PAH was a more appropriate measure of effects for these constituents. An analysis was conducted to evaluate the additive toxicity of a mixture of PAH compounds in Knobby's Ditch Head Pond sediments. The analysis was consistent with the USEPA's *Equilibrium Partitioning Sediment Guidelines (ESGs) for the Protection of Benthic Organisms: PAH Mixtures* (USEPA 2003). The approach is based on the approximate additivity of narcotic chemicals in water and tissue. The toxicities of 13 individual PAH compounds are expressed as the organic-carbon normalized sediment concentrations divided by the organic-carbon normalized final chronic value developed for each compound (USEPA 2003). The ESG for the 34 PAH compounds considered to be "total PAHs" is defined as the sum of the toxic units for the 13 PAH compounds multiplied by a conservative uncertainty factor. For this BERA, an uncertainty factor of 4.8 was applied as recommended to account for the differences in the number of PAHs analyzed (16) relative to the number of PAHs USEPA used to derive the criteria[3]. If ESGs are greater than 1.0, it is concluded that PAH mixtures in that sample may cause toxicity to benthic organisms (USEPA 2003).

It should be noted that although sulfide was identified as a direct contact COPC in the SLERA (in Knobby's Ditch Head Pond sediments), its presence in sediments in this pond likely limits the bioavailability of divalent cationic metals (cadmium, copper, lead, nickel, and zinc) through the formation of insoluble metal-sulfide complexes (DiToro et al. 1990; Ankley 1996). Sulfides occur naturally and may result from the bacterial breakdown of organic matter in pond sediments. Consequently, the direct contact evaluation focused on metals and PAH compounds that are more likely to drive direct contact risks.

5.4.3 Fishes

Dissolved cadmium and zinc were the only surface water COPCs retained from the SLERA for further evaluation in the BERA (CL1B Small Pond). Borgmann et al. (2005) provided 28-day, chronic no-effect data for the amphipod *Hyalella azteca* exposed to cadmium (0.39 µg/L) and

[3] This factor was calculated as the midpoint between adjustment factors provided by USEPA (2003) for datasets with 13 PAHs and those with 23 PAHs at the 80th percentile.

zinc (111 µg/L) at circumneutral pH in moderately hard water. Although no fish inhabit the CL1B Small Pond due to unsuitable physical conditions there for fish establishment, these values were used as surface water direct contact values for the protection of other water-column organisms (e.g., pelagic invertebrates) that may potentially inhabit the pond.

5.4.4 Birds and Mammals

Wildlife TRVs are derived from empirical studies of wildlife effects from chemical stressors. NOAELs are lower-bound levels at which there are no statistically or biologically significant increases in the frequency or severity of adverse effects (e.g., on growth, reproduction, survival) between the exposed population and its appropriate control population. These values tend to be conservative, and in many cases, underestimate the actual threshold dose at which no adverse effect is observed. LOAELs are the lowest level of a stressor evaluated in a toxicity test or biological field survey that has a statistically significant adverse effect on the exposed organisms compared with unexposed organisms in a control or reference site (USEPA 1997). LOAELs are lower-bound threshold effect levels and are used to provide a more realistic evaluation of the potential for adverse ecological effects to wildlife populations from exposure to COPCs.

Wildlife TRVs in the BERA were primarily derived from toxicological studies accepted by the USEPA for the derivation of Ecological Soil Screening Levels (Eco-SSLs). Where available, no observable adverse effects levels (NOAELs) used in the BERA are calculated as the geometric mean of NOAEL endpoints for growth and reproduction reported in studies selected for the derivation of Eco-SSLs (USEPA 2005d); low observable adverse effects levels (LOAELs) used in the BERA are calculated as the geometric mean of LOAEL endpoints for growth and reproduction in Eco-SSL studies.

The TRV values for the wildlife receptors are summarized in **Table 5-12**. Derivations of wildlife NOAEL and LOAEL TRVs are provided in **Appendix E**. Full citations for the sources of wildlife toxicity information are provided in Section 8.

A common practice used in BERAs in the past was to modify the TRVs according to body mass differences between the test organisms and the site-specific receptors being evaluated (e.g., scale to metabolic rate raised to the 0.67 or 0.75 power). Rhomberg and Wolff (1998) reviewed the mammalian toxicity database and Sample and Arenal (1999) reviewed both the avian and mammalian toxicity databases. These authors' comprehensive reviews concluded that body size scaling of toxicity values was not well-supported. Consequently, no scaling of wildlife TRVs was conducted in this BERA.

The BERA risk characterization uses the refined exposure estimates and ecological effects evaluation to determine a probability of adverse effects to ROCs. Risk is assessed in the BERA by comparing the refined exposure estimate based on the EPC of each COPC to the direct contact TRVs (invertebrates) or wildlife dose-based TRVs (birds and mammals) described in the ecological effects evaluation (Section 5.4). Resultant risk is characterized in terms of a hazard quotient, or HQ.

The risk estimate for evaluating direct contact exposure is calculated as follows:

$$\textit{Hazard Quotient (HQ)} = \frac{\textit{EPC}}{\textit{Direct Contact TRV}}$$

The risk estimate for evaluating food chain exposure is calculated as follows:

$$\textit{Hazard Quotient (HQ)} = \frac{\textit{EDD}}{\textit{Wildlife TRV}}$$

An HQ less than 1 indicates that the potential for adverse ecological impacts is negligible. An HQ value greater than 1 implies that there is the potential for adverse effects, not that adverse effects will occur. Nevertheless, the potential for risk increases as HQs increase above unity.

The fundamental unit for Sparrows Point BERA is the population, rather than the individual. While the exposure evaluation included both NOAEL and LOAEL TRV comparisons for wildlife, LOAEL TRVs provide a more realistic evaluation of the potential for adverse effects on wildlife populations. The NOAEL TRV is generally regarded to be applicable for the protection of individuals (e.g., federally or state protected species) and not populations. Application of NOAELs to protect populations of organisms is overly conservative and would subject the Site to unnecessary and potentially intrusive remedial measures.

Risk estimates for the direct contact and food-chain exposure pathways are discussed below. COPCs with the greatest HQs for each area of concern are presented in **Figures 11** through **16**.

6.1 RISK ESTIMATION

6.1.1 Direct Contact Evaluation

The following subsections characterize risk for all potentially complete direct contact exposure pathways. **Tables 6-1** though **6-5** and **Tables 6-7** through **6-9** present the HQs resulting from comparisons of EPC concentrations to direct contact TRVs for Humphrey Impoundment, the CL1B Parcel, Mud Reservoir, Former East Pond, Knobby's Ditch Head Pond, and CL1B Large and Small Ponds. Calculations of PAH ESGs for the two sediment sampling locations in Knobby's Ditch Head Pond are provided in **Table 6-6**.

Soil Invertebrates

Humphrey Impoundment

Direct contact HQs for soil invertebrates (earthworms) potentially inhabiting Humphrey Impoundment surface soil exceeded 1 for chromium, copper, cyanide, tin, and zinc (**Table 6-1**). The HQ was 32.5 for chromium and 29.9 for zinc; HQs for copper, cyanide, and tin were less than 4. HQs for the remaining six metals and HMW PAHs were <1.

CL1B Parcel

Direct contact HQs for soil invertebrates potentially inhabiting CL1B Parcel surface soil exceeded 1 for HMW PAHs, copper, and zinc (**Table 6-2)**. The highest HQ was for zinc (18.2). The HQ for HMW PAHs was slightly > 1 (1.2). The direct contact HQ for vanadium was 1.0. HQs for the remaining four metals and LMW PAHs were <1.

Mud Reservoir

Direct contact HQs for soil invertebrates potentially inhabiting Mud Reservoir surface soil marginally exceeded 1 for copper and zinc (**Table 6-3)**. HQs for the remaining four metals were <1.

Former East Pond

Direct contact HQs for soil invertebrates potentially inhabiting Former East Pond surface soil exceeded 1 for zinc (**Table 6-4)**. HQs for the remaining five metals were <1. This result indicates that zinc is the only constituent that poses a potential risk to soil invertebrates.

Benthic Invertebrates/Fish

Knobby's Ditch Head Pond

Direct contact HQs for benthic invertebrates inhabiting Knobby's Ditch Head Pond sediment marginally exceeded 1 for copper, cyanide, and zinc (**Table 6-5)**. The direct contact HQ for cadmium was 1.0. HQs for Aroclor 1260, BEHP, and the five remaining metals were <1.

The results of the ESG analysis indicate that the two sediment sampling locations in the pond contain total PAH concentrations that could cause toxicity in benthic organisms (**Table 6-6**). However, since all 16 PAHs were below detection at KD-FS-02, the ESG calculation for this station is based on the sum of one-half the reporting limit. This conservative approach resulted in an ESG greater than 1 for this station. The ESG result for KD-FS-02 represents an artifact of laboratory analytical limitations, and it is unlikely that PAHs in sediments at this location pose a risk to benthic macroinvertebrates. There is the potential for PAH toxicity at KD-FS-01 given that the ESG is <1; however, five of the 16 individual PAHs at this location were not detected at the laboratory reporting limits.

No direct contact surface water risks are posed to fish or other water-column receptors, based on the results of the SLERA (URS 2009a); hence, these results were not evaluated further in the BERA.

CL1B Large Pond

Direct contact HQs for benthic invertebrates inhabiting CL1B Large Pond sediment marginally exceeded 1 for chromium and zinc (**Table 6-7**). HQs for the remaining nine metals and cyanide were <1.

No direct contact surface water risks are posed to fish or other water-column receptors, based on the results of the SLERA (URS 2009b).

CL1B Small Pond

Direct contact HQs for benthic invertebrates inhabiting CL1B Small Pond sediment exceeded 1 for cadmium, copper, cyanide, and zinc (**Table 6-8**). The highest HQ was 49 for zinc. HQs for chromium and cyanide were 38 and 14, respectively. The HQ for copper was slightly greater than 1 (1.9). HQs for the remaining 10 metals were <1.

Surface water direct contact HQs for water-column biota exceeded 1 for dissolved cadmium (5.6) and dissolved zinc (1.5) in the CL1B Small Pond (**Table 6-9**).

6.1.2 Food Chain Evaluation

Food chain risks to terrestrial receptors are characterized in the following paragraphs and summarized in **Tables 6-10** through **6-34**. Receptors in each area of concern were evaluated only for potential risks associated with the metals, PAHs, or other organic compounds that resulted in a receptor-specific HQ greater than 1 during the screening-level risk characterization (URS 2009a, 2009b). Receptors in Humphrey Impoundment were evaluated for a maximum of nine metals and total HMW PAHs (**Tables 6-10** through **6-15**). For the CL1B Parcel, terrestrial food chain exposure modeling for up to seven metals and total HMW PAHs was conducted (**Tables 6-16** through **6-20**). Seven metals were evaluated for receptors in the Mud Reservoir (**Tables 6-21** through **6-25**). Four metals were evaluated for receptors in the Former East Pond (**Tables 6-26** through **6-30**). No modeling was conducted for the red fox in the CL1B Parcel, Mud Reservoir, or Former East Pond because no unacceptable risks were calculated for this receptor in these areas during the SLERA.

Food chain risks to semi-aquatic receptors in CL1B Large Pond and CL1B Small Pond are summarized in **Tables 6-31** through **6-34**. Risk evaluations were limited to either two or three metals in these areas. As discussed previously, Knobby's Ditch Head Pond was not evaluated because no unacceptable food chain risks were calculated during the SLERA.

The following results are based on the EPCs of COPCs and the exposure assumptions described in **Tables 5-3** and **5-4**.

Humphrey Impoundment

Red-tailed Hawk: NOAEL and LOAEL-based HQs for chromium, copper, lead, and zinc were <1 (**Table 6-10**). No TRVs were available for antimony or tin; therefore, HQs could not be calculated for these COPCs, and this represents an uncertainty.

The NOAEL-based HQ for HMW PAHs was <1.

American Robin: NOAEL and LOAEL-based HQs for cadmium, chromium, lead, and zinc exceeded 1; the maximum values were 82.7 (NOAEL-based HQ) and 14.1 (LOAEL-based HQ) for chromium (**Table 6-11**). LOAEL-based HQs for cadmium, lead, and zinc were less than 2.

No TRVs were available for antimony or tin; therefore, HQs could not be calculated for these COPCs, and this represents and uncertainty.

The NOAEL-based HQ for HMW PAHs was <1.

Mourning Dove: NOAEL and LOAEL-based HQs for the five metals with available TRVs were <1 (**Table 6-12**). No TRVs were available for antimony or tin; therefore, HQs could not be calculated for these COPCs, and this represents an uncertainty.

The NOAEL-based HQ for HMW PAHs was <1.

Meadow Vole: NOAEL-based HQs exceeded 1 for chromium, selenium, and zinc. LOAEL-based HQs exceeded 1 for chromium and selenium (2.5 and 1.6, respectively) (**Table 6-13**).

NOAEL and LOAEL-based HQs for HMW PAHs were <1.

Red Fox: NOAEL and LOAEL-based HQs were <1 (**Table 6-14**).

Short-tailed Shrew: NOAEL-based HQs exceeded 1 for cadmium, chromium, lead, nickel, selenium, and zinc (**Table 6-15**). The maximum HQ was 165 for chromium. LOAEL-based HQs exceeded 1 only for cadmium (4.2) and chromium (6.8).

NOAEL and LOAEL-based HQs for HMW PAHs were <1.

CL1B Parcel

Red-tailed Hawk: NOAEL and LOAEL-based HQs were <1 for copper and lead (**Table 6-16**). A HQ could not be calculated for antimony because no TRV was available; this represents an uncertainty.

The NOAEL-based HQ for HMW PAHs was <1.

American Robin: NOAEL-based HQs exceeded 1 for cadmium, chromium, and zinc; the maximum HQ was 2.6 for zinc (**Table 6-17**). LOAEL-based HQs for all COPCs were <1. A HQ could not be calculated for antimony because no TRV was available; this represents an uncertainty.

The NOAEL-based HQ for HMW PAHs was <1.

Mourning Dove: NOAEL- and LOAEL-based HQs were <1 for the four metals with available TRVs (**Table 6-18**). A HQ could not be calculated for antimony because no TRV was available; this represents an uncertainty.

The NOAEL-based HQ for HMW PAHs was <1.

Meadow Vole: NOAEL-based HQs slightly exceeded 1 for chromium (1.1), selenium (1.4), and zinc (2.5) (**Table 6-19**). LOAEL-based HQs for all COPCs were <1.

NOAEL and LOAEL-based HQs for HMW PAHs were <1.

Red Fox: No unacceptable risks were calculated during the SLERA. Therefore, this receptor was not further evaluated for food chain risks.

Short-tailed Shrew: NOAEL-based HQs for cadmium, chromium, and zinc exceeded 1; the maximum HQ was 3 for cadmium and zinc (**Table 6-20**). LOAEL-based HQs for all COPCs were <1.

The NOAEL-based HQ for HMW PAHs slightly exceeded 1 (1.3); the LOAEL-based HQ was <1.

Mud Reservoir

Red-tailed Hawk: NOAEL- and LOAEL-based HQs for chromium and lead were <1; no TRV was available for antimony; therefore, an HQ could not be calculated for this metal (**Table 6-21**). The lack of an avian TRV for antimony represents an uncertainty.

American Robin: NOAEL-based HQs for cadmium (1.4) and chromium (1.9) slightly exceeded 1 (**Table 6-22**). LOAEL-based HQs for all COPCs were <1. No TRVs were available for antimony and tin; therefore, HQs could not be calculated for these COPCs. The lack of avian TRVs for antimony and tin represents an uncertainty.

Mourning Dove: NOAEL- and LOAEL-based HQs were <1 for chromium and lead (**Table 6-23**). No TRVs were available for antimony and tin; therefore, HQs could not be calculated for these COPCs. The lack of avian TRVs for antimony and tin represents an uncertainty.

Meadow Vole: NOAEL-based HQs for chromium (1.4) and selenium (1.1) exceeded 1; LOAEL-based HQs for all COPCs were <1 (**Table 6-24**).

Red Fox: Since there were no unacceptable risks to the red fox identified in the SLERA, it was not evaluated for food chain risks in the BERA.

Short-tailed Shrew: NOAEL-based HQs were greater than 1 for cadmium, chromium, and zinc; the maximum HQ was 3.9 for chromium (**Table 6-25**). All LOAEL-based HQs were <1.

Former East Pond

Red-tailed Hawk: HQs for lead and zinc were <1 (**Table 6-26**).

American Robin: NOAEL-based HQs for cadmium (10.9) and zinc (2.5) exceeded 1; the LOAEL-based HQ for cadmium also exceeded 1 (2.5) (**Table 6-27**).

Mourning Dove: HQs for the three metals evaluated, cadmium, lead, and zinc, were <1 (**Table 6-28**).

Meadow Vole: The NOAEL-based HQ for two metals slightly exceeded 1: cadmium (1.1) and zinc (2.4) (**Table 6-29**). LOAEL-based HQs for all COPCs were <1.

Red Fox: Since there were no unacceptable risks to the red fox identified in the SLERA, it was not evaluated for food chain risks in the BERA.

Short-tailed Shrew: NOAEL-based HQs for three of the four metals evaluated exceeded 1; the maximum HQ was 20.6 for cadmium (**Table 6-30**). The LOAEL-based HQ for cadmium was also greater than 1 (5.5).

Knobby's Ditch Head Pond

Because no unacceptable risks were identified for any receptor in the SLERA, food chain risks were not evaluated for this area in the BERA.

CL1B Large Pond

Raccoon: NOAEL and LOAEL-based HQs for chromium and selenium were <1 (**Table 6-31**).

Great Blue Heron: NOAEL and LOAEL-based HQs for selenium were <1 (**Table 6-32**).

CL1B Small Pond

Raccoon: NOAEL and LOAEL-based HQs for cadmium, copper, and selenium were <1 (**Table 6-33**).

Great Blue Heron: NOAEL and LOAEL-based HQs for selenium and zinc were <1 (**Table 6-34**).

6.2 RISK CHARACTERIZATION SUMMARY AND DESCRIPTION

Tables 6-1 through **6-9** indicate the direct contact risks for community-level receptors exposed to soil, sediment, and surface water. **Tables 6-35** and **6-36** present a summary of potential food chain risks posed to terrestrial and semi-aquatic wildlife receptors, respectively. The following sections summarize the risk characterization of the direct contact and food chain exposure evaluations for each area of concern.

6.2.1 Humphrey Impoundment

- Exposure to UCL_{95} concentrations of cadmium, chromium, lead, nickel, selenium, and zinc in surficial soils resulted in elevated food chain risk estimates for populations of certain terrestrial wildlife receptors. Wildlife risks were highest for American robin and short-tailed shrew exposure to chromium (LOAEL HQs = 14.1 and 6.8, respectively). LOAEL-based HQs exceeding 1 for cadmium, lead, nickel, selenium, and zinc were generally low, and did not exceed 4.2. Both the American robin and short-tailed shrew have small home ranges, potentially resulting in 100% area use of Humphrey Impoundment. Given the poor conditions of the habitat in Humphrey Impoundment (very dense *Phragmites*), it is unlikely that populations of these receptors are established in this SSA, so actual exposure and risk is likely to be negligible.
- No unacceptable risks are posed to populations of wide-ranging receptors (red-tailed hawk, mourning dove, red fox) that may occasionally visit Humphrey Impoundment.
- Direct contact risks associated with exposure to UCL_{95} concentrations of COPCs to soil-dwelling invertebrate communities exceed the level at which adverse effects may occur for chromium, copper, cyanide, tin, and zinc. Chromium and zinc collectively contributed 87% of the direct contact risk to soil invertebrates.

6.2.2 County Lands 1B Parcel

Uplands

- Food chain exposure to UCL_{95} concentrations of COPCs in surficial soils does not pose a risk to terrestrial wildlife receptor populations.
- Direct contact risks associated with exposure to UCL_{95} concentrations of COPCs to soil-dwelling invertebrate communities exceed the level at which adverse effects may occur for copper, zinc, and total HMW PAHs. The HQ for total HMW PAHs was slightly greater than 1, suggesting that this group of compounds poses a low risk to the community.

Large Pond

- Food chain exposure to geometric mean concentrations of COPCs in sediments does not pose a risk to semi-aquatic wildlife receptor populations.
- Direct contact risks associated with exposure to geometric mean sediment concentrations of chromium and zinc may pose a marginal risk to the benthic macroinvertebrate community.
- Direct contact with surface water does not pose a risk to fish or water-column biota (URS 2009b).

Small Pond

- Food chain exposure to maximum concentrations of COPCs in sediments does not pose a risk to semi-aquatic wildlife receptor populations.
- Direct contact risks associated with exposure to maximum sediment concentrations of COPCs to the benthic invertebrate community exceed the level at which adverse effects may occur for cadmium, copper, cyanide, and zinc. The risk posed from potential exposure to copper is considered low (HQ=1.9).
- Direct contact risks associated with exposure to maximum surface water concentrations of dissolved cadmium and dissolved zinc to water-column receptors exceed the level at which adverse effects may occur. The risk posed to dissolved zinc is considered to be low, given the relatively low HQ (1.5) and the application of the maximum surface water concentration for this system.

6.2.3 Mud Reservoir

- Food chain exposure to UCL_{95} concentrations of COPCs in surficial soils does not pose a risk to terrestrial wildlife receptor populations.
- Direct contact risks associated with UCL_{95} concentrations of copper and zinc may pose a marginal risk to soil-dwelling invertebrate communities.

6.2.4 Former East Pond

- Exposure to the geometric mean concentration of cadmium in surficial soils results in elevated food chain risk estimates for receptors with small home ranges (American robin, short-tailed shrew). Other COPCs do not pose a risk to wildlife receptors. Given the poor conditions of the habitat in the Former East Pond (dense *Phragmites*), it is unlikely that populations of these receptors are established in this SWMU, so actual exposure and risk are likely to be negligible.
- No unacceptable risks are posed to populations of wide-ranging receptors that may occasionally visit the Former East Pond.
- Direct contact risks associated with geometric mean concentrations of zinc to soil-dwelling invertebrate communities exceed the level at which adverse effects may occur. Zinc was the only COPC to produce an HQ exceeding 1.

6.2.5 Knobby's Ditch Head Pond

- Food chain exposure to maximum concentrations of COPCs in sediments does not pose a risk to semi-aquatic wildlife receptor populations (URS 2009a).
- Direct contact risks associated with maximum sediment concentrations of copper, cyanide, and zinc may pose a marginal risk to the benthic invertebrate community. Concentrations of total PAHs in sediment may pose a small risk to the benthic invertebrate community.
- Direct contact with surface water does not pose a risk to fish or water-column biota (URS 2009a).

6.3 UNCERTAINTY ANALYSIS

Assumptions and other factors that influence the findings of the BERA are addressed below as a discussion of uncertainties in each phase of the BERA.

- **Data Sufficiency:** The collection of soil, sediment, and surface water data in 2007 provide widespread sample coverage creating data sets sufficient for use in both risk assessment and remedial decision-making. As a result, robust data sets have been compiled for the Humphrey Impoundment (n= 18), CL1B Parcel (n=19), Mud Reservoir (n=12) that comprehensively characterize the chemical concentrations in these study areas. Fewer data are available for the Former East Pond (n=3), CL1B Large Pond (n=3), Knobby's Ditch Head Pond (n=2), and CL1B Small Pond (n=2); however, these areas are small in size and it is not expected that additional analytical information would afford a greater understanding of the ecological risks in these areas.

  Influence on BERA results: Comprehensively addresses risk

- **Laboratory Analyses of Data:** For some constituents, attainment of the media-specific screening values cannot be achieved by standard USEPA laboratory analytical methods. As such, chemicals may be present at concentrations below the laboratory reporting limit but above the screening value. As stated in the above paragraph, it is anticipated that metals are the primary drivers of risk, and the BERA attempted to comprehensively quantify the risks to metals.

  Influence on BERA results: May underestimate risk.

- **Site Characterization:** The ecosystems potentially at risk were based initially on a comprehensive review of published information on the ecological resources present at the Site and observations made during several Site field investigations in 2005, 2006, 2007, and 2010. Aquatic and terrestrial habitat for receptors were identified and considered in this evaluation. In general, both terrestrial and aquatic habitat and resources at the Site are isolated and surrounded by roadways and industrial activity, but the areas of concern selected for evaluation were selected because they include habitat that may be impacted by steelmaking operations. The uncertainty associated with failing to identify a potentially exposed ecological resource is minimal.

  Influence on BERA results: Minimal

- **Bioavailability of COPCs:** Chemical analyses of exposure media measured the total levels of the COPCs rather than the more bioavailable toxic forms. The availability and assessment

using total concentrations assumes that the entire fraction is bioavailable and toxic. This is likely a very conservative assumption that varies from constituent to constituent.

It was assumed that no geochemical factors limited receptor exposure to, or the potential for toxic expression of, COPCs. It is likely that, to some degree, COPCs adsorb to fine-grain particles and/or combine with chemical complexing agents and organic ligands (acid-volatile sulfides, fine organic matter) in soil and sediment. Such actions may change the chemical speciation of the COPC to a less toxic form, or reduce the concentrations of bioavailable chemicals and subsequent uptake by the receptors.

Soil to prey accumulation factors are often derived under laboratory conditions that do not take bioavailability factors into account. In addition, many studies show that uptake in prey is not a constant function with constituent concentration and, at higher concentrations, bioaccumulation in prey can fluctuate with exposure time and also can occur at a lower rate. BERA food chain models assume prey bioaccumulation is constant regardless of constituent concentration.

Influence on BERA results: Overestimates risk

- **COPC Assimilation:** No attempt was made to correct for assimilation efficiency in the wildlife dose rate modeling. When data are available for a given species, the data are often obtained from laboratory testing that introduces uncertainty associated with extrapolation from a laboratory setting to a field setting. In addition, information for many exposure parameters such as avoidance behavior, absorption of food and constituent migration across the gut, chemical bioavailability and the natural degradation of a constituent are not attainable. Absorption across the gut and bioavailability are assumed to be 100 percent, while avoidance behavior and constituent degradation is assumed to be negligible. Furthermore, it is assumed that elimination, excretion, or metabolism of COPCs does not occur.

  Influence on BERA results: Overestimates risk

- **Wildlife Exposure Assumptions:** Dose models required a number of assumptions, which could result in either overestimation or underestimation of risks to receptors. Body weights and feeding rates used are considered suitable and representative for estimating exposure. In addition, receptors are assumed to feed on specified food sources, although some (e.g., raccoon) may feed opportunistically on a variety of food types that may vary seasonally. The application of home ranges to estimate use of the study areas by receptors reduced uncertainty in the BERA relative to the SLERA.

  Influence on BERA results: Unknown

- **COPCs:** The SLERA (URS 2009a) and corresponding Supplemental Report (URS 2009b) implemented a screening process whereby maximum concentrations in each ecological area of concern were compared to conservative ecological screening levels to identify COPCs. Consequently, the likelihood of "missing" a chemical that could potentially pose a risk is considered to be very low.

  The SLERA identified dibenzofuran as an uncertainty in Humphrey Impoundment, CL1B Parcel, and Mud Reservoir surface soils due to a lack of a screening benchmark for this compound. Dibenzofuran is a heterocyclic organic compound often associated with coking

operations; therefore, it is relevant for the Sparrows Point Site. Available toxicological information for this compound is lacking; however, it should be noted that it was detected relatively infrequently (2 of 18 samples in the Humphrey Impoundment, 6 of 19 samples in the CL1B Parcel, and 1 of 12 samples in the Mud Reservoir), and metals are the class of chemicals expected to drive any potential risk at the Sparrows Point Site. Nonetheless, the absence of toxicity information for dibenzofuran contributes to uncertainty in the risk characterization. Benzo(b)fluoranthene was also identified as an uncertainty in Knobby's Ditch Head Pond sediment; however, LMW PAHs were eliminated from consideration for food chain exposure in the SLERA and benzo(b)fluoranthene was evaluated for direct contact exposure in the BERA (Table 6-6). Uncertainty for this compound is therefore negligible.

Influence on BERA results: Comprehensively addresses risk; underestimates risk for dibenzofuran in soil.

- **Direct Contact Toxicity Data:** The evaluation of ecological effects was somewhat limited for the soil direct contact pathway due to limited toxicological data for certain chemicals (e.g., barium, cyanide, thallium, tin, vanadium). The use of a sensitive receptor (earthworm) to assess terrestrial direct contact risk may mitigate the uncertainty associated with limited toxicological data.

  Influence on BERA results: May underestimate risks for chemicals with limited toxicological data

- **TRVs:** NOAEL TRVs are relatively unreliable because, by definition, no effects were measured. More confidence with these values exists if the LOAEL is close to the NOAEL. However, all of the toxicity studies from which these TRVs are derived were conducted with chemical forms that likely overestimate bioavailability under natural conditions. Laboratory animals are selected and bred to be sensitive while natural stresses select for more robust organisms in the wild. This is particularly true of organisms that populate urban settings. Wildlife TRVs could be derived for almost all COPCs, with the exception of antimony and tin (for birds). For other COPCs, the wildlife TRVs were developed from toxicological data from multiple studies evaluated under a comprehensive federal peer review process (USEPA 2005d).

  Influence on BERA results: Contributes to realistic estimates of risk

- **Exposure Point Concentration:** Screening-level risk assessments generally utilize the maximum concentration to identify COPCs and to ensure that potential impacts from toxic or bioaccumulative chemicals are not overlooked. Ecological receptors would not be exposed to the maximum concentration for an extended period of time, particularly for mobile species that regularly move into and out of the site. The actual exposure point concentration varies depending on receptor behavior, and is likely to be lower than the maximum concentration. As such, the use of a more realistic EPC in the BERA provides a more realistic scenario of receptor exposure to constituents over time.

  Influence on BERA results: Contributes to realistic estimates of risk

- **Bioaccumulation:** Whenever feasible, bioaccumulation was estimated through regression models developed from a comprehensive review of wildlife dose studies. When these models were unavailable, point-estimate BAFs were generally applied. In a few instances,

assumptions had to be made regarding COPC uptake. For example, information regarding antimony and tin uptake in soil invertebrates is not available, and was estimated in the BERA based on uptake in higher-order animals. Both tin and antimony are not generally bioaccumulative, except in forms that are unlikely to be present at the Site.

Influence on BERA results: Unknown. Likely overestimates risk

- **Risk Characterization Limitations:** The application of hazard quotients to quantify ecological risk has certain limitations, although the USEPA recommends the approach for the screening-level risk calculation (USEPA 1997). One of the advantages is that the procedure intentionally overestimates risks to "ensure that potential ecological threats are not overlooked." However, the HQ method does limit the information transferred to the risk manager, particularly in the BERA stage, as it provides only a single point of comparison for the exposure-response relationship. The HQ method does not express the potential variability in either the exposure or toxicity parameters. For the assessment of ecological risks associated with the receptors evaluated here, the parameters were in large part selected to provide realistic, yet conservative estimates of risk.

  Given the use of realistic yet conservative exposure and effects assumptions to quantify risks to selected receptors of concern, there is minimal uncertainty that the potential for ecological risks from Site-related chemicals went undetected in the ERA process. Conversely, there is the probability for a false positive; that is, overestimating risk, and concluding that there are ecological risks for some individual receptors.

  Influence on BERA results: Likely overestimates risks

- **Risk Management:** It is important to recognize that substantial differences exist between observations and conclusions made at the individual, population, and community levels of biological organization. For example, effects at the population or community levels resulting from the effects to only a few individuals may not be observable with the type of studies implemented. The ramifications of this also include an understanding that because the assessment level endpoints are protective of populations (not individuals), risks projected to cause loss of a few individuals may not cause impacts that are important at the levels of assessment where risk management decisions are made; that is, at population and community levels of organization.

  Influence on BERA results: Provides necessary information for making informed risk management decisions.

A Baseline Ecological Risk Assessment for On-Site Areas (BERA) was conducted for the Severstal Sparrows Point Facility in Sparrows Point, Maryland. The primary objective of the BERA was to characterize risks for valued receptors potentially exposed to surface soil, on-site sediment, and on-site surface water in ecological areas of concern. The BERA provided more realistic estimates of exposure and risk to valued ecological receptors and focused on ecological areas that have been determined to: 1) provide habitat capable of supporting limited wildlife populations and communities typical of those inhabiting industrial sites or areas adjacent to industrial sites, and 2) be potentially impacted by historical operations or practices in RCRA-related SWMUs and AOCs.

The ecological areas of concern were identified in the USEPA-approved *Ecological Risk Assessment Work Plan for On-Site Areas* (URS 2007) and evaluated for screening-level risks in the *Screening Level Ecological Risk Assessment for On-Site Areas* (URS 2009a) and the *Supplemental Report, County Lands Parcel 1B Ponds* (URS 2009b). The focus areas were selected for evaluation based on numerous ecological surveys conducted of the entire Sparrows Point Site. Consequently, the ecological risk evaluations at the Sparrows Point Site, including this BERA, collectively represent a site-wide investigation that complies wholly with the provisions of the 1997 Consent Decree.

The results of the BERA provide the necessary information to support risk management decisions based on ecological concerns in:

- Humphrey Impoundment;
- CL1B Parcel;
- Mud Reservoir;
- Former East Pond; and
- Knobby's Ditch Head Pond.

The concentrations of COPCs, primarily metals, in some areas are sufficiently elevated that community-level receptors (soil invertebrates, benthic invertebrates) are potentially at risk. For soil invertebrates, elevated risks are attributable primarily to chromium (Humphrey Impoundment), copper (CL1B Parcel), and zinc (Humphrey Impoundment, CL1B Parcel, and Former East Pond). For benthic macroinvertebrates inhabiting the on-site ponds, elevated risks are posed mainly to the community in the CL1B Small Pond from potential exposure to cadmium, cyanide, and zinc in sediment. Dissolved cadmium may also pose a risk to water-column invertebrates in the CL1B Small Pond. While invertebrate communities are subject to potentially unacceptable direct contact risk (to some COPCs), certain wildlife populations, with the exception of two areas, are not at risk. Calculated numerical risk estimates for valued wildlife receptors suggest that exposure to some metals in surface soils in Humphrey Impoundment and the Former East Pond poses a risk to some terrestrial wildlife species in these areas. Wildlife risks in the CL1B Parcel (including the two small ponds), Mud Reservoir, and Knobby's Ditch Head Pond are acceptable; therefore, remediation based on ecological concerns in these areas is not necessary.

The numerical risk estimates in Humphrey Impoundment and the Former East Pond shows that the unacceptable risks apply only to wildlife with small home ranges that could potentially reside or forage 100 percent of the time within the area of concern (e.g., American robin, short-tailed

shrew, meadow vole). Wide-ranging wildlife species (e.g, red fox, red-tailed hawk, mourning dove) are not at risk from COPCs in on-site ecological media of concern. This conclusion should be considered in assessing the need for corrective measures at the Site, particularly given the poor quality of the habitat in these areas (very dense *Phragmites*) and the more suitable nesting and foraging opportunities available for wildlife in other, higher-quality habitat areas (e.g., the numerous County Lands Parcels).

Accardi-Dey, A. and P. Gschwend. 2003. Reinterpreting literature sorption data considering both adsorption into organic carbon and adsorption onto black carbon. *Envir. Sci. Technol.* 37:99-106.

Al-Khafaji, A.A., and M.A. Tabatabai. 1979. Effects of trace elements on arylsulfatase activity in soils. *Soil Science* 127:129-133.

Ainsworth, N. 1988. Distribution and Biological Effects of Antimony in Contaminated Grassland. Dissertation.

Ankley, G.T. 1996. Evaluation of metal/acid-volatile sulfide relationships in the prediction of metal bioaccumulation by benthic macroinvertebrates. *Environ. Toxicol. Chem.* 15:2138-2146.

ATSDR (Agency for Toxic Substances and Disease Registry). 1992. Toxicological Profile for Antimony and Compounds. U.S. Department of Health and Human Services. Public Health Service. Atlanta, GA.

ATSDR. 2003. Toxicological Profile for Selenium. U.S. Department of Health and Human Services. Public Health Service. Atlanta, GA.

ATSDR. 2004. Toxicological Profile for Copper. U.S. Department of Health and Human Services. Public Health Service. Atlanta, GA.

ATSDR. 2005a. Toxicological Profile for Nickel. U.S. Department of Health and Human Services. Public Health Service. Atlanta, GA.

ATSDR. 2005b Toxicological Profile for Tin and Tin Compounds. U.S. Department of Health and Human Services. Public Health Service. Atlanta, GA.

ATSDR. 2005c. Toxicological Profile for Zinc. U.S. Department of Health and Human Services. Public Health Service. Atlanta, GA.

ATSDR. 2007. Toxicological Profile for Lead. U.S. Department of Health and Human Services. Public Health Service. Atlanta, GA.

ATSDR. 2008a. Draft Toxicological Profile for Cadmium. U.S. Department of Health and Human Services. Public Health Service.

ATSDR. 2008b. Draft Toxicological Profile for Chromium. U.S. Department of Health and Human Services. Public Health Service.

Baes, C.F., R. Sharp, A. Sjoreen, and R. Shor. 1984. A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture. Prepared by Oak Ridge National Laboratory for U.S. Dept. of Energy. 150 pp.

Bechtel-Jacobs Company LLC. 1998a. Empirical Models for the Uptake of Inorganic Chemicals from Soil by Plants. BJC/OR-133. Oak Ridge, TN.

Bechtel-Jacobs Company LLC. 1998b. Biota Sediment Accumulation Factors for Invertebrates: Review and Recommendations for the Oak Ridge Reservation. BJC/OR-112. Oak Ridge, TN.

Beyer, W. and C. Stafford. 1993. Survey and evaluation of contaminants in earthworms and in soils derived from dredged material at confined disposal facilities in the Great Lakes Region. *Environmental Monitoring and Assessment* 24:151-165.

Beyer, W.N., Connor, E.E., and S. Gerould. 1994. Estimates of soil ingestion by wildlife. *Journal of Wildlife Management* 58(2):375-382.

Bogomolov, D. M., S.K. Chen, R.W. Parmelee, S. Subler, and C.A. Edwards. 1996. An ecosystem approach to soil toxicity testing: a study of copper contamination in laboratory soil microcosms. *Applied Soil Ecology: A Section of Agriculture, Ecosystems & Environment*. 4:95-105.

Borgmann, U., Y. Couillard, P. Doyle, and D.G. Dixon. 2005. Toxicity of sixty-three metals and metalloids to *Hyalella azteca* at two levels of water hardness. *Envir. Toxicol. Chem.* 24: 641-652

Brasher, A.M. and R.S. Ogle. 1993. Comparative toxicity of selenite and selenate to the amphipod *Hyalella azteca*. *Arch. Env. Contam. Toxicol*. 24: 182-186.

Brown, P.J., S.M. Long, D.J. Spurgeon, C. Svendsen, and P.K. Hankard. 2004. Toxicological and biochemical responses of the earthworm *Lumbricus rubellus* to pyrene, a non-carcinogenic polycyclic aromatic hydrocarbon. *Chemosphere* 57:1675-1681.

Canadian Wildlife Service. 2010. Project WILDSPACE. Mourning Dove: Life History Information. http://wildspace.ec.gc.ca/life.cfm?ID=MODO&Page=More&Lang=e.

CH2M Hill. 2000. Site-Wide Investigation (SWI) Work Plan. June 2000.

CH2M Hill. 2001. SWI Groundwater Study Report. July 2001.

CH2M Hill. 2002a. SWI RSC Study. June 2002.

CH2M Hill. 2002b. SWI/Work Plan to Evaluate the Nature and Extent of Releases to Groundwater from the Special Study Areas (SSAs). July 2002.

Checkai, R.T., M. Simini, R. Kuperman, C.T. Phillips, D.W. Johnson, R.M. Higashi, T.W.-M. Fan, and K. Sappington. 2004. Benchmarks for Developing Ecological Soil Screening Levels (Eco-SSL): Effects of Selenium on Soil Invertebrates. U.S. Army Edgewood Chemical Biological Center Aberdeen Proving Ground, MD, University of California, Davis, CA.

Cubbage, J., D. Batts, and J. Breidenbach. 1997. Creation and Analysis of Freshwater Sediment Quality Values in Washington State. WA Pub. No. 97-323A. Washington State Dept. of Ecology, Olympia, WA.

Davies, N.A., M.E. Hodson, and S. Black. 2003a. Is the OECD acute worm toxicity test environmentally relevant? The effect of mineral form on calculated lead toxicity. *Environmental Pollution* 121:49-54.

Davies, N.A., M.E. Hodson, and S. Black. 2003b. The influence of time on lead toxicity and bioaccumulation determined by the OECD earthworm toxicity test. *Environmental Pollution* 121:55-61.

DeGraaf, R.M., and D.D. Rudis. 1986. New England Wildlife: Habitat, Natural History, and Distribution**.** General Technical Report NE-108. Broomall, PA. USDA, Forest Service, Northeastern Forest Experiment Station. 491 pp.

De Groot, A.P., V. Feron, and H. Til. 1973. Short-term toxicity studies on some salts and oxides of tin in rats. *Food Cosmet. Toxicol.* 11:19-30.

DiToro, D.M., J.D. Mahony, D.J. Hanson, K.J. Scott, M.B. Hicks, and M.S. Redmond. 1990. Toxicity of cadmium in sediments: the role of acid volatile sulfide. *Environ. Toxicol. Chem.* 10:1299-1307.

Efroymson, R.A., B.E. Sample, and G.W. Suter. 2001. Uptake of inorganic chemicals from soil by plant leaves: Regressions of field data. Environmental Toxicology and Chemistry 20:2561-2571.

Eisler, R. 1989. Tin Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. Biological Report 85 (1.15). U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, MD. January 1989.

Environment Canada. 1995. Toxicity Testing of National Contaminated Sites Remediation Program Priority Substances for the Development of Soil Quality Criteria for Contaminated Sites. Environmental Conservation Service, Evaluation and Interpretation Branch, Guidelines Division, Ottawa, ON.

Fischer, E., and L. Koszorus. 1992. Sublethal effects, accumulation capacities and elimination rates of As, Hg, and Se in the manure worm, *Eisenia fetida* (Oligochaeta, Lubricidae). *Pedobiologia* 36:172-178.

Ghosh U., J.R. Zimmerman, and R.G. Luthy. 2003. PCB and PAH speciation among particle types in contaminated harbor sediments and effects on PAH bioavailability. *Environ. Sci. Technol*. 37:2209-17.

Hamilton, S.J., and K.J. Buhl. 2003a. Selenium and Other Trace Elements in Water, Sediment, Aquatic Plants, Aquatic Invertebrates, and Fish from Streams in Southeastern Idaho Near Phosphate Mining Operations: September 2000. U.S. Geological Survey, Columbia Environmental Research Center.

Hamilton, S.J., and K.J. Buhl. 2003b. Selenium and Other Trace Elements in Water, Sediment, Aquatic Plants, Aquatic Invertebrates, and Fish from Streams in Southeastern Idaho Near Phosphate Mining Operations: May 2001. U.S. Geological Survey, Columbia Environmental Research Center.

Higgins, C.J. and D.A. Dzombak. 2006. Free cyanide sorption on freshwater sediment and model components. *Soil and Sed. Contam*. 15:497-510.

Howe, P. and P. Watts. 2005. Tin and Inorganic Tin Compounds. Concise International Chemical Assessment Document 65. World Health Organization. Geneva, Switzerland.

Kula, H. and O. Larink. 1997. Development and standardization of test methods for the prediction of sublethal effects of chemicals on earthworms. *Soil Biol. Biochem.* 29:635-639.

Lewis, S.C., J.R. Lynch, and A.I. Nikiforov. 1990. A new approach to deriving community exposure guidelines from "no-observed-effect levels". Reg. Toxicol. Pharmacol. 11: 314-330.

Lock, K. and C. Janssen. 2002. Ecotoxicity of chromium (III) to *Eisenia fetida*, *Enchytraeus albidus* and *Folsomia candida*. *Ecotoxicol. Env. Saf.* 51:203-205.

Lussier, S.M., J.H. Gentile, and J. Walker. 1985. Acute and chronic effects of heavy metals and cyanide on *Mysidopsis bahia* (Crustacea: Mysidacea). *Aquat. Toxicol*. 7:25-35.

Ma, W.C. 1984. Sublethal toxic effects of copper on growth, reproduction and litter breakdown activity in the earthworm *Lumbricus rubellus*, with observations on the influence of temperature and soil pH. *Environmental Pollution (Series A)* 33: 207-219.

Ma, W.C. 1988. Toxicity of copper to lumbricid earthworms in sandy agricultural soils amended with Cu-enriched organic waste materials. *Ecol. Bull.* 39:53-56.

MacDonald, D.D. 1994. Approach to the Assessment of Sediment Quality in Florida Coastal Waters. Florida Department of Environmental Protection. Tallahassee, FL.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. *Arch. Environ. Contam. Toxicol.*: 39:20-31.

Malecki, M.R., E.F. Neuhauser, and R.C. Loehr. 1982. The effect of metals on the growth and reproduction of *Eisenia foetida* (Oligochaeta, Lumbricidae). *Pedobiologia* 24:129-137.

Molnar, L., E. Fischer, and M. Kallay. 1989. Laboratory studies on the effect, uptake and distribution of chromium in *Eisenia foetida* (Annelida, Oligochaeta). *Zoologischer Anzeiger* 223:57-66.

Nagy, K.A. 2001. Food requirements of wild animals: Predictive equations for free-living mammals, reptiles, and birds. Nutrition Abstracts and Reviews, Series B: Livestock Feeds and Feeding, Volume 71, No. 10.

Neuhauser, E.F., Z.V. Cukic, M.R. Malecki, R.C. Loehr and P.R. Durkin. 1995. Bioconcentration and biokinetics of heavy metals in the earthworm. *Environ. Pollut.* 89:293–301.

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. Standards Development Branch. Ontario Ministry of Environment and Energy. Toronto, Ontario. 27 pp.

Phillips, C.T., R.T. Checkai, and D.A. Berg. 1996. Standardized earthworm toxicity testing: comparison of artificial soil vs. natural soil using selected chemical pollutants on the earthworm *Eisenia foetida*. In: D.A.Berg (Eds.), ERDEC-SP-043, Proc. ERDEC Sci. Conf. Chem. Biol. Def. Res., Nov.14-17, 1995, Aberdeen Proving Ground, MD pp. 685-691.

Rhomberg, L.R. and S.K. Wolff. 1998. Empirical scaling of single oral lethal dose across mammalian species based on a large database. *Risk Anal*. 18:741-753.

Rust, A., R. Burgess, A. McElroy, M. Cantwell, and B. Brownawell. 2004. Influence of soot carbon on bioaccumulation of sediment-bound aromatic hydrocarbons by marine benthic invertebrates: An interspecies comparison. *Envir. Toxicol. Chem*. 23:2594-2603.

Rust Engineering & Infrastructure. 1998. Description of Current Conditions. Bethlehem Steel Corporation, Sparrows Point, MD.

SAIC. 2002. Addendum to SWI Work Plan to Evaluate the Nature and Extent of Releases to Groundwater from the Special Study Areas for BSC, Sparrows Point Division, Maryland. September 2002.

Sample, B.E. and G.W. Suter, II. 1994. Estimating Exposure of Terrestrial Wildlife to Contaminants. ES/ER/TM-125. Oak Ridge National Laboratory, Oak Ridge TN.

Sample, B.E., M.S. Aplin, R.A. Efroymson, G.W. Suter II, and C.J.E. Welsh. 1997. Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants. Oak Ridge National Laboratory, for U.S. Department of Energy DE-AC05-96OR22464.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, G.W. Suter, II, and T.L. Ashwood. 1998a. Development and Validation of Bioaccumulation Models for Earthworms. Oak Ridge National Laboratory, Oak Ridge TN. 93 pp. ES/ER/TM-220.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, and G.W. Suter, II. 1998b. Development and Validation of Bioaccumulation Models for Small Mammals. Oak Ridge National Laboratory, Oak Ridge TN. 89 pp. ES/ER/TM-219.

Sample, B.E. and C.A. Arenal. 1999. Allometric models for interspecies extrapolation of wildlife toxicity data. *Bull. Env. Contam. Toxicol*. 62:653-663

Sample, B.E., G.W. Suter, II, J.J. Beauchamp, and R.A. Efroymson. 1999. Literature-derived bioaccumulation models for earthworms. *Envir. Toxicol. Chem.* 18(9):2110-2120.

Scott-Fordsmand, J. J., J.M. Weeks, and P.H. Krogh. 1998. Toxicity of nickel to the earthworm *Eisenia veneta* (Oligochaeta: Annelida) and the applicability of the neutral red retention assay to indicate nickel toxicity. *Ecotoxicology* 7:291-295.

Severstal International. 2009. Response to US EPA Comments Dated July 9, 2009. Letter From Mr. R. Becker, Severstal to Mr. A. Fan, US EPA Region III and Mr. R. Johnson, MDE. August 7, 2009.

Simini, M., R.T. Checkai, R.G. Kuperman, C.T. Phillips, J.A. Speicher, and D.J. Barclift. 2002. Toxicity Assessments of Antimony, Barium, Beryllium, and Manganese for Development of Ecological Soil Screening Levels (Eco-SSL) Using Earthworm (*Eisenia fetida*) Benchmark Values. Technical Report No. ECBC-TR-325. U.S. Army Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD.

Song, K and T. Breslin. 1999. Accumulation and transport of sediment metals by the vertically migrating opossum shrimp, *Mysis relicta*. *Journal of Great Lakes Research* 25(3):429-442.

Sprague, J.B. 1986. Toxicity and Tissue Concentrations of Lead, Zinc, and Cadmium for Marine Mollusks and Crustaceans. Research Triangle Park, NC: International Lead Zinc Research Organization, Inc., 1-74.

Spurgeon, D.J., S.P. Hopkin, and D.T. Jones. 1994. Effects of cadmium, copper, lead, and zinc on growth, reproduction and survival of the earthworm *Eisenia fetida* (Savigny): Assessing the environmental impact of point-source metal contamination in terrestrial ecosystems. *Environmental Pollution* 84:123-130.

Spurgeon, D.J., and S.P. Hopkin. 1995. Extrapolation of the laboratory-based OECD earthworm toxicity test to metal-contaminated field sites. *Ecotoxicology* 4: 190-195.

Spurgeon, D.J., and S.P. Hopkin. 1996. Effects of metal-contaminated soils on the growth, sexual development, and early cocoon production of the earthworm *Eisenia fetida*, with particular reference to zinc. *Ecotox. Environ. Safety* 35: 86-95.

Spurgeon, D.J., and S.P. Hopkin. 1999. Tolerance to zinc in populations of the earthworm *Lumbricus rubellus* from uncontaminated and metal-contaminated ecosystems. *Arch. Environ. Contam. Toxicol.* 37:332-337.

Stubblefield, W., G. Hancock, H. Prince, and R. Ringer. 1995. Effects of naturally weathered Exxon Valdez crude oil on mallard reproduction. *Envir. Toxicol. Chem*. 14:1951-1960.

Suter II, G.W. and C.L. Tsao. 1996. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. ES/ER/TM-96/R2. Oak Ridge National Laboratory. Oak Ridge, TN.

Svendsen, C. and J.M. Weeks. 1997. Relevance and applicability of a simple earthworm biomarker of copper exposure. II. Validation and applicability under field conditions in a mesocosm experiment with *Lumbricus rubellus*. *Ecotoxicol. Environ. Saf.* 36:80-88.

Sverdrup, L.E., J. Jensen, A.E. Kelley, P.H. Krogh, and J. Stenersen. 2002. Effects of eight polycyclic aromatic hydrocarbons on the survival and reproduction of *Enchytraeus crypticus* (Oligochaeta, Clitellata). *Envir. Toxicol. Chem*. 21: 109-114.

URS (URS Corporation). 2005a. Site Wide Investigation, Report of Nature & Extent of Releases to Groundwater from the Special Study Areas. International Steel Group, ISG Sparrows Point, Inc. Facility, Sparrows Point, Maryland.

URS. 2005b. CA725 Facility Investigation and Human Health Risk Evaluation (HHRE) Findings, ISG Sparrows Point, June 9, 2005.

URS. 2006. Ecological Risk Assessment Strategy Document: ISG Sparrows Point Facility, Sparrows Point, Maryland.

URS. 2007. Final Ecological Risk Assessment Work Plan for On-Site Areas. ISG Sparrows Point Facility, Sparrows Point, Maryland. Prepared for ISG Sparrows Point, January 4, 2007.

URS. 2009a. Screening Level Ecological Risk Assessment for On-Site Areas, Final. ISG Sparrows Point Facility, Sparrows Point, Maryland. Prepared for ISG Sparrows Point, April 2009, revised August 2009.

URS. 2009b. Supplemental Report, County Lands Parcel 1B Ponds, Final. ISG Sparrows Point Facility, Sparrows Point, Maryland. Prepared for ISG Sparrows Point, May 2009, revised August 2009.

USEPA (United States Environmental Protection Agency). 1980. Ambient Water Quality Criteria for Antimony. EPA 440/5-80-020. Prepared for Office of Water Regulations and Standards Criteria Division, Washington, DC.

USEPA. 1985. Site Analysis, Bethlehem Steel Plant, Sparrows Point, Maryland, Volumes 1 & 2 Document TS-PIC-85054. Referenced in Rust Engineering & Infrastructure (1998).

USEPA. 1992. Framework for Ecological Risk Assessment. EPA/630/R-92/001. Risk Assessment Forum. Washington, D.C.

USEPA. 1993. Wildlife Exposure Factors Handbook. Volumes I and II. EPA/600/R-93/187a&b. U.S. Environmental Protection Agency, Office of Health and Environmental Assessment, Office of Research and Development, Washington, D.C.

USEPA. 1996. Soil Screening Guidance: User's Guide. Publication 9355.4-23. Office of Solid Waste and Emergency Response. Washington, DC. July 1996.

USEPA. 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. EPA 540-R-97-006. Office of Solid Waste and Emergency Response.

USEPA. 1998. Guidelines for Ecological Risk Assessment. EPA/630/R-95/002F. Risk Assessment Forum. Washington, DC.

USEPA. 2000a. Ecological Soil Screening Guidance. Office of Solid Waste and Emergency Response. Washington, DC.

USEPA. 2000b. Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs. EPA-823-R-00-001. Office of Water and Office of Solid Waste. Washington, DC.

USEPA. 2001. Planning for Ecological Risk Assessment: Developing Management Objectives. EPA/630/R-01/001A. Risk Assessment Forum. Washington, DC.

USEPA. 2002. Toxicity Assessments of Antimony, Barium, Beryllium, and Manganese for Development of Ecological Soil Screening Levels (Eco-SSL) Using Enchytraied Reproduction Benchmark Values. Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD.

USEPA. 2003. Equilibrium Partitioning Sediment Guidelines (ESGs) for the Protection of Benthic Organisms: PAH Mixtures. 822-R-02-046. Office of Science and Technology and Office of Research and Development. Washington, DC.

USEPA. 2005a. Ecological Soil Screening Levels for Antimony. Interim Final. OSWER Directive 9285.7-61. Office of Solid Waste and Emergency Response. Washington, DC.

USEPA. 2005b. Ecological Soil Screening Levels for Cadmium. Interim Final. OSWER Directive 9285.7-65. Office of Solid Waste and Emergency Response. Washington, DC.

USEPA. 2005c. Ecological Soil Screening Levels for Lead. Interim Final. OSWER Directive 9285.7-70. Office of Solid Waste and Emergency Response. Washington, DC.

USEPA. 2005d. Ecological Soil Screening Level Guidance. Office of Emergency and Remedial Response, Washington, DC.

USEPA. 2007a. Guidance for Developing Ecological Soil Screening Levels. OSWER Directive 92857-55. Office of Solid Waste and Emergency Response, Washington, D.C.

USEPA. 2007b. Ecological Soil Screening Levels for Copper. Interim Final. OSWER Directive 9285.7-68. Office of Solid Waste and Emergency Response. Washington, DC.

USEPA. 2007c. Ecological Soil Screening Levels for Nickel. Interim Final. OSWER Directive 9285.7-76. Office of Solid Waste and Emergency Response. Washington, DC.

USEPA. 2007d. Ecological Soil Screening Levels for Selenium. Interim Final. OSWER Directive 9285.7-72. Office of Solid Waste and Emergency Response. Washington, DC.

USEPA. 2007e. Ecological Soil Screening Levels for Zinc. Interim Final. OSWER Directive 9285.7-73. Office of Solid Waste and Emergency Response. Washington, DC.

USEPA. 2007f. Ecological Soil Screening Levels for Polycyclic Aromatic Hydrocarbons (PAHs). Interim Final. OSWER Directive 9285.7-78. Office of Solid Waste and Emergency Response. Washington, DC.

USEPA. 2008. Ecological Soil Screening Levels for Chromium. Interim Final. OSWER Directive 9285.7-66. Office of Solid Waste and Emergency Response. Washington, DC.

USEPA. 2009. ProUCL Version 4.00.04 Technical Guide (Draft). Office of Research and Development. EPA/600/R-07/041, February 2009.

USGS (United States Geological Survey). 1969. 7.5-Minute Series Topographic Map of Sparrows Point, Maryland Quadrangle.

Van Gestel, C. A. M., W.A. Van Dis, E.M. Van Breeman, and P.M. Sparenburg. 1989. Development of a standardized reproduction toxicity test with the earthworm species *Eisenia fetida* andrei using copper, pentachlorophenol, and 2,4-dichloroaniline. *Ecotoxicol. Environ. Saf.* 18:305-312.

Van Gestel, C.A.M., E.M. Dirven-Van Breemen, R. Baerselman, H.J.B. Emans, J.A.M. Janssen, R. Postuma, and P.J.M. Van Vliet. 1992. Comparison of sublethal and lethal criteria for nine different chemicals in standardized toxicity tests using the earthworm *Eisenia andrei*. *Ecotoxicol. Environ. Saf.* 23(2):206-220.

Wilson, E. and J. Mendelson. 1993. Bethlehem Steel Corporation, Sparrows Point Plant, Land Development Map and Overlay Map. Referenced in Rust Engineering & Infrastructure (1998).

Tables

TABLE 3-1
CONSTITUENTS OF POTENTIAL CONCERN EVALUATED IN THE BERA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Study Area:	Humphrey Impoundment	County Lands 1B (CL1B) Parcel	CL1B - Large Pond	CL1B - Large Pond	CL1B - Small Pond	CL1B - Small Pond	Mud Reservoir	Former East Pond	Knobby's Ditch (Head Pond)	
Medium:	Surface Soil	Surface Soil	Fresh Surface Water	Freshwater Sediment	Fresh Surface Water	Freshwater Sediment	Surface Soil	Surface Soil	Fresh Surface Water	Freshwater Sediment
Inorganics										
	Antimony Barium Cadmium Chromium Copper Cyanide Lead Nickel Selenium Thallium Tin Vanadium Zinc	Antimony Cadmium Chromium Copper Cyanide Lead Selenium Thallium Vanadium Zinc	None	Arsenic Chromium Copper Cyanide, total Lead Nickel Selenium Silver Tin Vanadium Zinc	Cadmium (D) Zinc (D)	Arsenic Barium Cadmium Chromium Copper Cyanide, total Lead Mercury Nickel Selenium Silver Tin Zinc	Antimony Barium Cadmium Chromium Copper Lead Selenium Tin Vanadium Zinc	Barium Cadmium Chromium Copper Lead Vanadium Zinc	None	Cadmium Chromium Copper Cyanide, Total Lead Nickel Sulfide, Total Tin Vanadium Zinc
Polychlorinated Biphenyls (PCBs)										
										Aroclor 1260
Polycyclic Aromatic Hydrocarbons (PAHs)										
	Total HMW PAHs	Total LMW PAHs Total HMW PAHs								Benzo(a)anthracene Benzo(a)pyrene Benzo(ghi)perylene Chrysene Fluoranthene Indeno(1,2,3-cd)pyrene Naphthalene Phenanthrene Pyrene
Other Semi-Volatile Organic Compounds (SVOCs)										
										bis(2-Ethylhexyl) phthalate

D = dissolved
HMW PAHs = high molecular weight polycyclic aromatic hydrocarbons
LMW PAHs = low molecular weight polycyclic aromatic hydrocarbons

TABLE 5-1
SUMMARY OF EXPOSURE POINT CONCENTRATIONS FROM SOIL SAMPLES
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

	Humphrey Impoundment		County Lands 1B Parcel		Mud Reservoir		Former East Pond	
	Concentration	Note	Concentration	Note	Concentration	Note	Concentration	Note
Inorganics (mg/kg)								
Antimony	3.78	UCL95 - a	7.03	UCL95 - f	3.61	UCL95 - c		
Barium	171.41	UCL95 - c			276.86	UCL95 - g	113	geometric mean
Cadmium	50.34	UCL95 - d	4.11	UCL95 - c	3.45	UCL95 - j	76.3	geometric mean
Chromium	8,794.24	UCL95 - e	156.52	UCL95 - g	206.18	UCL95 - c	58.5	geometric mean
Copper	359.40	UCL95 - c	1,214.35	UCL95 - e	142.37	UCL95 - b	70.3	geometric mean
Cyanide	51.46	UCL95 - c	4.62	UCL95 - d			0.68	geometric mean
Lead	3,239.44	UCL95 - c	529.34	UCL95 - h	258.67	UCL95 - c	254	geometric mean
Nickel	133.82	UCL95 - c						
Selenium	7.11	UCL95 - a	4.41	UCL95 - d	3.74	UCL95 - i		
Thallium	9.36	UCL95 - a	1.80	UCL95 - i				
Tin	9,639.18	UCL95 - e			545.17	UCL95 - c		
Vanadium	148.55	UCL95 - c	419.16	UCL95 - g	97.42	UCL95 - b	115	geometric mean
Zinc	10,798.53	UCL95 - c	6,569.34	UCL95 - e	756.19	UCL95 - c	6,302	geometric mean
Polycyclic Aromatic Hydrocarbons (PAHs) (ug/kg)								
LMW PAHs			30,315.40	UCL95 - e				
HMW PAHs	16,330.46	UCL95 - e	64,788.62	UCL95 - e				

HMW PAHs = high molecular weight polycyclic aromatic hydrocarbons
LMW PAHs = low molecular weight polycyclic aromatic hydrocarbons
mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram
UCL_{95} = 95 percent upper confidence levels of the arithmetic mean

a = 95% KM (Percentile Bootstrap) UCL
b = 95% Student's-t UCL
c = 95% Approximate Gamma UCL
d = 95% KM (Chebyshev) UCL
e = 99% Chebyshev (Mean, Sd) UCL
f = 97.5% KM (Chebyshev) UCL
g = 95% Chebyshev (Mean, Sd) UCL
h = 95% Chebyshev (MVUE) UCL
i = 95% KM (t) UCL
j = 95% KM (BCA) UCL

TABLE 5-2
SUMMARY OF EXPOSURE POINT CONCENTRATIONS FROM SEDIMENT AND SURFACE WATER SAMPLES
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

	CL1B Large Pond Sediment		CL1B Small Pond Surface Water		CL1B Small Pond Sediment		Knobby's Ditch Head Pond Sediment	
	Concentration	Note	Concentration	Note	Concentration	Note	Concentration	Note
Inorganics								
Antimony	--	--	--	--	--	--	--	
Arsenic	8.8	geometric mean	--	--	29.1	maximum	--	--
Barium	--	--	--	--	167	maximum	--	--
Beryllium	--	--	--	--	1.2	maximum	--	--
Cadmium	--	--	2.2	maximum	191	maximum	5.1	maximum
Chromium	158	geometric mean	--	--	53	maximum	109	maximum
Copper	26.9	geometric mean	--	--	277	maximum	211	maximum
Cyanide	3.7	geometric mean	--	--	417	maximum	50.5	maximum
Lead	82.4	geometric mean	--	--	116	maximum	75.6	maximum
Mercury	--	--	--	--	0.28	maximum	--	--
Nickel	31.7	geometric mean	--	--	26.7	maximum	27.2	maximum
Selenium	25.9	geometric mean	--	--	114	maximum	--	--
Silver	1.1	geometric mean	--	--	2	maximum	--	--
Thallium	--	--	--	--	--	--	--	--
Tin	12.5	geometric mean	--	--	19	maximum	42.6	maximum
Vanadium	1,215	geometric mean	--	--	--	--	175	maximum
Zinc	718	geometric mean	166*	maximum	22,400	maximum	798	maximum
Polychlorinated Biphenyls (PCBs)								
Aroclor 1260	--	--	--	--	--	--	90	maximum
Polycyclic Aromatic Hydrocarbons (PAHs)								
Benzo(a)anthracene	--	--	--	--	--	--	450	maximum
Benzo(a)pyrene	--	--	--	--	--	--	600	maximum
Benzo(ghi)perylene	--	--	--	--	--	--	720	maximum
Chrysene	--	--	--	--	--	--	520	maximum
Fluoranthene	--	--	--	--	--	--	730	maximum
Indeno(1,2,3-cd)pyrene	--	--	--	--	--	--	590	maximum
Naphthalene	--	--	--	--	--	--	190	maximum
Phenanthrene	--	--	--	--	--	--	350	maximum
Pyrene	--	--	--	--	--	--	580	maximum
Other Semi-Volatile Organic Compounds (SVOCs)								
bis(2-Ethylhexyl) phthalate	--	--	--	--	--	--	470	maximum

Notes:
No COPECs identified in CL1B Large Pond surface water or Knobby's Ditch Head Pond surface water.
Sediment concentrations are shown in mg/kg for inorganics and µg/kg for organic compounds. Surface water concentrations are shown in µg/L.
* Maximum concentration for dissolved zinc from two samples erroneously reported in SLERA as 5,850 µg/L, which is the value for *total* zinc. Value reported in BERA is the sole result for dissolved zinc.

TABLE 5-3
SUMMARY OF EXPOSURE PARAMETERS FOR RECEPTORS OF CONCERN
ISG SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Representative Species			Home Range[a]	Home Range Reference	Body Weight (kg wet weight)	Dietary Composition					Ingestion Rates				
											Food		Substrate		
Common Name	Scientific Name	Food-web classification				Plant Material	Invertebrates	Fish	Small Mammals	References	kg dry weight/day	Reference	% of Dry Intake	kg dry wt./day	Reference
Avian Receptors															
American robin	*Turdus migratorius*	small soil probing invertivore	0.42 ha	Sample and Suter (1994)	0.077	60%	40%			USEPA (1993)	0.010	Nagy (2001)[b]	4.2%	0.0004	Beyer et al. (1994)[i]
Mourning dove	*Zenaida macroura*	avian granivore	4,300 ha	Canadian Wildlife Service (2010)	0.115	100%				USEPA (2007e)	0.006	Nagy (2001)[c]	13.9%	0.0008	USEPA (2007a)
Great blue heron	*Ardea herodias*	avian piscivore	7 - 8 km	Sample and Suter (1994)	2.39			100%		USEPA (1993)	0.147	Nagy (2001)[d]	0%	0	Sample and Suter (1994)
Red-tailed hawk	*Buteo jamaicensis*	avian carnivore	857 ha	USEPA (1993)	1.13				100%	USEPA (1993)	0.090	Nagy (2001)[d]	5.7%	0.0051	USEPA (2007a)
Mammalian Receptors															
Meadow vole	*Microtus pennsylvanicus*	small terrestrial herbivore	0.02 ha	DeGraaf and Rudis (1986)	0.037	100%				DeGraaf and Rudis (1986)	0.008	Nagy (2001)[e]	3.2%	0.00026	USEPA (2007a)
Raccoon	*Procyon lotor*	semi-aquatic omnivore	108 ha	USEPA (1993)	5.8		100%			USEPA (1993)	0.154	Nagy (2001)[f]	9.4%	0.014	Beyer et al. (1994)
Red fox	*Vulpes vulpes*	medium terrestrial carnivore	407 ha	Sample and Suter (1994)	4.5				100%	USEPA (1993)	0.170	Nagy (2001)[g]	2.8%	0.005	Beyer et al. (1994)
Short-tailed shrew	*Blarina brevicauda*	small terrestrial invertivore	0.39 ha	Sample and Suter (1994)	0.015		100%			Sample and Suter (1994)	0.002	Nagy (2001)[h]	3%	0.00006	USEPA (2007a)

Notes:
a, km =kilometers; ha = hectares;
b, Estimated food ingestion rate (kg/day dry weight) for omnivorous birds = (0.670[Body Weight in kg*1000] $^{0.627}$)/1000;
c, Estimated food ingestion rate (kg/day dry weight) for granivorous birds (quail, grouse) = (0.088[Body Weight in kg*1000] $^{0.891}$)/1000;
d, Estimated food ingestion rate (kg/day dry weight) for carnivorous birds = (0.849[Body Weight in kg*1000] $^{0.663}$)/1000;
e, Estimated food ingestion rate (kg/day dry weight) for mammalian herbivores = (0.859[Body Weight in kg*1000] $^{0.628}$)/1000;
f, Estimated food ingestion rate (kg/day dry weight) for mammalian omnivores = (0.432[Body Weight in kg*1000] $^{0.678}$)/1000;
g, Estimated food ingestion rate (kg/day dry weight) for mammalian carnivores = (0.153[Body Weight in kg*1000] $^{0.834}$)/1000;
h, Estimated food ingestion rate (kg/day dry weight) for mammalian insectivores = (0.373[Body Weight in kg*1000] $^{0.622}$)/1000;
i, Estimated based on a soil consumption rate of woodcock of 10.4% (Beyer et al. 1994). If the diet of woodcock is 99% earthworms and 10.4% of its diet is soil, then a robin consuming 40% earthworms would consume 4.2% soil.

TABLE 5-4
WILDLIFE AREA USE FACTORS FOR ECOLOGICAL AREAS OF CONCERN
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Terrestrial Receptor		Home Range[a]	Home Range Reference	Refined Area Use Factor					
Common Name	Scientific Name			Humphrey Impoundment (24.4 ha)	CL1B Parcel (Uplands) (24.6 ha)	CL1B Parcel (Large Pond) (0.2 ha)	CL1B Parcel (Small Pond) (0.05 ha)	Mud Reservoir (15.7 ha)	Former East Pond (1.5 ha)
Avian Receptors									
American robin	*Turdus migratorius*	0.42 ha	Sample and Suter (1994)	1.0	1.0	NA	NA	1.0	1.0
Mourning dove	*Zenaida macroura*	4,300 ha	Canadian Wildlife Service (2007)	0.01	0.01	NA	NA	0.01	0.01
Great blue heron	*Ardea herodias*	7 - 8 km	Sample and Suter (1994)	NA	NA	0.01	0.01	NA	NA
Red-tailed hawk	*Buteo jamaicensis*	857 ha	USEPA (1993)	0.03	0.03	NA	NA	0.02	0.01
Mammalian Receptors									
Meadow vole	*Microtus pennsylvanicus*	0.02 ha	DeGraaf et al. (1986)	1.0	1.0	NA	NA	1.0	1.0
Raccoon	*Procyon lotor*	108 ha	USEPA (1993)	NA	NA	0.01	0.01	NA	NA
Red fox	*Vulpes vulpes*	407 ha	Sample and Suter (1994)	0.06	0.06	NA	NA	0.04	0.01
Short-tailed shrew	*Blarina brevicauda*	0.39 ha	Sample and Suter (1994)	1.0	1.0	NA	NA	1.0	1.0

Notes:
a, km =kilometers; ha = hectares

TABLE 5-5
ESTIMATED TERRESTRIAL PREY CONCENTRATIONS IN HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Exposure Point Concentration (mg/kg, dry weight)	Estimated Concentrations in Dietary Items of Terrestrial Receptors (mg/kg, dry weight)								
		Plants			Soil Invertebrates			Small Mammals		
		Bioaccumulation Factor (BAF)	Estimated Concentration	BAF Reference	Bioaccumulation Factor (BAF)	Estimated Concentration	BAF Reference	Bioaccumulation Factor (BAF)	Estimated Concentration	BAF Reference
Inorganics										
Antimony	3.8	Regression[a]	0.14	USEPA (2007e)	0.001	0.004	Baes et al. (1984)[b]	0.0002	0.0008	Baes et al. (1984)[e]
Cadmium	50	Regression[a]	5.3	Efroymson et al. (2001)	Regression[c]	214	Neuhauser et al. (1995)	Regression[d]	2.0	Sample et al. (1998b)
Chromium	8794	0.041	361	Bechtel-Jacobs (1998a)	0.306	2691	Sample et al. (1998a)	Regression[d]	182	Sample et al. (1998b)
Copper	359	Regression[a]	19.4	Efroymson et al. (2001)	Regression[c]	24.5	Sample et al. (1999)	Regression[d]	18.0	Sample et al. (1998b)
Lead	3239	Regression[a]	24.4	Efroymson et al. (2001)	Regression[c]	565	Sample et al. (1999)	Regression[d]	38.5	Sample et al. (1998b)
Nickel	134	Regression[a]	4.3	Efroymson et al. (2001)	0.41	54.9	Beyer and Stafford (1993)	Regression[d]	7.7	Sample et al. (1998b)
Selenium	7.1	Regression[a]	4.4	Efroymson et al. (2001)	Regression[c]	3.9	Sample et al. (1999)	Regression[d]	1.4	Sample et al. (1998b)
Tin	9639	0.03	289	Baes et al. (1984)	0.08	771	Baes et al. (1984)[b]	0.0024	23.1	Baes et al. (1984)[e]
Zinc	10799	Regression[a]	881	Efroymson et al. (2001)	Regression[c]	1817	Sample et al. (1999)	Regression[d]	151	Sample et al. (1998b)
PAHs										
HMW PAHs	16.3	Regression[a]	2.6	USEPA (2007e)	2.6	42.4	USEPA (2007e)	--	0.0	USEPA (2007e)[f]

Notes:

a, Plant tissue concentrations (mg/kg dry weight) calculated based on regression models, where ln([tissue]) = B0 + B1(ln[soil]). Slopes (B1) and intercepts (B0) are as follows:

Chemical	BO	B1	Data Source for Model
Antimony	-3.233	0.938	USEPA (2007a)
Cadmium	-0.48	0.55	Efroymson et al. (2001)
Copper	0.67	0.39	Efroymson et al. (2001)
Lead	-1.33	0.56	Efroymson et al. (2001)
Nickel	-2.22	0.75	Efroymson et al. (2001)
Selenium	-0.68	1.1	Efroymson et al. (2001)
Zinc	1.58	0.56	Efroymson et al. (2001)
HMW PAHs	-1.7026	0.9469	USEPA (2007e)

b, Bioaccumulation factor specific to soil invertebrates could not be identified; ingestion-beef uptake factors used to estimate bioaccumulation.

c, Soil invertebrate tissue concentrations (mg/kg dry weight) calculated based on regression models, where ln([tissue]) = B0 + B1(ln[soil]). Slopes (B1) and intercepts (B0) are as follows:

Metal	BO	B1	Data Source for Model
Cadmium	1.21	0.66	Neuhauser et al. (1995); log([tissue]) = B0 + B1(log[soil])
Copper	1.67	0.26	Sample et al. (1999)
Lead	-0.21	0.81	Sample et al. (1999)
Selenium	-0.075	0.73	Sample et al. (1999)
Zinc	4.44	0.33	Sample et al. (1999)

d, Small mammal tissue concentrations (mg/kg dry weight) calculated based on regression models, where ln([tissue]) = B0 + B1(ln[soil]). Slopes (B1) and intercepts (B0) are as follows:

Metal	BO	B1	Data Source for Model
Cadmium	-1.5383	0.566	Sample et al. (1998b)
Chromium	-1.4599	0.7338	Sample et al. (1998b)
Copper	2.042	0.1444	Sample et al. (1998b)
Lead	0.0761	0.4422	Sample et al. (1998b)
Nickel	-0.2462	0.4658	Sample et al. (1998b)
Selenium	-0.4158	0.3764	Sample et al. (1998b)
Zinc	4.3632	0.0706	Sample et al. (1998b)

e, Bioaccumulation factor estimated as the product of the soil-plant and ingestion-beef factors reported in Baes et al. (1984)

f, Bioaccumulation expected to be minimal due to rapid metabolism of these compounds after ingestion (USEPA 2007e).

TABLE 5-6
ESTIMATED TERRESTRIAL PREY CONCENTRATIONS IN COUNTY LANDS 1B PARCEL
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Exposure Point Concentration (mg/kg, dry weight)	Estimated Concentrations in Dietary Items of Terrestrial Receptors (mg/kg, dry weight)								
		Plants			Soil Invertebrates			Small Mammals		
		Bioaccumulation Factor (BAF)	Estimated Concentration	BAF Reference	Bioaccumulation Factor (BAF)	Estimated Concentration	BAF Reference	Bioaccumulation Factor (BAF)	Estimated Concentration	BAF Reference
Inorganics										
Antimony	7.0	Regression[a]	0.24	USEPA (2007e)	0.001	0.007	Baes et al. (1984)[b]	0.0002	0.001	Baes et al. (1984)[e]
Cadmium	4.1	Regression[a]	1.3	Efroymson et al. (2001)	Regression[c]	41.2	Neuhauser et al. (1995)	Regression[d]	0.5	Sample et al. (1998b)
Chromium	157	0.041	6	Bechtel-Jacobs (1998a)	0.306	48.0	Sample et al. (1998a)	Regression[d]	9.5	Sample et al. (1998b)
Copper	1214	Regression[a]	31.2	Efroymson et al. (2001)	Regression[c]	33.7	Sample et al. (1999)	Regression[d]	21.5	Sample et al. (1998b)
Lead	529	Regression[a]	8.9	Efroymson et al. (2001)	Regression[c]	130	Sample et al. (1999)	Regression[d]	17.3	Sample et al. (1998b)
Selenium	4.4	Regression[a]	2.6	Efroymson et al. (2001)	Regression[c]	2.7	Sample et al. (1999)	Regression[d]	1.2	Sample et al. (1998b)
Zinc	6569	Regression[a]	667	Efroymson et al. (2001)	Regression[c]	1542	Sample et al. (1999)	Regression[d]	146	Sample et al. (1998b)
PAHs										
HMW PAHs	64.8	Regression[a]	9.5	USEPA (2007e)	2.6	168	USEPA (2007e)	--	0.0	USEPA (2007e)[f]

Notes:

a, Plant tissue concentrations (mg/kg dry weight) calculated based on regression models, where ln([tissue]) = B0 + B1(ln[soil]). Slopes (B1) and intercepts (B0) are as follows:

Chemical	BO	B1	Data Source for Model
Antimony	-3.233	0.938	USEPA (2007a)
Cadmium	-0.48	0.55	Efroymson et al. (2001)
Copper	0.67	0.39	Efroymson et al. (2001)
Lead	-1.33	0.56	Efroymson et al. (2001)
Selenium	-0.68	1.1	Efroymson et al. (2001)
Zinc	1.58	0.56	Efroymson et al. (2001)
HMW PAHs	-1.7026	0.9469	USEPA (2007e)

b, Bioaccumulation factor specific to soil invertebrates could not be identified; ingestion-beef uptake factors used to estimate bioaccumulation.

c, Soil invertebrate tissue concentrations (mg/kg dry weight) calculated based on regression models, where ln([tissue]) = B0 + B1(ln[soil]). Slopes (B1) and intercepts (B0) are as follows:

Metal	BO	B1	Data Source for Model
Cadmium	1.21	0.66	Neuhauser et al. (1995); log([tissue]) = B0 + B1(log[soil])
Copper	1.67	0.26	Sample et al. (1999)
Lead	-0.21	0.81	Sample et al. (1999)
Selenium	-0.075	0.73	Sample et al. (1999)
Zinc	4.44	0.33	Sample et al. (1999)

d, Small mammal tissue concentrations (mg/kg dry weight) calculated based on regression models, where ln([tissue]) = B0 + B1(ln[soil]). Slopes (B1) and intercepts (B0) are as follows:

Metal	BO	B1	Data Source for Model
Cadmium	-1.5383	0.566	Sample et al. (1998b)
Chromium	-1.4599	0.7338	Sample et al. (1998b)
Copper	2.042	0.1444	Sample et al. (1998b)
Lead	0.0761	0.4422	Sample et al. (1998b)
Selenium	-0.4158	0.3764	Sample et al. (1998b)
Zinc	4.3632	0.0706	Sample et al. (1998b)

e, Bioaccumulation factor estimated as the product of the soil-plant and ingestion-beef factors reported in Baes et al. (1984)

f, Bioaccumulation expected to be minimal due to rapid metabolism of these compounds after ingestion (USEPA 2007e).

TABLE 5-7
ESTIMATED TERRESTRIAL PREY CONCENTRATIONS IN MUD RESERVOIR
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Exposure Point Concentration (mg/kg, dry weight)	Estimated Concentrations in Dietary Items of Terrestrial Receptors (mg/kg, dry weight)								
		Plants			Soil Invertebrates			Small Mammals		
		Bioaccumulation Factor (BAF)	Estimated Concentration	BAF Reference	Bioaccumulation Factor (BAF)	Estimated Concentration	BAF Reference	Bioaccumulation Factor (BAF)	Estimated Concentration	BAF Reference
Inorganics										
Antimony	3.6	Regression[a]	0.13	USEPA (2007e)	0.001	0.004	Baes et al. (1984)[b]	0.0002	0.001	Baes et al. (1984)[e]
Cadmium	3.6	Regression[a]	1.3	Efroymson et al. (2001)	Regression[c]	37.8	Neuhauser et al. (1995)	Regression[d]	0.4	Sample et al. (1998b)
Chromium	206	0.041	8.4	Bechtel-Jacobs (1998a)	0.306	63.0	Sample et al. (1998a)	Regression[d]	11.6	Sample et al. (1998b)
Lead	259	Regression[a]	5.9	Efroymson et al. (2001)	Regression[c]	73.0	Sample et al. (1999)	Regression[d]	12.6	Sample et al. (1998b)
Selenium	3.7	Regression[a]	2.1	Efroymson et al. (2001)	Regression[c]	2.4	Sample et al. (1999)	Regression[d]	1.1	Sample et al. (1998b)
Tin	545	0.03	16.4	Baes et al. (1984)	0.08	44	Baes et al. (1984)[b]	0.0024	1.3	Baes et al. (1984)[e]
Zinc	756	Regression[a]	199	Efroymson et al. (2001)	Regression[c]	755	Sample et al. (1999)	Regression[d]	125	Sample et al. (1998b)

Notes:

a, Plant tissue concentrations (mg/kg dry weight) calculated based on regression models, where ln([tissue]) = B0 + B1(ln[soil]). Slopes (B1) and intercepts (B0) are as follows:

Metal	BO	B1	Data Source for Model
Antimony	-3.233	0.938	USEPA 2005a
Cadmium	-0.48	0.55	Efroymson et al. (2001)
Lead	-1.33	0.56	Efroymson et al. (2001)
Selenium	-0.68	1.1	Efroymson et al. (2001)
Zinc	1.58	0.56	Efroymson et al. (2001)

b, Bioaccumulation factor specific to soil invertebrates could not be identified; ingestion-beef uptake factors used to estimate bioaccumulation.

c, Soil invertebrate tissue concentrations (mg/kg dry weight) calculated based on regression models, where ln([tissue]) = B0 + B1(ln[soil]). Slopes (B1) and intercepts (B0) are as follows:

Metal	BO	B1	Data Source for Model
Cadmium	1.21	0.66	Neuhauser et al. (1995); log([tissue]) = B0 + B1(log[soil])
Lead	-0.21	0.81	Sample et al. (1999)
Selenium	-0.075	0.73	Sample et al. (1999)
Zinc	4.44	0.33	Sample et al. (1999)

d, Small mammal tissue concentrations (mg/kg dry weight) calculated based on regression models, where ln([tissue]) = B0 + B1(ln[soil]). Slopes (B1) and intercepts (B0) are as follows:

Metal	BO	B1	Data Source for Model
Cadmium	-1.5383	0.566	Sample et al. (1998b)
Chromium	-1.4599	0.7338	Sample et al. (1998b)
Lead	0.0761	0.4422	Sample et al. (1998b)
Selenium	-0.4158	0.3764	Sample et al. (1999)
Zinc	4.3632	0.0706	Sample et al. (1998b)

e, Bioaccumulation factor estimated as the product of the soil-plant and ingestion-beef factors reported in Baes et al. (1984)

TABLE 5-8
ESTIMATED TERRESTRIAL PREY CONCENTRATIONS IN THE FORMER EAST POND
ISG SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	Geometric Mean Soil Exposure Point Concentration (mg/kg, dry weight)	Estimated Concentrations in Dietary Items of Terrestrial Receptors (mg/kg, dry weight)								
		Plants			Soil Invertebrates			Small Mammals		
		Bioaccumulation Factor (BAF)	Estimated Concentration	BAF Reference	Bioaccumulation Factor (BAF)	Estimated Concentration	BAF Reference	Bioaccumulation Factor (BAF)	Estimated Concentration	BAF Reference
Inorganics										
Cadmium	76.3	Regression[a]	6.7	Efroymson et al. (2001)	Regression[b]	283	Neuhauser et al. (1995)	Regression[c]	2.5	Sample et al. (1998b)
Chromium	58.5	0.041	2.4	Bechtel-Jacobs (1998a)	0.306	17.9	Sample et al. (1998a)	Regression[c]	4.6	Sample et al. (1998b)
Lead	254	Regression[a]	5.9	Efroymson et al. (2001)	Regression[b]	71.9	Sample et al. (1999)	Regression[c]	12.5	Sample et al. (1998b)
Zinc	6,302	Regression[a]	651	Efroymson et al. (2001)	Regression[b]	1521	Sample et al. (1999)	Regression[c]	146	Sample et al. (1998b)

Notes:

a, Plant tissue concentrations (mg/kg dry weight) calculated based on regression models, where ln([tissue]) = B0 + B1(ln[soil]). Slopes (B1) and intercepts (B0) are as follows:

Metal	BO	B1	Data Source for Model
Cadmium	-0.48	0.55	Efroymson et al. (2001)
Lead	-1.33	0.56	Efroymson et al. (2001)
Zinc	1.58	0.56	Efroymson et al. (2001)

b, Soil invertebrate tissue concentrations (mg/kg dry weight) calculated based on regression models, where ln([tissue]) = B0 + B1(ln[soil]). Slopes (B1) and intercepts (B0) are as follows:

Metal	BO	B1	Data Source for Model
Cadmium	1.21	0.66	Neuhauser et al. (1995); log([tissue]) = B0 + B1(log[soil])
Lead	-0.21	0.81	Sample et al. (1999)
Zinc	4.44	0.33	Sample et al. (1999)

c, Small mammal tissue concentrations (mg/kg dry weight) calculated based on regression models, where ln([tissue]) = B0 + B1(ln[soil]). Slopes (B1) and intercepts (B0) are as follows:

Metal	BO	B1	Data Source for Model
Cadmium	-1.5383	0.566	Sample et al. (1998b)
Chromium	-1.4599	0.7338	Sample et al. (1998b)
Lead	0.0761	0.4422	Sample et al. (1998b)
Zinc	4.3632	0.0706	Sample et al. (1998b)

d, Bioaccumulation factor estimated as the product of the soil-plant and ingestion-beef factors reported in Baes et al. (1984)

TABLE 5-9
ESTIMATED AQUATIC PREY CONCENTRATIONS IN THE CL1B LARGE POND
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	Geometric Mean Sediment Concentration (mg/kg, dry weight)	Concentrations in Dietary Items of Aquatic Receptors (mg/kg, dry weight)					
		Benthic Invertebrates			Fish		
		BSAF	Estimated Concentration	Reference	BSAF	Estimated Concentration	Reference
Inorganics							
Chromium	158	0.588	92.9	Bechtel-Jacobs (1998b)[b]	0.009	1.42	Song and Breslin 1999
Selenium	25.9	Regression[a]	36.8	Hamilton and Buhl (2003a,b)	Regression[a]	36.8	c

Notes:

a, Invertebrate selenium concentration (mg/kg dry weight) calculated based on regression model, where slopes (B1) and intercepts (B0) are as follows:

Model	B0	B1	Data Source for Model
y = B0 + B1*ln([sediment])	--	0.7219	Hamilton and Buhl (2003a and 2003b)

b, 90th percentile BSAF for depurated invertebrates

c, Benthic invertebrate BSAF used as a default for metals not reported in Song and Breslin (1999)

TABLE 5-10
ESTIMATED AQUATIC PREY CONCENTRATIONS IN THE CL1B SMALL POND
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	Maximum Sediment Concentration (mg/kg, dry weight)	Concentrations in Dietary Items of Aquatic Receptors (mg/kg, dry weight)					
		Benthic Invertebrates			Fish		
		BSAF	Estimated Concentration	Reference	BSAF	Estimated Concentration	Reference
Inorganics							
Cadmium	191	3.073	587	Bechtel-Jacobs (1998b)[c]	0.037	7.1	Song and Breslin 1999
Copper	277	95% UPL[a]	186	Bechtel-Jacobs (1998b)	0.17	47	Song and Breslin 1999
Selenium	114	Regression[b]	162	Hamilton and Buhl (2003a,b)	Regression[b]	162	d
Zinc	22400	95% UPL[a]	586	Bechtel-Jacobs (1998b)	0.22	4838	Song and Breslin 1999

Notes:

a, 95% upper prediction limit (UPL) of regressions calculated by Bechtel-Jacobs (1998); calculated according to Appendix A in Bechtel-Jacobs (1998)

b, Invertebrate selenium concentration (mg/kg dry weight) calculated based on regression model, where slopes (B1) and intercepts (B0) are as follows:

Model	B0	B1	Data Source for Model
y = B1*ln([sediment])	--	1.422	Hamilton and Buhl (2003a,b)

c, 90th percentile BSAF for depurated invertebrates

d, Benthic invertebrate BSAF used as a default for metals not reported in Song and Breslin (1999)

TABLE 5-11
SOIL INVERTEBRATE TOXICITY REFERENCE VALUES
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	Screening Benchmark mg/kg	Endpoint		Effects Concentration mg/kg	Species	Form	Notes	Reference
Barium	330[1]	21-d LOEC	Cocoon production	433	*E. fetida*	$BaSO_4$	Lab; freshly added relevant salt	Simini et al. 2002
benchmark				***433***				
Cadmium	140[1]	20-w NOEC	Reproduction	50	*E. fetida*	$CdCl_2$	Lab; freshly added relevant salt	Malecki et al. 1982
		20-w NOEC	Reproduction	75	*E. fetida*	$Cd(NO_3)_2$	Lab; freshly added relevant salt	
		20-w NOEC	Reproduction	10000	*E. fetida*	$Cd(CO_3)_2$	Lab; freshly added relevant salt	
		20-w NOEC	Reproduction	25	*E. fetida*	CdO	Lab; freshly added relevant salt	
		20-w NOEC	Reproduction	75	*E. fetida*	$CdSO_4$	Lab; freshly added relevant salt	
		56-d NOEC	Reproduction	39.2	*E. fetida*	$Cd(NO_3)_2$	Lab; freshly added relevant salt	Spurgeon et al. 1994
benchmark				***118***				
Chromium	57[1]	21-d NOEC	Reproduction	560	*E. fetida*	$Cr(NO_3)_3$	Lab; freshly added relevant salt	Lock and Janssen 2002
		56-d LOEC	Cocoon production	625	*E. fetida*	$KCr(SO_4)_2$	Lab; freshly added relevant salt	Molnar et al. 1989
		Geometric mean of NOAEL and LOAEL	Reproduction	57	*E. andrei*	$Cr(NO_3)_3$	Lab; freshly added relevant salt	Van Gestel et al. 1992
benchmark				***271***				
Copper	80[1]	20-w NOEC	Reproduction	2000	*E. fetida*	$CuCl_2$	Lab; freshly added relevant salt	Malecki et al. 1982
		20-w NOEC	Reproduction	75	*E. fetida*	$Cu(NO_3)_2$	Lab; freshly added relevant salt	
		20-w NOEC	Reproduction	2000	*E. fetida*	$Cu(CO_3)_2$	Lab; freshly added relevant salt	
		20-w NOEC	Reproduction	20000	*E. fetida*	CuO	Lab; freshly added relevant salt	
		20-w NOEC	Reproduction	100	*E. fetida*	$CuSO_4$	Lab; freshly added relevant salt	
		56-d NOEC	Cocoon production	32	*E. fetida*	$Cu(NO_3)_2$	Lab; freshly added relevant salt	Spurgeon et al. 1994
		Geometric mean of NOAEL and LOAEL	Reproduction	133	*E. fetida*	NA		Svenson and Weeks 1997a
		Geometric mean of NOAEL and LOAEL	Reproduction	84	*L. rubellus*	NA		Ma 1984
		Geometric mean of NOAEL and LOAEL	Reproduction	203	*L. rubellus*	NA		
		Geometric mean of NOAEL and LOAEL	Growth	188	*L. rubellus*	NA		Svendsen and Weeks 1997
		EC10	Reproduction	27	*A. caliginosa*	NA		Ma 1988
		EC10	Reproduction	28	*A. chlorotica*	NA		
		EC10	Reproduction	80	*L. rubellus*	NA		
		Geometric mean of NOAEL and LOAEL	Reproduction	179	*E. andrei*	NA		Kula and Larink 1997
		Geometric mean of NOAEL and LOAEL	Reproduction	18	*E. fetida*	NA		
		Geometric mean of NOAEL and LOAEL	Reproduction	6	*E. andrei*	NA		
		Geometric mean of NOAEL and LOAEL	Reproduction	141	*A. tuberclata*	NA		Bogomolov et al. 1996
		Geometric mean of NOAEL and LOAEL	Growth	75	*E. andrei*	NA		Van Gestel et al., 1991
		Geometric mean of NOAEL and LOAEL	Growth	200	*E. fetida*	NA		Phillips et al., 1996
		Geometric mean of NOAEL and LOAEL	Reproduction	85	*E. andrei*	NA		Van Gestel et al., 1989
		21-d NOEC	Reproduction	29	*E. fetida*	$Cu(NO_3)_2$	Lab; freshly added relevant salt	Spurgeon and Hopkin 1995
		21-d NOEC	Growth	725	*E. fetida*	$Cu(NO_3)_2$	Lab; freshly added relevant salt	
benchmark				***131***				

TABLE 5-11
SOIL INVERTEBRATE TOXICITY REFERENCE VALUES
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	Screening Benchmark mg/kg	Endpoint		Effects Concentration mg/kg	Species	Form	Notes	Reference
Lead	1700[1]	28-d NOEC	Growth	3000	*E. fetida*	$Pb(NO_3)_2$	Lab; freshly added relevant salt	Davies et al. 2003a
		28-d NOEC	Cocoon production	625	*E. fetida*	$Pb(NO_3)_2$	Lab; freshly added relevant salt	Davies et al. 2003b
		28-d NOEC	Cocoon production	8000	*E. fetida*	$PbCO_3$	Lab; freshly added relevant salt	
		28-d NOEC	Cocoon production	12500	*E. fetida*	PbS	Lab; freshly added relevant salt	
		20-w NOEC	Reproduction	10000	*E. fetida*	$PbCl_2$	Lab; freshly added relevant salt	Malecki et al. 1982
		20-w NOEC	Reproduction	2000	*E. fetida*	$Pb(NO_3)_2$	Lab; freshly added relevant salt	
		20-w NOEC	Reproduction	8000	*E. fetida*	$Pb(CO_3)_2$	Lab; freshly added relevant salt	
		20-w NOEC	Reproduction	8000	*E. fetida*	PbO	Lab; freshly added relevant salt	
		20-w NOEC	Reproduction	8000	*E. fetida*	$PbSO_4$	Lab; freshly added relevant salt	
		56-d NOEC	Cocoon production	1810	*E. fetida*	$Pb(NO_3)_2$	Lab; freshly added relevant salt	Spurgeon et al. 1994
benchmark				***4509***				
Nickel	280[2]	20-w NOEC	Reproduction	100	*E. fetida*	$NiCl_2$	Lab; freshly added relevant salt	Malecki et al. 1982
		20-w NOEC	Reproduction	300	*E. fetida*	$Ni(NO_3)_2$	Lab; freshly added relevant salt	
		20-w NOEC	Reproduction	1000	*E. fetida*	$Ni(CO_3)_2$	Lab; freshly added relevant salt	
		20-w NOEC	Reproduction	30000	*E. fetida*	NiO	Lab; freshly added relevant salt	
		20-w NOEC	Reproduction	300	*E. fetida*	$NiSO_4$	Lab; freshly added relevant salt	
		Geometric mean of NOAEL and LOAEL	Cocoon production	173	*E. veneta*	$NiCl_2$	Lab; freshly added relevant salt	Scott-Fordsmand et al. 1998
		Geometric mean of NOAEL and LOAEL	Cocoon production	240	*E. fetida*	$Ni(NO_3)_2$	Lab; freshly added relevant salt	Lock and Janssen 2002
benchmark				***526***				
Selenium	4.1[1]	NOEC	Cocoon production	100	*E. fetida*	Na_2SeO_3	Lab; freshly added relevant salt	Fischer and Koszorus 1992
		13-w EC20	Reproduction	3.4	*E. fetida*	Na_2SeO_3	Lab; freshly added relevant salt	Checkai et al. 2004
benchmark				***18.4***				
Thallium	1[3]	28-d LOEC	Cocoon production	5	*E. fetida*	Tl_2CO_3	Lab; freshly added relevant salt	Heim et al. 2002
		28-d LOEC	Growth	100	*E. fetida*	Tl_2CO_3	Lab; freshly added relevant salt	
benchmark				***22.4***				
Tin	300[3]	LOEC	Arylsulfatase activity	2968	Microorganisms	$SnCl_2$	Lab; freshly added relevant salt	Al-Khafaji and Tabatabai 1979
benchmark				***2968***				
Vanadium	20[2]	LOEC	Reproduction	410	*E. fetida*	V_2O_5	Lab; freshly added relevant salt	Environment Canada 1995
benchmark				***410***				
Zinc	120[1]	20-w NOEC	Reproduction	1000	*E. fetida*	$ZnCl_2$	Lab; freshly added relevant salt	Malecki et al. 1982
		20-w NOEC	Reproduction	1000	*E. fetida*	$Zn(NO_3)_2$	Lab; freshly added relevant salt	
		20-w NOEC	Reproduction	300	*E. fetida*	$Zn(CO_3)_2$	Lab; freshly added relevant salt	
		20-w NOEC	Reproduction	2000	*E. fetida*	ZnO	Lab; freshly added relevant salt	
		20-w NOEC	Reproduction	300	*E. fetida*	$ZnSO_4$	Lab; freshly added relevant salt	
		21-d NOEC	Cocoon production	1879	*E. fetida*	$Zn(NO_3)_2$	Lab; freshly added relevant salt	Spurgeon and Hopkin 1996
		NOEC	Reproduction	115	*E. fetida*	NA		Spurgeon and Hopkin 1996
		NOEC	Reproduction	85	*E. fetida*	NA		
		NOEC	Reproduction	97	*E. fetida*	NA		
		NOEC	Reproduction	161	*E. fetida*	NA		
		NOEC	Reproduction	183	*E. fetida*	NA		
		NOEC	Reproduction	553	*E. fetida*	NA		
		Geometric mean of NOAEL and LOAEL	Reproduction	423	*E. andrei*	NA		Van Gestel et al. 1993
		Geometric mean of NOAEL and LOAEL	Reproduction	466	*E. andrei*	NA		Spurgeon and Hopkin 1996a
		21-d NOEC	Growth	237	*E. andrei*	$Zn(NO_3)_2$	Lab; freshly added relevant salt	Spurgeon and Hopkin 1995
		56-d NOEC	Cocoon production	199	*E. fetida*	$Zn(NO_3)_2$	Lab; freshly added relevant salt	Spurgeon et al. 1994
		42-d NOEC	Cocoon production	620	*L. rubellus*	$Zn(NO_3)_2$	Lab; field-adapted organisms	Spurgeon and Hopkin 1999
benchmark				***361***				

TABLE 5-11
SOIL INVERTEBRATE TOXICITY REFERENCE VALUES
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	Screening Benchmark mg/kg	Endpoint		Effects Concentration mg/kg	Species	Form	Notes	Reference
Cyanide	8[3]	LOEC	Reproduction	15	*E. fetida*	KCN	Lab; freshly added relevant salt	Environment Canada 1995
benchmark				***15***				
LMW PAHs	29[1]	EC10	Growth	113	*E. veneta*	Fluoranthene	Lab; freshly added	Sverdrup et al. 2002
		EC10	Growth	31	*E. veneta*	Fluorene	Lab; freshly added	
		EC10	Growth	25	*E. veneta*	Phenanthrene	Lab; freshly added	
benchmark				***44.4***				
HMW PAHs	18[1]	EC10	Growth	80	*E. veneta*	Pyrene	Lab setting	Sverdrup et al. 2002
		EC10	Reproduction	38	*L. rubellus*	Pyrene	Lab; added w/ acetone; then	Brown et al. 2004
benchmark				***55.1***				

1) USEPA Ecological Soil Screening Level (Eco-SSL)
2) Oak Ridge National Laboratory screening value
3) Canadian Soil Quality Guidelines
NA - not available

TABLE 5-12
WILDLIFE TOXICITY REFERENCE VALUES
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analytes	Avian Receptors					Mammalian Receptors				
	Chronic NOAEL[a] (mg/kg-bw/d)	Chronic LOAEL[b] (mg/kg-bw/d)	Test Animal(s)	Endpoint[c]	Source	Chronic NOAEL[a] (mg/kg-bw/d)	Chronic LOAEL[b] (mg/kg-bw/d)	Test Animal(s)	Endpoint[c]	Source
Metals										
Antimony	NA	NA	--	--	--	13.3	66.5[d]	Rat, mouse	Rep, Gr	USEPA 2005a
Cadmium	1.47	6.35	Chicken, mallard, Japanese quail, wood duck	Rep, Gr	USEPA 2005b	1.86	6.9	Rat, mouse, cattle, dog, bank vole, vole, pig, sheep, shrew	Rep, Gr	USEPA 2005b
Chromium	2.66	15.6	Chicken, black duck, turkey	Rep, Gr	USEPA 2008	2.4	58.3	Rat, mouse, cattle, pig	Rep, Gr[e]	USEPA 2008
Copper	18.5	34.9	Chicken, duck, turkey, Japanese quail	Rep, Gr	USEPA 2007b	25	85.3	Rat, mouse, cattle, pig, sheep, guinea pig, mink, horse, rabbit, common shrew, goat	Rep, Gr	USEPA 2007b
Lead	10.9	44.6	Chicken, mallard, Japanese quail, duck, ringed turtle dove, American kestrel	Rep, Gr	USEPA 2005c	40.7	188.1	Rat, mouse, cattle, sheep, guinea pig, cotton rat, hamster, horse, rabbit, dog, pig, shrew	Rep, Gr	USEPA 2005c
Nickel	6.71	18.6	Chicken, duck	Rep, Gr	USEPA 2007c	7.32	17.5	Rat, mouse, cattle, dog, meadow vole	Rep, Gr	USEPA 2007c
Selenium	0.61	0.82	Chicken, mallard, Japanese quail, duck, American kestrel, black-crowned night heron, owl	Rep, Gr	USEPA 2007d	0.45	0.66	Rat, mouse, cattle, pig, sheep, hamster, rabbit, dog, pronghorn	Rep, Gr	USEPA 2007d
Tin	NA	NA	--	--	--	6300	8800	Rat	Gr	De Groot et al. 1973
Zinc	66.5	171.4	Chicken, mallard, Japanese quail, turkey	Rep, Gr	USEPA 2007e	78.3	297.6	Rat, mouse, cattle, pig, sheep, hamster, rabbit, golden hamster, water buffalo	Rep, Gr	USEPA 2007e
PAHs										
HMW PAHs	2120	NA	Mallard	Rep	Stubblefield et al. 1995	18	38.4	Rat, mouse	Rep, Gr	USEPA 2007f

Notes:

a, NOAEL is no observable adverse effects level.

b, LOAEL is lowest observable adverse effects level.

c, Rep = reproduction; Gr = growth

d, Chronic LOAEL estimated by multiplying NOAEL by a factor of 5 (Lewis et al. 1990)

e, No reproduction endpoint effects data available for development of NOAEL; NOAEL based on growth only

-- - Information not provided or applicable

TABLE 6-1
SOIL INVERTEBRATE DIRECT CONTACT RISK SUMMARY - HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Concentration (mg/kg)	Soil Invertebrate Toxicity Reference Value (mg/kg)	Receptor/Endpoint	Hazard Quotient
SVOCs				
Total HMW PAHs	16.3	55.1	Earthworm reproduction, growth	<1
Inorganics				
Barium	171	433	Earthworm reproduction	<1
Chromium	8794	271	Earthworm reproduction	**32.5**
Copper	359	131	Earthworm reproduction, growth	**2.7**
Cyanide, total	51.5	15	Earthworm reproduction	**3.4**
Lead	3239	4509	Earthworm reproduction, growth	<1
Nickel	134	526	Earthworm reproduction	<1
Selenium	7.1	18.4	Earthworm reproduction	<1
Thallium	9.4	22.4	Earthworm reproduction, growth	<1
Tin	9639	2968	Microbial arylsulfatase activity	**3.2**
Vanadium	149	410	Earthworm reproduction	<1
Zinc	10799	361	Earthworm reproduction, growth	**29.9**

Notes:
See Table 5-11 for sources of TRVs.

TABLE 6-2
SOIL INVERTEBRATE DIRECT CONTACT RISK SUMMARY - COUNTY LANDS 1B PARCEL
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Concentration (mg/kg)	Soil Invertebrate Toxicity Reference Value (mg/kg)	Receptor/Endpoint	Hazard Quotient
SVOCs				
Total LMW PAHs	30.3	44.4	Earthworm growth	<1
Total HMW PAHs	64.8	55.1	Earthworm reproduction, growth	**1.2**
Inorganics				
Chromium	157	271	Earthworm reproduction	<1
Copper	1214	131	Earthworm reproduction, growth	**9.3**
Cyanide, total	4.6	15	Earthworm reproduction	<1
Selenium	4.4	18.4	Earthworm reproduction	<1
Thallium	1.8	22.4	Earthworm reproduction, growth	<1
Vanadium	419	410	Earthworm reproduction	1.0
Zinc	6569	361	Earthworm reproduction, growth	**18.2**

Notes:
See Table 5-11 for sources of TRVs.

TABLE 6-3
SOIL INVERTEBRATE DIRECT CONTACT RISK SUMMARY - MUD RESERVOIR
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Concentration (mg/kg)	Soil Invertebrate Toxicity Reference Value (mg/kg)	Receptor/Endpoint	Hazard Quotient
Barium	277	433	Earthworm reproduction	<1
Chromium	206	271	Earthworm reproduction	<1
Copper	142	131	Earthworm reproduction, growth	**1.1**
Selenium	3.7	18.4	Earthworm reproduction	<1
Vanadium	97	410	Earthworm reproduction	<1
Zinc	756	361	Earthworm reproduction, growth	**2.1**

Notes:
See Table 5-11 for sources of TRVs.

TABLE 6-4
SOIL INVERTEBRATE DIRECT CONTACT RISK SUMMARY - FORMER EAST POND
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	Geometric Mean Soil Concentration (mg/kg)	Soil Invertebrate Toxicity Reference Value (mg/kg)	Receptor/Endpoint	Hazard Quotient
Barium	113	433	Earthworm reproduction	<1
Cadmium	76.3	118	Earthworm reproduction, growth	<1
Chromium	58.5	271	Earthworm reproduction	<1
Copper	70.3	131	Earthworm reproduction, growth	<1
Vanadium	115	410	Earthworm reproduction	<1
Zinc	6302	361	Earthworm reproduction, growth	**17.5**

Notes:
See Table 5-11 for sources of TRVs.

TABLE 6-5
SEDIMENT DIRECT CONTACT RISK SUMMARY - KNOBBY'S DITCH HEAD POND
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	Constituent Maximum Concentration (mg/kg)	Refined Sediment Quality TRV (mg/kg)	Source[1]	Hazard Quotient
Inorganics				
Cadmium	5.1	5	MacDonald et al. 2000	1.0
Chromium	109	111	MacDonald et al. 2000	<1
Copper	211	149	MacDonald et al. 2000	**1.4**
Cyanide, total	50.5	29	Lussier et al. 1985; Higgins and Dzombak 2006	**1.7**
Lead	75.6	128	MacDonald et al. 2000	<1
Nickel	27.2	48.6	MacDonald et al. 2000	<1
Tin	42.6	5000	Borgmann et al. 2005	<1
Vanadium	175	39520	Suter and Tsao 1996	<1
Zinc	798	459	MacDonald et al. 2000	**1.7**
PAHs				
Addressed as total PAHs in Table 6-6				
PCBs				
Aroclor 1260	0.09	0.676	MacDonald et al. 2000[2]	<1
Other SVOCs				
bis(2-Ethylhexyl)phthalate	0.47	2.65	MacDonald 1994	<1

Notes:
NA - no reference information is available
1 - MacDonald et al. (2000) values based on consensus-based probable effect concentrations (PECs).
MacDonald (1994) value based on probable effect level (PEL).
2 - TRV is based on value for total PCBs

TABLE 6-6
DERIVATION OF EQUILIBRIUM PARTITIONING SEDIMENT GUIDELINES (ESGs) FOR PAH MIXTURES - KNOBBY'S DITCH HEAD POND
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

PAH Compound	$C_{oc,PAHi,FCVi}$/ $C_{oc,PAHi,Maxi}$ [a]	KD-FS-01 f_{oc} = 0.0151			KD-FS-02 f_{oc} = 0.0265		
		C_{sed} (ug/g)	C_{oc} (ug/g_{oc})	$ESBTU_{FCVi}$	C_{sed} (ug/g)	C_{oc} (ug/g_{oc})	$ESBTU_{FCVi}$
Acenaphthene	491	*0.39*	25.8278	0.0526	*0.55*	20.7547	0.0423
Acenaphthylene	452	*0.39*	25.8278	0.0571	*0.55*	20.7547	0.0459
Anthracene	594	*0.39*	25.8278	0.0435	*0.55*	20.7547	0.0349
Benzo(a)anthracene	841	0.45	29.8013	0.0354	*0.55*	20.7547	0.0247
Benzo(a)pyrene	965	0.6	39.7351	0.0412	*0.55*	20.7547	0.0215
Benzo(b)fluoranthene	979	0.79	52.3179	0.0534	*0.55*	20.7547	0.0212
Benzo(ghi)perylene	648	0.72	47.6821	0.0736	*0.55*	20.7547	0.0320
Benzo(k)fluoranthene	981	0.24	15.8940	0.0162	*0.55*	20.7547	0.0212
Chrysene	826	0.52	34.4371	0.0417	*0.55*	20.7547	0.0251
Dibenz(a,h)anthracene	1123	*0.39*	25.8278	0.0230	*0.55*	20.7547	0.0185
Fluoranthene	707	0.73	48.3444	0.0684	*0.55*	20.7547	0.0294
Fluorene	538	*0.39*	25.8278	0.0480	*0.55*	20.7547	0.0386
Indeno(1,2,3-cd)pyrene	1115	0.59	39.0728	0.0350	*0.55*	20.7547	0.0186
Naphthalene	385	0.19	12.5828	0.0327	*0.55*	20.7547	0.0539
Phenanthrene	596	0.35	23.1788	0.0389	*0.55*	20.7547	0.0348
Pyrene	697	0.58	38.4106	0.0551	*0.55*	20.7547	0.0298
			Σ $ESBTU_{FCV,16}$ =	0.7159		**Σ $ESBTU_{FCV,13}$ =**	0.4924
			Σ $ESBTU_{FCV}$ [b] =	3.4		**Σ $ESBTU_{FCV}$ [b] =**	2.4

Notes:
Italicized cells indicate non-detected sample concentration; concentration was set at one-half the sample reporting limit.
Equilibrium Partitioning Sediment Benchmarks for PAH mixtures calculated as:

$$\sum ESGTU_{FCV} = \sum_{i} \frac{C_{OC,PAHi}}{C_{OC,PAHi,FCVi}}$$

where:

$ESBTU_{FCV}$ = Equilibrium Partitioning Sediment Benchmark Toxic Unit based on the Final Chronic Value (FCV)
$C_{OCiPAHi}$ = Organic-carbon-normalized sediment concentration of PAH_i
$C_{OCiPAHiFCVi}$ = Critical concentration of PAH_i in sediment
f_{oc} = Fraction of organic carbon

a, The lower value of $C_{oc,PAHi,FCVi}$ and $C_{oc,PAHi,Maxi}$ was used in the calculation
b, An uncertainty factor of 4.8 was multiplied to Σ $ESBTU_{FCV,13}$ to estimate Σ $ESBTU_{FCV}$ for 34 PAHs with 80% confidence (USEPA 2003).

TABLE 6-7
SEDIMENT DIRECT CONTACT RISK SUMMARY - COUNTY LANDS 1B LARGE POND
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	Geometric Mean Sediment Concentration (mg/kg)	Refined Sediment Quality TRV (mg/kg)	Source[2]	Hazard Quotient
Inorganics				
Arsenic	8.8	33	MacDonald et al. 2000	<1
Beryllium	15.1	40	USEPA 2002	<1
Chromium	158	111	MacDonald et al. 2000	**1.4**
Copper	26.9	149	MacDonald et al. 2000	<1
Cyanide, total	3.7	29	Lussier et al. 1985; Higgins and Dzombak 2006	<1
Lead	82.4	128	MacDonald et al. 2000	<1
Nickel	31.7	48.6	MacDonald et al. 2000	<1
Selenium	25.9	130	Brasher and Ogle 1993	<1
Silver[1]	1.1	3.9	Cubbage et al. 1997	<1
Tin	12.5	5000	Borgmann et al. 2005	<1
Vanadium	1214	70680	Brasher and Ogle 1993	<1
Zinc	718	459	MacDonald et al. 2000	**1.6**

Notes:

NA - Not available

1 - Only one of three samples had a detectable result; maximum silver concentration applied.

2 - MacDonald et al. (2000) values based on consensus-based threshold effect concentrations (PECs).

TABLE 6-8
SEDIMENT DIRECT CONTACT RISK SUMMARY - COUNTY LANDS 1B SMALL POND
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	Maximum Sediment Concentration (mg/kg)	Refined Sediment Quality TRV (mg/kg)	Source[1]	Hazard Quotient
Inorganics				
Arsenic	29.1	33	MacDonald et al. 2000	<1
Barium	167	26610	Suter and Tsao 1996	<1
Beryllium	1.2	40	USEPA 2002	<1
Cadmium	191	5	MacDonald et al. 2000	**38**
Chromium	53	111	MacDonald et al. 2000	<1
Copper	277	149	MacDonald et al. 2000	**1.9**
Cyanide, total	417	29	Lussier et al. 1985; Higgins and Dzombak 2006	**14**
Lead	116	128	MacDonald et al. 2000	<1
Mercury	0.28	1.06	MacDonald et al. 2000	<1
Nickel	26.7	48.6	MacDonald et al. 2000	<1
Selenium	114	392	Brasher and Ogle 1993	<1
Silver	2.2	3.9	Cubbage et al. 1997	<1
Tin	19	5000	Borgmann et al. 2005	<1
Zinc	22400	459	MacDonald et al. 2000	**49**

Notes:
NA - Not available
1 - MacDonald etal. (2000) values based on consensus-based threshold effect concentrations (PECs).

TABLE 6-9
SURFACE WATER DIRECT CONTACT RISK SUMMARY - COUNTY LANDS 1B SMALL POND
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	Maximum Concentration (µg/L)	Water Column TRV (µg/L)	Source	Hazard Quotient
Inorganics				
Cadmium (D)	2.2	0.39	Borgmann et al. 1998	**5.6**
Zinc (D)*	166	111	Borgmann et al. 1998	**1.5**

Notes:

* Maximum concentration for dissolved zinc from two samples erroneously reported in SLERA as 5,850 µg/L, which is value for *total* zinc. Value reported in BERA is sole result for dissolved zinc.

D = dissolved

TABLE 6-10
EXPOSURE AND RISK ESTIMATES FOR THE RED-TAILED HAWK - HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Exposure Point Concentration (mg/kg, dry weight)	Red-Tailed Hawk Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
		Diet				Substrate	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$					
Metals											
Antimony	3.8	0.0	0.0	0.000002	0.000002	0.0005	0.0005	NA	--	NA	--
Chromium	8794	0.0	0.0	0.4	0.4	1.2	1.6	2.66	<1	15.6	<1
Copper	359	0.0	0.0	0.04	0.04	0.05	0.1	18.5	<1	34.9	<1
Lead	3239	0.0	0.0	0.09	0.09	0.4	0.5	10.9	<1	44.6	<1
Tin	9639	0.0	0.0	0.06	0.06	1.3	1.4	NA	--	NA	--
Zinc	10799	0.0	0.0	0.4	0.4	1.5	1.8	66.5	<1	171.4	<1
Polycyclic Aromatic Hydrocarbons (PAHs)											
HMW PAHs	16.3	0.0	0.0	0.0	0.0	0.002	0.002	2120	<1	NA	--

Notes:

a, Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

b, Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

c, Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{water} + ADD_{substrate}$$

where:

ADD_{diet}	= Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet}	= Ingestion rate of food (kg food ingested per day, dry weight)
B(S)AF	= Bioaccumulation factor (BAF) or biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i	= Dietary fraction of food item *i*
AUF	= Refined area use factor accounts for receptor home range
BW	= Body weight of the receptor, wet weight
IR_s	= Incidental ingestion rate of soil (kg substrate ingested per day, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE 6-11
EXPOSURE AND RISK ESTIMATES FOR THE AMERICAN ROBIN - HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Exposure Point Concentration (mg/kg, dry weight)	American Robin Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
		Diet				Substrate	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$					
Metals											
Antimony	3.8	0.01	0.0	0.0	0.0	0.02	0.0	NA	--	NA	--
Cadmium	50	0.4	11.4	0.0	11.8	0.3	12.1	1.47	**8.2**	6.4	**1.9**
Chromium	8794	28.7	142.7	0.0	171.4	48.5	219.9	2.66	**82.7**	15.6	**14.1**
Copper	359	1.5	1.3	0.0	2.8	2.0	4.8	18.5	<1	34.9	<1
Lead	3239	1.9	30.0	0.0	31.9	17.9	49.8	10.9	**4.6**	44.6	**1.1**
Nickel	134	0.3	2.9	0.0	3.3	0.7	4.0	6.71	<1	18.6	<1
Selenium	7.1	0.3	0.21	0.0	0.6	0.04	0.6	0.61	<1	0.82	<1
Tin	9639	23.0	40.9	0.0	63.9	53.2	117.0	NA	--	NA	--
Zinc	10799	70.1	96.3	0.0	166.4	59.6	225.9	66.5	**3.4**	171.4	**1.3**
Polycyclic Aromatic Hydrocarbons (PAHs)											
HMW PAHs	16.3	0.2	2.2	0.0	2.45	0.09	2.5	2120	<1	NA	--

Notes:

a, Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

b, Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

c, Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{water} + ADD_{substrate}$$

where:

ADD_{diet}	= Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet}	= Ingestion rate of food (kg food ingested per day, dry weight)
B(S)AF	= Bioaccumulation factor (BAF) or biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i	= Dietary fraction of food item *i*
AUF	= Refined area use factor accounts for receptor home range
BW	= Body weight of the receptor, wet weight
IR_s	= Incidental ingestion rate of soil (kg substrate ingested per day, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE 6-12
EXPOSURE AND RISK ESTIMATES FOR THE MOURNING DOVE - HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Exposure Point Concentration (mg/kg, dry weight)	Mourning Dove Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
		Diet				Substrate	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$					
Metals											
Antimony	3.8	0.00007	0.0	0.0	0.00007	0.0003	0.0003	NA	--	NA	--
Chromium	8794	0.2	0.0	0.0	0.2	0.6	0.8	2.66	<1	15.6	<1
Copper	359	0.01	0.0	0.0	0.01	0.03	0.04	18.50	<1	34.9	<1
Lead	3239	0.01	0.0	0.0	0.01	0.2	0.2	10.90	<1	44.6	<1
Selenium	7.1	0.002	0.0	0.0	0.002	0.0005	0.003	0.61	<1	0.82	<1
Tin	9639	0.2	0.0	0.0	0.2	0.7	0.9	NA	--	NA	--
Zinc	10799	0.5	0.0	0.0	0.5	0.8	1.2	66.5	<1	171.4	<1
Polycyclic Aromatic Hydrocarbons (PAHs)											
HMW PAHs	16.3	0.001	0.0	0.0	0.001	0.0012	0.003	2120	<1	NA	--

Notes:

a, Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

b, Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

c, Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{water} + ADD_{substrate}$$

where:

ADD_{diet}	= Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet}	= Ingestion rate of food (kg food ingested per day, dry weight)
B(S)AF	= Bioaccumulation factor (BAF) or biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i	= Dietary fraction of food item *i*
AUF	= Refined area use factor accounts for receptor home range
BW	= Body weight of the receptor, wet weight
IR_s	= Incidental ingestion rate of soil (kg substrate ingested per day, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE 6-13
EXPOSURE AND RISK ESTIMATES FOR THE MEADOW VOLE - HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Exposure Point Concentration (mg/kg, dry weight)	Meadow Vole Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
		Diet				Substrate	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$					
Metals											
Antimony	3.8	0.03	0.0	0.0	0.03	0.03	0.06	13.3	<1	66.5	<1
Cadmium	50	1.2	0.0	0.0	1.2	0.4	1.6	1.86	<1	6.9	<1
Chromium	8794	80.9	0.0	0.0	80.9	63.2	144.1	2.4	**60.0**	58.3	**2.5**
Copper	359	4.4	0.0	0.0	4.4	2.6	6.9	25.0	<1	85.3	<1
Lead	3239	5.5	0.0	0.0	5.5	23.3	28.7	40.7	<1	188.1	<1
Nickel	134	1.0	0.0	0.0	1.0	1.0	1.9	7.32	<1	17.5	<1
Selenium	7.1	1.0	0.0	0.0	1.0	0.05	1.0	0.45	**2.3**	0.66	**1.6**
Tin	9639	64.9	0.0	0.0	64.9	69.2	134.1	6300	<1	8800	<1
Zinc	10799	197.7	0.0	0.0	197.7	77.6	275.2	78.3	**3.5**	297.6	<1
Polycyclic Aromatic Hydrocarbons (PAHs)											
HMW PAHs	16.3	0.6	0.0	0.0	0.57	0.1	0.7	18	<1	38.4	<1

Notes:

a, Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

b, Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

c, Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{water} + ADD_{substrate}$$

where:

ADD_{diet}	= Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet}	= Ingestion rate of food (kg food ingested per day, dry weight)
B(S)AF	= Bioaccumulation factor (BAF) or biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i	= Dietary fraction of food item *i*
AUF	= Refined area use factor accounts for receptor home range
BW	= Body weight of the receptor, wet weight
IR_s	= Incidental ingestion rate of soil (kg substrate ingested per day, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE 6-14
EXPOSURE AND RISK ESTIMATES FOR THE RED FOX - HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Exposure Point Concentration (mg/kg, dry weight)	Red Fox Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
		Diet				Substrate	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$					
Metals											
Chromium	8794	0.0	0.0	0.4	0.4	0.6	1.0	2.4	<1	58.3	<1
Lead	3239	0.0	0.0	0.09	0.09	0.2	0.3	40.7	<1	188.1	<1

Notes:

a, Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

b, Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

c, Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{water} + ADD_{substrate}$$

where:

ADD_{diet} = Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
B(S)AF = Bioaccumulation factor (BAF) or biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$ = COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i = Dietary fraction of food item *i*
AUF = Refined area use factor accounts for receptor home range
BW = Body weight of the receptor, wet weight
IR_s = Incidental ingestion rate of soil (kg substrate ingested per day, dry weight)
$C_{substrate}$ = COPC concentration in substrate (mg COPC/kg substrate, dry weight)

TABLE 6-15
EXPOSURE AND RISK ESTIMATES FOR THE SHORT-TAILED SHREW - HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Exposure Point Concentration (mg/kg, dry weight)	Short-Tailed Shrew Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
		Diet				Substrate	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$					
Metals											
Antimony	3.8	0.0	0.0	0.0	0.0005	0.02	0.02	13.3	<1	66.5	<1
Cadmium	50	0.0	28.7	0.0	28.7	0.2	28.9	1.86	**15.6**	6.9	**4.2**
Chromium	8794	0.0	360.6	0.0	360.6	35.4	396.0	2.4	**165**	58.3	**6.8**
Copper	359	0.0	3.3	0.0	3.3	1.4	4.7	25.0	<1	85.3	<1
Lead	3239	0.0	75.7	0.0	75.7	13.0	88.8	40.7	**2.2**	188.1	<1
Nickel	134	0.0	7.4	0.0	7.4	0.5	7.9	7.3	**1.1**	17.5	<1
Selenium	7.1	0.0	0.5	0.0	0.5	0.03	0.5	0.45	**1.2**	0.66	<1
Tin	9639	0.0	103	0.0	103	38.8	142	6300	<1	8800	<1
Zinc	10799	0.0	243.5	0.0	243.5	43.4	286.9	78.3	**3.7**	297.6	<1
Polycyclic Aromatic Hydrocarbons (PAHs)											
HMW PAHs	16.3	0.0	5.7	0.0	5.7	0.07	5.7	18.0	<1	38.4	<1

Notes:

a, Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

b, Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

c, Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{water} + ADD_{substrate}$$

where:

ADD_{diet}	= Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet}	= Ingestion rate of food (kg food ingested per day, dry weight)
B(S)AF	= Bioaccumulation factor (BAF) or biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i	= Dietary fraction of food item *i*
AUF	= Refined area use factor accounts for receptor home range
BW	= Body weight of the receptor, wet weight
IR_s	= Incidental ingestion rate of soil (kg substrate ingested per day, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE 6-16
EXPOSURE AND RISK ESTIMATES FOR THE RED-TAILED HAWK - COUNTY LANDS 1B PARCEL
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Exposure Point Concentration (mg/kg, dry weight)	Red-Tailed Hawk Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
		Diet				Substrate	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$					
Metals											
Antimony	7.0	0.0	0.0	0.000003	0.000003	0.001	0.001	NA	--	NA	--
Copper	1214	0.0	0.0	0.05	0.05	0.2	0.2	18.5	<1	34.9	<1
Lead	529	0.0	0.0	0.04	0.04	0.07	0.1	10.9	<1	44.6	<1
Polycyclic Aromatic Hydrocarbons (PAHs)											
HMW PAHs	64.8	0.0	0.0	0.0	0.0	0.009	0.009	2120	<1	NA	--

Notes:

a, Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

b, Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

c, Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{water} + ADD_{substrate}$$

where:

ADD_{diet} = Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
B(S)AF = Bioaccumulation factor (BAF) or biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$ = COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i = Dietary fraction of food item *i*
AUF = Refined area use factor accounts for receptor home range
BW = Body weight of the receptor, wet weight
IR_s = Incidental ingestion rate of soil (kg substrate ingested per day, dry weight)
$C_{substrate}$ = COPC concentration in substrate (mg COPC/kg substrate, dry weight)

NA, Not available
--, HQ not calculated because TRV was not available

TABLE 6-17
EXPOSURE AND RISK ESTIMATES FOR THE AMERICAN ROBIN - COUNTY LANDS 1B PARCEL
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Exposure Point Concentration (mg/kg, dry weight)	American Robin Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
		Diet				Substrate	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$					
Metals											
Antimony	7.0	0.02	0.0	0.0	0.0	0.04	0.1	NA	--	NA	--
Cadmium	4.1	0.1	2.2	0.0	2.3	0.02	2.3	1.47	**1.6**	6.4	<1
Chromium	157	0.5	2.5	0.0	3.1	0.9	3.9	2.66	**1.5**	15.6	<1
Copper	1214	2.5	1.8	0.0	4.3	6.7	11.0	18.5	<1	34.9	<1
Lead	529	0.7	6.9	0.0	7.6	2.9	10.5	10.9	<1	44.6	<1
Selenium	4.4	0.2	0.1	0.0	0.4	0.02	0.4	0.61	<1	0.82	<1
Zinc	6569	53.0	81.8	0.0	134.8	36.2	171.0	66.5	**2.6**	171.4	<1
Polycyclic Aromatic Hydrocarbons (PAHs)											
HMW PAHs	64.8	0.8	8.9	0.0	9.7	0.4	10.0	2120	<1	NA	--

Notes:

a, Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

b, Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

c, Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{water} + ADD_{substrate}$$

where:

ADD_{diet}	= Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet}	= Ingestion rate of food (kg food ingested per day, dry weight)
B(S)AF	= Bioaccumulation factor (BAF) or biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i	= Dietary fraction of food item *i*
AUF	= Refined area use factor accounts for receptor home range
BW	= Body weight of the receptor, wet weight
IR_s	= Incidental ingestion rate of soil (kg substrate ingested per day, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)

NA, Not available

--, HQ not calculated because TRV was not available

TABLE 6-18
EXPOSURE AND RISK ESTIMATES FOR THE MOURNING DOVE - COUNTY LANDS 1B PARCEL
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Exposure Point Concentration (mg/kg, dry weight)	Mourning Dove Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
		Diet				Substrate	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$					
Metals											
Antimony	7.0	0.0001	0.0	0.0	0.0001	0.0005	0.0006	NA	--	NA	--
Copper	1214	0.02	0.0	0.0	0.02	0.09	0.10	18.50	<1	34.9	<1
Lead	529	0.005	0.0	0.0	0.005	0.04	0.04	10.90	<1	44.6	<1
Selenium	4.4	0.001	0.0	0.0	0.001	0.0003	0.002	0.61	<1	0.82	<1
Zinc	6569	0.3	0.0	0.0	0.3	0.5	0.8	66.5	<1	171	<1
Polycyclic Aromatic Hydrocarbons (PAHs)											
HMW PAHs	64.8	0.005	0.0	0.0	0.005	0.005	0.01	2120	<1	NA	--

Notes:

a, Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

b, Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

c, Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{water} + ADD_{substrate}$$

where:

ADD_{diet}	= Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet}	= Ingestion rate of food (kg food ingested per day, dry weight)
B(S)AF	= Bioaccumulation factor (BAF) or biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i	= Dietary fraction of food item *i*
AUF	= Refined area use factor accounts for receptor home range
BW	= Body weight of the receptor, wet weight
IR_s	= Incidental ingestion rate of soil (kg substrate ingested per day, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)

NA, Not available
--, HQ not calculated because TRV was not available

TABLE 6-19
EXPOSURE AND RISK ESTIMATES FOR THE MEADOW VOLE - COUNTY LANDS 1B PARCEL
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Exposure Point Concentration (mg/kg, dry weight)	Meadow Vole Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
		Diet				Substrate	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$					
Metals											
Antimony	7.0	0.05	0.0	0.0	0.05	0.05	0.1	13.30	<1	66.5	<1
Chromium	157	1.4	0.0	0.0	1.4	1.1	2.6	2.40	**1.1**	58.3	<1
Copper	1214	7.0	0.0	0.0	7.0	8.7	15.7	25.00	<1	85.3	<1
Lead	529	2.0	0.0	0.0	2.0	3.8	5.8	40.70	<1	188.1	<1
Selenium	4.4	0.6	0.0	0.0	0.6	0.03	0.6	0.45	**1.4**	0.66	<1
Zinc	6569	149.6	0.0	0.0	149.6	47.2	196.8	78.3	**2.5**	297.6	<1
Polycyclic Aromatic Hydrocarbons (PAHs)											
HMW PAHs	64.8	2.1	0.0	0.0	2.1	0.5	2.6	18.00	<1	38.4	<1

Notes:

a, Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

b, Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

c, Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{water} + ADD_{substrate}$$

where:

ADD_{diet} = Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
B(S)AF = Bioaccumulation factor (BAF) or biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$ = COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i = Dietary fraction of food item *i*
AUF = Refined area use factor accounts for receptor home range
BW = Body weight of the receptor, wet weight
IR_s = Incidental ingestion rate of soil (kg substrate ingested per day, dry weight)
$C_{substrate}$ = COPC concentration in substrate (mg COPC/kg substrate, dry weight)

TABLE 6-20
EXPOSURE AND RISK ESTIMATES FOR THE SHORT-TAILED SHREW - COUNTY LANDS 1B PARCEL
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Exposure Point Concentration (mg/kg, dry weight)	Short-Tailed Shrew Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
		Diet				Substrate	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$					
Metals											
Antimony	7.0	0.0	0.0009	0.0	0.0009	0.03	0.03	13.3	<1	66.5	<1
Cadmium	4.1	0.0	5.5	0.0	5.5	0.02	5.5	1.86	**3.0**	6.9	<1
Chromium	157	0.0	6.4	0.0	6.4	0.6	7.1	2.4	**2.9**	58.3	<1
Copper	1214	0.0	4.5	0.0	4.5	4.9	9.4	25.0	<1	85.3	<1
Lead	529	0.0	17.5	0.0	17.5	2.1	19.6	40.7	<1	188.1	<1
Selenium	4.4	0.0	0.4	0.0	0.4	0.02	0.4	0.45	<1	0.66	<1
Zinc	6569	0.0	206.6	0.0	206.6	26.4	233.0	78.3	**3.0**	297.6	<1
Polycyclic Aromatic Hydrocarbons (PAHs)											
HMW PAHs	64.8	0.0	22.6	0.0	22.6	0.3	22.8	18	**1.3**	38.4	<1

Notes:

a, Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

b, Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

c, Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{water} + ADD_{substrate}$$

where:

- ADD_{diet} = Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
- IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
- B(S)AF = Bioaccumulation factor (BAF) or biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
- $C_{substrate}$ = COPC concentration in substrate (mg COPC/kg substrate, dry weight)
- DF_i = Dietary fraction of food item *i*
- AUF = Refined area use factor accounts for receptor home range
- BW = Body weight of the receptor, wet weight
- IR_s = Incidental ingestion rate of soil (kg substrate ingested per day, dry weight)
- $C_{substrate}$ = COPC concentration in substrate (mg COPC/kg substrate, dry weight)

TABLE 6-21
EXPOSURE AND RISK ESTIMATES FOR THE RED-TAILED HAWK - MUD RESERVOIR
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Exposure Point Concentration (mg/kg, dry weight)	Red-Tailed Hawk Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
		Diet				Substrate	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$					
Metals											
Antimony	3.6	0.0	0.0	0.000001	0.000001	0.0003	0.0003	NA	--	NA	--
Chromium	206	0.0	0.0	0.02	0.02	0.02	0.04	2.66	<1	15.6	<1
Lead	259	0.0	0.0	0.02	0.02	0.02	0.04	10.90	<1	44.6	<1

Notes:

a, Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

b, Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

c, Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{water} + ADD_{substrate}$$

where:

ADD_{diet}	= Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet}	= Ingestion rate of food (kg food ingested per day, dry weight)
B(S)AF	= Bioaccumulation factor (BAF) or biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i	= Dietary fraction of food item *i*
AUF	= Refined area use factor accounts for receptor home range
BW	= Body weight of the receptor, wet weight
IR_s	= Incidental ingestion rate of soil (kg substrate ingested per day, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE 6-22
EXPOSURE AND RISK ESTIMATES FOR THE AMERICAN ROBIN - MUD RESERVOIR
SEVERSTALSPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Exposure Point Concentration (mg/kg, dry weight)	American Robin Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
		Diet				Substrate	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$					
Metals											
Antimony	3.6	0.01	0.0	0.0	0.0	0.02	0.0	NA	--	NA	--
Cadmium	3.5	0.1	2.0	0.0	2.1	0.02	2.1	1.47	**1.4**	6.4	<1
Chromium	206	0.7	3.3	0.0	4.0	1.1	5.2	2.66	**1.9**	15.6	<1
Lead	259	0.5	3.9	0.0	4.3	1.4	5.8	10.90	<1	44.6	<1
Selenium	3.7	0.2	0.1	0.0	0.3	0.02	0.3	0.61	<1	0.82	<1
Tin	545	1.3	2.3	0.0	3.6	3.0	6.6	NA	--	NA	--
Zinc	756	15.8	40.1	0.0	55.9	4.2	60.0	66.5	<1	171.4	<1

Notes:

a, Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

b, Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

c, Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{water} + ADD_{substrate}$$

where:

ADD_{diet}	= Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet}	= Ingestion rate of food (kg food ingested per day, dry weight)
B(S)AF	= Bioaccumulation factor (BAF) or biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i	= Dietary fraction of food item *i*
AUF	= Refined area use factor accounts for receptor home range
BW	= Body weight of the receptor, wet weight
IR_s	= Incidental ingestion rate of soil (kg substrate ingested per day, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE 6-23
EXPOSURE AND RISK ESTIMATES FOR THE MOURNING DOVE - MUD RESERVOIR
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Exposure Point Concentration (mg/kg, dry weight)	Mourning Dove Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
		Diet				Substrate	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$					
Metals											
Antimony	3.6	0.00007	0.0	0.0	0.00007	0.0003	0.0003	NA	--	NA	--
Chromium	206	0.004	0.0	0.0	0.004	0.02	0.02	2.66	<1	15.6	<1
Lead	259	0.003	0.0	0.0	0.003	0.02	0.02	10.90	<1	44.6	<1
Tin	545	0.009	0.0	0.0	0.009	0.04	0.05	NA	--	NA	--

Notes:

a, Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

b, Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

c, Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{water} + ADD_{substrate}$$

where:

ADD_{diet} = Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
B(S)AF = Bioaccumulation factor (BAF) or biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$ = COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i = Dietary fraction of food item *i*
AUF = Refined area use factor accounts for receptor home range
BW = Body weight of the receptor, wet weight
IR_s = Incidental ingestion rate of soil (kg substrate ingested per day, dry weight)
$C_{substrate}$ = COPC concentration in substrate (mg COPC/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE 6-24
EXPOSURE AND RISK ESTIMATES FOR THE MEADOW VOLE - MUD RESERVOIR
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Exposure Point Concentration (mg/kg, dry weight)	Meadow Vole Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
		Diet				Substrate	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$					
Metals											
Antimony	3.6	0.03	0.0	0.0	0.03	0.03	0.06	13.30	<1	66.5	<1
Chromium	206	1.9	0.0	0.0	1.9	1.5	3.4	2.40	**1.4**	58.3	<1
Lead	259	1.3	0.0	0.0	1.3	1.9	3.2	40.70	<1	188.1	<1
Selenium	3.7	0.5	0.0	0.0	0.5	0.03	0.5	0.45	**1.1**	0.66	<1
Zinc	756	44.6	0.0	0.0	44.6	5.4	50.0	78.3	<1	297.6	<1

Notes:

a, Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

b, Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

c, Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{water} + ADD_{substrate}$$

where:

ADD_{diet} = Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
B(S)AF = Bioaccumulation factor (BAF) or biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$ = COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i = Dietary fraction of food item *i*
AUF = Refined area use factor accounts for receptor home range
BW = Body weight of the receptor, wet weight
IR_s = Incidental ingestion rate of soil (kg substrate ingested per day, dry weight)
$C_{substrate}$ = COPC concentration in substrate (mg COPC/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE 6-25
EXPOSURE AND RISK ESTIMATES FOR THE SHORT-TAILED SHREW - MUD RESERVOIR
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	UCL_{95} Soil Exposure Point Concentration (mg/kg, dry weight)	Short-Tailed Shrew Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
		Diet				Substrate	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$					
Metals											
Antimony	3.6	0.0	0.0005	0.0	0.0005	0.01	0.01	13.30	<1	66.5	<1
Cadmium	3.6	0.0	5.1	0.0	5.1	0.01	5.1	1.86	**2.7**	6.9	<1
Chromium	206	0.0	8.4	0.0	8.4	0.8	9.3	2.40	**3.9**	58.3	<1
Lead	259	0.0	9.8	0.0	9.8	1.0	10.8	40.70	<1	188.1	<1
Selenium	3.7	0.0	0.3	0.0	0.3	0.01	0.3	0.45	<1	0.66	<1
Tin	545	0.0	5.8	0.0	5.8	2.2	8.0	6300	<1	8800	<1
Zinc	756	0.0	101.2	0.0	101.2	3.0	104.3	78.3	**1.3**	297.6	<1

Notes:

a, Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

b, Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

c, Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{water} + ADD_{substrate}$$

where:

ADD_{diet}	= Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet}	= Ingestion rate of food (kg food ingested per day, dry weight)
B(S)AF	= Bioaccumulation factor (BAF) or biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i	= Dietary fraction of food item *i*
AUF	= Refined area use factor accounts for receptor home range
BW	= Body weight of the receptor, wet weight
IR_s	= Incidental ingestion rate of soil (kg substrate ingested per day, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE 6-26
EXPOSURE AND RISK ESTIMATES FOR THE RED-TAILED HAWK - FORMER EAST POND
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	Geometric Mean Soil Exposure Point Concentration (mg/kg, dry weight)	Red-Tailed Hawk Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
		Diet				Substrate	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$					
Metals											
Lead	254	0.0	0.0	1.0	1.0	0.01	1.0	10.90	<1	44.6	<1
Zinc	6302	0.0	0.0	11.6	11.6	0.3	11.9	66.5	<1	171	<1

Notes:

a, Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

b, Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

c, Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{water} + ADD_{substrate}$$

where:

ADD_{diet}	= Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet}	= Ingestion rate of food (kg food ingested per day, dry weight)
B(S)AF	= Bioaccumulation factor (BAF) or biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i	= Dietary fraction of food item *i*
AUF	= Refined area use factor accounts for receptor home range
BW	= Body weight of the receptor, wet weight
IR_s	= Incidental ingestion rate of soil (kg substrate ingested per day, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)

TABLE 6-27
EXPOSURE AND RISK ESTIMATES FOR THE AMERICAN ROBIN - FORMER EAST POND
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	Geometric Mean Soil Exposure Point Concentration (mg/kg, dry weight)	American Robin Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
		Diet				Substrate					
		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals											
Cadmium	76	0.5	15.0	0.0	15.6	0.4	16.0	1.47	**10.9**	6.4	**2.5**
Chromium	59	0.2	0.9	0.0	1.1	0.3	1.5	2.66	<1	15.6	<1
Lead	254	0.5	3.8	0.0	4.3	1.4	5.7	10.90	<1	44.6	<1
Zinc	6302	51.8	80.6	0.0	132.5	34.8	167.2	66.5	**2.5**	171	<1

Notes:

a, Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

b, Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

c, Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{water} + ADD_{substrate}$$

where:

ADD_{diet}	= Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet}	= Ingestion rate of food (kg food ingested per day, dry weight)
B(S)AF	= Bioaccumulation factor (BAF) or biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i	= Dietary fraction of food item *i*
AUF	= Refined area use factor accounts for receptor home range
BW	= Body weight of the receptor, wet weight
IR_s	= Incidental ingestion rate of soil (kg substrate ingested per day, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)

TABLE 6-28
EXPOSURE AND RISK ESTIMATES FOR THE MOURNING DOVE - FORMER EAST POND
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	Geometric Mean Soil Exposure Point Concentration (mg/kg, dry weight)	Mourning Dove Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
		Diet				Substrate					
		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals											
Cadmium	76	0.4	0.0	0.0	0.4	0.006	0.4	1.47	<1	6.4	<1
Lead	254	0.3	0.0	0.0	0.3	0.02	0.3	10.90	<1	44.6	<1
Zinc	6302	34.2	0.0	0.0	34.2	0.5	34.6	66.5	<1	171	<1

Notes:

a, Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

b, Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

c, Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{water} + ADD_{substrate}$$

where:

ADD_{diet}	= Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet}	= Ingestion rate of food (kg food ingested per day, dry weight)
B(S)AF	= Bioaccumulation factor (BAF) or biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i	= Dietary fraction of food item *i*
AUF	= Refined area use factor accounts for receptor home range
BW	= Body weight of the receptor, wet weight
IR_s	= Incidental ingestion rate of soil (kg substrate ingested per day, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)

TABLE 6-29
EXPOSURE AND RISK ESTIMATES FOR THE MEADOW VOLE - FORMER EAST POND
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	Geometric Mean Soil Exposure Point Concentration (mg/kg, dry weight)	Meadow Vole Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
		Diet				Substrate	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$					
Metals											
Cadmium	76	1.5	0.0	0.0	1.51	0.5	2.1	1.86	**1.1**	6.9	<1
Lead	254	1.3	0.0	0.0	1.32	1.8	3.1	40.70	<1	188	<1
Zinc	6302	146	0.0	0.0	146	45	191	78.3	**2.4**	298	<1

Notes:

a, Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

b, Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

c, Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{water} + ADD_{substrate}$$

where:

ADD_{diet} = Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
B(S)AF = Bioaccumulation factor (BAF) or biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$ = COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i = Dietary fraction of food item *i*
AUF = Refined area use factor accounts for receptor home range
BW = Body weight of the receptor, wet weight
IR_s = Incidental ingestion rate of soil (kg substrate ingested per day, dry weight)
$C_{substrate}$ = COPC concentration in substrate (mg COPC/kg substrate, dry weight)

TABLE 6-30
EXPOSURE AND RISK ESTIMATES FOR THE SHORT-TAILED SHREW - FORMER EAST POND
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	Geometric Mean Soil Exposure Point Concentration (mg/kg, dry weight)	Short-Tailed Shrew Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
		Diet				Substrate	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$					
Metals											
Cadmium	76	0.0	38.0	0.0	38.0	0.3	38.3	1.86	**20.6**	6.9	**5.5**
Chromium	59	0.0	2.4	0.0	2.4	0.2	2.6	2.40	**1.1**	58.3	<1
Lead	254	0.0	9.6	0.0	9.6	1.0	10.7	40.70	<1	188	<1
Zinc	6302	0.0	204	0.0	204	25.3	229	78.3	**2.9**	298	<1

Notes:

a, Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

b, Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

c, Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{water} + ADD_{substrate}$$

where:

ADD_{diet} = Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
B(S)AF = Bioaccumulation factor (BAF) or biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$ = COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i = Dietary fraction of food item *i*
AUF = Refined area use factor accounts for receptor home range
BW = Body weight of the receptor, wet weight
IR_s = Incidental ingestion rate of soil (kg substrate ingested per day, dry weight)
$C_{substrate}$ = COPC concentration in substrate (mg COPC/kg substrate, dry weight)

TABLE 6-31
EXPOSURE AND RISK ESTIMATES FOR THE RACCOON - COUNTY LANDS 1B LARGE POND
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	Geometric Mean Sediment Concentration (mg/kg, dry weight)	Raccoon Dose (mg/kg bw-day)				TRV (mg/kg bw-day)				
		Diet			Substrate	Unadjusted for Bioavailability				
		Invertebrates	Fish	$Dose_{diet}$	$Dose_{substrate}$	$Total\ Dose_{Unadjusted}$	TRV_{NOAEL}	HQ	TRV_{LOAEL}	HQ
Inorganics										
Chromium	158	0.02	0.0	0.0	0.004	0.03	2.4	<1	58.3	<1
Selenium	25.9	0.01	0.0	0.0	0.0006	0.01	0.45	<1	0.66	<1

Notes:

Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{substrate}$$

where:

ADD_{diet}	= Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet}	= Ingestion rate of food (0.154 kg food ingested per day, dry weight)
B(S)AF	= Biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i	= Dietary fraction of food item *i* (100% invertebrates in the diet)
AUF	= Refined area use factor accounts for receptor home range
BW	= Body weight of the receptor, wet weight (5.8 kg)
IR_s	= Incidental ingestion rate of sediment (0.014 kg substrate ingested per day, dry weight)

TABLE 6-32
EXPOSURE AND RISK ESTIMATES FOR THE GREAT BLUE HERON - COUNTY LANDS 1B LARGE POND
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	Geometric Mean Sediment Concentration (mg/kg, dry weight)	Great Blue Heron Dose (mg/kg bw-day)				TRV (mg/kg bw-day)				
		Diet			Substrate	Unadjusted for Bioavailability				
		Invertebrates	Fish	$Dose_{diet}$	$Dose_{substrate}$	Total $Dose_{Unadjusted}$	TRV_{NOAEL}	HQ	TRV_{LOAEL}	HQ
Inorganics										
Selenium	25.9	0.0	0.02	0.0	0.0	0.02	0.61	<1	0.82	<1

Notes:

Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{substrate}$$

where:

ADD_{diet} = Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet} = Ingestion rate of food (0.147 kg food ingested per day, dry weight)
B(S)AF = Biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$ = COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i = Dietary fraction of food item *i* (100% fish in the diet)
AUF = Refined area use factor accounts for receptor home range
BW = Body weight of the receptor, wet weight (2.39 kg)
IR_s = Incidental ingestion rate of sediment (0 kg substrate ingested per day, dry weight)

TABLE 6-33
EXPOSURE AND RISK ESTIMATES FOR THE RACCOON - COUNTY LANDS 1B SMALL POND
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	Maximum Sediment Concentration (mg/kg, dry weight)	Raccoon Dose (mg/kg bw-day)				TRV (mg/kg bw-day)				
		Diet			Substrate	Unadjusted for Bioavailability				
		Invertebrates	Fish	$Dose_{diet}$	$Dose_{substrate}$	$Total\ Dose_{Unadjusted}$	TRV_{NOAEL}	HQ	TRV_{LOAEL}	HQ
Inorganics										
Cadmium	191	0.2	0.0	0.2	0.005	0.2	1.86	<1	6.9	<1
Copper	277	0.05	0.0	0.05	0.007	0.06	25.0	<1	85.3	<1
Selenium	114	0.04	0.0	0.04	0.003	0.05	0.45	<1	0.66	<1

Notes:

Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{substrate}$$

where:

ADD_{diet} = Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet} = Ingestion rate of food (0.154 kg food ingested per day, dry weight)
B(S)AF = Biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$ = COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i = Dietary fraction of food item *i* (100% invertebrates in the diet)
AUF = Refined area use factor accounts for receptor home range
BW = Body weight of the receptor, wet weight (5.8 kg)
IR_s = Incidental ingestion rate of sediment (0.014 kg substrate ingested per day, dry weight)

TABLE 6-34
EXPOSURE AND RISK ESTIMATES FOR THE GREAT BLUE HERON - COUNTY LANDS 1B SMALL POND
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Analyte	Maximum Sediment Concentration (mg/kg, dry weight)	Great Blue Heron Dose (mg/kg bw-day)				TRV (mg/kg bw-day)				
		Diet			Substrate	Unadjusted for Bioavailability				
		Invertebrates	Fish	$Dose_{diet}$	$Dose_{substrate}$	Total $Dose_{Unadjusted}$	TRV_{NOAEL}	HQ	TRV_{LOAEL}	HQ
Inorganics										
Selenium	114	0.0	0.1	0.1	0.0	0.1	0.61	<1	0.82	<1
Zinc	22400	0.0	3.0	3.0	0.0	3	66.5	<1	171	<1

Notes:

Dietary dose calculated as:

$$ADD_{diet} = \frac{IR_{diet} \times \sum (B[S]AF \times C_{substrate} \times DF_i) \times AUF}{BW}$$

Substrate dose calculated as:

$$ADD_{substrate} = \frac{IR_{substrate} \times C_{substrate} \times AUF}{BW}$$

Total dose calculated as:

$$ADD_{total} = ADD_{diet} + ADD_{substrate}$$

where:

ADD_{diet}	= Dose of COPC obtained from the diet (mg COPC/kg receptor body weight-day)
IR_{diet}	= Ingestion rate of food (0.147 kg food ingested per day, dry weight)
B(S)AF	= Biota-sediment accumulation factor (BSAF), specific to prey type and COPC (kg substrate/kg food, dry weight)
$C_{substrate}$	= COPC concentration in substrate (mg COPC/kg substrate, dry weight)
DF_i	= Dietary fraction of food item *i* (100% fish in the diet)
AUF	= Refined area use factor accounts for receptor home range
BW	= Body weight of the receptor, wet weight (2.39 kg)
IR_s	= Incidental ingestion rate of sediment (0 kg substrate ingested per day, dry weight)

TABLE 6-35
RISK SUMMARY FOR TERRESTRIAL RECEPTORS
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

	Red-Tailed Hawk		American Robin		Mourning Dove		Meadow Vole		Red Fox		Short-Tailed Shrew	
	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ
Humphrey Impoundment												
Antimony	NA	NA	NA	NA	NA	NA	<1	<1	NR	NR	<1	<1
Cadmium	NR	NR	**8.2**	**1.9**	NR	NR	<1	<1	NR	NR	**15.6**	**4.2**
Chromium	<1	<1	**82.7**	**14.1**	<1	<1	**60**	**2.5**	<1	<1	**165**	**6.8**
Copper	<1	<1	<1	<1	<1	<1	<1	<1	NR	NR	<1	<1
Lead	<1	<1	**4.6**	**1.1**	<1	<1	<1	<1	<1	<1	**2.2**	<1
Nickel	NR	NR	<1	<1	NR	NR	<1	<1	NR	NR	**1.1**	<1
Selenium	NR	NR	<1	<1	<1	<1	**2.3**	**1.6**	NR	NR	**1.2**	<1
Tin	NA	NA	NA	NA	NA	NA	<1	<1	NR	NR	<1	<1
Zinc	<1	<1	**3.4**	**1.3**	<1	<1	**3.5**	<1	NR	NR	**3.7**	<1
HMW PAHs	<1	NA	<1	NA	<1	NA	<1	<1	NR	NR	<1	<1
CL1B Parcel												
Antimony	NA	NA	NA	NA	NA	NA	<1	<1	All risks determined to be acceptable in the SLERA		<1	<1
Cadmium	NR	NR	**1.6**	<1	NR	NR	NR	NR			**3.0**	<1
Chromium	NR	NR	**1.5**	<1	NR	NR	**1.1**	<1			**2.9**	<1
Copper	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1
Lead	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1
Selenium	NR	NR	<1	<1	<1	<1	**1.4**	<1			<1	<1
Zinc	NR	NR	**2.6**	<1	<1	<1	**2.5**	<1			**3.0**	<1
HMW PAHs	<1	NA	<1	NA	<1	NA	<1	<1			**1.3**	<1
Mud Reservoir												
Antimony	NA	NA	NA	NA	NA	NA	<1	<1	All risks determined to be acceptable in the SLERA		<1	<1
Cadmium	NR	NR	**1.4**	<1	NR	NR	NR	NR			**2.7**	<1
Chromium	<1	<1	**1.9**	<1	<1	<1	**1.4**	<1			**3.9**	<1
Lead	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1
Selenium	NR	NR	<1	<1	NR	NR	**1.1**	<1			<1	<1
Tin	NR	NR	NA	NA	NA	NA	NR	NR			<1	<1
Zinc	NR	NR	<1	<1	NR	NR	<1	<1			**1.3**	<1
Former East Pond												
Cadmium	NR	NR	**10.9**	**2.5**	<1	<1	**1.1**	<1	All risks determined to be acceptable in the SLERA		**20.6**	**5.5**
Chromium	NR	NR	<1	<1	NR	NR	NR	NR			**1.1**	<1
Lead	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1
Zinc	<1	<1	**2.5**	<1	<1	<1	2.4	<1			**2.9**	<1

HQ - Hazard quotient
NOAEL - no observable adverse effects level
LOAEL - lowest observable adverse effects level
HQs highlighted in **bold** exceed 1; LOAEL-based HQs are proposed as the basis for remedial decision-making.
NA - No TRV was available, therefore no HQ could be calculated.
NR - No risk posed, as determined in the SLERA; not evaluated in the BERA.

TABLE 6-36
RISK SUMMARY FOR SEMI-AQUATIC RECEPTORS
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	Raccoon		Great Blue Heron	
	NOAEL-based HQ	LOAEL-based HQ	NOAEL-based HQ	LOAEL-based HQ
Knobby's Ditch Head Pond				
All risks determined to be acceptable in the SLERA				
County Lands 1B Large Pond				
Chromium	<1	<1	NR	NR
Selenium	<1	<1	<1	<1
County Lands 1B Small Pond				
Cadmium	<1	<1	NR	NR
Copper	<1	<1	NR	NR
Selenium	<1	<1	<1	<1
Zinc	NR	NR	<1	<1

HQ - Hazard Quotient
NOAEL - no observable adverse effects level
LOAEL - lowest observable adverse effects level
NR - No risk posed, as determined in the SLERA; not evaluated in the BERA.

Figures

Reference:
USGS Quadrangle Curtis Bay
& Sparrows Point, MD

2,000 1,000 0 2,000 Feet

1 inch = 2,000 feet

N

NAD 1983 State Plane
Maryland FIPS 1900 Feet
Lambert Conformal Conic
False Easting: 1312333.333333
False Northing: 0.000000
Central Meridian: -77.000000
Standard Parallel 1: 38.300000
Standard Parallel 2: 39.450000
Latitude Of Origin: 37.666667

Quadrangle Location

URS

335 Commerce Drive, Suite 300
Fort Washington, PA 19034
Phone: (215) 367-2500 Fax: (215) 367-1000

Job:	15302184.00002
Prepared by:	PLJ
Checked by:	CC
Date:	07/06/2010

Figure 1
Regional Location Plan

Severstal Sparrows Point
Sparrows Point, Maryland

Q:\GIS_Data\MTTALSTEEL\Projects\BERA\Figure 1 Mittal Steel Loc Plan.mxd

Reference:
2008 Aerial Imagery provided
by AEX (WDC Baltimore).

2,000 1,000 0 2,000 Feet

1 inch = 2,000 feet

N

NAD 1983 State Plane
Maryland FIPS 1900 Feet
Lambert Conformal Conic
False Easting: 1312333.333333
False Northing: 0.000000
Central Meridian: -77.000000
Standard Parallel 1: 38.300000
Standard Parallel 2: 39.450000
Latitude Of Origin: 37.666667

Quadrangle Location

URS

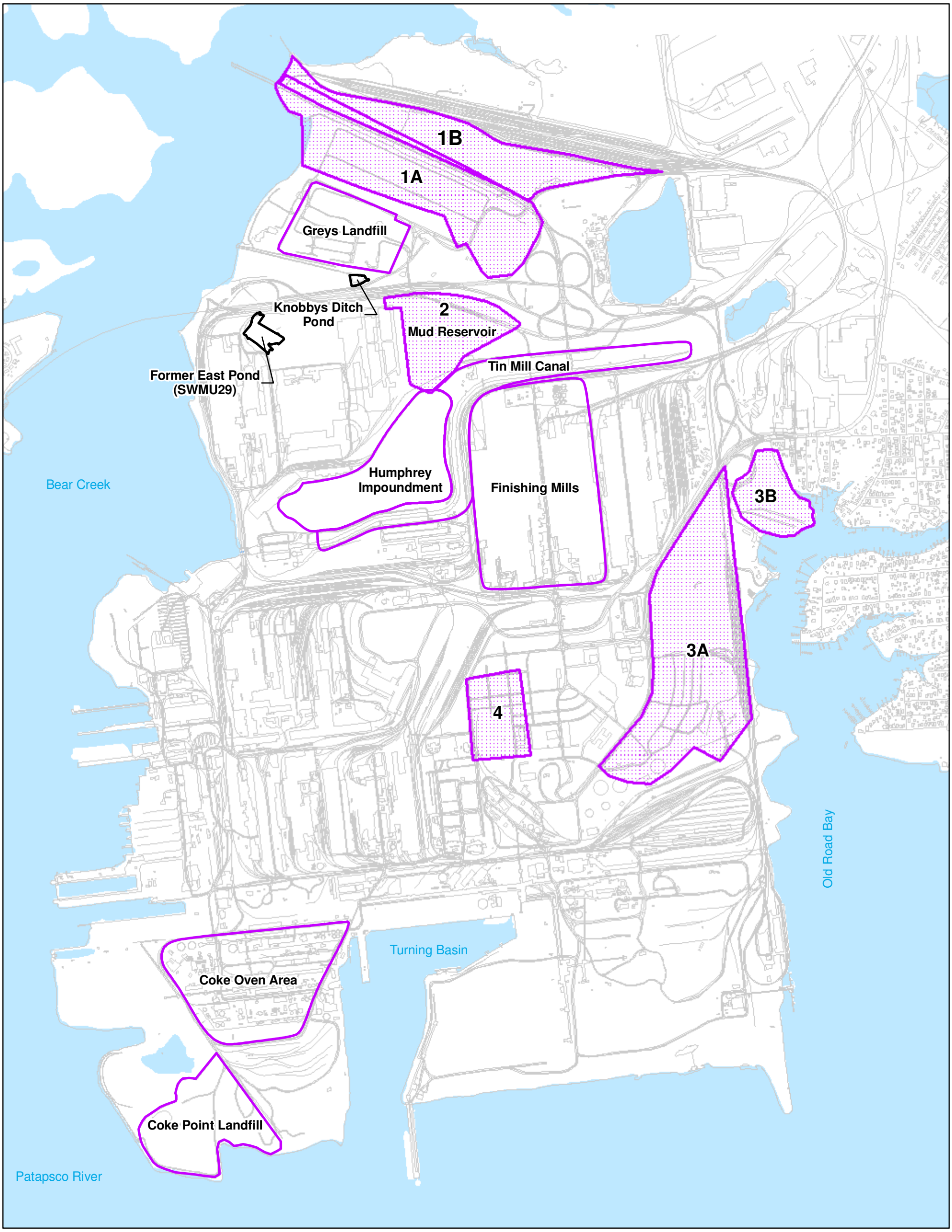
335 Commerce Drive, Suite 300
Fort Washington, PA 19034
Phone: (215) 367-2500 Fax: (215) 367-1000

Job: 15302184.00002
Prepared by: PLJ
Checked by: CC
Date: 07/06/2010

Figure 2
Aerial Photograph

Severstal Sparrows Point
Sparrows Point, Maryland

Q:\GIS_Data\MTTALSTEEL\Projects\BERA\Figure 2 Mittal Steel Aerial.mxd



Legend

- Special Study Area
- County Lands Parcel

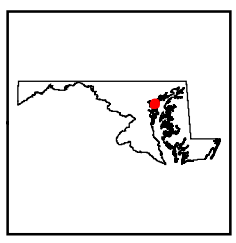
0 700 1,400 2,800 Feet

1 inch = 1,400 feet

(when printed at 11x17)

N

NAD 1983 StatePlane Connecticut
FIPS 0600 Feet
Projection: Lambert Conformal Conic
False Easting: 999999.999996
False Northing: 499999.999998
Central Meridian: -72.750000
Standard Parallel 1: 41.200000
Standard Parallel 2: 41.866667
Latitude Of Origin: 40.833333
Linear Unit: Foot US



Key Map - Not to Scale

URS

335 Commerce Drive, Suite 300
Fort Washington, PA 19034
Phone: (215) 367-2500 Fax: (215) 367-1000

Job: 15302184.00002

Prepared By: PLJ

Checked by: MR

Date: 07/13/2010

Figure 3
Site Features Map

Severstal Sparrows Point
Sparrows Point, Maryland

Legend

- Surface Soil Sample Location
- Humphrey Impoundment SSA
- Sampling Grid

Key Map
Not to Scale

N

NAD 1983 StatePlane Maryland
Projection: Lambert Conformal Conic
Linear Unit: US Foot

Data Sources -
Aerial Photography- Aerials Express 2005
URS Corporation

0 125 250 500 Feet

1 inch = 250 feet
(when printed at 11x17)

URS

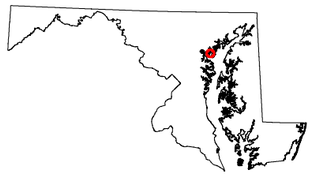
Figure 4
Humphrey Impoundment
Surface Soil Sampling Locations
Severstal Sparrows Point

Sparrows Point, Maryland

Prepared By: PLJ	Checked By: MR
Job: 15302184.00002	Q:\GIS_Data\MTTALSTEEL\Projects\BERA\Mittal Steel Samples Hmphry Imp Figure 4.mxd

Legend

- Surface Soil Sample Location
- CL1B Parcel
- Sampling Grid



Key Map
Not to Scale

N

NAD 1983 StatePlane Maryland
Projection: Lambert Conformal Conic
Linear Unit: US Foot

Data Sources:
Aerial Photography - Aerials Express 2005
URS Corporation

0 250 500 1,000 Feet

1 inch = 500 feet

(when printed at 11x17)

URS

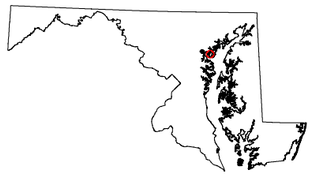
Figure 5
County Lands Parcel 1B
Surface Soil Sampling Locations

Severstal Sparrows Point
Sparrows Point, Maryland

Prepared By: BAB/RRM	Checked By: MR/CC
Job: 15302184.00002	Map: \\GIS_Data\MTTALSTEEL\Projects\Mittal Steel Samples CLP1B Figure 5.mxd

Legend

- Surface Soil Sample Location
- Mud Reservoir
- Sampling Grid



Key Map
Not to Scale

N

NAD 1983 StatePlane Maryland
Projection: Lambert Conformal Conic
Linear Unit: US Foot

Data Sources:
Aerial Photography - Aerials Express 2005
URS Corporation

0 100 200 400
Feet

1 inch = 200 feet

(when printed at 11x17)

URS

Figure 6
Mud Reservoir
Surface Soil Sampling Locations

Severstal Sparrows Point
Sparrows Point, Maryland

Prepared By: BAB/RRM	Checked By: MR/CC
Job: 15302184.00002	Map: \\GIS_Data\MTTALSTEEL\Projects\Mittal Steel Samples Mud Reservior Figure 6.mxd

Legend

- Surface Soil Sample Location
- Former East Pond SWMU

Key Map
Not to Scale

N

NAD 1983 StatePlane Maryland
Projection: Lambert Conformal Conic
Linear Unit: US Foot

Data Sources:
Aerial Photography - Aerials Express 2005
URS Corporation

0 87.5 175 350
Feet

1 inch = 175 feet

(when printed at 11x17)

URS

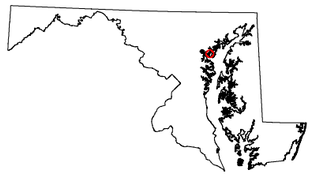
Figure 7
Former East Pond
Surface Soil Sampling Locations

Severstal Sparrows Point
Sparrows Point, Maryland

Prepared By: BAB/RRM	Checked By: MR/CC
Job: 15302184.00002	Map: \\GIS_Data\MTTALSTEEL\Projects\Mittal Steel Samples Frmr East Pond Figure 7.mxd

Legend

- Sediment/Surface Water Sample Location
- Greys Landfill SSA
- Knobby's Ditch Head Pond



Key Map
Not to Scale

N

NAD 1983 StatePlane Maryland
Projection: Lambert Conformal Conic
Linear Unit: US Foot

Data Sources:
Aerial Photography - Aerials Express 2005
URS Corporation

0 75 150 300 Feet

1 inch = 150 feet

(when printed at 11x17)

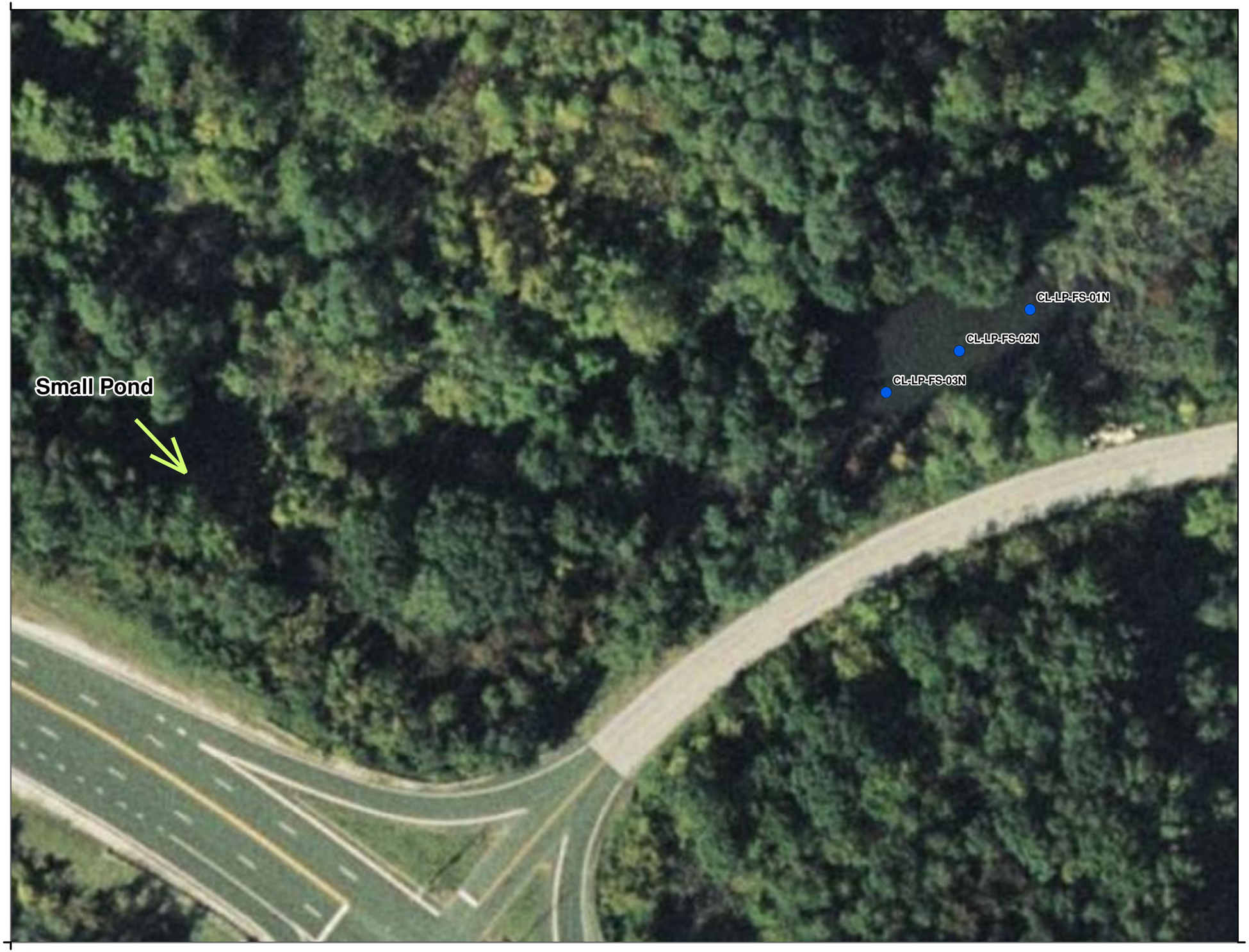
URS

Figure 8
Knobby's Ditch Head Pond
Sediment and Surface Water Sampling Locations

Severstal Sparrows Point
Sparrows Point, Maryland

Prepared By: PLJ	Checked By: MR/CC
Job: 15302184.00002	Map: \\GIS_Data\MTTALSTEEL\Projects\Mittal Steel Samples Knobbys Ditch Figure 8.mxd

1460718



Legend

- Large Pond Sediment/Surface Water Sample Location

Note: Small pond not visible due to its size & heavy tree cover.

Key Map
Not to Scale

N

NAD 1983 StatePlane Maryland
Projection: Lambert Conformal Conic
Linear Unit: US Foot

Data Sources -
Imagery provided by Bing Maps
URS Corporation

0 25 50 100 Feet

1 inch = 50 feet
(when printed at 11x17)

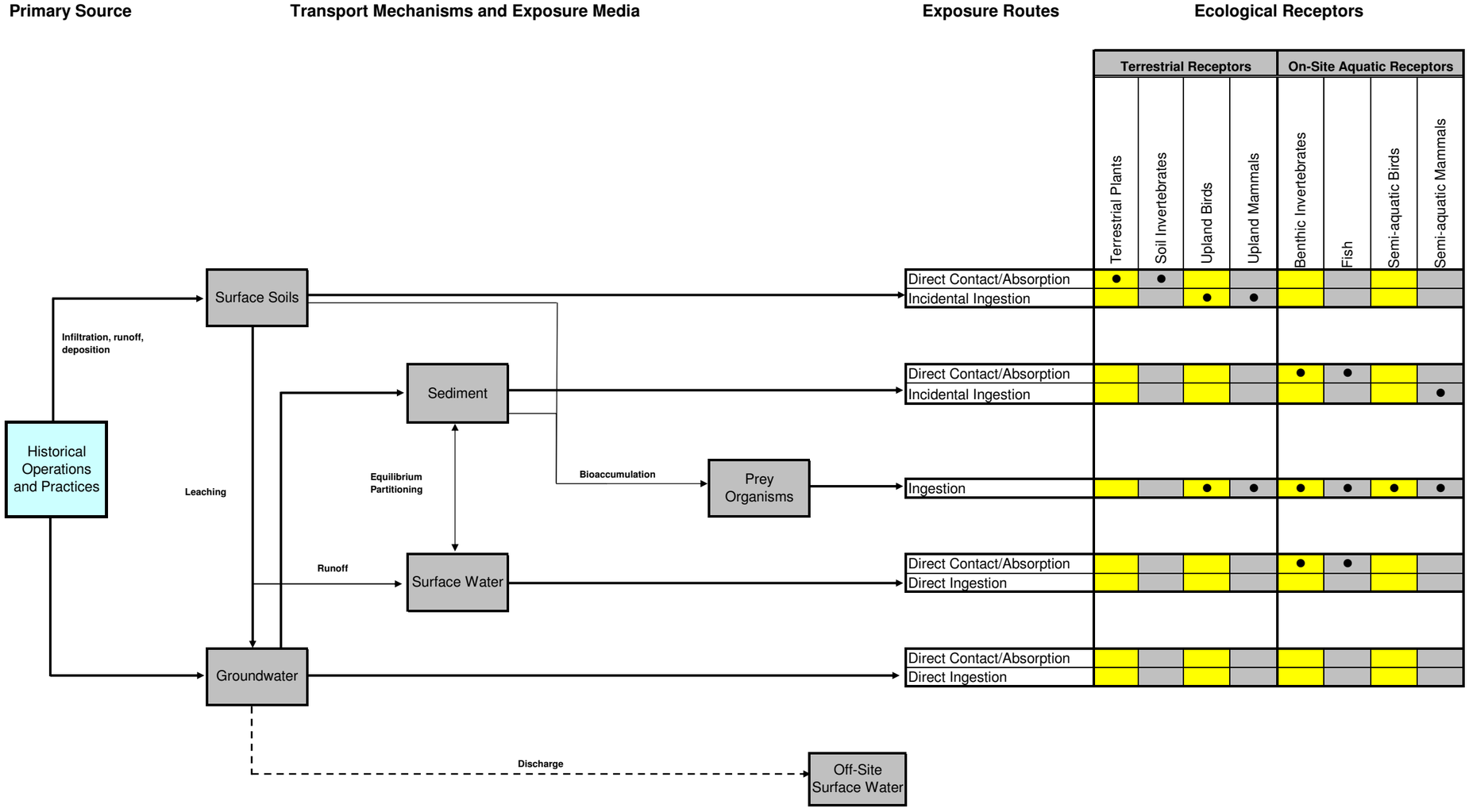
URS

Figure 9
County Lands Parcel 1B
Locations of Small and Large Ponds

Severstal Sparrows Point
Sparrows Point, Maryland

Prepared By: PLJ	Checked By: MR
Job: 15302184.00002	Map: \\GIS_Data\MTTALSTEEL\Projects\Mittal Steel Ponds.mxd

1460718



LEGEND:

● = POTENTIALLY COMPLETE EXPOSURE PATHWAY

BLANK CELL = INCOMPLETE OR INSIGNIFICANT PATHWAY; DOES NOT CONTRIBUTE TO POTENTIAL SITE RISK SINCE RECEPTOR'S DOSE IS MINIMAL OR RECEPTOR DOES NOT COME IN CONTACT WITH AFFECTED MEDIA

- - - - - - = OFF-SITE MIGRATION PATHWAY (NOT EVALUATED IN THIS BERA)

FIGURE 10
ECOLOGICAL CONCEPTUAL SITE MODEL
Severstal Sparrows Point Site
Sparrows Point, Maryland

Legend

- Surface Soil Sample Location
- Humphrey Impoundment SSA

Key Map
Not to Scale

N

NAD 1983 StatePlane Maryland
Projection: Lambert Conformal Conic
Linear Unit: US Foot

Data Sources:
Aerial Photography - Aerials Express 2005
URS Corporation

Note: Concentrations shown in mg/kg.

0 125 250 500 Feet

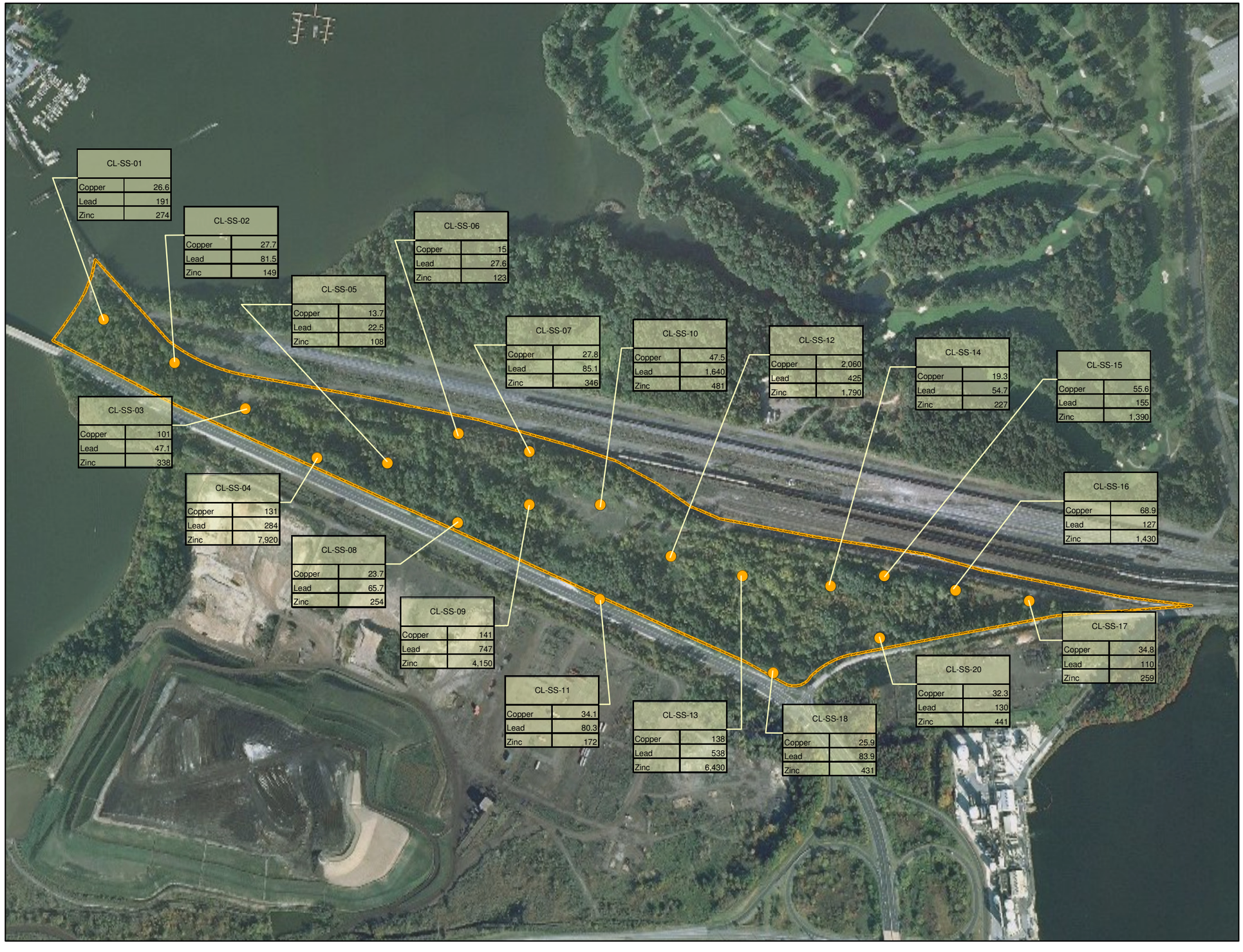
1 inch = 250 feet
(when printed at 11x17)

URS

Figure 11
Humphrey Impoundment
Chemical Concentrations of
Risk Drivers

Severstal Sparrows Point
Sparrows Point, Baltimore County, Maryland

Prepared By:PLJ	Checked By: MR/CC
Job: 13810877.00004	Q:\GIS_Data\MTTALSTEEL\Projects\BERA Mittal Steel Chem Conc Hmphry Imp Figure 11.mxd



Legend

- Surface Soil Sample Location
- CL1B Parcel

Key Map
Not to Scale

N

NAD 1983 StatePlane Maryland
Projection: Lambert Conformal Conic
Linear Unit: US Foot

Data Sources:
Aerial Photography - Aerials Express 2005
URS Corporation

Note: Concentrations shown in mg/kg.

0 250 500 1,000 Feet

1 inch = 500 feet

(when printed at 11x17)

URS

Figure 12
County Lands Parcel 1B
Chemical Concentrations of Risk Drivers

Severstal Sparrows Point
Sparrows Point, Maryland

Prepared By: PLJ	Checked By: MR/CC
Job: 15302184.00002	Map: \\GIS_Data\MTTALSTEEL\Projects\Mittal Steel Chem Conc CLP1B Figure 12.mxd

Legend

- Surface Soil Sample Location
- Mud Reservoir

Key Map
Not to Scale

N

NAD 1983 StatePlane Maryland
Projection: Lambert Conformal Conic
Linear Unit: US Foot

Data Sources:
Aerial Photography - Aerials Express 2005
URS Corporation

Note: Concentrations shown in mg/kg.

0 100 200 400 Feet

1 inch = 200 feet
(when printed at 11x17)

URS

Figure 13
Mud Reservoir
Chemical Concentrations of Risk Drivers

Severstal Sparrows Point
Sparrows Point, Maryland

Prepared By: PLJ	Checked By: MR/CC
Job: 15302184.00002	Q:\GIS_Data\MTTALSTEEL\Projects\BERA \Mittal Steel Chem Conc Mud Reservoir Figure 13.mxd

Legend

- Surface Soil Sample Location
- Former East Pond SWMU

Key Map
Not to Scale

N

NAD 1983 StatePlane Maryland
Projection: Lambert Conformal Conic
Linear Unit: US Foot

Data Sources:
Aerial Photography - Aerials Express 2005
URS Corporation

Note: Concentrations in mg/kg.

0 87.5 175 350 Feet

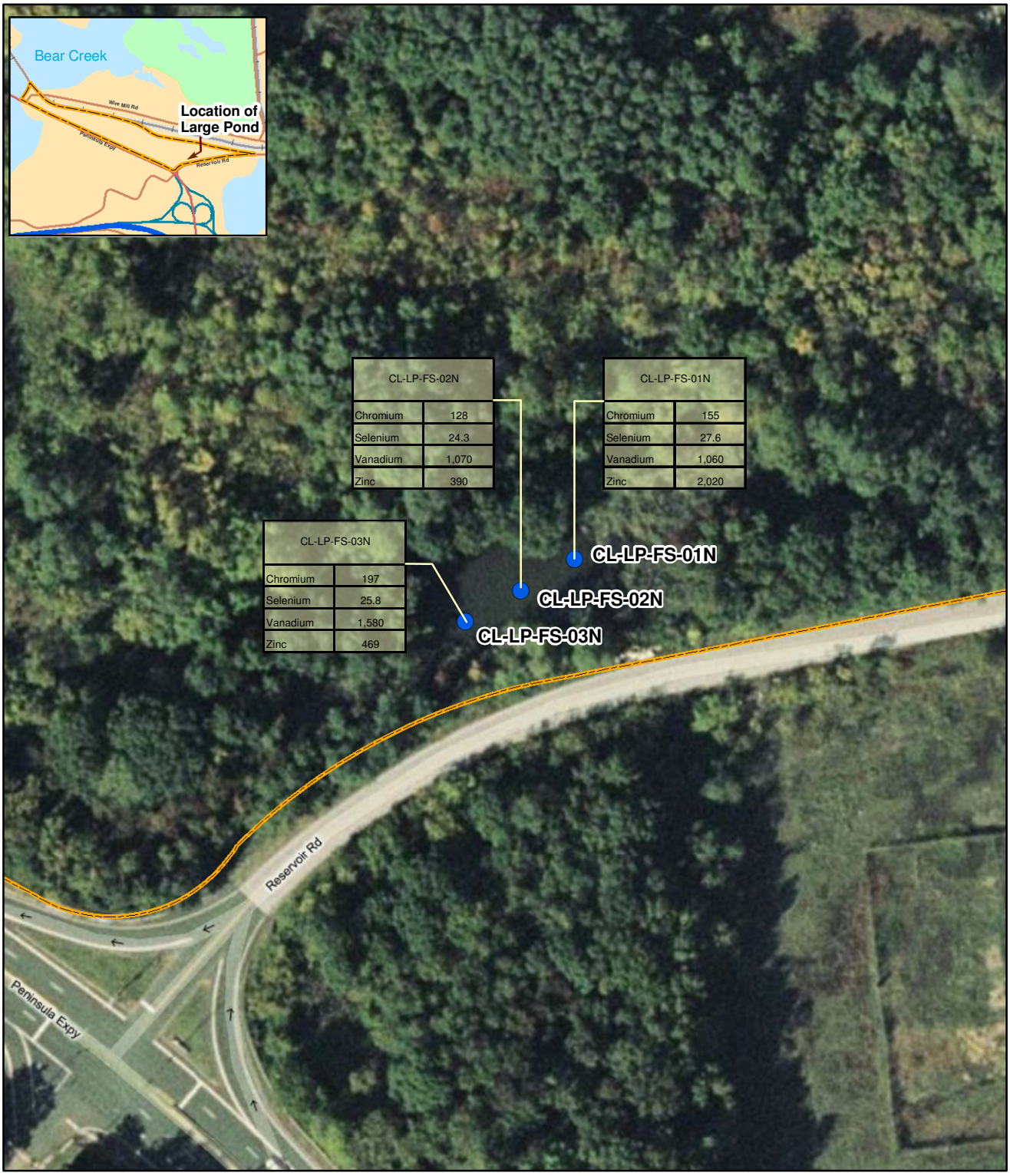
1 inch = 175 feet
(when printed at 11x17)

URS

Figure 14
Former East Pond
Chemical Concentrations of Risk Drivers

Severstal Sparrows Point
Sparrows Point, Maryland

Prepared By: PLJ	Checked By: MR/CC
Job: 15302184.00002	Q:\GIS_Data\MTTALSTEEL\Projects\BERA \Mittal Steel Chem Conc Frmr East Pond Figure 14.mxd



Legend

- Sediment/Surface Water Sample Location
- CL1B Parcel

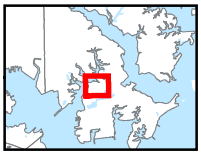
0 50 100 200 Feet

1 inch = 100 feet

(when printed at 8.5x11)

Reference:
Imagery provided by Bing Maps

NAD 1983 StatePlane Maryland
Projection: Lambert Conformal Conic
Linear Unit: US Foot



Note: Sampling locations are approximated and based on imagery. Sediment concentrations are shown in mg/kg.

URS

335 Commerce Drive, Suite 300
Fort Washington, PA 19034
Phone: (215) 367-2500 Fax: (215) 367-1000

Job:	15302184.00002
Prepared by:	PLJ
Checked by:	MR
Date:	07-09-2010

Figure 15
County Lands Parcel 1B-Large Pond
Chemical Concentrations of Risk Drivers
Severstal Sparrows Point
Sparrows Point, Maryland

O:\GIS_Data\MTTALSTEEL\Projects\BERA\Mittal Steel Chem Conc Large Pond Figure 15.mxd

Legend

- Sediment/Surface Water Sample Location
- CL1B Parcel

0 125 250 500 Feet

1 inch = 250 feet

(when printed at 8.5x11)

Reference:
Imagery obtained via field review

NAD 1983 StatePlane Maryland
Projection: Lambert Conformal Conic
Linear Unit: US Foot

Note: Sampling locations are approximated and based on imagery. Sediment concentrations are shown in mg/kg.

URS
335 Commerce Drive, Suite 300
Fort Washington, PA 19034
Phone: (215) 367-2500 Fax: (215) 367-1000

Job: 15302184.00002

Prepared by: PLJ

Checked by: MR

Date: 07/08/2010

Figure 16
County Lands Parcel 1B-Small Pond
Chemical Concentrations of Risk Drivers
Severstal Sparrows Point
Sparrows Point, Maryland

O:\GIS_Data\MTTALSTEEL\Projects\BERA\Mittal Steel Chem Conc Small Pond Figure 16.mxd

Appendix A

Photographic Log

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Severstal	Sparrows Point, Maryland	15302184

Photo No.	Date:
1	5/10/05

Direction Photo Taken:

South

Description:

Humphrey Impoundment. Note the dense growth of common reed (*Phragmites australis*).

Photo No.	Date:
2	9/27/07

Direction Photo Taken:

Southwest

Description:

Humphrey Impoundment common reed community, with peripheral vegetation in foreground.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Severstal	Sparrows Point, Maryland	15302184

Photo No.	Date:
3	9/27/07

Direction Photo Taken:

Description:

Mature common reed plants in Humphrey Impoundment.

Photo No.	Date:
4	9/27/07

Direction Photo Taken:

Southeast

Description:
Humphrey Impoundment – peripheral vegetation. Note dense woody growth and overstory.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Severstal	Sparrows Point, Maryland	15302184

Photo No.	Date:
5	9/27/07

Direction Photo Taken:

East

Description:

Humphrey Impoundment – peripheral woody and herbaceous vegetation.

Photo No.	Date:
6	9/27/07

Direction Photo Taken:

Southeast

Description:

Mud Reservoir. Note dense area of common reed and woodlands beyond non-vegetated area.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Severstal	Sparrows Point, Maryland	15302184

Photo No.	Date:
7	9/27/07

Direction Photo Taken:

East

Description:

Mud Reservoir. Note lush growth of common reed and fringe woody and herbaceous vegetation.

Photo No.	Date:
8	9/27/07

Direction Photo Taken:

Description:

Mud Reservoir. Wooded community in interior of study area adjacent to non-vegetated area.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Severstal	Sparrows Point, Maryland	15302184

Photo No.	Date:
9	9/27/07

Direction Photo Taken:

East

Description:

Mud Reservoir. Common reed community beneath highway overpass.

Photo No.	Date:
10	9/27/07

Direction Photo Taken:

East

Description:

Former East Pond. Note dense common reed and poison ivy (*Toxicodendron radicans)* in foreground.

URS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Severstal	Sparrows Point, Maryland	15302184

Photo No.	Date:
11	9/27/07

Direction Photo Taken:

Northeast

Description:

Former East Pond. Herbaceous vegetation with few canopy trees present.

Photo No.	Date:
12	9/27/07

Direction Photo Taken:

East

Description:

Former East Pond. Mature common reed plants.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Severstal	Sparrows Point, Maryland	15302184

Photo No. 13	Date: 9/27/07

Direction Photo Taken:

Description:

CL1B. Canopy and understory vegetation is abundant and diverse in this parcel.

Photo No. 14	Date: 9/27/07

Direction Photo Taken:

West

Description:

CL1B. Note dense herbaceous layer and diverse overstory.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Severstal	Sparrows Point, Maryland	15302184

Photo No.	Date:
15	9/27/07

Direction Photo Taken:

East

Description:

CL1B. Tree-of-heaven (*Ailanthus altissima*), poison ivy, and various grasses along southcentral periphery.

Photo No.	Date:
16	9/27/07

Direction Photo Taken:

Description:

CL1B. Dense vegetation in interior portion of western portion of parcel.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Severstal	Sparrows Point, Maryland	15302184

Photo No.	Date:
17	4/26/07

Direction Photo Taken:

Northeast

Description:

Western portion of CL1B Large Pond. Invertebrates and a limited fish community (eastern mosquitofish) inhabit this pond.

Photo No.	Date:
18	4/26/07

Direction Photo Taken:

Northeast

Description:

Central portion of CL1B Large Pond. Maximum water depth is approximately 3.5 feet in this surface water feature.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Severstal	Sparrows Point, Maryland	15302184

Photo No.	Date:
19	5/12/10

Direction Photo Taken:

East

Description:

CL1B Large Pond. Minimal submerged aquatic vegetation is present in this pond.

Photo No.	Date:
20	5/12/10

Direction Photo Taken:

West

Description:

Dense vegetation in nearshore area of CL1B Large Pond.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Severstal	Sparrows Point, Maryland	15302184

Photo No.	Date:
21	4/26/07

Direction Photo Taken:

Description:

CL1B Small Pond. This pond supports benthic invertebrates, but the physical restraints of the pond (e.g., small size, shallow depth) does not support a fish community here.

Photo No.	Date:
22	5/12/10

Direction Photo Taken:

Description:

Cl1B Small Pond. Algae and submerged aquatic vegetation are present in this pond.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Severstal	Sparrows Point, Maryland	15302184

Photo No.	Date:
23	4/26/07

Direction Photo Taken:

South

Description:

Knobby's Ditch Head Pond. This pond supports a community of fish and benthic invertebrates.

Photo No.	Date:
24	5/12/10

Direction Photo Taken:

Northwest

Description:

Knobby's Ditch Head Pond. Maximum depth in this pond is approximately 6 feet.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Severstal	Sparrows Point, Maryland	15302184

Photo No.	Date:
25	5/12/10

Direction Photo Taken:

South

Description:

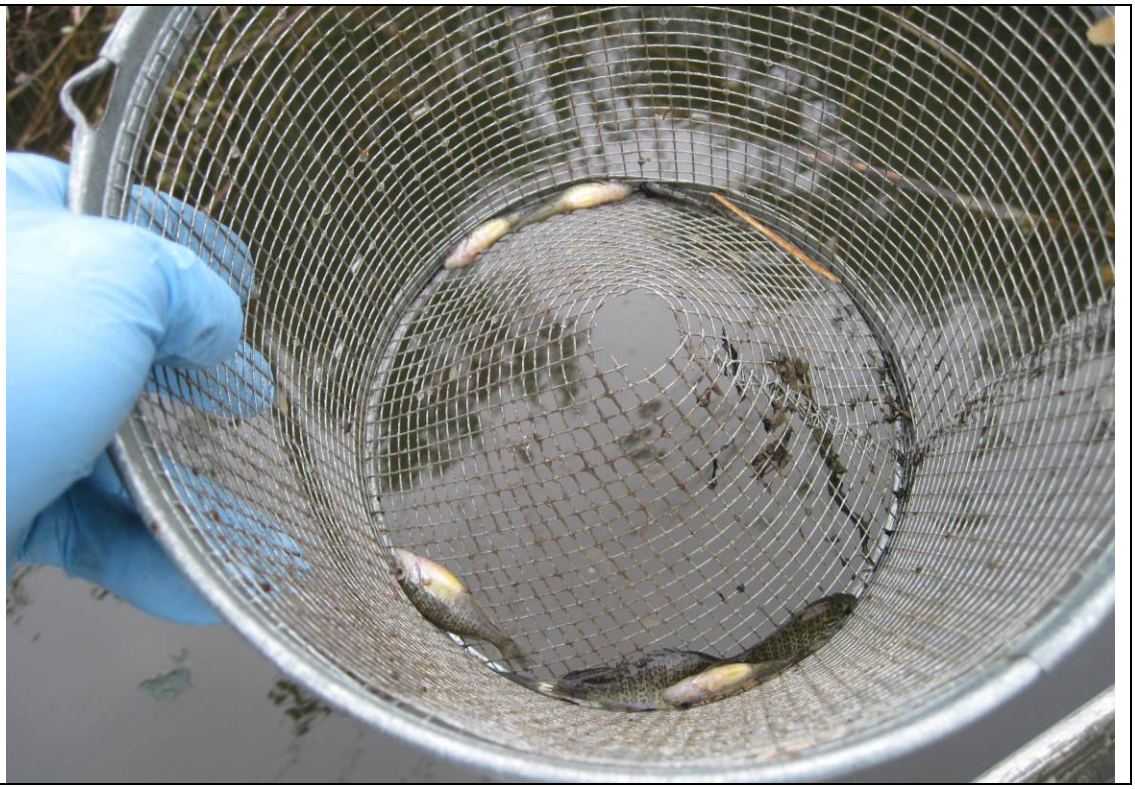
Knobby's Ditch Head Pond. An experimental gill net (along with other methods) was used to assess the pond's fish community.

Photo No.	Date:
26	5/12/10

Direction Photo Taken:

Description:

Redear sunfish (*Lepomis microlophus)* and a banded killifish (*Fundulus diaphanus*) collected from Knobby's Ditch Head Pond using fish traps.



Appendix B

Analytical Data Used in the BERA

Key to Acronyms/Qualifiers:

NA = not available
Qual = validated data qualifier
RL = reporting limit
TOC = total organic carbon
B = The analyte was not detected substantially above the level reported in laboratory or field blanks
J = The analyte was positively detected; the associated numerical value is approximate
K = The analyte was positively detected; the reported value may be biased high
L = The analyte was positively detected; the reported value may be biased low
U = The analyte was not detected above the reporting limit
UJ = The analyte's reporting limit is approximate
UL = The analyte was not detected above the reporting limit; the reporting limit may be biased low
R = Rejected data

TABLE B-1
CL1B LARGE POND SEDIMENT DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-LP-FS-01N			CL-LP-FS-02N			CL-LP-FS-03N		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
Inorganics (mg/kg)										
Antimony	7440-36-0		U	41.9		U	7.4		U	9.7
Arsenic	7440-38-2	12.8	B	41.9	6.6	B	7.4	8.2	B	9.7
Barium	7440-39-3	72.9	B	838	67.5	B	148	68.4	B	194
Beryllium	7440-41-7	21.9		16.8	12		3	13.1		3.9
Cadmium	7440-43-9		U	20.9		U	3.7	0.55	B	4.8
Chromium	7440-47-3	155	J	20.9	128	J	3.7	197	J	4.8
Cobalt	7440-48-4	10.1	B	209	4.1	B	37.1	7	B	48.4
Copper	7440-50-8	48.7	B	105	16.2	B	18.6	24.8		24.2
Cyanide, Total	57-12-5	4	B	4.2	3.6	B	3.7	3.6	B	4.8
Lead	7439-92-1	155		12.6	58.9		2.2	61.2		2.9
Mercury	7439-97-6	0.11	B	0.28	0.082	B	0.24	0.12	B	0.32
Nickel	7440-02-0	44.8	B	168	21.3	B	29.7	33.5	B	38.8
Selenium	7782-49-2	27.6		20.9	24.3		3.7	25.8		4.8
Silver	7440-22-4		U	20.9	1.1	B	3.7		U	4.8
Thallium	7440-28-0		U	41.9		U	7.4		U	9.7
Tin	7440-31-5		U	419	11	B	74.2	14.2	B	96.9
Total Sulfide	18496-25-8	17200		251	7720		223	14000		291
Vanadium	7440-62-2	1060		209	1070		37.1	1580		48.4
Zinc	7440-66-6	2020	J	83.8	390	J	14.8	469	J	19.4
PCBs (ug/kg)										
Aroclor 1016	12674-11-2		U	140		U	120		U	160
Aroclor 1221	11104-28-2		U	140		U	120		U	160
Aroclor 1232	11141-16-5		U	140		U	120		U	160
Aroclor 1242	53469-21-9		U	140		U	120		U	160
Aroclor 1248	12672-29-6		U	140		U	120		U	160
Aroclor 1254	11097-69-1		U	140		U	120		U	160
Aroclor 1260	11096-82-5		U	140		U	120		U	160
VOCs (ug/kg)										
1,1,1,2-Tetrachloroethane	630-20-6		U	140		U	120		U	160
1,1,1-Trichloroethane	71-55-6		U	42		U	37		U	48
1,1,2,2-Tetrachloroethane	79-34-5		U	42		U	37		U	48
1,1,2-Trichloroethane	79-00-5		U	42		U	37		U	48
1,1-Dichloroethane	75-34-3		U	42		U	37		U	48
1,1-Dichloroethene	75-35-4		U	42		U	37		U	48
1,2-Dichloroethane	107-06-2		U	42		U	37		U	48
1,2-Dichloropropane	78-87-5		U	42		U	37		U	48
2-Butanone	78-93-3		U	42		U	37		U	48
2-Hexanone	591-78-6		U	42		U	37		U	48
4-Methyl-2-pentanone	108-10-1		U	42		U	37		U	48
Acetone	67-64-1		U	170	83	J	150	91	J	190
Benzene	71-43-2		U	42		U	37		U	48
Bromoform	75-25-2		U	42		U	37		U	48
Carbon disulfide	75-15-0		U	42		U	37		U	48
Carbon tetrachloride	56-23-5		U	42		U	37		U	48
Chlorobenzene	108-90-7		U	42		U	37		U	48
Chloroethane	75-00-3		U	42		U	37		U	48
Chloroform	67-66-3		U	42		U	37		U	48
cis-1,3-Dichloropropene	10061-01-5		U	42		U	37		U	48
Ethylbenzene	100-41-4		U	42		U	37		U	48
Methylene chloride	75-09-2	7	J B	42		U	37		U	48
Tetrachloroethene	127-18-4		U	42		U	37		U	48
Toluene	108-88-3		U	42		U	37		U	48
trans-1,2-Dichloroethene	156-60-5		U	42		U	37		U	48
trans-1,3-Dichloropropene	10061-02-6		U	42		U	37		U	48
Trichloroethene	79-01-6		U	42		U	37		U	48
Vinyl chloride	75-01-4		U	42		U	37		U	48
Xylenes (total)	1330-20-7		U	130		U	110		U	150

TABLE B-1
CL1B LARGE POND SEDIMENT DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-LP-FS-01N			CL-LP-FS-02N			CL-LP-FS-03N		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
PAHs (ug/kg)										
2-Methylnaphthalene	91-57-6		U	560		U	500		U	640
Acenaphthene	83-32-9		U	560		U	500		U	640
Acenaphthylene	208-96-8		U	560		U	500		U	640
Anthracene	120-12-7		U	560		U	500		U	640
Benzo(a)anthracene	56-55-3		U	560		U	500		U	640
Benzo(a)pyrene	50-32-8		U	560		U	500		U	640
Benzo(b)fluoranthene	205-99-2	120	J	560	120	J	500	140	J	640
Benzo(ghi)perylene	191-24-2		U	560		U	500		U	640
Benzo(k)fluoranthene	207-08-9		U	560		U	500		U	640
Chrysene	218-01-9		U	560		U	500		U	640
Dibenz(a,h)anthracene	53-70-3		U	560		U	500		U	640
Fluoranthene	206-44-0		U	560		U	500		U	640
Fluorene	86-73-7		U	560		U	500		U	640
Indeno(1,2,3-cd)pyrene	193-39-5		U	560		U	500		U	640
Naphthalene	91-20-3		U	560		U	500		U	640
Phenanthrene	85-01-8		U	560		U	500		U	640
Pyrene	129-00-0		U	560		U	500		U	640
Other SVOCs (ug/kg)										
1,2,4-Trichlorobenzene	120-82-1		U	560		U	500		U	640
1,2-Dichlorobenzene	95-50-1		U	560		U	500		U	640
1,3-Dichlorobenzene	541-73-1		U	560		U	500		U	640
1,4-Dichlorobenzene	106-46-7		U	560		U	500		U	640
2,2'-oxybis(1-Chloropropane)	108-60-1		U	560		U	500		U	640
2,4,5-Trichlorophenol	95-95-4		U	2700		U	2400		U	3200
2,4,6-Trichlorophenol	88-06-2		U	2700		U	2400		U	3200
2,4-Dichlorophenol	120-83-2		U	560		U	500		U	640
2,4-Dimethylphenol	105-67-9		U	2700		U	2400		U	3200
2,4-Dinitrophenol	51-28-5		U	14000		U	13000		U	16000
2,4-Dinitrotoluene	121-14-2		U	2700		U	2400		U	3200
2,6-Dinitrotoluene	606-20-2		U	2700		U	2400		U	3200
2-Chloronaphthalene	91-58-7		U	560		U	500		U	640
2-Chlorophenol	95-57-8		U	2700		U	2400		U	3200
2-Methylphenol	95-48-7		U	2700		U	2400		U	3200
2-Nitrophenol	88-75-5		U	2700		U	2400		U	3200
3,3'-Dichlorobenzidine	91-94-1		U	2700		U	2400		U	3200
3,3'-Dimethylbenzidine	119-93-7		U	14000		U	13000		U	16000
3-Methylphenol & 4-Methylphenol	MEPH1314		U	2700		U	2400		U	3200
4,6-Dinitro-2-methylphenol	534-52-1		U	14000		U	13000		U	16000
4-Bromophenyl phenyl ether	101-55-3		U	2700		U	2400		U	3200
4-Chloro-3-methylphenol	59-50-7		U	2700		U	2400		U	3200
4-Chlorophenyl phenyl ether	7005-72-3		U	2700		U	2400		U	3200
4-Nitrophenol	100-02-7		U	14000		U	13000		U	16000
bis(2-Chloroethoxy)methane	111-91-1		U	2700		U	2400		U	3200
bis(2-Chloroethyl) ether	111-44-4		U	560		U	500		U	640
bis(2-Ethylhexyl) phthalate	117-81-7		U	2700		U	2400		U	3200
Butyl benzyl phthalate	85-68-7		U	2700		U	2400		U	3200
Dibenzofuran	132-64-9		U	2700		U	2400		U	3200
Diethyl phthalate	84-66-2		U	2700		U	2400		U	3200
Dimethyl phthalate	131-11-3		U	2700		U	2400		U	3200
Di-n-butyl phthalate	84-74-2		U	2700		U	2400		U	3200
Di-n-octyl phthalate	117-84-0		U	2700		U	2400		U	3200
Hexachlorobenzene	118-74-1		U	560		U	500		U	640
Hexachlorobutadiene	87-68-3		U	560		U	500		U	640
Hexachlorocyclopentadiene	77-47-4		U	2700		U	2400		U	3200
Hexachloroethane	67-72-1		U	2700		U	2400		U	3200
Isophorone	78-59-1		U	2700		U	2400		U	3200
Nitrobenzene	98-95-3		U	560		U	500		U	640
Pentachloroethane	76-01-7		U	2800		U	2500		U	3200

TABLE B-1
CL1B LARGE POND SEDIMENT DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-LP-FS-01N			CL-LP-FS-02N			CL-LP-FS-03N		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
Pentachlorophenol	87-86-5		U	2700		U	2400		U	3200
Phenol	108-95-2		U	560		U	500		U	640
Pyridine	110-86-1		U	2700		U	2400		U	3200
Other										
TOC (mg/kg)	7440-44-0	43000		14300	34000	B	35700	34600	B	9610

TABLE B-2
CL1B PARCEL LARGE POND SURFACE WATER DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

		CL-LP-SW-01N			CL-LP-SW-02N			CL-LP-SW-03N		
Constituent	**CAS #**	**Result**	**Qual**	**RL**	**Result**	**Qual**	**RL**	**Result**	**Qual**	**RL**
Inorganics (ug/L)										
Antimony, Dissolved	7440-36-0		U	10		U	10		U	10
Arsenic, Dissolved	7440-38-2		U	10		U	10		U	10
Barium, Dissolved	7440-39-3	41.9	B	200	57.5	B	200	42.3	B	200
Beryllium, Dissolved	7440-41-7		U	4		U	4		U	4
Cadmium, Dissolved	7440-43-9		U	5		U	5		U	5
Chromium, Dissolved	7440-47-3		U	5		U	5		U	5
Cobalt, Dissolved	7440-48-4	5.8	B	50	2.4	B	50		U	50
Copper, Dissolved	7440-50-8	1.5	B J	25	0.93	B J	25	1.4	B J	25
Lead, Dissolved	7439-92-1		U	3		U	3		U	3
Mercury, Dissolved	7439-97-6	0.089	B J	0.2	0.1	B J	0.2	0.08	B J	0.2
Nickel, Dissolved	7440-02-0	1.4	B	40		U	40		U	40
Selenium, Dissolved	7782-49-2		U	5	4.5	B	5		U	5
Silver, Dissolved	7440-22-4		U	5	0.65	B	5		U	5
Thallium, Dissolved	7440-28-0		U	10		U	10		U	10
Tin, Dissolved	7440-31-5		U	100		U	100		U	100
Vanadium, Dissolved	7440-62-2	5	B	50	10.2	B	50	4.9	B	50
Zinc, Dissolved	7440-66-6	9	B J	20	6.8	B J	20	7.1	B J	20
Antimony, Total	7440-36-0		U	10		U	10		U	10
Arsenic, Total	7440-38-2		U	10		U	10		U	10
Barium, Total	7440-39-3	44.1	B	200	67.9	B	200	45.8	B	200
Beryllium, Total	7440-41-7		U	4		U	4		U	4
Cadmium, Total	7440-43-9		U	5		U	5		U	5
Chromium, Total	7440-47-3	1.8	B	5	2.5	B	5		U	5
Cobalt, Total	7440-48-4		U	50		U	50		U	50
Copper, Total	7440-50-8	1	B	25	1.2	B	25	0.96	B	25
Cyanide, Total	57-12-5		U	10	2.6	B	10		U	10
Lead, Total	7439-92-1		U	3		U	3		U	3
Mercury, Total	7439-97-6		U	0.2		U	0.2		U	0.2
Nickel, Total	7440-02-0	1.3	B	40	1.9	B	40		U	40
Selenium, Total	7782-49-2	2.8	B	5	4.1	B	5	2.7	B	5
Silver, Total	7440-22-4		U	5	1.1	B	5		U	5
Thallium, Total	7440-28-0		U	10		U	10		U	10
Tin, Total	7440-31-5		U	100		U	100		U	100
Total Sulfide, Total	18496-25-8		U	3		U	3		U	3
Vanadium, Total	7440-62-2	14.8	B	50	19.6	B	50	7.7	B	50
Zinc, total	7440-66-6	5.9	B J	20	10.3	B J	20	8.5	B J	20
PCBs (ug/L)										
Aroclor 1016	12674-11-2		U	0.41		U	0.41		U	0.41
Aroclor 1221	11104-28-2		U	0.41		U	0.41		U	0.41
Aroclor 1232	11141-16-5		U	0.41		U	0.41		U	0.41
Aroclor 1242	53469-21-9		U	0.41		U	0.41		U	0.41
Aroclor 1248	12672-29-6		U	0.41		U	0.41		U	0.41
Aroclor 1254	11097-69-1		U	0.41		U	0.41		U	0.41
Aroclor 1260	11096-82-5		U	0.41		U	0.41		U	0.41
VOCs (ug/L)										
1,1,1,2-Tetrachloroethane	630-20-6		U	1		U	1		U	1
1,1,1-Trichloroethane	71-55-6		U	1		U	1		U	1
1,1,2,2-Tetrachloroethane	79-34-5		U	1		U	1		U	1
1,1,2-Trichloroethane	79-00-5		U	1		U	1		U	1
1,1-Dichloroethane	75-34-3		U	1		U	1		U	1
1,1-Dichloroethene	75-35-4		U	1		U	1		U	1
1,2-Dichloroethane	107-06-2		U	1		U	1		U	1
1,2-Dichloropropane	78-87-5		U	1		U	1		U	1

TABLE B-2
CL1B PARCEL LARGE POND SURFACE WATER DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

		CL-LP-SW-01N			CL-LP-SW-02N			CL-LP-SW-03N		
Constituent	**CAS #**	**Result**	**Qual**	**RL**	**Result**	**Qual**	**RL**	**Result**	**Qual**	**RL**
2-Butanone	78-93-3		U	5	1.6	J	5	1.1	J	5
2-Hexanone	591-78-6		U	5		U	5		U	5
4-Methyl-2-pentanone	108-10-1		U	5		U	5		U	5
Acetone	67-64-1	7.4		5	7.7		5	5.5		5
Benzene	71-43-2		U	1		U	1		U	1
Bromoform	75-25-2		U	1		U	1		U	1
Carbon disulfide	75-15-0		U	1		U	1		U	1
Carbon tetrachloride	56-23-5		U	1		U	1		U	1
Chlorobenzene	108-90-7		U	1		U	1		U	1
Chloroethane	75-00-3		U	1		U	1		U	1
Chloroform	67-66-3		U	1		U	1		U	1
cis-1,3-Dichloropropene	10061-01-5		U	1		U	1		U	1
Ethylbenzene	100-41-4		U	1		U	1		U	1
Methylene chloride	75-09-2		U	1		U	1		U	1
Tetrachloroethene	127-18-4		U	1		U	1		U	1
Toluene	108-88-3		U	1	0.25	J	1		U	1
trans-1,2-Dichloroethene	156-60-5		U	1		U	1		U	1
trans-1,3-Dichloropropene	10061-02-6		U	1		U	1		U	1
Trichloroethene	79-01-6		U	1		U	1		U	1
Vinyl chloride	75-01-4		U	1		U	1		U	1
Xylenes (total)	1330-20-7		U	3		U	3		U	3
PAHs (ug/L)										
2-Methylnaphthalene	91-57-6		U	2.1		U	2.2		U	2.2
Acenaphthene	83-32-9		U	2.1		U	2.2		U	2.2
Acenaphthylene	208-96-8		U	2.1		U	2.2		U	2.2
Anthracene	120-12-7		U	2.1		U	2.2		U	2.2
Benzo(a)anthracene	56-55-3		U	2.1		U	2.2		U	2.2
Benzo(a)pyrene	50-32-8		U	2.1		U	2.2		U	2.2
Benzo(b)fluoranthene	205-99-2		U	2.1		U	2.2		U	2.2
Benzo(ghi)perylene	191-24-2		U	2.1		U	2.2		U	2.2
Benzo(k)fluoranthene	207-08-9		U	2.1		U	2.2		U	2.2
Chrysene	218-01-9		U	2.1		U	2.2		U	2.2
Dibenz(a,h)anthracene	53-70-3		U	2.1		U	2.2		U	2.2
Fluoranthene	206-44-0		U	2.1		U	2.2		U	2.2
Fluorene	86-73-7		U	2.1		U	2.2		U	2.2
Indeno(1,2,3-cd)pyrene	193-39-5		U	2.1		U	2.2		U	2.2
Naphthalene	91-20-3		U	2.1		U	2.2		U	2.2
Phenanthrene	85-01-8		U	2.1		U	2.2		U	2.2
Pyrene	129-00-0		U	2.1		U	2.2		U	2.2
Other SVOCs (ug/L)										
1,2,4-Trichlorobenzene	120-82-1		U	2.1		U	2.2		U	2.2
1,2-Dichlorobenzene	95-50-1		U	2.1		U	2.2		U	2.2
1,3-Dichlorobenzene	541-73-1		U	2.1		U	2.2		U	2.2
1,4-Dichlorobenzene	106-46-7		U	2.1		U	2.2		U	2.2
2,2'-oxybis(1-Chloropropane)	108-60-1		U	2.1		U	2.2		U	2.2
2,4,5-Trichlorophenol	95-95-4		U	10		U	11		R	11
2,4,6-Trichlorophenol	88-06-2		U	10		U	11		R	11
2,4-Dichlorophenol	120-83-2		U	2.1		U	2.2		R	2.2
2,4-Dimethylphenol	105-67-9		U	10		U	11		R	11
2,4-Dinitrophenol	51-28-5		U	52		U	56		R	56
2,4-Dinitrotoluene	121-14-2		U	10		U	11		U	11
2,6-Dinitrotoluene	606-20-2		U	10		U	11		U	11
2-Chloronaphthalene	91-58-7		U	2.1		U	2.2		U	2.2
2-Chlorophenol	95-57-8		U	10		U	11		R	11

TABLE B-2
CL1B PARCEL LARGE POND SURFACE WATER DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-LP-SW-01N			CL-LP-SW-02N			CL-LP-SW-03N		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
2-Methylphenol	95-48-7		U	10		U	11		R	11
2-Nitrophenol	88-75-5		U	10		U	11		R	11
3,3'-Dichlorobenzidine	91-94-1		U	10		U	11		U	11
3,3'-Dimethylbenzidine	119-93-7		U	100		U	110		U	110
3-Methylphenol & 4-Methylphenol	MEPH1314		U	10		U	11		R	11
4,6-Dinitro-2-methylphenol	534-52-1		U	52		U	56		R	56
4-Bromophenyl phenyl ether	101-55-3		U	10		U	11		U	11
4-Chloro-3-methylphenol	59-50-7		U	10		U	11		R	11
4-Chlorophenyl phenyl ether	7005-72-3		U	10		U	11		R	11
4-Nitrophenol	100-02-7		U	52		U	56		R	56
bis(2-Chloroethoxy)methane	111-91-1		U	10		U	11		U	11
bis(2-Chloroethyl) ether	111-44-4		U	2.1		U	2.2		U	2.2
bis(2-Ethylhexyl) phthalate	117-81-7		U	10		U	11		U	11
Butyl benzyl phthalate	85-68-7		U	10		U	11		U	11
Dibenzofuran	132-64-9		U	10		U	11		U	11
Diethyl phthalate	84-66-2		U	10		U	11		U	11
Dimethyl phthalate	131-11-3		U	10		U	11		U	11
Di-n-butyl phthalate	84-74-2		U	10		U	11		U	11
Di-n-octyl phthalate	117-84-0		U	10		U	11		U	11
Hexachlorobenzene	118-74-1		U	2.1		U	2.2		U	2.2
Hexachlorobutadiene	87-68-3		U	2.1		U	2.2		U	2.2
Hexachlorocyclopentadiene	77-47-4		U	10		U	11		U	11
Hexachloroethane	67-72-1		U	10		U	11		U	11
Isophorone	78-59-1		U	10		U	11		U	11
Pentachloroethane	76-01-7		U	21		U	22		U	22
Pentachlorophenol	87-86-5		U	10		U	11		R	11
Phenol	108-95-2		U	2.1		U	2.2		U	2.2
Pyridine	110-86-1		U	10		U	11		U	11
Other (mg/L)										
Hardness, as CaCO3	HARDNESS	282		5	372		10	296		5

TABLE B-3
CL1B PARCEL SMALL POND SEDIMENT DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-FS-02			CL-SP-FS-01		
		Result	Qual	RL	Result	Qual	RL
Inorganics (mg/kg)							
Antimony	7440-36-0	1.2		7.8		U	5.1
Arsenic	7440-38-2	29.1		7.8	14		5.1
Barium	7440-39-3	167		156	82.5	B	102
Beryllium	7440-41-7	1.2		3.1	1.2	B	2
Cadmium	7440-43-9	191		3.9	68.2		2.5
Chromium	7440-47-3	36.3		3.9	53	J	2.5
Cobalt	7440-48-4	9.4		39.1	8.8	B	25.4
Copper	7440-50-8	277		19.6	231		12.7
Cyanide, Total	57-12-5	417		97.8	3.8		2.5
Lead	7439-92-1	115		2.3	116		1.5
Mercury	7439-97-6	0.2		0.26	0.28		0.17
Nickel	7440-02-0	24.4		31.3	26.7		20.4
Selenium	7782-49-2	114		3.9	74		2.5
Silver	7440-22-4	1.7	L	3.9	2.2	B	2.5
Thallium	7440-28-0	4		7.8	5.1	J	5.1
Tin	7440-31-5	17.4		78.2	19	B	50.9
Total Sulfide	18496-25-8	22200		235	4720		153
Vanadium	7440-62-2	50		39.1	51.9		25.4
Zinc	7440-66-6	22400		78.2	14500	J	102
PCBs (ug/kg)							
Aroclor 1016	12674-11-2		U	130		U	85
Aroclor 1221	11104-28-2		U	130		U	85
Aroclor 1232	11141-16-5		U	130		U	85
Aroclor 1242	53469-21-9		U	130		U	85
Aroclor 1248	12672-29-6		U	130		U	85
Aroclor 1254	11097-69-1		U	130		U	85
Aroclor 1260	11096-82-5	44		130		U	85
VOCs (ug/kg)							
1,1,1,2-Tetrachloroethane	630-20-6		U	39		U	25
1,1,1-Trichloroethane	71-55-6		U	39		U	25
1,1,2,2-Tetrachloroethane	79-34-5		U	39		U	25
1,1,2-Trichloroethane	79-00-5		U	39		U	25
1,1-Dichloroethane	75-34-3		U	39		U	25
1,1-Dichloroethene	75-35-4		U	39		U	25
1,2-Dichloroethane	107-06-2		U	39		U	25
1,2-Dichloropropane	78-87-5		U	39		U	25
2-Butanone	78-93-3	32		39		U	25
2-Hexanone	591-78-6		U	39		U	25
4-Methyl-2-pentanone	108-10-1		U	39		U	25
Acetone	67-64-1	96	J	160		U	100
Benzene	71-43-2		U	39		U	25
Bromoform	75-25-2		U	39		U	25
Carbon disulfide	75-15-0		U	39		U	25
Carbon tetrachloride	56-23-5		U	39		U	25
Chlorobenzene	108-90-7		U	39		U	25

TABLE B-3
CL1B PARCEL SMALL POND SEDIMENT DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-FS-02			CL-SP-FS-01		
		Result	Qual	RL	Result	Qual	RL
Chloroethane	75-00-3		U	39		U	25
Chloroform	67-66-3		U	39		U	25
cis-1,3-Dichloropropene	10061-01-5		U	39		U	25
Ethylbenzene	100-41-4		U	39		U	25
Methylene chloride	75-09-2	22		39		U	25
Tetrachloroethene	127-18-4		U	39		U	25
Toluene	108-88-3		U	39		U	25
trans-1,2-Dichloroethene	156-60-5		U	39		U	25
trans-1,3-Dichloropropene	10061-02-6		U	39		U	25
Trichloroethene	79-01-6		U	39		U	25
Vinyl chloride	75-01-4		U	39		U	25
Xylenes (total)	1330-20-7		U	120		U	76
PAHs (ug/kg)							
2-Methylnaphthalene	91-57-6		U	520		U	3400
Acenaphthene	83-32-9		U	520		U	3400
Acenaphthylene	208-96-8		U	520		U	3400
Anthracene	120-12-7		U	520		U	3400
Benzo(a)anthracene	56-55-3		U	520		U	3400
Benzo(a)pyrene	50-32-8		U	520		U	3400
Benzo(b)fluoranthene	205-99-2		U	520		U	3400
Benzo(ghi)perylene	191-24-2		U	520		U	3400
Benzo(k)fluoranthene	207-08-9		U	520		U	3400
Chrysene	218-01-9		U	520		U	3400
Dibenz(a,h)anthracene	53-70-3		U	520		U	3400
Fluoranthene	206-44-0		U	520		U	3400
Fluorene	86-73-7		U	520		U	3400
Indeno(1,2,3-cd)pyrene	193-39-5		U	520		U	3400
Naphthalene	91-20-3		U	520		U	3400
Phenanthrene	85-01-8		U	520		U	3400
Pyrene	129-00-0		U	520		U	3400
Other SVOCs (ug/kg)							
1,2,4-Trichlorobenzene	120-82-1		U	2600		U	3400
1,2-Dichlorobenzene	95-50-1		U	520		U	3400
1,3-Dichlorobenzene	541-73-1		U	520		U	3400
1,4-Dichlorobenzene	106-46-7		U	520		U	3400
2,2'-oxybis(1-Chloropropane)	108-60-1		U	520		U	3400
2,4,5-Trichlorophenol	95-95-4		U	2600		U	17000
2,4,6-Trichlorophenol	88-06-2		U	2600		U	17000
2,4-Dichlorophenol	120-83-2		U	520		U	3400
2,4-Dimethylphenol	105-67-9		U	2600		U	17000
2,4-Dinitrophenol	51-28-5		U	12000		U	87000
2,4-Dinitrotoluene	121-14-2		U	2600		U	17000
2,6-Dinitrotoluene	606-20-2		U	2600		U	17000
2-Chloronaphthalene	91-58-7		U	520		U	3400
2-Chlorophenol	95-57-8		U	2600		U	17000
2-Methylphenol	95-48-7		U	2600		U	17000

TABLE B-3
CL1B PARCEL SMALL POND SEDIMENT DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-FS-02			CL-SP-FS-01		
		Result	Qual	RL	Result	Qual	RL
2-Nitrophenol	88-75-5		U	2600		U	17000
3,3'-Dichlorobenzidine	91-94-1		U	2600		U	17000
3,3'-Dimethylbenzidine	119-93-7		U	13000		U	87000
3-Methylphenol & 4-Methylphenol	MEPH1314		U	2600		U	17000
4,6-Dinitro-2-methylphenol	534-52-1		U	12000		U	87000
4-Bromophenyl phenyl ether	101-55-3		U	2600		U	17000
4-Chloro-3-methylphenol	59-50-7		U	2600		U	17000
4-Chlorophenyl phenyl ether	7005-72-3		U	2600		U	17000
4-Nitrophenol	100-02-7		U	2600		U	87000
bis(2-Chloroethoxy)methane	111-91-1		U	2600		U	17000
bis(2-Chloroethyl) ether	111-44-4		U	520		U	3400
bis(2-Ethylhexyl) phthalate	117-81-7		U	2600		U	17000
Butyl benzyl phthalate	85-68-7		U	2600		U	17000
Dibenzofuran	132-64-9		U	2600		U	17000
Diethyl phthalate	84-66-2		U	2600		U	17000
Dimethyl phthalate	131-11-3		U	2600		U	17000
Di-n-butyl phthalate	84-74-2		U	2600		U	17000
Di-n-octyl phthalate	117-84-0		U	2600		U	17000
Hexachlorobenzene	118-74-1		U	520		U	3400
Hexachlorobutadiene	87-68-3		U	520		U	3400
Hexachlorocyclopentadiene	77-47-4		U	2600		U	17000
Hexachloroethane	67-72-1		U	2600		U	17000
Isophorone	78-59-1		U	2600		U	17000
Nitrobenzene	98-95-3		U	520		U	3400
Pentachloroethane	76-01-7		U	2600		U	17000
Pentachlorophenol	87-86-5		U	770		U	17000
Phenol	108-95-2		U	520		U	3400
Pyridine	110-86-1		U	2600		U	17000
Other							
TOC (mg/kg)	7440-44-0	129000		39100	94700		39800

TABLE B-4
CL1B PARCEL SMALL POND SURFACE WATER DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-SW-02			CL-SP-SW-01		
		Result	Qual	RL	Result	Qual	RL
Inorganics (ug/L)							
Antimony, Dissolved	7440-36-0		U	10		U	10
Arsenic, Dissolved	7440-38-2	4.5	B	10		U	10
Barium, Dissolved	7440-39-3	54.1		200	32.9	B	200
Beryllium, Dissolved	7440-41-7		U	4		U	4
Cadmium, Dissolved	7440-43-9	1.1		5	2.2	B	5
Chromium, Dissolved	7440-47-3		U	5		U	5
Cobalt, Dissolved	7440-48-4		U	50	11.1	B	50
Copper, Dissolved	7440-50-8	2.8		25	3	B J	25
Lead, Dissolved	7439-92-1		U	3		U	3
Mercury, Dissolved	7439-97-6		U	0.2	0.081	B J	0.2
Nickel, Dissolved	7440-02-0	3.6	B	40	14	B	40
Selenium, Dissolved	7782-49-2	8.3		5	16.6		5
Silver, Dissolved	7440-22-4		U	5	1	B	5
Thallium, Dissolved	7440-28-0		U	10	4.3	B	10
Tin, Dissolved	7440-31-5	4.7	B	100		U	100
Vanadium, Dissolved	7440-62-2	10.1		50	3.1	B	50
Zinc, Dissolved	7440-66-6	166		20	5850	J	20
Antimony, Total	7440-36-0		U	10		U	10
Arsenic, Total	7440-38-2	10.1	B	10		U	10
Barium, Total	7440-39-3	101		200	36.3	B	200
Beryllium, Total	7440-41-7		U	4		U	4
Cadmium, Total	7440-43-9	29.6		5	1.4	B	5
Chromium, Total	7440-47-3	8.3		5		U	5
Cobalt, Total	7440-48-4	1.6		50	11.3	B	50
Copper, Total	7440-50-8	51.3		25	3.8	B	25
Cyanide, Total	57-12-5	3.2		10	2.1	B	10
Lead, Total	7439-92-1	21.5		3		U	3
Mercury, Total	7439-97-6		U	0.2		U	0.2
Nickel, Total	7440-02-0	8.5		40	14.9	B	40
Selenium, Total	7782-49-2	24.6		5	16.5		5
Silver, Total	7440-22-4		U	5	1.2	B	5
Thallium, Total	7440-28-0	3.8		10		U	10
Tin, Total	7440-31-5	7	B	100		U	100
Total Sulfide, Total	18496-25-8		U	3		U	3
Vanadium, Total	7440-62-2	17.2		50	2	B	50
Zinc, total	7440-66-6	4170		20	5850	J	20
PCBs (ug/L)							
Aroclor 1016	12674-11-2		U	0.41		U	0.41
Aroclor 1221	11104-28-2		U	0.41		U	0.41
Aroclor 1232	11141-16-5		U	0.41		U	0.41
Aroclor 1242	53469-21-9		U	0.41		U	0.41
Aroclor 1248	12672-29-6		U	0.41		U	0.41
Aroclor 1254	11097-69-1		U	0.41		U	0.41
Aroclor 1260	11096-82-5		U	0.41		U	0.41

TABLE B-4
CL1B PARCEL SMALL POND SURFACE WATER DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-SW-02			CL-SP-SW-01		
		Result	Qual	RL	Result	Qual	RL
VOCs (ug/L)							
1,1,1,2-Tetrachloroethane	630-20-6		U	1		U	1
1,1,1-Trichloroethane	71-55-6		U	1		U	1
1,1,2,2-Tetrachloroethane	79-34-5		U	1		U	1
1,1,2-Trichloroethane	79-00-5		U	1		U	1
1,1-Dichloroethane	75-34-3		U	1		U	1
1,1-Dichloroethene	75-35-4		U	1	0.26	J	1
1,2-Dichloroethane	107-06-2		U	1		U	1
1,2-Dichloropropane	78-87-5		U	1		U	1
2-Butanone	78-93-3		U	5	1.9	J	5
2-Hexanone	591-78-6		U	5		U	5
4-Methyl-2-pentanone	108-10-1		U	5		U	5
Acetone	67-64-1	5	J	5	10		5
Benzene	71-43-2		U	1		U	1
Bromoform	75-25-2		U	1		U	1
Carbon disulfide	75-15-0	0.53		1		U	1
Carbon tetrachloride	56-23-5		U	1		U	1
Chlorobenzene	108-90-7		U	1		U	1
Chloroethane	75-00-3		UJ	1		U	1
Chloroform	67-66-3		U	1		U	1
cis-1,3-Dichloropropene	10061-01-5		U	1		U	1
Ethylbenzene	100-41-4		U	1		U	1
Methylene chloride	75-09-2		U	1		U	1
Tetrachloroethene	127-18-4		U	1		U	1
Toluene	108-88-3	0.3		1		U	1
trans-1,2-Dichloroethene	156-60-5		U	1		U	1
trans-1,3-Dichloropropene	10061-02-6		U	1		U	1
Trichloroethene	79-01-6		U	1		U	1
Vinyl chloride	75-01-4		U	1		U	1
Xylenes (total)	1330-20-7		U	3		U	3
PAHs (ug/L)							
2-Methylnaphthalene	91-57-6		U	2.4		U	2.2
Acenaphthene	83-32-9		U	2.4		U	2.2
Acenaphthylene	208-96-8		U	2.4		U	2.2
Anthracene	120-12-7		U	2.4		U	2.2
Benzo(a)anthracene	56-55-3		U	2.4		U	2.2
Benzo(a)pyrene	50-32-8		U	2.4		U	2.2
Benzo(b)fluoranthene	205-99-2		U	2.4		U	2.2
Benzo(ghi)perylene	191-24-2		U	2.4		U	2.2
Benzo(k)fluoranthene	207-08-9		U	2.4		U	2.2
Chrysene	218-01-9		U	2.4		U	2.2
Dibenz(a,h)anthracene	53-70-3		U	2.4		U	2.2
Fluoranthene	206-44-0		U	2.4		U	2.2
Fluorene	86-73-7		U	2.4		U	2.2
Indeno(1,2,3-cd)pyrene	193-39-5		U	2.4		U	2.2
Naphthalene	91-20-3		U	2.4		U	2.2
Phenanthrene	85-01-8		U	2.4		U	2.2

TABLE B-4
CL1B PARCEL SMALL POND SURFACE WATER DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-SW-02			CL-SP-SW-01		
		Result	Qual	RL	Result	Qual	RL
Pyrene	129-00-0		U	2.4		U	2.2
Other SVOCs (ug/kg)							
1,2,4-Trichlorobenzene	120-82-1		U	2.4		U	2.2
1,2-Dichlorobenzene	95-50-1		U	2.4		U	2.2
1,3-Dichlorobenzene	541-73-1		U	2.4		U	2.2
1,4-Dichlorobenzene	106-46-7		U	2.4		U	2.2
2,2'-oxybis(1-Chloropropane)	108-60-1		U	2.4		U	2.2
2,4,5-Trichlorophenol	95-95-4		U	12		U	11
2,4,6-Trichlorophenol	88-06-2		U	12		U	11
2,4-Dichlorophenol	120-83-2		U	2.4		U	2.2
2,4-Dimethylphenol	105-67-9		U	12		U	11
2,4-Dinitrophenol	51-28-5		UJ	60		U	56
2,4-Dinitrotoluene	121-14-2		U	12		U	11
2,6-Dinitrotoluene	606-20-2		U	12		U	11
2-Chloronaphthalene	91-58-7		U	2.4		U	2.2
2-Chlorophenol	95-57-8		U	12		U	11
2-Methylphenol	95-48-7		U	12		U	11
2-Nitrophenol	88-75-5		U	12		U	11
3,3'-Dichlorobenzidine	91-94-1		U	12		U	11
3,3'-Dimethylbenzidine	119-93-7		U	60		U	110
3-Methylphenol & 4-Methylphenol	MEPH1314		U	12		U	11
4,6-Dinitro-2-methylphenol	534-52-1		U	60		U	56
4-Bromophenyl phenyl ether	101-55-3		U	12		U	11
4-Chloro-3-methylphenol	59-50-7		U	12		U	11
4-Chlorophenyl phenyl ether	7005-72-3		U	12		U	11
4-Nitrophenol	100-02-7		U	60		U	56
bis(2-Chloroethoxy)methane	111-91-1		U	12		U	11
bis(2-Chloroethyl) ether	111-44-4		U	2.4		U	2.2
bis(2-Ethylhexyl) phthalate	117-81-7		U	12		U	11
Butyl benzyl phthalate	85-68-7		U	12		U	11
Dibenzofuran	132-64-9		U	12		U	11
Diethyl phthalate	84-66-2		U	12		U	11
Dimethyl phthalate	131-11-3		U	12		U	11
Di-n-butyl phthalate	84-74-2		U	12		U	11
Di-n-octyl phthalate	117-84-0		U	12		U	11
Hexachlorobenzene	118-74-1		U	2.4		U	2.2
Hexachlorobutadiene	87-68-3		U	2.4		U	2.2
Hexachlorocyclopentadiene	77-47-4		U	12		U	11
Hexachloroethane	67-72-1		U	12		U	11
Isophorone	78-59-1		U	12		U	11
Nitrobenzene	98-95-3		U	2.4		U	2.2
Pentachloroethane	76-01-7		U	60		U	22
Pentachlorophenol	87-86-5		U	12		U	11
Phenol	108-95-2		U	2.4		U	2.2
Pyridine	110-86-1		U	12		U	11
Other (mg/L)							
Hardness, as CaCO3	HARDNESS	1270		25	2000		50

TABLE B-5
HUMPHREY IMPOUNDMENT SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	HI-SS-01			HI-SS-02			HI-SS-03			HI-SS-06			HI-SS-07		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
Inorganics (mg/kg)																
Antimony	7440-36-0	3		6.8	4.8		9.4	6.1		15		U	1		U	6.4
Arsenic	7440-38-2	34.2		1.4	53.5		9.4	65.7		15	1.8		1	15.3		6.4
Barium	7440-39-3	119		27.4	400		37.6	220		60	131		20.8	42.3		25.6
Beryllium	7440-41-7	0.76		0.55	0.58		0.75	0.8	B	1.2	2		0.42	0.95		2.6
Cadmium	7440-43-9	10.8	K	3.4	54.9	K	4.7	115	K	7.5	0.54	K	0.52		U	3.2
Chromium	7440-47-3	2490		3.4	5750		4.7	11700		7.5	124		0.52	169		3.2
Cobalt	7440-48-4	10.9		6.8	13.7		9.4	32		15	1.8		5.2	7		6.4
Copper	7440-50-8	436		3.4	501		4.7	991		7.5	20.4		2.6	99.9		3.2
Cyanide, Total	57-12-5	9.2		0.68	33.2		0.94	20.8		1.5	4.9		0.52	12.1		0.64
Lead	7439-92-1	941		2.1	1160		2.8	1010		4.5	42.5		0.31	487		1.9
Mercury	7439-97-6	0.092	L	0.045	1.7	L	0.062	1.5	L	0.099		UL	0.034	0.17	L	0.042
Nickel	7440-02-0	44		5.5	98.4		7.5	337		12	11.1		4.2	36.8		5.1
Selenium	7782-49-2	4.5		3.4	5.7		4.7	16.9		7.5		U	1	3.8		3.2
Silver	7440-22-4	8.1		0.68	10.4		0.94	18		1.5	0.79		0.52	4.9		0.64
Sulfide, Total	18496-25-8	21.9		41.1		U	56.4		U	90	316		31.2		U	38.4
Thallium	7440-28-0		U	6.8		U	9.4		U	15		U	2.1	5.4		6.4
Tin	7440-31-5	6910		68.5	10000		94	9610		150	86.8		10.4	18.9		12.8
Vanadium	7440-62-2	131		34.2	103		47	88.7		75	88.9		5.2	83.3		32
Zinc	7440-66-6	3140	J	13.7	10700	J	37.6	23300	J	60	475	J	2.1	4830	J	12.8
PCBs (ug/kg)																
Aroclor 1016	12674-11-2	95		23		U	31		U	50		U	17		U	21
Aroclor 1221	11104-28-2		U	23		U	31		U	50		U	17		U	21
Aroclor 1232	11141-16-5		U	23		U	31		U	50		U	17		U	21
Aroclor 1242	53469-21-9		U	23		U	31		U	50		U	17		U	21
Aroclor 1248	12672-29-6		U	23		U	31		U	50		U	17		U	21
Aroclor 1254	11097-69-1		U	23		U	31		U	50		U	17		U	21
Aroclor 1260	11096-82-5	1600		23	1200		31	1100		50	270		17	13		21

TABLE B-5
HUMPHREY IMPOUNDMENT SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	HI-SS-08			HI-SS-09			HI-SS-10			HI-SS-11			HI-SS-12		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
Inorganics (mg/kg)																
Antimony	7440-36-0	3.1		11.7	4		8.2	5.7		12.2	5.5		8.7	1.5		11.8
Arsenic	7440-38-2	28.4		5.9	23.6		8.2	29.1		6.1	47.2		8.7	26.5		5.9
Barium	7440-39-3	15.2		23.4	13.7		32.9	25.7		24.3	320		35	17.7		23.6
Beryllium	7440-41-7	0.36		2.3	0.49		3.3	0.78		2.4	0.37		0.7	0.26	B	2.4
Cadmium	7440-43-9	9.5	K	5.9	6.9	K	4.1	19	K	6.1	68	K	4.4	13.9	K	5.9
Chromium	7440-47-3	278		5.9	280		4.1	459		6.1	5360		4.4	247		5.9
Cobalt	7440-48-4	9.6		5.9	9.6		8.2	12		6.1	16.9		8.7	9.4		5.9
Copper	7440-50-8	165		2.9	130		4.1	163		3	621		4.4	150		3
Cyanide, Total	57-12-5	50.7		5.9	35.7		8.2	132		6.1	33.4		0.87	55.9		5.9
Lead	7439-92-1	1040		3.5	2090		2.5	3350		3.7	456		2.6	876		3.5
Mercury	7439-97-6	0.54	L	0.039	0.51	L	0.054	0.64	L	0.04	1.2	L	0.058	0.35	L	0.039
Nickel	7440-02-0	97.1		4.7	93.4		6.6	133		4.9	269		7	93		4.7
Selenium	7782-49-2	8		5.9	8.5		4.1	7.9		6.1	4.3		4.4	4.9		5.9
Silver	7440-22-4	5.7		0.59	5.3		0.82	8.4		0.61	8.4		0.87	7.6		0.59
Sulfide, Total	18496-25-8		U	35.1		U	49.3		U	36.5		U	52.5		U	35.4
Thallium	7440-28-0		U	11.7	7.8		8.2	10.8		12.2		U	8.7		U	11.8
Tin	7440-31-5	75.6		11.7	138		16.4	336		12.2	2180		17.5	51.3		11.8
Vanadium	7440-62-2	111		58.5	87.7		41.1	124		60.8	42		43.7	46.1		59
Zinc	7440-66-6	8760	J	23.4	7990	J	16.4	10900	J	24.3	13400	J	35	9560	J	23.6
PCBs (ug/kg)																
Aroclor 1016	12674-11-2		U	20		U	27		U	20		U	29		U	20
Aroclor 1221	11104-28-2		U	20		U	27		U	20		U	29		U	20
Aroclor 1232	11141-16-5		U	20		U	27		U	20		U	29		U	20
Aroclor 1242	53469-21-9		U	20		U	27		U	20		U	29		U	20
Aroclor 1248	12672-29-6		U	20		U	27		U	20		U	29		U	20
Aroclor 1254	11097-69-1		U	20		U	27		U	20		U	29		U	20
Aroclor 1260	11096-82-5	29		20	52		27	62		20	1000		29	14		20

TABLE B-5
HUMPHREY IMPOUNDMENT SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	HI-SS-13			HI-SS-14			HI-SS-15			HI-SS-16			HI-SS-17		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
Inorganics (mg/kg)																
Antimony	7440-36-0	1.6		6		U	12.4	3.4		11.8	0.63		2.1		U	2.1
Arsenic	7440-38-2	33.8		6	26.2		6.2	20.3		5.9	10.4		1.1	3.8		1
Barium	7440-39-3	37.2		24	29.4		24.8	14.9		23.6	68.7		21.1	120		20.8
Beryllium	7440-41-7	0.97		2.4	0.47		2.5	0.45		2.4	0.48		0.42	1.4		0.42
Cadmium	7440-43-9	16.7	K	3	14.6	K	6.2	8.1	K	5.9	1.7	K	1.1	1.1	K	1
Chromium	7440-47-3	151		3	161		6.2	327		5.9	526		1.1	430		1
Cobalt	7440-48-4	8.2		6	9.5		6.2	11		5.9	7		5.3	2.4		5.2
Copper	7440-50-8	179		3	151		3.1	170		2.9	79.2		2.6	65		2.6
Cyanide, Total	57-12-5	74.1		6	24.6		0.62	62.5		5.9	14.2		0.53	4.3		0.52
Lead	7439-92-1	1860		1.8	963		3.7	667		3.5	15400		15.8	155		0.62
Mercury	7439-97-6	3	L	0.2	0.1	L	0.041	0.4	L	0.039	0.25	L	0.035	0.03	L	0.034
Nickel	7440-02-0	64.3		4.8	44.6		5	116		4.7	37.4		4.2	18.6		4.2
Selenium	7782-49-2	8.2		3	5		6.2	7.9		5.9		U	2.6		U	2.6
Silver	7440-22-4	9		0.6	7.7		0.62	5.9		0.59	2		0.53	2.5		0.52
Sulfide, Total	18496-25-8		U	35.9		U	37.2		U	35.4		U	31.6	233		31.2
Thallium	7440-28-0	9.1		6		U	12.4		U	11.8		U	5.3		U	5.2
Tin	7440-31-5	102		12	36.5		12.4	59.9		11.8	1580		10.5	146		10.4
Vanadium	7440-62-2	40.6		29.9	47.2		62	120		59	485		10.5	209		10.4
Zinc	7440-66-6	7060	J	24	8960	J	24.8	3640	J	23.6	988	J	4.2	768	J	4.2
PCBs (ug/kg)																
Aroclor 1016	12674-11-2		U	20		U	21		U	20		U	17		U	17
Aroclor 1221	11104-28-2		U	20		U	21		U	20		U	17		U	17
Aroclor 1232	11141-16-5		U	20		U	21		U	20		U	17		U	17
Aroclor 1242	53469-21-9		U	20		U	21		U	20		U	17		U	17
Aroclor 1248	12672-29-6		U	20	4.1		21		U	20	65		17	24		17
Aroclor 1254	11097-69-1		U	20		U	21		U	20		U	17		U	17
Aroclor 1260	11096-82-5	61		20	10		21	29		20	140		17	730		17

TABLE B-5
HUMPHREY IMPOUNDMENT SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	HI-SS-18			HI-SS-19			HI-SS-20		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
Inorganics (mg/kg)										
Antimony	7440-36-0		U	1.3		U	1		U	1.1
Arsenic	7440-38-2	9.2		1.3	1.7		1	1.7		1.1
Barium	7440-39-3	39.8		25.1	209		20.8	129		21
Beryllium	7440-41-7	0.85		0.5	5		0.42	2.5		0.42
Cadmium	7440-43-9	0.31	K	0.63	0.36	K	0.52	1	K	0.53
Chromium	7440-47-3	162		0.63	63.5		0.52	49.4		0.53
Cobalt	7440-48-4	6.5		6.3	0.11		5.2	1.2		5.3
Copper	7440-50-8	32.1		3.1	11.5		2.6	24.1		2.6
Cyanide, Total	57-12-5	1.2		0.63	9.9		0.52	13.8		0.53
Lead	7439-92-1	53.7		0.38	39.8		0.31	106		0.32
Mercury	7439-97-6	0.16	L	0.041	0.0076	L	0.034		UL	0.035
Nickel	7440-02-0	18		5	4.4		4.2	9.3		4.2
Selenium	7782-49-2	0.92		0.63		U	1		U	0.53
Silver	7440-22-4	0.34	B	0.63	0.98		0.52	1.1		0.53
Sulfide, Total	18496-25-8		U	37.6	225		31.2	681		31.5
Thallium	7440-28-0		U	1.3		U	2.1		U	1.1
Tin	7440-31-5	273		12.5	7		10.4	24.3		10.5
Vanadium	7440-62-2	48.8		6.3	28.3		5.2	21.1		5.3
Zinc	7440-66-6	194	J	2.5	194	J	2.1	1330	J	4.2
PCBs (ug/kg)										
Aroclor 1016	12674-11-2		U	21		U	17		U	18
Aroclor 1221	11104-28-2		U	21		U	17		U	18
Aroclor 1232	11141-16-5		U	21		U	17		U	18
Aroclor 1242	53469-21-9		U	21		U	17		U	18
Aroclor 1248	12672-29-6	41		21		U	17		U	18
Aroclor 1254	11097-69-1		U	21		U	17		U	18
Aroclor 1260	11096-82-5	75		21	8.6		17	34		18

TABLE B-5
HUMPHREY IMPOUNDMENT SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	HI-SS-01			HI-SS-02			HI-SS-03			HI-SS-06			HI-SS-07		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
VOCs (ug/kg)																
1,1,1,2-Tetrachloroethane	630-20-6		U	12		U	21		U	39		UJ	7.5		U	8.2
1,1,1-Trichloroethane	71-55-6		U	12		U	21		U	39		UJ	7.5		U	8.2
1,1,2,2-Tetrachloroethane	79-34-5		U	12		U	21		U	39		UJ	7.5		U	8.2
1,1,2-Trichloroethane	79-00-5		U	12		U	21		U	39		UJ	7.5		U	8.2
1,1-Dichloroethane	75-34-3		U	12		U	21		U	39		UJ	7.5		U	8.2
1,1-Dichloroethene	75-35-4		U	12		U	21		U	39		UJ	7.5		U	8.2
1,2-Dichloroethane	107-06-2		U	12		U	21		U	39		UJ	7.5		U	8.2
1,2-Dichloropropane	78-87-5		U	12		U	21		U	39		UJ	7.5		U	8.2
2-Butanone	78-93-3		U	12		U	21		U	39		UJ	7.5		U	8.2
2-Hexanone	591-78-6		U	12		U	21		U	39		UJ	7.5		U	8.2
4-Methyl-2-pentanone	108-10-1		U	12		U	21		U	39		UJ	7.5		U	8.2
Acetone	67-64-1		U	46		U	83		U	160		UJ	30		U	33
Benzene	71-43-2		U	12		U	21		U	39		UJ	7.5		U	8.2
Bromoform	75-25-2		U	12		U	21		U	39		UJ	7.5		U	8.2
Carbon disulfide	75-15-0		U	12		U	21		U	39		UJ	7.5		U	8.2
Carbon tetrachloride	56-23-5		U	12		U	21		U	39		UJ	7.5		U	8.2
Chlorobenzene	108-90-7		U	12		U	21		U	39		UJ	7.5		U	8.2
Chloroethane	75-00-3		U	12		U	21		U	39		UJ	7.5		U	8.2
Chloroform	67-66-3		U	12		U	21		U	39		UJ	7.5		U	8.2
cis-1,3-Dichloropropene	10061-01-5		U	12		U	21		U	39		UJ	7.5		U	8.2
Ethylbenzene	100-41-4		U	12		U	21		U	39		UJ	7.5		U	8.2
Methylene chloride	75-09-2	4.2	B	12	7.9	B	21	17	B	39	4.3	B	7.5	3.1	B	8.2
Tetrachloroethene	127-18-4		U	12		U	21		U	39		UJ	7.5		U	8.2
Toluene	108-88-3		U	12		U	21		U	39		UJ	7.5		U	8.2
trans-1,2-Dichloroethene	156-60-5		U	12		U	21		U	39		UJ	7.5		U	8.2
trans-1,3-Dichloropropene	10061-02-6		U	12		U	21		U	39		UJ	7.5		U	8.2
Trichloroethene	79-01-6		U	12		U	21		U	39		UJ	7.5		U	8.2
Vinyl chloride	75-01-4		U	12		U	21		U	39		UJ	7.5		U	8.2
Xylenes (total)	1330-20-7		U	35		U	62		U	120		U	23		U	25

TABLE B-5
HUMPHREY IMPOUNDMENT SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	HI-SS-08			HI-SS-09			HI-SS-10			HI-SS-11			HI-SS-12		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
VOCs (ug/kg)																
1,1,1,2-Tetrachloroethane	630-20-6		U	5.5		U	8.6		U	5.4		U	16		U	6.1
1,1,1-Trichloroethane	71-55-6		U	5.5		U	8.6		U	5.4		U	16		U	6.1
1,1,2,2-Tetrachloroethane	79-34-5		U	5.5		U	8.6		U	5.4		U	16		U	6.1
1,1,2-Trichloroethane	79-00-5		U	5.5		U	8.6		U	5.4		U	16		U	6.1
1,1-Dichloroethane	75-34-3		U	5.5		U	8.6		U	5.4		U	16		U	6.1
1,1-Dichloroethene	75-35-4		U	5.5		U	8.6		U	5.4		U	16		U	6.1
1,2-Dichloroethane	107-06-2		U	5.5		U	8.6		U	5.4		U	16		U	6.1
1,2-Dichloropropane	78-87-5		U	5.5		U	8.6		U	5.4		U	16		U	6.1
2-Butanone	78-93-3		U	5.5		U	8.6		U	5.4		U	16		U	6.1
2-Hexanone	591-78-6		U	5.5		U	8.6		U	5.4		U	16		U	6.1
4-Methyl-2-pentanone	108-10-1		U	5.5		U	8.6		U	5.4		U	16		U	6.1
Acetone	67-64-1		U	22		U	34		U	22		U	63		U	24
Benzene	71-43-2		U	5.5		U	8.6		U	5.4		U	16		U	6.1
Bromoform	75-25-2		U	5.5		U	8.6		U	5.4		U	16		U	6.1
Carbon disulfide	75-15-0		U	5.5		U	8.6		U	5.4		U	16		U	6.1
Carbon tetrachloride	56-23-5		U	5.5		U	8.6		U	5.4		U	16		U	6.1
Chlorobenzene	108-90-7		U	5.5		U	8.6		U	5.4		U	16		U	6.1
Chloroethane	75-00-3		U	5.5		U	8.6		U	5.4		U	16		U	6.1
Chloroform	67-66-3		U	5.5		U	8.6		U	5.4		U	16		U	6.1
cis-1,3-Dichloropropene	10061-01-5		U	5.5		U	8.6		U	5.4		U	16		U	6.1
Ethylbenzene	100-41-4		U	5.5		U	8.6		U	5.4		U	16		U	6.1
Methylene chloride	75-09-2	2.3	B	5.5	3.7	B	8.6	2.5	B	5.4	3.5	B	16	2.9	B	6.1
Tetrachloroethene	127-18-4		U	5.5		U	8.6		U	5.4		U	16		U	6.1
Toluene	108-88-3		U	5.5		U	8.6		U	5.4		U	16		U	6.1
trans-1,2-Dichloroethene	156-60-5		U	5.5		U	8.6		U	5.4		U	16		U	6.1
trans-1,3-Dichloropropene	10061-02-6		U	5.5		U	8.6		U	5.4		U	16		U	6.1
Trichloroethene	79-01-6		U	5.5		U	8.6		U	5.4		U	16		U	6.1
Vinyl chloride	75-01-4		U	5.5		U	8.6		U	5.4		U	16		U	6.1
Xylenes (total)	1330-20-7		U	17		U	26		U	16		U	47		U	18

TABLE B-5
HUMPHREY IMPOUNDMENT SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	HI-SS-13			HI-SS-14			HI-SS-15			HI-SS-16			HI-SS-17		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
VOCs (ug/kg)																
1,1,1,2-Tetrachloroethane	630-20-6		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
1,1,1-Trichloroethane	71-55-6		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
1,1,2,2-Tetrachloroethane	79-34-5		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
1,1,2-Trichloroethane	79-00-5		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
1,1-Dichloroethane	75-34-3		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
1,1-Dichloroethene	75-35-4		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
1,2-Dichloroethane	107-06-2		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
1,2-Dichloropropane	78-87-5		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
2-Butanone	78-93-3		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
2-Hexanone	591-78-6		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
4-Methyl-2-pentanone	108-10-1		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
Acetone	67-64-1		U	24		UJ	26		U	26		U	29		U	30
Benzene	71-43-2		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
Bromoform	75-25-2		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
Carbon disulfide	75-15-0		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
Carbon tetrachloride	56-23-5		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
Chlorobenzene	108-90-7		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
Chloroethane	75-00-3		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
Chloroform	67-66-3		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
cis-1,3-Dichloropropene	10061-01-5		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
Ethylbenzene	100-41-4		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
Methylene chloride	75-09-2	2.5	B	5.9	1.9	B	6.5	3	B	6.5	3	B	7.2	3.5	B	7.5
Tetrachloroethene	127-18-4		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
Toluene	108-88-3		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
trans-1,2-Dichloroethene	156-60-5		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
trans-1,3-Dichloropropene	10061-02-6		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
Trichloroethene	79-01-6		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
Vinyl chloride	75-01-4		U	5.9		UJ	6.5		U	6.5		U	7.2		U	7.5
Xylenes (total)	1330-20-7		U	18		U	20		U	19		U	22		U	23

TABLE B-5
HUMPHREY IMPOUNDMENT SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	HI-SS-18			HI-SS-19			HI-SS-20		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
VOCs (ug/kg)										
1,1,1,2-Tetrachloroethane	630-20-6		U	12		U	5.8		U	6.8
1,1,1-Trichloroethane	71-55-6		U	12		U	5.8		U	6.8
1,1,2,2-Tetrachloroethane	79-34-5		U	12		U	5.8		U	6.8
1,1,2-Trichloroethane	79-00-5		U	12		U	5.8		U	6.8
1,1-Dichloroethane	75-34-3		U	12		U	5.8		U	6.8
1,1-Dichloroethene	75-35-4		U	12		U	5.8		U	6.8
1,2-Dichloroethane	107-06-2		U	12		U	5.8		U	6.8
1,2-Dichloropropane	78-87-5		U	12		U	5.8		U	6.8
2-Butanone	78-93-3		U	12		U	5.8		U	6.8
2-Hexanone	591-78-6		U	12		U	5.8		U	6.8
4-Methyl-2-pentanone	108-10-1		U	12		U	5.8		U	6.8
Acetone	67-64-1		U	48		U	23		U	27
Benzene	71-43-2		U	12		U	5.8		U	6.8
Bromoform	75-25-2		U	12		U	5.8		U	6.8
Carbon disulfide	75-15-0		U	12		U	5.8		U	6.8
Carbon tetrachloride	56-23-5		U	12		U	5.8		U	6.8
Chlorobenzene	108-90-7		U	12		U	5.8		U	6.8
Chloroethane	75-00-3		U	12		U	5.8		U	6.8
Chloroform	67-66-3		U	12		U	5.8		U	6.8
cis-1,3-Dichloropropene	10061-01-5		U	12		U	5.8		U	6.8
Ethylbenzene	100-41-4		U	12		U	5.8		U	6.8
Methylene chloride	75-09-2	4.1	B	12	1.2	B	5.8	3.5	B	6.8
Tetrachloroethene	127-18-4		U	12		U	5.8		U	6.8
Toluene	108-88-3		U	12		U	5.8		U	6.8
trans-1,2-Dichloroethene	156-60-5		U	12		U	5.8		U	6.8
trans-1,3-Dichloropropene	10061-02-6		U	12		U	5.8		U	6.8
Trichloroethene	79-01-6		U	12		U	5.8		U	6.8
Vinyl chloride	75-01-4		U	12		U	5.8		U	6.8
Xylenes (total)	1330-20-7		U	36		U	17		U	20

TABLE B-5
HUMPHREY IMPOUNDMENT SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	HI-SS-01			HI-SS-02			HI-SS-03			HI-SS-06			HI-SS-07		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
PAHs (ug/kg)																
2-Methylnaphthalene	91-57-6		U	910		U	620		U	1000		U	70		U	85
Acenaphthene	83-32-9		U	910		U	620		U	1000		U	70		U	85
Acenaphthylene	208-96-8		U	910		U	620	550		1000	45		70		U	85
Anthracene	120-12-7		U	910	250		620		U	1000	21		70		U	85
Fluoranthene	206-44-0		U	910	660		620	400		1000	52		70	62		85
Fluorene	86-73-7		U	910		U	620		U	1000		U	70		U	85
Naphthalene	91-20-3		U	910	310		620		U	1000		U	70		U	85
Phenanthrene	85-01-8		U	910	680		620	320		1000	43		70	50		85
Benzo(a)anthracene	56-55-3		U	910	540		620		U	1000	70		70	82		85
Benzo(a)pyrene	50-32-8		U	910	410		620		U	1000	190		70	100		85
Benzo(b)fluoranthene	205-99-2		U	910		U	620		U	1000	180		70	150		85
Benzo(ghi)perylene	191-24-2		U	910		U	620		U	1000	250		70	71		85
Benzo(k)fluoranthene	207-08-9		U	910		U	620		U	1000	60		70	54		85
Chrysene	218-01-9		U	910	470		620		U	1000	90		70	94		85
Dibenz(a,h)anthracene	53-70-3		U	910		U	620		U	1000		U	70		U	85
Indeno(1,2,3-cd)pyrene	193-39-5		U	910		U	620		U	1000	190		70	89		85
Pyrene	129-00-0		U	910	780		620		U	1000	75		70	100		85
Other SVOCs (ug/kg)																
1,2,4-Trichlorobenzene	120-82-1		U	4500		U	3100		U	5000		U	340		U	420
1,2-Dichlorobenzene	95-50-1		U	910		U	620		U	1000		U	70		U	85
1,3-Dichlorobenzene	541-73-1		U	910		U	620		U	1000		U	70		U	85
1,4-Dichlorobenzene	106-46-7		U	910		U	620		U	1000		U	70		U	85
2,2'-oxybis(1-Chloropropane)	108-60-1		U	910		U	620		U	1000		U	70		U	85
2,4,5-Trichlorophenol	95-95-4		U	4500		U	3100		U	5000		U	340		U	420
2,4,6-Trichlorophenol	88-06-2		U	4500		U	3100		U	5000		U	340		U	420
2,4-Dichlorophenol	120-83-2		U	910		U	620		U	1000		U	70		U	85
2,4-Dimethylphenol	105-67-9		U	4500		U	3100		U	5000		U	340		U	420
2,4-Dinitrophenol	51-28-5		U	20000		U	14000		U	23000		U	1600		U	1900
2,4-Dinitrotoluene	121-14-2		U	4500		U	3100		U	5000		U	340		U	420
2,6-Dinitrotoluene	606-20-2		U	4500		U	3100		U	5000		U	340		U	420
2-Chloronaphthalene	91-58-7		U	910		U	620		U	1000		U	70		U	85
2-Chlorophenol	95-57-8		U	4500		U	3100		U	5000		U	340		U	420
2-Methylphenol	95-48-7		U	4500		U	3100		U	5000		U	340		U	420
2-Nitrophenol	88-75-5		U	4500		U	3100		U	5000		U	340		U	420
3,3'-Dichlorobenzidine	91-94-1		U	4500		U	3100		U	5000		U	340		U	420

TABLE B-5
HUMPHREY IMPOUNDMENT SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	HI-SS-08			HI-SS-09			HI-SS-10			HI-SS-11			HI-SS-12		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
PAHs (ug/kg)																
2-Methylnaphthalene	91-57-6		U	78		U	110		U	82		U	120		U	79
Acenaphthene	83-32-9		U	78		U	110		U	82		U	120		U	79
Acenaphthylene	208-96-8		U	78		U	110		U	82		U	120		U	79
Anthracene	120-12-7		U	78		U	110		U	82		U	120		U	79
Fluoranthene	206-44-0	38		78	39		110	37		82	42		120		U	79
Fluorene	86-73-7		U	78		U	110		U	82		U	120		U	79
Naphthalene	91-20-3		U	78		U	110		U	82	28		120		U	79
Phenanthrene	85-01-8	27		78	44		110	32		82	43		120		U	79
Benzo(a)anthracene	56-55-3	34		78	44		110	50		82		U	120		U	79
Benzo(a)pyrene	50-32-8	30		78		U	110	43		82		U	120		U	79
Benzo(b)fluoranthene	205-99-2	65		78	84		110	97		82		U	120		U	79
Benzo(ghi)perylene	191-24-2	84		78		U	110		U	82		U	120		U	79
Benzo(k)fluoranthene	207-08-9	15		78		U	110	22		82		U	120		U	79
Chrysene	218-01-9	53		78	55		110	82		82		U	120		U	79
Dibenz(a,h)anthracene	53-70-3		U	78		U	110		U	82		U	120		U	79
Indeno(1,2,3-cd)pyrene	193-39-5	60		78		U	110	26		82		U	120		U	79
Pyrene	129-00-0	40		78	52		110	45		82		U	120		U	79
Other SVOCs (ug/kg)																
1,2,4-Trichlorobenzene	120-82-1		U	390		U	540		U	400		U	570		U	390
1,2-Dichlorobenzene	95-50-1		U	78		U	110		U	82		U	120		U	79
1,3-Dichlorobenzene	541-73-1		U	78		U	110		U	82		U	120		U	79
1,4-Dichlorobenzene	106-46-7		U	78		U	110		U	82		U	120		U	79
2,2'-oxybis(1-Chloropropane)	108-60-1		U	78		U	110		U	82		U	120		U	79
2,4,5-Trichlorophenol	95-95-4		U	390		U	540		U	400		U	570		U	390
2,4,6-Trichlorophenol	88-06-2		U	390		U	540		U	400		U	570		U	390
2,4-Dichlorophenol	120-83-2		U	78		U	110		U	82		U	120		U	79
2,4-Dimethylphenol	105-67-9		U	390		U	540		U	400		U	570		U	390
2,4-Dinitrophenol	51-28-5		U	1800		U	2500		U	1800		U	2600		U	1800
2,4-Dinitrotoluene	121-14-2		U	390		U	540		U	400		U	570		U	390
2,6-Dinitrotoluene	606-20-2		U	390		U	540		U	400		U	570		U	390
2-Chloronaphthalene	91-58-7		U	78		U	110		U	82		U	120		U	79
2-Chlorophenol	95-57-8		U	390		U	540		U	400		U	570		U	390
2-Methylphenol	95-48-7		U	390		U	540		U	400		U	570		U	390
2-Nitrophenol	88-75-5		U	390		U	540		U	400		U	570		U	390
3,3'-Dichlorobenzidine	91-94-1		U	390		U	540		U	400		U	570		U	390

TABLE B-5
HUMPHREY IMPOUNDMENT SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	HI-SS-13			HI-SS-14			HI-SS-15			HI-SS-16			HI-SS-17		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
PAHs (ug/kg)																
2-Methylnaphthalene	91-57-6		U	80		U	83		U	79	84		140	110		140
Acenaphthene	83-32-9		U	80		U	83		U	79	89		140		U	140
Acenaphthylene	208-96-8		U	80		U	83		U	79	1700		140	700		140
Anthracene	120-12-7		U	80		U	83		U	79	510		140	200		140
Fluoranthene	206-44-0	43		80		U	83		U	79	4400		140	360		140
Fluorene	86-73-7		U	80		U	83		U	79	99		140		U	140
Naphthalene	91-20-3		U	80		U	83		U	79	260		140	180		140
Phenanthrene	85-01-8	46		80		U	83		U	79	1900		140	270		140
Benzo(a)anthracene	56-55-3	44		80		U	83	26		79	3000		140	300		140
Benzo(a)pyrene	50-32-8	45		80		U	83	21		79	2900		140	430		140
Benzo(b)fluoranthene	205-99-2	80		80		U	83	40		79	3600		140	540		140
Benzo(ghi)perylene	191-24-2	130		80		U	83		U	79	3000		140	1100		140
Benzo(k)fluoranthene	207-08-9	37		80		U	83	15		79	1600		140	230		140
Chrysene	218-01-9	59		80		U	83	32		79	3000		140	390		140
Dibenz(a,h)anthracene	53-70-3		U	80		U	83		U	79	440		140		U	140
Indeno(1,2,3-cd)pyrene	193-39-5	91		80		U	83		U	79	2600		140	670		140
Pyrene	129-00-0	51		80		U	83		U	79	5000		140	540		140
Other SVOCs (ug/kg)																
1,2,4-Trichlorobenzene	120-82-1		U	400		U	410		U	390		U	690		U	690
1,2-Dichlorobenzene	95-50-1		U	80		U	83		U	79		U	140		U	140
1,3-Dichlorobenzene	541-73-1		U	80		U	83		U	79		U	140		U	140
1,4-Dichlorobenzene	106-46-7		U	80		U	83		U	79		U	140		U	140
2,2'-oxybis(1-Chloropropane)	108-60-1		U	80		U	83		U	79		U	140		U	140
2,4,5-Trichlorophenol	95-95-4		U	400		U	410		U	390		U	690		U	690
2,4,6-Trichlorophenol	88-06-2		U	400		U	410		U	390		U	690		U	690
2,4-Dichlorophenol	120-83-2		U	80		U	83		U	79		U	140		U	140
2,4-Dimethylphenol	105-67-9		U	400		U	410		U	390		U	690		U	690
2,4-Dinitrophenol	51-28-5		U	1800		U	1900		U	1800		U	3100		U	3100
2,4-Dinitrotoluene	121-14-2		U	400		U	410		U	390		U	690		U	690
2,6-Dinitrotoluene	606-20-2		U	400		U	410		U	390		U	690		U	690
2-Chloronaphthalene	91-58-7		U	80		U	83		U	79		U	140		U	140
2-Chlorophenol	95-57-8		U	400		U	410		U	390		U	690		U	690
2-Methylphenol	95-48-7		U	400		U	410		U	390		U	690		U	690
2-Nitrophenol	88-75-5		U	400		U	410		U	390		U	690		U	690
3,3'-Dichlorobenzidine	91-94-1		U	400		U	410		U	390		U	690		U	690

TABLE B-5
HUMPHREY IMPOUNDMENT SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	HI-SS-18			HI-SS-19			HI-SS-20		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
PAHs (ug/kg)										
2-Methylnaphthalene	91-57-6		U	84		U	70		U	70
Acenaphthene	83-32-9		U	84		U	70		U	70
Acenaphthylene	208-96-8		U	84		U	70		U	70
Anthracene	120-12-7		U	84		U	70		U	70
Fluoranthene	206-44-0	34		84		U	70	31		70
Fluorene	86-73-7		U	84		U	70		U	70
Naphthalene	91-20-3		U	84		U	70		U	70
Phenanthrene	85-01-8	29		84		U	70		U	70
Benzo(a)anthracene	56-55-3	21		84	24		70	26		70
Benzo(a)pyrene	50-32-8		U	84		U	70		U	70
Benzo(b)fluoranthene	205-99-2		U	84		U	70	43		70
Benzo(ghi)perylene	191-24-2		U	84		U	70		U	70
Benzo(k)fluoranthene	207-08-9		U	84		U	70	13		70
Chrysene	218-01-9	26		84	25		70	23		70
Dibenz(a,h)anthracene	53-70-3		U	84		U	70		U	70
Indeno(1,2,3-cd)pyrene	193-39-5		U	84		U	70		U	70
Pyrene	129-00-0	48		84		U	70	31		70
Other SVOCs (ug/kg)										
1,2,4-Trichlorobenzene	120-82-1		U	410		U	340		U	350
1,2-Dichlorobenzene	95-50-1		U	84		U	70		U	70
1,3-Dichlorobenzene	541-73-1		U	84		U	70		U	70
1,4-Dichlorobenzene	106-46-7		U	84		U	70		U	70
2,2'-oxybis(1-Chloropropane)	108-60-1		U	84		U	70		U	70
2,4,5-Trichlorophenol	95-95-4		U	410		U	340		U	350
2,4,6-Trichlorophenol	88-06-2		U	410		U	340		U	350
2,4-Dichlorophenol	120-83-2		U	84		U	70		U	70
2,4-Dimethylphenol	105-67-9		U	410		U	340		U	350
2,4-Dinitrophenol	51-28-5		U	1900		U	1600		U	1600
2,4-Dinitrotoluene	121-14-2		U	410		U	340		U	350
2,6-Dinitrotoluene	606-20-2		U	410		U	340		U	350
2-Chloronaphthalene	91-58-7		U	84		U	70		U	70
2-Chlorophenol	95-57-8		U	410		U	340		U	350
2-Methylphenol	95-48-7		U	410		U	340		U	350
2-Nitrophenol	88-75-5		U	410		U	340		U	350
3,3'-Dichlorobenzidine	91-94-1		U	410		U	340		U	350

TABLE B-5
HUMPHREY IMPOUNDMENT SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	HI-SS-01			HI-SS-02			HI-SS-03			HI-SS-06			HI-SS-07		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
3,3'-Dimethylbenzidine	119-93-7		U	23000		U	16000		U	25000		U	1700		U	2100
3-Methylphenol & 4-Methylphenol	MEPH1314		U	4500		U	3100		U	5000		U	340		U	420
4,6-Dinitro-2-methylphenol	534-52-1		U	20000		U	14000		U	23000		U	1600		U	1900
4-Bromophenyl phenyl ether	101-55-3		U	4500		U	3100		U	5000		U	340		U	420
4-Chloro-3-methylphenol	59-50-7		U	4500		U	3100		U	5000		U	340		U	420
4-Chlorophenyl phenyl ether	7005-72-3		U	4500		U	3100		U	5000		U	340		U	420
4-Nitrophenol	100-02-7		U	4500		U	3100		U	5000		U	340		U	420
bis(2-Chloroethoxy)methane	111-91-1		U	4500		U	3100		U	5000		U	340		U	420
bis(2-Chloroethyl) ether	111-44-4		U	910		U	620		U	1000		U	70		U	85
bis(2-Ethylhexyl) phthalate	117-81-7		U	4500		U	3100		U	5000		U	340		U	420
Butyl benzyl phthalate	85-68-7		U	4500		U	3100		U	5000		U	340		U	420
Dibenzofuran	132-64-9		U	4500		U	3100		U	5000		U	340		U	420
Diethyl phthalate	84-66-2		U	4500		U	3100		U	5000		U	340		U	420
Dimethyl phthalate	131-11-3		U	4500		U	3100		U	5000		U	340		U	420
Di-n-butyl phthalate	84-74-2		U	4500		U	3100		U	5000		U	340		U	420
Di-n-octyl phthalate	117-84-0		U	4500		U	3100		U	5000		U	340		U	420
Hexachlorobenzene	118-74-1		U	910		U	620		U	1000		U	70		U	85
Hexachlorobutadiene	87-68-3		U	910		U	620		U	1000		U	70		U	85
Hexachlorocyclopentadiene	77-47-4		U	4500		U	3100		U	5000		U	340		U	420
Hexachloroethane	67-72-1		U	4500		U	3100		U	5000		U	340		U	420
Isophorone	78-59-1		U	4500		U	3100		U	5000		U	340		U	420
Nitrobenzene	98-95-3		U	910		U	620		U	1000		U	70		U	85
Pentachloroethane	76-01-7		U	4500		U	3100		U	5000		U	350		U	420
Pentachlorophenol	87-86-5		U	1400		U	930		U	1500		U	100		U	130
Phenol	108-95-2		U	910		U	620		U	1000		U	70		U	85
Pyridine	110-86-1		U	4500		U	3100		U	5000		U	340		U	420

TABLE B-5
HUMPHREY IMPOUNDMENT SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	HI-SS-08			HI-SS-09			HI-SS-10			HI-SS-11			HI-SS-12		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
3,3'-Dimethylbenzidine	119-93-7		U	2000		U	2700		U	2000		U	2900		U	2000
3-Methylphenol & 4-Methylphenol	MEPH1314		U	390		U	540		U	400		U	570		U	390
4,6-Dinitro-2-methylphenol	534-52-1		U	1800		U	2500		U	1800		U	2600		U	1800
4-Bromophenyl phenyl ether	101-55-3		U	390		U	540		U	400		U	570		U	390
4-Chloro-3-methylphenol	59-50-7		U	390		U	540		U	400		U	570		U	390
4-Chlorophenyl phenyl ether	7005-72-3		U	390		U	540		U	400		U	570		U	390
4-Nitrophenol	100-02-7		U	390		U	540		U	400		U	570		U	390
bis(2-Chloroethoxy)methane	111-91-1		U	390		U	540		U	400		U	570		U	390
bis(2-Chloroethyl) ether	111-44-4		U	78		U	110		U	82		U	120		U	79
bis(2-Ethylhexyl) phthalate	117-81-7		U	390		U	540		U	400		U	570		U	390
Butyl benzyl phthalate	85-68-7		U	390		U	540		U	400		U	570		U	390
Dibenzofuran	132-64-9		U	390		U	540		U	400		U	570		U	390
Diethyl phthalate	84-66-2		U	390		U	540		U	400		U	570		U	390
Dimethyl phthalate	131-11-3		U	390		U	540		U	400		U	570		U	390
Di-n-butyl phthalate	84-74-2		U	390		U	540		U	400		U	570		U	390
Di-n-octyl phthalate	117-84-0		U	390		U	540		U	400		U	570		U	390
Hexachlorobenzene	118-74-1		U	78		U	110		U	82		U	120		U	79
Hexachlorobutadiene	87-68-3		U	78		U	110		U	82		U	120		U	79
Hexachlorocyclopentadiene	77-47-4		U	390		U	540		U	400		U	570		U	390
Hexachloroethane	67-72-1		U	390		U	540		U	400		U	570		U	390
Isophorone	78-59-1		U	390		U	540		U	400		U	570		U	390
Nitrobenzene	98-95-3		U	78		U	110		U	82		U	120		U	79
Pentachloroethane	76-01-7		U	390		U	550		U	410		U	580		U	390
Pentachlorophenol	87-86-5		U	120		U	160		U	120		U	170		U	120
Phenol	108-95-2		U	78		U	110		U	82		U	120		U	79
Pyridine	110-86-1		U	390		U	540		U	400		U	570		U	390

TABLE B-5
HUMPHREY IMPOUNDMENT SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	HI-SS-13			HI-SS-14			HI-SS-15			HI-SS-16			HI-SS-17		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
3,3'-Dimethylbenzidine	119-93-7		U	2000		U	2100		U	2000		U	3500		U	3500
3-Methylphenol & 4-Methylphenol	MEPH1314		U	400		U	410		U	390		U	690		U	690
4,6-Dinitro-2-methylphenol	534-52-1		U	1800		U	1900		U	1800		U	3100		U	3100
4-Bromophenyl phenyl ether	101-55-3		U	400		U	410		U	390		U	690		U	690
4-Chloro-3-methylphenol	59-50-7		U	400		U	410		U	390		U	690		U	690
4-Chlorophenyl phenyl ether	7005-72-3		U	400		U	410		U	390		U	690		U	690
4-Nitrophenol	100-02-7		U	400		U	410		U	390		U	690		U	690
bis(2-Chloroethoxy)methane	111-91-1		U	400		U	410		U	390		U	690		U	690
bis(2-Chloroethyl) ether	111-44-4		U	80		U	83		U	79		U	140		U	140
bis(2-Ethylhexyl) phthalate	117-81-7		U	400		U	410		U	390		U	690		U	690
Butyl benzyl phthalate	85-68-7		U	400		U	410		U	390		U	690		U	690
Dibenzofuran	132-64-9		U	400		U	410		U	390	120		690	41		690
Diethyl phthalate	84-66-2		U	400		U	410		U	390		U	690		U	690
Dimethyl phthalate	131-11-3		U	400		U	410		U	390		U	690		U	690
Di-n-butyl phthalate	84-74-2		U	400		U	410		U	390		U	690		U	690
Di-n-octyl phthalate	117-84-0		U	400		U	410		U	390		U	690		U	690
Hexachlorobenzene	118-74-1		U	80		U	83		U	79		U	140		U	140
Hexachlorobutadiene	87-68-3		U	80		U	83		U	79		U	140		U	140
Hexachlorocyclopentadiene	77-47-4		U	400		U	410		U	390		U	690		U	690
Hexachloroethane	67-72-1		U	400		U	410		U	390		U	690		U	690
Isophorone	78-59-1		U	400		U	410		U	390		U	690		U	690
Nitrobenzene	98-95-3		U	80		U	83		U	79		U	140		U	140
Pentachloroethane	76-01-7		U	400		U	410		U	390		U	690		U	690
Pentachlorophenol	87-86-5		U	120		U	120		U	120		U	210		U	210
Phenol	108-95-2		U	80		U	83		U	79		U	140		U	140
Pyridine	110-86-1		U	400		U	410		U	390		U	690		U	690

TABLE B-5
HUMPHREY IMPOUNDMENT SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	HI-SS-18			HI-SS-19			HI-SS-20		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
3,3'-Dimethylbenzidine	119-93-7		U	2100		U	1700		U	1800
3-Methylphenol & 4-Methylphenol	MEPH1314		U	410		U	340		U	350
4,6-Dinitro-2-methylphenol	534-52-1		U	1900		U	1600		U	1600
4-Bromophenyl phenyl ether	101-55-3		U	410		U	340		U	350
4-Chloro-3-methylphenol	59-50-7		U	410		U	340		U	350
4-Chlorophenyl phenyl ether	7005-72-3		U	410		U	340		U	350
4-Nitrophenol	100-02-7		U	410		U	340		U	350
bis(2-Chloroethoxy)methane	111-91-1		U	410		U	340		U	350
bis(2-Chloroethyl) ether	111-44-4		U	84		U	70		U	70
bis(2-Ethylhexyl) phthalate	117-81-7		U	410		U	340		U	350
Butyl benzyl phthalate	85-68-7		U	410		U	340		U	350
Dibenzofuran	132-64-9		U	410		U	340		U	350
Diethyl phthalate	84-66-2		U	410		U	340		U	350
Dimethyl phthalate	131-11-3		U	410		U	340		U	350
Di-n-butyl phthalate	84-74-2		U	410		U	340		U	350
Di-n-octyl phthalate	117-84-0		U	410		U	340		U	350
Hexachlorobenzene	118-74-1		U	84		U	70		U	70
Hexachlorobutadiene	87-68-3		U	84		U	70		U	70
Hexachlorocyclopentadiene	77-47-4		U	410		U	340		U	350
Hexachloroethane	67-72-1		U	410		U	340		U	350
Isophorone	78-59-1		U	410		U	340		U	350
Nitrobenzene	98-95-3		U	84		U	70		U	70
Pentachloroethane	76-01-7		U	420		U	350		U	350
Pentachlorophenol	87-86-5		U	130		U	100		U	110
Phenol	108-95-2		U	84		U	70		U	70
Pyridine	110-86-1		U	410		U	340		U	350

TABLE B-6
COUNTY LANDS 1B PARCEL SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-SS-01			CL-SS-02			CL-SS-03			CL-SS-04			CL-SS-05		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
Inorganics (mg/kg)																
Antimony	7440-36-0	0.61	L	1.1	0.49	L	1.1		UL	1.1	1.8	L	5.7	0.25	L	1.2
Arsenic	7440-38-2	3.1		1.1	5.2		1.1	4.1		1.1	36.4		5.7	3.1		1.2
Barium	7440-39-3	62.8		21.6	51.9		22.5	210		21.6	8.8		22.8	75.3		24.4
Beryllium	7440-41-7	0.43		0.43	0.39		0.45	4.4		0.43		UL	2.3	1.3		0.49
Cadmium	7440-43-9	0.78		0.54	0.25		0.56	0.74		0.54	3.1		2.8	0.13		0.61
Chromium	7440-47-3	22.6	K	0.54	21.6	K	0.56	31.7	K	0.54	178	K	2.8	20.8	K	0.61
Cobalt	7440-48-4	3		5.4	4		5.6	60		5.4	10.4		5.7	2.7		6.1
Copper	7440-50-8	26.6		2.7	27.7		2.8	101		2.7	131		2.8	13.7		3.1
Cyanide, Total	57-12-5	0.33		0.54		U	0.56	1.8		0.54	0.52		0.57	0.21		0.61
Lead	7439-92-1	191	L	0.32	81.5	L	0.34	47.1		0.32	284	L	1.7	22.5	L	0.37
Mercury	7439-97-6	0.19		0.036	0.2		0.037		U	0.036	0.037		0.038	0.06		0.04
Nickel	7440-02-0	9.5		4.3	9.1		4.5	14.9		4.3	42.9		4.6	6.6		4.9
Selenium	7782-49-2	1		0.54	1.5		0.56	1.2		0.54	8.7		2.8	3.4		0.61
Silver	7440-22-4	0.38		0.54	0.19		0.56	0.86		0.54	2.5		0.57	0.23		0.61
Sulfide, Total	18496-25-8		U	32.4		U	33.7	355		32.5		U	34.2		U	36.7
Thallium	7440-28-0		U	1.1		U	1.1		U	2.2	3.8		5.7		U	1.2
Tin	7440-31-5	5.8		10.8	5.9		11.2	17.4		10.8	17.6		11.4	4.3		12.2
Vanadium	7440-62-2	40.1		5.4	49.6		5.6	73.4		5.4	40.3		28.5	29		6.1
Zinc	7440-66-6	274		2.2	149		2.2	338	K	2.2	7920		22.8	108		2.4
PCBs (ug/kg)																
Aroclor 1016	12674-11-2		U	18		U	19		U	18		U	19		U	20
Aroclor 1221	11104-28-2		U	18		U	19		U	18		U	19		U	20
Aroclor 1232	11141-16-5		U	18		U	19		U	18		U	19		U	20
Aroclor 1242	53469-21-9		U	18		U	19		U	18		U	19		U	20
Aroclor 1248	12672-29-6	8		18		U	19		U	18		U	19		U	20
Aroclor 1254	11097-69-1		U	18		U	19		U	18		U	19		U	20
Aroclor 1260	11096-82-5	28		18		U	19		U	18	4.8		19	110		20

TABLE B-6
COUNTY LANDS 1B PARCEL SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-SS-06			CL-SS-07			CL-SS-08			CL-SS-09			CL-SS-10		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
Inorganics (mg/kg)																
Antimony	7440-36-0		UL	1.1	0.33	L	1.1	0.11	L	1.1	17.1	L	5.8		UL	1.1
Arsenic	7440-38-2	4		1.1	5.5		1.1	4.8		1.1	41		5.8	5.3		1.1
Barium	7440-39-3	40.3		22	38.4		22.9	62.3		22.4	4.1		23.3	279		22.8
Beryllium	7440-41-7	0.68	B	0.44	0.56	B	0.46	0.63		0.45		U	2.3	5.2		0.46
Cadmium	7440-43-9	0.23		0.55	2.7		0.57	0.52		0.56	1.7		2.9	3.8		0.57
Chromium	7440-47-3	19.9	K	0.55	19.6	K	0.57	27.7	K	0.56	143	K	2.9	54.2	K	0.57
Cobalt	7440-48-4	4.2		5.5	6.4		5.7	6.1		5.6	11.2		5.8	2.5		5.7
Copper	7440-50-8	15		2.8	27.8		2.9	23.7		2.8	141		2.9	47.5		2.8
Cyanide, Total	57-12-5	0.26		0.55		U	0.57	0.19		0.56	0.34		0.58	3.8		0.57
Lead	7439-92-1	27.6		0.33	85.1		0.34	65.7	L	0.34	747		1.7	1640		1.7
Mercury	7439-97-6	0.083		0.036	0.13		0.038	0.12		0.037	0.02		0.038		U	0.038
Nickel	7440-02-0	9.3		4.4	8.8		4.6	12.7		4.5	48.3		4.7	48.9		4.6
Selenium	7782-49-2	1.2		0.55	0.86		0.57	1.3		0.56	5		2.9		U	0.57
Silver	7440-22-4	0.15		0.55	0.32		0.57	0.25		0.56	1.8		0.58	0.81		0.57
Sulfide, Total	18496-25-8		U	33		U	34.3		U	33.6		U	35	1080		34.2
Thallium	7440-28-0		U	1.1		U	1.1		U	1.1	2.3		5.8		U	5.7
Tin	7440-31-5	4.4		11	5.1		11.4	5.5		11.2	33.9		11.7	13		11.4
Vanadium	7440-62-2	24.8		5.5	26.4		5.7	31.1		5.6	43.7		29.2	66.3		5.7
Zinc	7440-66-6	123	K	2.2	346	K	2.3	254		2.2	4150	K	11.7	481	K	2.3
PCBs (ug/kg)																
Aroclor 1016	12674-11-2		U	18		U	19		U	19		U	19		U	19
Aroclor 1221	11104-28-2		U	18		U	19		U	19		U	19		U	19
Aroclor 1232	11141-16-5		U	18		U	19		U	19		U	19		U	19
Aroclor 1242	53469-21-9		U	18		U	19		U	19		U	19		U	19
Aroclor 1248	12672-29-6		U	18		U	19		U	19		U	19		U	19
Aroclor 1254	11097-69-1		U	18		U	19		U	19		U	19		U	19
Aroclor 1260	11096-82-5		U	18		U	19		U	19		U	19		U	19

TABLE B-6
COUNTY LANDS 1B PARCEL SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-SS-11			CL-SS-12			CL-SS-13			CL-SS-14			CL-SS-15		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
Inorganics (mg/kg)																
Antimony	7440-36-0	0.27	L	1.1	2.4	L	5.1		UL	12.4		UL	1.1		UL	2.2
Arsenic	7440-38-2	4.1		1.1	13.5		1	12.7		6.2	3.3		1.1	3.7		1.1
Barium	7440-39-3	42.9		22.1	74.3		20.3	44.2		24.8	211		22.2	195		22
Beryllium	7440-41-7	0.41		0.44	0.74	B	0.41	0.27	B	2.5	2.4	B	0.44	2.5	B	0.44
Cadmium	7440-43-9	0.4		0.55	3.2		2.5	5.1		6.2	0.67		0.56	2.9		1.1
Chromium	7440-47-3	26.1	K	0.55	96.6	K	2.5	212	K	6.2	27	K	0.56	223	K	1.1
Cobalt	7440-48-4	5		5.5	8.1		5.1	7.4		6.2	3.1		5.6	3.2		5.5
Copper	7440-50-8	34.1		2.8	2060		12.7	138		3.1	19.3		2.8	55.6		2.7
Cyanide, Total	57-12-5	2		0.55	1.5		0.51	13.5		0.62	2.1		0.56	0.93		0.55
Lead	7439-92-1	80.3	L	0.33	425		1.5	538		3.7	54.7		0.33	155		0.66
Mercury	7439-97-6	0.27		0.036	0.012		0.034	0.19		0.041		U	0.037		U	0.036
Nickel	7440-02-0	8.4		4.4	53.9		4.1	53.9		5	8.9		4.4	19.8		4.4
Selenium	7782-49-2	1.5		0.55	1.5		2.5	6.1		6.2	0.92		0.56		U	5.5
Silver	7440-22-4	0.19		0.55	1.5		0.51	5.4		0.62	0.61		0.56	3.2		0.55
Sulfide, Total	18496-25-8		U	33.1	73.2		30.5		U	37.1	249		33.3	290		32.9
Thallium	7440-28-0		U	1.1		U	5.1		U	12.4	1.1		1.1		U	11
Tin	7440-31-5	7.5		11	179		10.2	55.8		12.4	6.3		11.1	14.6		11
Vanadium	7440-62-2	40.6		5.5	55.7		25.4	64.3		61.9	32.4		5.6	1210		11
Zinc	7440-66-6	172		2.2	1790	K	10.2	6430	K	24.8	227	K	2.2	1390	K	4.4
PCBs (ug/kg)																
Aroclor 1016	12674-11-2		U	18		U	17		U	21		U	19		U	18
Aroclor 1221	11104-28-2		U	18		U	17		U	21		U	19		U	18
Aroclor 1232	11141-16-5		U	18		U	17		U	21		U	19		U	18
Aroclor 1242	53469-21-9		U	18		U	17		U	21		U	19		U	18
Aroclor 1248	12672-29-6		U	18		U	17		U	21		U	19		U	18
Aroclor 1254	11097-69-1		U	18		U	17		U	21		U	19		U	18
Aroclor 1260	11096-82-5	33		18		U	17		U	21		U	19		U	18

TABLE B-6
COUNTY LANDS 1B PARCEL SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-SS-16			CL-SS-17			CL-SS-18			CL-SS-20		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
Inorganics (mg/kg)													
Antimony	7440-36-0	0.15	L	1.1	0.56	L	1.1	0.12	L	1.1	0.76	L	1.2
Arsenic	7440-38-2	3.8		1.1	6		1.1	2.7		1.1	5		1.2
Barium	7440-39-3	82.3		21.3	90.8		22.4	120		22.3	90.8		23.2
Beryllium	7440-41-7	0.86	B	0.43	0.58	B	0.45	0.88		0.45	0.4		0.46
Cadmium	7440-43-9	17.6		0.53	0.83		0.56	1.1		0.56	1.2		0.58
Chromium	7440-47-3	175	K	0.53	27.6	K	0.56	175	K	0.56	25.2	K	0.58
Cobalt	7440-48-4	6.3		5.3	5.6		5.6	3.8		5.6	3.8		5.8
Copper	7440-50-8	68.9		2.7	34.8		2.8	25.9		2.8	32.3		2.9
Cyanide, Total	57-12-5	0.29		0.53	0.29		0.56	0.16		0.56	0.9		0.58
Lead	7439-92-1	127		0.32	110		0.34	83.9	L	0.33	130	L	0.35
Mercury	7439-97-6	0.035		0.035	0.2		0.037	0.13		0.037	0.14		0.038
Nickel	7440-02-0	76.3		4.3	12.9		4.5	9.7		4.5	11.9		4.6
Selenium	7782-49-2	0.66		0.53	1.2		0.56		U	5.6	1.7		0.58
Silver	7440-22-4	0.65		0.53	0.38		0.56	3.5		0.56	0.41		0.58
Sulfide, Total	18496-25-8	136		31.9		U	33.6		U	33.5		U	34.7
Thallium	7440-28-0		U	1.1		U	1.1		U	11.2		U	1.2
Tin	7440-31-5	21		10.6	15.8		11.2	10.2		11.2	12.6		11.6
Vanadium	7440-62-2	81.8		5.3	46.7		5.6	548		5.6	40.2		5.8
Zinc	7440-66-6	1430	K	4.3	259	K	2.2	431		2.2	441		2.3
PCBs (ug/kg)													
Aroclor 1016	12674-11-2		U	18		U	19		U	19		U	19
Aroclor 1221	11104-28-2		U	18		U	19		U	19		U	19
Aroclor 1232	11141-16-5		U	18		U	19		U	19		U	19
Aroclor 1242	53469-21-9		U	18		U	19		U	19		U	19
Aroclor 1248	12672-29-6		U	18		U	19		U	19		U	19
Aroclor 1254	11097-69-1		U	18		U	19		U	19		U	19
Aroclor 1260	11096-82-5		U	18		U	19	79		19		U	19

TABLE B-6
COUNTY LANDS 1B PARCEL SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-SS-01			CL-SS-02			CL-SS-03			CL-SS-04			CL-SS-05		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
VOCs (ug/kg)																
1,1,1,2-Tetrachloroethane	630-20-6		U	7		U	8.7		U	8.5		U	4.4		U	8.1
1,1,1-Trichloroethane	71-55-6		U	7		U	8.7		U	8.5		U	4.4		U	8.1
1,1,2,2-Tetrachloroethane	79-34-5		U	7		U	8.7		U	8.5		U	4.4		U	8.1
1,1,2-Trichloroethane	79-00-5		U	7		U	8.7		U	8.5		U	4.4		U	8.1
1,1-Dichloroethane	75-34-3		U	7		U	8.7		U	8.5		U	4.4		U	8.1
1,1-Dichloroethene	75-35-4		U	7		U	8.7		U	8.5		U	4.4		U	8.1
1,2-Dichloroethane	107-06-2		U	7		U	8.7		U	8.5		U	4.4		U	8.1
1,2-Dichloropropane	78-87-5		U	7		U	8.7		U	8.5		U	4.4		U	8.1
2-Butanone	78-93-3		U	7		U	8.7		U	8.5		U	4.4		U	8.1
2-Hexanone	591-78-6		U	7		U	8.7		U	8.5		U	4.4		U	8.1
4-Methyl-2-pentanone	108-10-1		U	7		U	8.7		U	8.5		U	4.4		U	8.1
Acetone	67-64-1		UJ	28		UJ	35		U	34		UJ	18		UJ	33
Benzene	71-43-2		U	7		U	8.7		U	8.5		U	4.4		U	8.1
Bromoform	75-25-2		U	7		U	8.7		U	8.5		U	4.4		U	8.1
Carbon disulfide	75-15-0		U	7		U	8.7		U	8.5		U	4.4		U	8.1
Carbon tetrachloride	56-23-5		U	7		U	8.7		U	8.5		U	4.4		U	8.1
Chlorobenzene	108-90-7		U	7		U	8.7		U	8.5		U	4.4		U	8.1
Chloroethane	75-00-3		UJ	7		UJ	8.7		U	8.5		UJ	4.4		UJ	8.1
Chloroform	67-66-3		U	7		U	8.7		U	8.5		U	4.4		U	8.1
cis-1,3-Dichloropropene	10061-01-5		U	7		U	8.7		U	8.5		U	4.4		U	8.1
Ethylbenzene	100-41-4		U	7		U	8.7		U	8.5		U	4.4		U	8.1
Methylene chloride	75-09-2	1.2	B	7	1.6	B	8.7		U	8.5	1.3	B	4.4	2	B	8.1
Tetrachloroethene	127-18-4		U	7		U	8.7		U	8.5		U	4.4		U	8.1
Toluene	108-88-3		U	7		U	8.7		U	8.5		U	4.4		U	8.1
trans-1,2-Dichloroethene	156-60-5		U	7		U	8.7		U	8.5		U	4.4		U	8.1
trans-1,3-Dichloropropene	10061-02-6		U	7		U	8.7		U	8.5		U	4.4		U	8.1
Trichloroethene	79-01-6		U	7		U	8.7		U	8.5		U	4.4		U	8.1
Vinyl chloride	75-01-4		U	7		U	8.7		U	8.5		U	4.4		U	8.1
Xylenes (total)	1330-20-7		U	21		U	26		U	26		U	13		U	24

TABLE B-6
COUNTY LANDS 1B PARCEL SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-SS-06			CL-SS-07			CL-SS-08			CL-SS-09			CL-SS-10		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
VOCs (ug/kg)																
1,1,1,2-Tetrachloroethane	630-20-6		U	8.1		U	7		U	7.2		U	3.8		U	8.1
1,1,1-Trichloroethane	71-55-6		U	8.1		U	7		U	7.2		U	3.8		U	8.1
1,1,2,2-Tetrachloroethane	79-34-5		U	8.1		U	7		U	7.2		U	3.8		U	8.1
1,1,2-Trichloroethane	79-00-5		U	8.1		U	7		U	7.2		U	3.8		U	8.1
1,1-Dichloroethane	75-34-3		U	8.1		U	7		U	7.2		U	3.8		U	8.1
1,1-Dichloroethene	75-35-4		U	8.1		U	7		U	7.2		U	3.8		U	8.1
1,2-Dichloroethane	107-06-2		U	8.1		U	7		U	7.2		U	3.8		U	8.1
1,2-Dichloropropane	78-87-5		U	8.1		U	7		U	7.2		U	3.8		U	8.1
2-Butanone	78-93-3		U	8.1		U	7		U	7.2		U	3.8		U	8.1
2-Hexanone	591-78-6		U	8.1		U	7		U	7.2		U	3.8		U	8.1
4-Methyl-2-pentanone	108-10-1		U	8.1		U	7		U	7.2		U	3.8		U	8.1
Acetone	67-64-1		U	32	10	B	28		U	29		U	15		U	32
Benzene	71-43-2		U	8.1		U	7		U	7.2		U	3.8		U	8.1
Bromoform	75-25-2		UJ	8.1		U	7		U	7.2		U	3.8		UJ	8.1
Carbon disulfide	75-15-0		U	8.1		U	7		U	7.2		U	3.8		U	8.1
Carbon tetrachloride	56-23-5		U	8.1		U	7		U	7.2		U	3.8		U	8.1
Chlorobenzene	108-90-7		U	8.1		U	7		U	7.2		U	3.8		U	8.1
Chloroethane	75-00-3		U	8.1		U	7		U	7.2		U	3.8		U	8.1
Chloroform	67-66-3		U	8.1		U	7		U	7.2		U	3.8		U	8.1
cis-1,3-Dichloropropene	10061-01-5		U	8.1		U	7		U	7.2		U	3.8		U	8.1
Ethylbenzene	100-41-4		U	8.1		U	7		U	7.2		U	3.8		U	8.1
Methylene chloride	75-09-2	1.9		8.1		U	7	8.9	B	7.2		U	3.8	7	B	8.1
Tetrachloroethene	127-18-4		U	8.1		U	7		U	7.2		U	3.8		U	8.1
Toluene	108-88-3		U	8.1		U	7		U	7.2		U	3.8		U	8.1
trans-1,2-Dichloroethene	156-60-5		U	8.1		U	7		U	7.2		U	3.8		U	8.1
trans-1,3-Dichloropropene	10061-02-6		U	8.1		U	7		U	7.2		U	3.8		U	8.1
Trichloroethene	79-01-6		U	8.1		U	7		U	7.2		U	3.8		U	8.1
Vinyl chloride	75-01-4		U	8.1		U	7		U	7.2		U	3.8		U	8.1
Xylenes (total)	1330-20-7		U	24		U	21		U	22		U	12		U	24

TABLE B-6
COUNTY LANDS 1B PARCEL SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-SS-11			CL-SS-12			CL-SS-13			CL-SS-14			CL-SS-15		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
VOCs (ug/kg)																
1,1,1,2-Tetrachloroethane	630-20-6		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
1,1,1-Trichloroethane	71-55-6		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
1,1,2,2-Tetrachloroethane	79-34-5		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
1,1,2-Trichloroethane	79-00-5		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
1,1-Dichloroethane	75-34-3		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
1,1-Dichloroethene	75-35-4		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
1,2-Dichloroethane	107-06-2		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
1,2-Dichloropropane	78-87-5		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
2-Butanone	78-93-3		U	8.3		UJ	6.2		U	8.1	11		9.7		U	7.4
2-Hexanone	591-78-6		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
4-Methyl-2-pentanone	108-10-1		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
Acetone	67-64-1		U	33	14	B	25		U	32	70	B	39		U	29
Benzene	71-43-2		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
Bromoform	75-25-2		U	8.3		UJ	6.2		U	8.1		U	9.7		UJ	7.4
Carbon disulfide	75-15-0		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
Carbon tetrachloride	56-23-5		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
Chlorobenzene	108-90-7		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
Chloroethane	75-00-3		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
Chloroform	67-66-3		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
cis-1,3-Dichloropropene	10061-01-5		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
Ethylbenzene	100-41-4		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
Methylene chloride	75-09-2	9.4	B	8.3	2.5		6.2		U	8.1	4.4	B	9.7	3.9	B	7.4
Tetrachloroethene	127-18-4		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
Toluene	108-88-3		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
trans-1,2-Dichloroethene	156-60-5		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
trans-1,3-Dichloropropene	10061-02-6		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
Trichloroethene	79-01-6		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
Vinyl chloride	75-01-4		U	8.3		UJ	6.2		U	8.1		U	9.7		U	7.4
Xylenes (total)	1330-20-7		U	25		U	18		U	24		U	29		U	22

TABLE B-6
COUNTY LANDS 1B PARCEL SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-SS-16			CL-SS-17			CL-SS-18			CL-SS-20		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
VOCs (ug/kg)													
1,1,1,2-Tetrachloroethane	630-20-6		U	6.8		U	9.6		U	8.9		U	9.7
1,1,1-Trichloroethane	71-55-6		U	6.8		U	9.6		U	8.9		U	9.7
1,1,2,2-Tetrachloroethane	79-34-5		U	6.8		U	9.6		U	8.9		U	9.7
1,1,2-Trichloroethane	79-00-5		U	6.8		U	9.6		U	8.9		U	9.7
1,1-Dichloroethane	75-34-3		U	6.8		U	9.6		U	8.9		U	9.7
1,1-Dichloroethene	75-35-4		U	6.8		U	9.6		U	8.9		U	9.7
1,2-Dichloroethane	107-06-2		U	6.8		U	9.6		U	8.9		U	9.7
1,2-Dichloropropane	78-87-5		U	6.8		U	9.6		U	8.9		U	9.7
2-Butanone	78-93-3		U	6.8	42		9.6		U	8.9		U	9.7
2-Hexanone	591-78-6		U	6.8		U	9.6		U	8.9		U	9.7
4-Methyl-2-pentanone	108-10-1		U	6.8		U	9.6		U	8.9		U	9.7
Acetone	67-64-1	9.1	B	27	240		38		U	36		U	39
Benzene	71-43-2		U	6.8		U	9.6		U	8.9		U	9.7
Bromoform	75-25-2		U	6.8		UJ	9.6		U	8.9		U	9.7
Carbon disulfide	75-15-0		U	6.8		U	9.6		U	8.9		U	9.7
Carbon tetrachloride	56-23-5		U	6.8		U	9.6		U	8.9		U	9.7
Chlorobenzene	108-90-7		U	6.8		U	9.6		U	8.9		U	9.7
Chloroethane	75-00-3		U	6.8		U	9.6		U	8.9		U	9.7
Chloroform	67-66-3		U	6.8		U	9.6		U	8.9		U	9.7
cis-1,3-Dichloropropene	10061-01-5		U	6.8		U	9.6		U	8.9		U	9.7
Ethylbenzene	100-41-4		U	6.8		U	9.6		U	8.9		U	9.7
Methylene chloride	75-09-2	1	B	6.8	3.6	B	9.6	10	B	8.9	11	B	9.7
Tetrachloroethene	127-18-4		U	6.8		U	9.6		U	8.9		U	9.7
Toluene	108-88-3		U	6.8		U	9.6		U	8.9		U	9.7
trans-1,2-Dichloroethene	156-60-5		U	6.8		U	9.6		U	8.9		U	9.7
trans-1,3-Dichloropropene	10061-02-6		U	6.8		U	9.6		U	8.9		U	9.7
Trichloroethene	79-01-6		U	6.8		U	9.6		U	8.9		U	9.7
Vinyl chloride	75-01-4		U	6.8		U	9.6		U	8.9		U	9.7
Xylenes (total)	1330-20-7		U	20		U	29		U	27		U	29

TABLE B-6
COUNTY LANDS 1B PARCEL SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-SS-01			CL-SS-02			CL-SS-03			CL-SS-04			CL-SS-05		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
PAHs (ug/kg)																
2-Methylnaphthalene	91-57-6		U	360		U	150	21		73		U	150		U	160
Acenaphthene	83-32-9		U	360		U	150		U	73		U	150		U	160
Acenaphthylene	208-96-8		U	360		U	150	81		73		U	150		U	160
Anthracene	120-12-7		U	360		U	150	58		73		U	150		U	160
Fluoranthene	206-44-0	200		360	220		150	170		73		U	150		U	160
Fluorene	86-73-7		U	360		U	150		U	73		U	150		U	160
Naphthalene	91-20-3		U	360		U	150		U	73		U	150		U	160
Benzo(a)pyrene	50-32-8	110		360	110		150	150		73		U	150	27		160
Benzo(b)fluoranthene	205-99-2	110		360	130		150	240		73		U	150		U	160
Benzo(ghi)perylene	191-24-2	97		360	96		150	150		73		U	150	30		160
Benzo(k)fluoranthene	207-08-9		U	360	59		150		U	73		U	150		U	160
Chrysene	218-01-9	110		360	120		150	140		73		U	150		U	160
Dibenz(a,h)anthracene	53-70-3		U	360		U	150		U	73		U	150		U	160
Indeno(1,2,3-cd)pyrene	193-39-5	90		360	83		150	120		73		U	150		U	160
Pyrene	129-00-0	150		360	180		150	120		73		U	150		U	160
Other SVOCs (ug/kg)																
1,2,4-Trichlorobenzene	120-82-1		U	1800		U	730		U	360		U	740		U	800
1,2-Dichlorobenzene	95-50-1		U	360		U	150		U	73		U	150		U	160
1,3-Dichlorobenzene	541-73-1		U	360		U	150		U	73		U	150		U	160
1,4-Dichlorobenzene	106-46-7		U	360		U	150		U	73		U	150		U	160
2,2'-oxybis(1-Chloropropane)	108-60-1		U	360		U	150		U	73		U	150		U	160
2,4,5-Trichlorophenol	95-95-4		U	1800		U	730		U	360		U	740		U	800
2,4,6-Trichlorophenol	88-06-2		U	1800		U	730		U	360		U	740		U	800
2,4-Dichlorophenol	120-83-2		U	360		U	150		U	73		U	150		U	160
2,4-Dimethylphenol	105-67-9		U	1800		U	730		U	360		U	740		U	800
2,4-Dinitrophenol	51-28-5		UJ	8100		UJ	3300		UJ	1600		UJ	3400		UJ	3600
2,4-Dinitrotoluene	121-14-2		U	1800		U	730		U	360		U	740		U	800
2,6-Dinitrotoluene	606-20-2		U	1800		U	730		U	360		U	740		U	800
2-Chloronaphthalene	91-58-7		U	360		U	150		U	73		U	150		U	160
2-Chlorophenol	95-57-8		U	1800		U	730		U	360		U	740		U	800
2-Methylphenol	95-48-7		U	1800		U	730		U	360		U	740		U	800

TABLE B-6
COUNTY LANDS 1B PARCEL SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-SS-06			CL-SS-07			CL-SS-08			CL-SS-09			CL-SS-10		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
PAHs (ug/kg)																
2-Methylnaphthalene	91-57-6		U	73		U	77		U	75		U	78	32		76
Acenaphthene	83-32-9		U	73		U	77		U	75		U	78		U	76
Acenaphthylene	208-96-8		U	73		U	77		U	75		U	78	50		76
Anthracene	120-12-7		U	73		U	77		U	75		U	78	45		76
Fluoranthene	206-44-0	53		73	120		77	130		75		U	78	290		76
Fluorene	86-73-7		U	73		U	77		U	75		U	78		U	76
Naphthalene	91-20-3		U	73		U	77		U	75		U	78	38		76
Benzo(a)pyrene	50-32-8	29		73	58		77	67		75		U	78	200		76
Benzo(b)fluoranthene	205-99-2	39		73	82		77	89		75		U	78	310		76
Benzo(ghi)perylene	191-24-2	34		73	58		77	73		75		U	78	180		76
Benzo(k)fluoranthene	207-08-9	14		73	31		77		U	75		U	78	100		76
Chrysene	218-01-9	44		73	73		77	77		75		U	78	220		76
Dibenz(a,h)anthracene	53-70-3		U	73		U	77		U	75		U	78	32		76
Indeno(1,2,3-cd)pyrene	193-39-5	30		73	50		77	64		75		U	78	150		76
Pyrene	129-00-0	32		73	72		77	68		75		U	78	200		76
Other SVOCs (ug/kg)																
1,2,4-Trichlorobenzene	120-82-1		U	360		U	380		U	370		U	380		U	370
1,2-Dichlorobenzene	95-50-1		U	73		U	77		U	75		U	78		U	76
1,3-Dichlorobenzene	541-73-1		U	73		U	77		U	75		U	78		U	76
1,4-Dichlorobenzene	106-46-7		U	73		U	77		U	75		U	78		U	76
2,2'-oxybis(1-Chloropropane)	108-60-1		U	73		U	77		U	75		U	78		U	76
2,4,5-Trichlorophenol	95-95-4		U	360		U	380		U	370		U	380		U	370
2,4,6-Trichlorophenol	88-06-2		U	360		U	380		U	370		U	380		U	370
2,4-Dichlorophenol	120-83-2		U	73		U	77		U	75		U	78		U	76
2,4-Dimethylphenol	105-67-9		U	360		U	380		U	370		U	380		U	370
2,4-Dinitrophenol	51-28-5		UJ	1600		UJ	1700		UJ	1700		UJ	1700		UJ	1700
2,4-Dinitrotoluene	121-14-2		U	360		U	380		U	370		U	380		U	370
2,6-Dinitrotoluene	606-20-2		U	360		U	380		U	370		U	380		U	370
2-Chloronaphthalene	91-58-7		U	73		U	77		U	75		U	78		U	76
2-Chlorophenol	95-57-8		U	360		U	380		U	370		U	380		U	370
2-Methylphenol	95-48-7		U	360		U	380		U	370		U	380		U	370

TABLE B-6
COUNTY LANDS 1B PARCEL SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-SS-11			CL-SS-12			CL-SS-13			CL-SS-14			CL-SS-15		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
PAHs (ug/kg)																
2-Methylnaphthalene	91-57-6	91		150	41		67		U	83	22		74	45		74
Acenaphthene	83-32-9	220		150		U	67		U	83	51		74	19		74
Acenaphthylene	208-96-8	5800		150	78		67		U	83	570		74	230		74
Anthracene	120-12-7	4300		150	79		67		U	83	890		74	100		74
Fluoranthene	206-44-0	29000		150	520		67	140		83	1100		74	540		74
Fluorene	86-73-7	390		150		U	67		U	83	74		74		U	74
Naphthalene	91-20-3	540		150	78		67		U	83	30		74	110		74
Benzo(a)pyrene	50-32-8	11000		150	480		67	54		83	730		74	330		74
Benzo(b)fluoranthene	205-99-2	19000		150	530		67	160		83	1400		74	500		74
Benzo(ghi)perylene	191-24-2	12000		150	450		67	120		83	1300		74	320		74
Benzo(k)fluoranthene	207-08-9	7300		150	240		67	42		83	390		74	200		74
Chrysene	218-01-9	13000		150	370		67	120		83	800		74	360		74
Dibenz(a,h)anthracene	53-70-3	3600		150	89		67		U	83	250		74	88		74
Indeno(1,2,3-cd)pyrene	193-39-5	12000		150	380		67	81		83	910		74	300		74
Pyrene	129-00-0	13000		150	360		67	79		83	780		74	290		74
Other SVOCs (ug/kg)																
1,2,4-Trichlorobenzene	120-82-1		U	730		U	330		U	410		U	370		U	360
1,2-Dichlorobenzene	95-50-1		U	150		U	67		U	83		U	74		U	74
1,3-Dichlorobenzene	541-73-1		U	150		U	67		U	83		U	74		U	74
1,4-Dichlorobenzene	106-46-7		U	150		U	67		U	83		U	74		U	74
2,2'-oxybis(1-Chloropropane)	108-60-1		U	150		U	67		U	83		U	74		U	74
2,4,5-Trichlorophenol	95-95-4		U	730		U	330		U	410		U	370		U	360
2,4,6-Trichlorophenol	88-06-2		U	730		U	330		U	410		U	370		U	360
2,4-Dichlorophenol	120-83-2		U	150		U	67		U	83		U	74		U	74
2,4-Dimethylphenol	105-67-9		U	730		U	330		U	410		U	370		U	360
2,4-Dinitrophenol	51-28-5		UJ	3300		UJ	1500		UJ	1900		UJ	1700		UJ	1600
2,4-Dinitrotoluene	121-14-2		U	730		U	330		U	410		U	370		U	360
2,6-Dinitrotoluene	606-20-2		U	730		U	330		U	410		U	370		U	360
2-Chloronaphthalene	91-58-7		U	150		U	67		U	83		U	74		U	74
2-Chlorophenol	95-57-8		U	730		U	330		U	410		U	370		U	360
2-Methylphenol	95-48-7		U	730		U	330		U	410		U	370		U	360

TABLE B-6
COUNTY LANDS 1B PARCEL SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-SS-16			CL-SS-17			CL-SS-18			CL-SS-20		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
PAHs (ug/kg)													
2-Methylnaphthalene	91-57-6	140		140		U	75	47		75		U	78
Acenaphthene	83-32-9	200		140		U	75		U	75		U	78
Acenaphthylene	208-96-8	1600		140		U	75	120		75		U	78
Anthracene	120-12-7	1700		140		U	75	66		75	24		78
Fluoranthene	206-44-0	11000		140	130		75	470		75	180		78
Fluorene	86-73-7	480		140		U	75		U	75		U	78
Naphthalene	91-20-3	180		140		U	75	49		75	21		78
Benzo(a)pyrene	50-32-8	3900		140	57		75	220		75	76		78
Benzo(b)fluoranthene	205-99-2	4500		140	93		75	300		75	120		78
Benzo(ghi)perylene	191-24-2	3200		140	60		75	210		75	71		78
Benzo(k)fluoranthene	207-08-9	1600		140	29		75		U	75		U	78
Chrysene	218-01-9	4200		140	88		75	230		75	100		78
Dibenz(a,h)anthracene	53-70-3	700		140		U	75	54		75		U	78
Indeno(1,2,3-cd)pyrene	193-39-5	2700		140	48		75	180		75	62		78
Pyrene	129-00-0	6700		140	71		75	230		75	98		78
Other SVOCs (ug/kg)													
1,2,4-Trichlorobenzene	120-82-1		U	700		U	370		U	370		U	380
1,2-Dichlorobenzene	95-50-1		U	140		U	75		U	75		U	78
1,3-Dichlorobenzene	541-73-1		U	140		U	75		U	75		U	78
1,4-Dichlorobenzene	106-46-7		U	140		U	75		U	75		U	78
2,2'-oxybis(1-Chloropropane)	108-60-1		U	140		U	75		U	75		U	78
2,4,5-Trichlorophenol	95-95-4		U	700		U	370		U	370		U	380
2,4,6-Trichlorophenol	88-06-2		U	700		U	370		U	370		U	380
2,4-Dichlorophenol	120-83-2		U	140		U	75		U	75		U	78
2,4-Dimethylphenol	105-67-9		U	700		U	370		U	370		U	380
2,4-Dinitrophenol	51-28-5		UJ	3200		UJ	1700		UJ	1700		UJ	1700
2,4-Dinitrotoluene	121-14-2		U	700		U	370		U	370		U	380
2,6-Dinitrotoluene	606-20-2		U	700		U	370		U	370		U	380
2-Chloronaphthalene	91-58-7		U	140		U	75		U	75		U	78
2-Chlorophenol	95-57-8		U	700		U	370		U	370		U	380
2-Methylphenol	95-48-7		U	700		U	370		U	370		U	380

TABLE B-6
COUNTY LANDS 1B PARCEL SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-SS-01			CL-SS-02			CL-SS-03			CL-SS-04			CL-SS-05		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
2-Nitrophenol	88-75-5		U	1800		U	730		U	360		U	740		U	800
3,3'-Dichlorobenzidine	91-94-1		U	1800		U	730		U	360		U	740		U	800
3,3'-Dimethylbenzidine	119-93-7		U	9000		U	3700		U	1800		U	3800		U	4000
3-Methylphenol & 4-Methylphenol	MEPH1314		U	1800		U	730		U	360		U	740		U	800
4,6-Dinitro-2-methylphenol	534-52-1		UJ	8100		UJ	3300		UJ	1600		UJ	3400		UJ	3600
4-Bromophenyl phenyl ether	101-55-3		U	1800		U	730		U	360		U	740		U	800
4-Chloro-3-methylphenol	59-50-7		U	1800		U	730		U	360		U	740		U	800
4-Chlorophenyl phenyl ether	7005-72-3		U	1800		U	730		U	360		U	740		U	800
4-Nitrophenol	100-02-7		U	1800		U	730		U	360		U	740		U	800
bis(2-Chloroethoxy)methane	111-91-1		U	1800		U	730		U	360		U	740		U	800
bis(2-Chloroethyl) ether	111-44-4		U	360		U	150		U	73		U	150		U	160
bis(2-Ethylhexyl) phthalate	117-81-7		U	1800	940		730	41		360		U	740		U	800
Butyl benzyl phthalate	85-68-7		U	1800		U	730	42		360		U	740		U	800
Dibenzofuran	132-64-9		U	1800		U	730		U	360		U	740		U	800
Diethyl phthalate	84-66-2		U	1800		U	730		U	360		U	740		U	800
Dimethyl phthalate	131-11-3		U	1800		U	730		U	360		U	740		U	800
Di-n-butyl phthalate	84-74-2		U	1800		U	730		U	360		U	740		U	800
Di-n-octyl phthalate	117-84-0		U	1800		U	730		U	360		U	740		U	800
Hexachlorobenzene	118-74-1		U	360		U	150		U	73		U	150		U	160
Hexachlorobutadiene	87-68-3		U	360		U	150		U	73		U	150		U	160
Hexachlorocyclopentadiene	77-47-4		U	1800		U	730		U	360		U	740		U	800
Hexachloroethane	67-72-1		U	1800		U	730		U	360		U	740		U	800
Isophorone	78-59-1		U	1800		U	730		U	360		U	740		U	800
Nitrobenzene	98-95-3		U	360		U	150		U	73		U	150		U	160
Pentachloroethane	76-01-7		U	1800		U	740		U	360		U	750		U	810
Pentachlorophenol	87-86-5		U	540		U	220		U	110		U	230		U	240
Phenol	108-95-2		U	360		U	150		U	73		U	150		U	160
Pyridine	110-86-1		U	1800		U	730		U	360		U	740		U	800

TABLE B-6
COUNTY LANDS 1B PARCEL SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-SS-06			CL-SS-07			CL-SS-08			CL-SS-09			CL-SS-10		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
2-Nitrophenol	88-75-5		U	360		U	380		U	370		U	380		U	370
3,3'-Dichlorobenzidine	91-94-1		U	360		U	380		U	370		U	380		U	370
3,3'-Dimethylbenzidine	119-93-7		U	1800		U	1900		U	1900		U	1900		U	1900
3-Methylphenol & 4-Methylphenol	MEPH1314		U	360		U	380		U	370		U	380		U	370
4,6-Dinitro-2-methylphenol	534-52-1		UJ	1600		UJ	1700		UJ	1700		UJ	1700		UJ	1700
4-Bromophenyl phenyl ether	101-55-3		U	360		U	380		U	370		U	380		U	370
4-Chloro-3-methylphenol	59-50-7		U	360		U	380		U	370		U	380		U	370
4-Chlorophenyl phenyl ether	7005-72-3		U	360		U	380		U	370		U	380		U	370
4-Nitrophenol	100-02-7		U	360		U	380		U	370		U	380		U	370
bis(2-Chloroethoxy)methane	111-91-1		U	360		U	380		U	370		U	380		U	370
bis(2-Chloroethyl) ether	111-44-4		U	73		U	77		U	75		U	78		U	76
bis(2-Ethylhexyl) phthalate	117-81-7	67		360	31		380	63		370		U	380	54		370
Butyl benzyl phthalate	85-68-7		U	360	31		380		U	370		U	380	32		370
Dibenzofuran	132-64-9		U	360		U	380		U	370		U	380		U	370
Diethyl phthalate	84-66-2		U	360		U	380		U	370		U	380		U	370
Dimethyl phthalate	131-11-3		U	360		U	380		U	370		U	380		U	370
Di-n-butyl phthalate	84-74-2		U	360		U	380		U	370		U	380		U	370
Di-n-octyl phthalate	117-84-0		U	360		U	380		U	370		U	380		U	370
Hexachlorobenzene	118-74-1		U	73		U	77		U	75		U	78		U	76
Hexachlorobutadiene	87-68-3		U	73		U	77		U	75		U	78		U	76
Hexachlorocyclopentadiene	77-47-4		U	360		U	380		U	370		U	380		U	370
Hexachloroethane	67-72-1		U	360		U	380		U	370		U	380		U	370
Isophorone	78-59-1		U	360		U	380		U	370		U	380		U	370
Nitrobenzene	98-95-3		U	73		U	77		U	75		U	78		U	76
Pentachloroethane	76-01-7		U	360		U	380		U	370		U	390		U	380
Pentachlorophenol	87-86-5		U	110		U	110		U	110		U	120		U	110
Phenol	108-95-2		U	73		U	77		U	75		U	78		U	76
Pyridine	110-86-1		U	360		U	380		U	370		U	380		U	370

TABLE B-6
COUNTY LANDS 1B PARCEL SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-SS-11			CL-SS-12			CL-SS-13			CL-SS-14			CL-SS-15		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
2-Nitrophenol	88-75-5		U	730		U	330		U	410		U	370		U	360
3,3'-Dichlorobenzidine	91-94-1		U	730		U	330		U	410		U	370		U	360
3,3'-Dimethylbenzidine	119-93-7		U	3700		U	1700		U	2100		U	1900		U	1800
3-Methylphenol & 4-Methylphenol	MEPH1314		U	730		U	330		U	410		U	370		U	360
4,6-Dinitro-2-methylphenol	534-52-1		UJ	3300		UJ	1500		UJ	1900		UJ	1700		UJ	1600
4-Bromophenyl phenyl ether	101-55-3		U	730		U	330		U	410		U	370		U	360
4-Chloro-3-methylphenol	59-50-7		U	730		U	330		U	410		U	370		U	360
4-Chlorophenyl phenyl ether	7005-72-3		U	730		U	330		U	410		U	370		U	360
4-Nitrophenol	100-02-7		U	730		U	330		U	410		U	370		U	360
bis(2-Chloroethoxy)methane	111-91-1		U	730		U	330		U	410		U	370		U	360
bis(2-Chloroethyl) ether	111-44-4		U	150		U	67		U	83		U	74		U	74
bis(2-Ethylhexyl) phthalate	117-81-7		U	730	32		330	40		410	39		370	58		360
Butyl benzyl phthalate	85-68-7		U	730		U	330		U	410		U	370		U	360
Dibenzofuran	132-64-9	230		730	28		330		U	410	43		370	36		360
Diethyl phthalate	84-66-2		U	730	56		330		U	410		U	370		U	360
Dimethyl phthalate	131-11-3		U	730		U	330		U	410		U	370		U	360
Di-n-butyl phthalate	84-74-2		U	730		U	330		U	410		U	370		U	360
Di-n-octyl phthalate	117-84-0		U	730		U	330		U	410		U	370		U	360
Hexachlorobenzene	118-74-1		U	150		U	67		U	83		U	74		U	74
Hexachlorobutadiene	87-68-3		U	150		U	67		U	83		U	74		U	74
Hexachlorocyclopentadiene	77-47-4		U	730		U	330		U	410		U	370		U	360
Hexachloroethane	67-72-1		U	730		U	330		U	410		U	370		U	360
Isophorone	78-59-1		U	730		U	330		U	410		U	370		U	360
Nitrobenzene	98-95-3		U	150		U	67		U	83		U	74		U	74
Pentachloroethane	76-01-7		U	740		U	340		U	410		U	370		U	370
Pentachlorophenol	87-86-5		U	220		U	100		U	120		U	110		U	110
Phenol	108-95-2		U	150		U	67		U	83		U	74		U	74
Pyridine	110-86-1		U	730		U	330		U	410		U	370		U	360

TABLE B-6
COUNTY LANDS 1B PARCEL SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	CL-SS-16			CL-SS-17			CL-SS-18			CL-SS-20		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
2-Nitrophenol	88-75-5		U	700		U	370		U	370		U	380
3,3'-Dichlorobenzidine	91-94-1		U	700		U	370		U	370		U	380
3,3'-Dimethylbenzidine	119-93-7		U	3500		U	1900		U	1900		U	1900
3-Methylphenol & 4-Methylphenol	MEPH1314		U	700		U	370		U	370		U	380
4,6-Dinitro-2-methylphenol	534-52-1		UJ	3200		UJ	1700		UJ	1700		UJ	1700
4-Bromophenyl phenyl ether	101-55-3		U	700		U	370		U	370		U	380
4-Chloro-3-methylphenol	59-50-7		U	700		U	370		U	370		U	380
4-Chlorophenyl phenyl ether	7005-72-3		U	700		U	370		U	370		U	380
4-Nitrophenol	100-02-7		U	700		U	370		U	370		U	380
bis(2-Chloroethoxy)methane	111-91-1		U	700		U	370		U	370		U	380
bis(2-Chloroethyl) ether	111-44-4		U	140		U	75		U	75		U	78
bis(2-Ethylhexyl) phthalate	117-81-7	100		700	44		370	100		370	82		380
Butyl benzyl phthalate	85-68-7		U	700		U	370	49		370	37		380
Dibenzofuran	132-64-9	320		700		U	370	28		370		U	380
Diethyl phthalate	84-66-2		U	700		U	370		U	370		U	380
Dimethyl phthalate	131-11-3		U	700		U	370		U	370		U	380
Di-n-butyl phthalate	84-74-2		U	700		U	370		U	370		U	380
Di-n-octyl phthalate	117-84-0		U	700		U	370		U	370		U	380
Hexachlorobenzene	118-74-1		U	140		U	75		U	75		U	78
Hexachlorobutadiene	87-68-3		U	140		U	75		U	75		U	78
Hexachlorocyclopentadiene	77-47-4		U	700		U	370		U	370		U	380
Hexachloroethane	67-72-1		U	700		U	370		U	370		U	380
Isophorone	78-59-1		U	700		U	370		U	370		U	380
Nitrobenzene	98-95-3		U	140		U	75		U	75		U	78
Pentachloroethane	76-01-7		U	700		U	370		U	370		U	390
Pentachlorophenol	87-86-5		U	210		U	110		U	110		U	120
Phenol	108-95-2		U	140		U	75		U	75		U	78
Pyridine	110-86-1		U	700		U	370		U	370		U	380

TABLE B-7
MUD RESERVOIR SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	MR-SS-01			MR-SS-02			MR-SS-03			MR-SS-04		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
Inorganics (mg/kg)													
Antimony	7440-36-0	0.17	L	1.1	2	L	1.4	0.52	L	1.4	1.2	L	3.2
Arsenic	7440-38-2	3.4		1.1	31.3		1.4	10.6		1.4	21.9		1.6
Barium	7440-39-3	90.4		22.6	47.1		27.1	64.6		27.5	39.9		31.6
Beryllium	7440-41-7	0.65		0.45	0.42		0.54	1.6		0.55	0.53		0.63
Cadmium	7440-43-9	0.3		0.56	0.24		0.68	0.91		0.69		U	1.6
Chromium	7440-47-3	33	K	0.56	184	K	0.68	94.8	K	0.69	117	K	1.6
Cobalt	7440-48-4	3.7		5.6	3.8		6.8	13.3		6.9	2.6		7.9
Copper	7440-50-8	21.7	K	2.8	128	K	3.4	205	K	3.4	102	K	3.9
Cyanide, Total	57-12-5	0.47		0.56	1.7		0.68	1		0.69	2.3		0.79
Lead	7439-92-1	37.7	L	0.34	188	L	0.41	158	L	0.41	150	L	0.95
Mercury	7439-97-6	0.065	L	0.037	0.54	L	0.045	0.23	L	0.045	0.37	L	0.052
Nickel	7440-02-0	9.9		4.5	13.2		5.4	40.1		5.5	9		6.3
Selenium	7782-49-2	0.37		0.56	4.6		0.68	2.7		0.69	6.3		1.6
Silver	7440-22-4	0.27		0.56	1.6		0.68	0.32		0.69	0.66		0.79
Sulfide, Total	18496-25-8	163		33.9		U	40.7		U	41.3		U	47.3
Thallium	7440-28-0		U	1.1		U	1.4		U	1.4		U	3.2
Tin	7440-31-5	6		11.3	1100		13.6	226		13.8	528		15.8
Vanadium	7440-62-2	96.2		5.6	101		6.8	51.6		6.9	60.6		15.8
Zinc	7440-66-6	165		2.3	152		2.7	606		2.8	98.7		6.3
PCBs (ug/kg)													
Aroclor 1016	12674-11-2		U	19		U	23		U	23		U	26
Aroclor 1221	11104-28-2		U	19		U	23		U	23		U	26
Aroclor 1232	11141-16-5		U	19		U	23		U	23		U	26
Aroclor 1242	53469-21-9		U	19		U	23		U	23		U	26
Aroclor 1248	12672-29-6		U	19	18		23		U	23		U	26
Aroclor 1254	11097-69-1		U	19		U	23		U	23		U	26
Aroclor 1260	11096-82-5	17		19	100		23	87		23	53		26

TABLE B-7
MUD RESERVOIR SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	MR-SS-05			MR-SS-06			MR-SS-07			MR-SS-08		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
Inorganics (mg/kg)													
Antimony	7440-36-0	9.1	L	1	0.6	L	1.2	0.71	L	1.1	0.77	L	1.4
Arsenic	7440-38-2	5.5		1	8.4		1.2	8.2		1.1	13.9		1.4
Barium	7440-39-3	264		20.9	26.5		24.7	44.5		22	29.1		28.4
Beryllium	7440-41-7	2.8		0.42	0.1		0.49	0.31		0.44	0.35		0.57
Cadmium	7440-43-9	2.2		0.52		U	0.62	0.28		0.55		U	0.71
Chromium	7440-47-3	69.1	K	0.52	44	K	0.62	39.2	K	0.55	72.8	K	0.71
Cobalt	7440-48-4	4.6		5.2	1.3		6.2	1.7		5.5	1.6		7.1
Copper	7440-50-8	131	K	2.6	20.3	K	3.1	27.6	K	2.7	63.4	K	3.5
Cyanide, Total	57-12-5	0.39		0.52	0.79		0.62	0.47		0.55	1.5		0.71
Lead	7439-92-1	288	L	0.31	50.5	L	0.37	45	L	0.33	84.8	L	0.43
Mercury	7439-97-6	0.13	L	0.034	0.11	L	0.041	0.079	L	0.036	0.18	L	0.047
Nickel	7440-02-0	26.4		4.2	4.1		4.9	6.9		4.4	5.4		5.7
Selenium	7782-49-2		U	2.6	1.6		0.62	1.3		0.55	3.4		0.71
Silver	7440-22-4	1.5		0.52	0.29		0.62	0.24		0.55	0.43		0.71
Sulfide, Total	18496-25-8	134		31.3		U	37		U	33		U	42.6
Thallium	7440-28-0		U	5.2		U	1.2		U	1.1	0.59		1.4
Tin	7440-31-5	53.2		10.4	204		12.3	55.8		11	342		14.2
Vanadium	7440-62-2	122		5.2	24.4		6.2	54.5		5.5	43.4		7.1
Zinc	7440-66-6	721		2.1	28.5		2.5	233		2.2	51.8		2.8
PCBs (ug/kg)													
Aroclor 1016	12674-11-2		U	17		U	21		U	18		U	24
Aroclor 1221	11104-28-2		U	17		U	21		U	18		U	24
Aroclor 1232	11141-16-5		U	17		U	21		U	18		U	24
Aroclor 1242	53469-21-9		U	17		U	21		U	18		U	24
Aroclor 1248	12672-29-6	5.6		17		U	21		U	18		U	24
Aroclor 1254	11097-69-1		U	17		U	21		U	18		U	24
Aroclor 1260	11096-82-5	78		17	17		21		U	18	89		24

TABLE B-7
MUD RESERVOIR SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	MR-SS-09			MR-SS-10			MR-SS-11			MR-SS-12		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
Inorganics (mg/kg)													
Antimony	7440-36-0	0.35	L	1.1	0.72	L	1.2	1.4	L	2.7	5.1	L	5.2
Arsenic	7440-38-2	2.2		1.1	11.5		1.2	19.7		1.3	6.8		5.2
Barium	7440-39-3	380		21.5	29.5		24.2	41.7		26.6	323		20.7
Beryllium	7440-41-7	4.4		0.43	0.16		0.48	0.57		0.53	2.3		2.1
Cadmium	7440-43-9	0.34		0.54		U	0.6		U	1.3	12.3		2.6
Chromium	7440-47-3	18.3	K	0.54	37.7	K	0.6	550	K	1.3	167	K	2.6
Cobalt	7440-48-4	0.73		5.4	1		6	2.9		6.6	14.5		5.2
Copper	7440-50-8	19.5	K	2.7	33.4	K	3	207	K	3.3	240	K	2.6
Cyanide, Total	57-12-5	7.3		0.54	0.84		0.6	1.8		0.66	6.5		0.52
Lead	7439-92-1	33.7	L	0.32	74.5	L	0.36	129	L	0.8	622	L	1.6
Mercury	7439-97-6	0.015	L	0.035	0.17	L	0.04	0.3	L	0.044	0.32	L	0.034
Nickel	7440-02-0	4.1		4.3	4.1		4.8	12.6		5.3	125		4.1
Selenium	7782-49-2		U	2.7	2.9		0.6	4.7		1.3	3.4		2.6
Silver	7440-22-4	1.5		0.54	0.22		0.6	0.6		0.66	1.4		0.52
Sulfide, Total	18496-25-8	481		32.2		U	36.3		U	39.9	82.7		31
Thallium	7440-28-0		U	5.4		U	1.2		U	2.7		U	5.2
Tin	7440-31-5	10.8		10.7	155		12.1	381		13.3	36.6		10.3
Vanadium	7440-62-2	59.2		5.4	32.3		6	92.2		13.3	170		25.8
Zinc	7440-66-6	102		2.1	29.1		2.4	204		5.3	2000		10.3
PCBs (ug/kg)													
Aroclor 1016	12674-11-2		U	18		U	20		U	22		U	17
Aroclor 1221	11104-28-2		U	18		U	20		U	22		U	17
Aroclor 1232	11141-16-5		U	18		U	20		U	22		U	17
Aroclor 1242	53469-21-9		U	18		U	20		U	22		U	17
Aroclor 1248	12672-29-6		U	18		U	20	8.6		22	190		17
Aroclor 1254	11097-69-1		U	18		U	20		U	22		U	17
Aroclor 1260	11096-82-5	35		18	17		20	78		22	740		17

TABLE B-7
MUD RESERVOIR SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	MR-SS-01			MR-SS-02			MR-SS-03			MR-SS-04		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
VOCs (ug/kg)													
1,1,1,2-Tetrachloroethane	630-20-6		U	8		U	9.1		U	11		U	8.4
1,1,1-Trichloroethane	71-55-6		U	8		U	9.1		U	11		U	8.4
1,1,2,2-Tetrachloroethane	79-34-5		U	8		U	9.1		U	11		U	8.4
1,1,2-Trichloroethane	79-00-5		U	8		U	9.1		U	11		U	8.4
1,1-Dichloroethane	75-34-3		U	8		U	9.1		U	11		U	8.4
1,1-Dichloroethene	75-35-4		U	8		U	9.1		U	11		U	8.4
1,2-Dichloroethane	107-06-2		U	8		U	9.1		U	11		U	8.4
1,2-Dichloropropane	78-87-5		U	8		U	9.1		U	11		U	8.4
2-Butanone	78-93-3		U	8		U	9.1		U	11		U	8.4
2-Hexanone	591-78-6		U	8		U	9.1		U	11		U	8.4
4-Methyl-2-pentanone	108-10-1		U	8		U	9.1		U	11		U	8.4
Acetone	67-64-1		U	32		U	36		U	43		U	34
Benzene	71-43-2		U	8		U	9.1		U	11		U	8.4
Bromoform	75-25-2		UJ	8		UJ	9.1		UJ	11		UJ	8.4
Carbon disulfide	75-15-0		U	8		U	9.1		U	11		U	8.4
Carbon tetrachloride	56-23-5		U	8		U	9.1		U	11		U	8.4
Chlorobenzene	108-90-7		U	8		U	9.1		U	11		U	8.4
Chloroethane	75-00-3		U	8		U	9.1		U	11		U	8.4
Chloroform	67-66-3		U	8		U	9.1		U	11		U	8.4
cis-1,3-Dichloropropene	10061-01-5		U	8		U	9.1		U	11		U	8.4
Ethylbenzene	100-41-4		U	8		U	9.1		U	11		U	8.4
Methylene chloride	75-09-2		U	8		U	9.1		U	11		U	8.4
Tetrachloroethene	127-18-4		U	8		U	9.1		U	11		U	8.4
Toluene	108-88-3		U	8		U	9.1		U	11		U	8.4
trans-1,2-Dichloroethene	156-60-5		U	8		U	9.1		U	11		U	8.4
trans-1,3-Dichloropropene	10061-02-6		U	8		U	9.1		U	11		U	8.4
Trichloroethene	79-01-6		U	8		U	9.1		U	11		U	8.4
Vinyl chloride	75-01-4		U	8		U	9.1		U	11		U	8.4
Xylenes (total)	1330-20-7		U	24		U	27		U	32		U	25

TABLE B-7
MUD RESERVOIR SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	MR-SS-05			MR-SS-06			MR-SS-07			MR-SS-08		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
VOCs (ug/kg)													
1,1,1,2-Tetrachloroethane	630-20-6		U	6.9		U	370		U	8		U	7.5
1,1,1-Trichloroethane	71-55-6		U	6.9		U	370		U	8		U	7.5
1,1,2,2-Tetrachloroethane	79-34-5		U	6.9		U	370		U	8		U	7.5
1,1,2-Trichloroethane	79-00-5		U	6.9		U	370		U	8		U	7.5
1,1-Dichloroethane	75-34-3		U	6.9		U	370		U	8		U	7.5
1,1-Dichloroethene	75-35-4		U	6.9		U	370		U	8		U	7.5
1,2-Dichloroethane	107-06-2		U	6.9		U	370		U	8		U	7.5
1,2-Dichloropropane	78-87-5		U	6.9		U	370		U	8		U	7.5
2-Butanone	78-93-3		U	6.9		U	370		U	8		U	7.5
2-Hexanone	591-78-6		U	6.9		U	370		U	8		U	7.5
4-Methyl-2-pentanone	108-10-1		U	6.9		U	370		U	8		U	7.5
Acetone	67-64-1		U	28		U	1500		U	32		U	30
Benzene	71-43-2		U	6.9		U	370		U	8		U	7.5
Bromoform	75-25-2		U	6.9		U	370		UJ	8		U	7.5
Carbon disulfide	75-15-0		U	6.9		U	370		U	8		U	7.5
Carbon tetrachloride	56-23-5		U	6.9		U	370		U	8		U	7.5
Chlorobenzene	108-90-7		U	6.9		U	370		U	8		U	7.5
Chloroethane	75-00-3		U	6.9		U	370		U	8		U	7.5
Chloroform	67-66-3		U	6.9		U	370		U	8		U	7.5
cis-1,3-Dichloropropene	10061-01-5		U	6.9		U	370		U	8		U	7.5
Ethylbenzene	100-41-4		U	6.9		U	370		U	8		U	7.5
Methylene chloride	75-09-2		U	6.9	690	B	370		U	8		U	7.5
Tetrachloroethene	127-18-4		U	6.9		U	370		U	8		U	7.5
Toluene	108-88-3		U	6.9		U	370		U	8	0.52	B	7.5
trans-1,2-Dichloroethene	156-60-5		U	6.9		U	370		U	8		U	7.5
trans-1,3-Dichloropropene	10061-02-6		U	6.9		U	370		U	8		U	7.5
Trichloroethene	79-01-6		U	6.9		U	370		U	8		U	7.5
Vinyl chloride	75-01-4		U	6.9		U	370		U	8		U	7.5
Xylenes (total)	1330-20-7		U	21		U	1100		U	24		U	22

TABLE B-7
MUD RESERVOIR SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	MR-SS-09			MR-SS-10			MR-SS-11			MR-SS-12		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
VOCs (ug/kg)													
1,1,1,2-Tetrachloroethane	630-20-6		U	6.8		U	6.8		UJ	17		U	320
1,1,1-Trichloroethane	71-55-6		U	6.8		U	6.8		UJ	17		U	320
1,1,2,2-Tetrachloroethane	79-34-5		U	6.8		U	6.8		UJ	17		U	320
1,1,2-Trichloroethane	79-00-5		U	6.8		U	6.8		UJ	17		U	320
1,1-Dichloroethane	75-34-3		U	6.8		U	6.8		UJ	17		U	320
1,1-Dichloroethene	75-35-4		U	6.8		U	6.8		UJ	17		U	320
1,2-Dichloroethane	107-06-2		U	6.8		U	6.8		UJ	17		U	320
1,2-Dichloropropane	78-87-5		U	6.8		U	6.8		UJ	17		U	320
2-Butanone	78-93-3		U	6.8		U	6.8		UJ	17		U	320
2-Hexanone	591-78-6		U	6.8		U	6.8		UJ	17		U	320
4-Methyl-2-pentanone	108-10-1		U	6.8		U	6.8		UJ	17		U	320
Acetone	67-64-1		U	27		U	27	34	J	68		U	1300
Benzene	71-43-2		U	6.8		U	6.8		UJ	17		U	320
Bromoform	75-25-2		U	6.8		U	6.8		UJ	17		U	320
Carbon disulfide	75-15-0		U	6.8		U	6.8		UJ	17		U	320
Carbon tetrachloride	56-23-5		U	6.8		U	6.8		UJ	17		U	320
Chlorobenzene	108-90-7		U	6.8		U	6.8		UJ	17		U	320
Chloroethane	75-00-3		U	6.8		U	6.8		UJ	17		U	320
Chloroform	67-66-3		U	6.8		U	6.8		UJ	17		U	320
cis-1,3-Dichloropropene	10061-01-5		U	6.8		U	6.8		UJ	17		U	320
Ethylbenzene	100-41-4		U	6.8		U	6.8		UJ	17		U	320
Methylene chloride	75-09-2		U	6.8		U	6.8	23		17	600	B	320
Tetrachloroethene	127-18-4		U	6.8		U	6.8		UJ	17		U	320
Toluene	108-88-3		U	6.8		U	6.8		UJ	17		U	320
trans-1,2-Dichloroethene	156-60-5		U	6.8		U	6.8		UJ	17		U	320
trans-1,3-Dichloropropene	10061-02-6		U	6.8		U	6.8		UJ	17		U	320
Trichloroethene	79-01-6		U	6.8		U	6.8		UJ	17		U	320
Vinyl chloride	75-01-4		U	6.8		U	6.8		UJ	17		U	320
Xylenes (total)	1330-20-7		U	20		U	20		U	51		U	950

TABLE B-7
MUD RESERVOIR SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	MR-SS-01			MR-SS-02			MR-SS-03			MR-SS-04		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
PAHs (ug/kg)													
2-Methylnaphthalene	91-57-6	36		76	27		91	33		91		U	100
Acenaphthene	83-32-9	30		76		U	91		U	91		U	100
Acenaphthylene	208-96-8	34		76		U	91		U	91		U	100
Anthracene	120-12-7	93		76	29		91	60		91		U	100
Fluoranthene	206-44-0	640		76	99		91	250		91	140		100
Fluorene	86-73-7		U	76		U	91		U	91		U	100
Naphthalene	91-20-3	83		76	45		91	46		91		U	100
Phenanthrene	85-01-8	320		76	75		91	110		91	71		100
Benzo(a)anthracene	56-55-3	370		76		U	91	170		91		U	100
Benzo(a)pyrene	50-32-8	340		76	46	J	91	160		91	54		100
Benzo(b)fluoranthene	205-99-2	370		76		U	91	240		91	110		100
Benzo(ghi)perylene	191-24-2	260		76		U	91	130		91	55		100
Benzo(k)fluoranthene	207-08-9	170		76		U	91		U	91		U	100
Chrysene	218-01-9	320		76		U	91	230		91	130		100
Dibenz(a,h)anthracene	53-70-3	24		76		U	91		U	91		U	100
Indeno(1,2,3-cd)pyrene	193-39-5	220		76	59	J	91	120		91	52		100
Pyrene	129-00-0	580		76	68		91	170		91	77		100
Other SVOCs (ug/kg)													
1,2,4-Trichlorobenzene	120-82-1		U	370		U	450		U	450		U	520
1,2-Dichlorobenzene	95-50-1		U	76		U	91		U	91		U	100
1,3-Dichlorobenzene	541-73-1		U	76		U	91		U	91		U	100
1,4-Dichlorobenzene	106-46-7		U	76		U	91		U	91		U	100
2,2'-oxybis(1-Chloropropane)	108-60-1		U	76		U	91		U	91		U	100
2,4,5-Trichlorophenol	95-95-4		U	370		U	450		U	450		U	520
2,4,6-Trichlorophenol	88-06-2		U	370		U	450		U	450		U	520
2,4-Dichlorophenol	120-83-2		U	76		U	91		U	91		U	100
2,4-Dimethylphenol	105-67-9		U	370		U	450		U	450		U	520
2,4-Dinitrophenol	51-28-5		UJ	1700		UJ	2000		UJ	2000		UJ	2300
2,4-Dinitrotoluene	121-14-2		U	370		U	450		U	450		U	520
2,6-Dinitrotoluene	606-20-2		U	370		U	450		U	450		U	520
2-Chloronaphthalene	91-58-7		U	76		U	91		U	91		U	100

TABLE B-7
MUD RESERVOIR SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	MR-SS-05			MR-SS-06			MR-SS-07			MR-SS-08		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
PAHs (ug/kg)													
2-Methylnaphthalene	91-57-6		U	70		U	83		U	73		U	95
Acenaphthene	83-32-9		U	70		U	83		U	73		U	95
Acenaphthylene	208-96-8	34		70		U	83		U	73		U	95
Anthracene	120-12-7	40		70		U	83		U	73	36		95
Fluoranthene	206-44-0	130		70		U	83	28		73	230		95
Fluorene	86-73-7		U	70		U	83		U	73		U	95
Naphthalene	91-20-3		U	70		U	83		U	73		U	95
Phenanthrene	85-01-8	30		70		U	83		U	73	160		95
Benzo(a)anthracene	56-55-3	81		70		U	83	14		73	100		95
Benzo(a)pyrene	50-32-8	97		70		U	83		U	73	82		95
Benzo(b)fluoranthene	205-99-2	160		70		U	83		U	73	140		95
Benzo(ghi)perylene	191-24-2	97		70		U	83		U	73	70		95
Benzo(k)fluoranthene	207-08-9	64		70		U	83		U	73		U	95
Chrysene	218-01-9	120		70		U	83	18		73	170		95
Dibenz(a,h)anthracene	53-70-3		U	70		U	83		U	73		U	95
Indeno(1,2,3-cd)pyrene	193-39-5	86		70		U	83		U	73	62		95
Pyrene	129-00-0	170		70		U	83	35		73	140		95
Other SVOCs (ug/kg)													
1,2,4-Trichlorobenzene	120-82-1		U	340		U	410		U	360		U	470
1,2-Dichlorobenzene	95-50-1		U	70		U	83		U	73		U	95
1,3-Dichlorobenzene	541-73-1		U	70		U	83		U	73		U	95
1,4-Dichlorobenzene	106-46-7		U	70		U	83		U	73		U	95
2,2'-oxybis(1-Chloropropane)	108-60-1		U	70		U	83		U	73		U	95
2,4,5-Trichlorophenol	95-95-4		U	340		U	410		U	360		U	470
2,4,6-Trichlorophenol	88-06-2		U	340		U	410		U	360		U	470
2,4-Dichlorophenol	120-83-2		U	70		U	83		U	73		U	95
2,4-Dimethylphenol	105-67-9		U	340		U	410		U	360		U	470
2,4-Dinitrophenol	51-28-5		UJ	1600		UJ	1800		UJ	1600		UJ	2100
2,4-Dinitrotoluene	121-14-2		U	340		U	410		U	360		U	470
2,6-Dinitrotoluene	606-20-2		U	340		U	410		U	360		U	470
2-Chloronaphthalene	91-58-7		U	70		U	83		U	73		U	95

TABLE B-7
MUD RESERVOIR SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	MR-SS-09			MR-SS-10			MR-SS-11			MR-SS-12		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
PAHs (ug/kg)													
2-Methylnaphthalene	91-57-6		U	72		U	81		U	88		U	69
Acenaphthene	83-32-9		U	72		U	81		U	88		U	69
Acenaphthylene	208-96-8		U	72		U	81		U	88		U	69
Anthracene	120-12-7		U	72		U	81		U	88		U	69
Fluoranthene	206-44-0	47		72		U	81	62		88	84		69
Fluorene	86-73-7		U	72		U	81		U	88		U	69
Naphthalene	91-20-3		U	72		U	81		U	88		U	69
Phenanthrene	85-01-8	35		72		U	81	27		88	34		69
Benzo(a)anthracene	56-55-3	33		72		U	81	57		88	57		69
Benzo(a)pyrene	50-32-8	39		72		U	81	45		88	59		69
Benzo(b)fluoranthene	205-99-2	60		72		U	81	63		88	92		69
Benzo(ghi)perylene	191-24-2	34		72		U	81		U	88	28		69
Benzo(k)fluoranthene	207-08-9		U	72		U	81	30		88	29		69
Chrysene	218-01-9	45		72		U	81	52		88	63		69
Dibenz(a,h)anthracene	53-70-3		U	72		U	81		U	88		U	69
Indeno(1,2,3-cd)pyrene	193-39-5	27		72		U	81		U	88	35		69
Pyrene	129-00-0	34		72		U	81	82		88	100		69
Other SVOCs (ug/kg)													
1,2,4-Trichlorobenzene	120-82-1		U	350		U	400		U	430		U	340
1,2-Dichlorobenzene	95-50-1		U	72		U	81		U	88		U	69
1,3-Dichlorobenzene	541-73-1		U	72		U	81		U	88		U	69
1,4-Dichlorobenzene	106-46-7		U	72		U	81		U	88		U	69
2,2'-oxybis(1-Chloropropane)	108-60-1		U	72		U	81		U	88		U	69
2,4,5-Trichlorophenol	95-95-4		U	350		U	400		U	430		U	340
2,4,6-Trichlorophenol	88-06-2		U	350		U	400		U	430		U	340
2,4-Dichlorophenol	120-83-2		U	72		U	81		U	88		U	69
2,4-Dimethylphenol	105-67-9		U	350		U	400		U	430		U	340
2,4-Dinitrophenol	51-28-5		UJ	1600		UJ	1800		UJ	2000		UJ	1600
2,4-Dinitrotoluene	121-14-2		U	350		U	400		U	430		U	340
2,6-Dinitrotoluene	606-20-2		U	350		U	400		U	430		U	340
2-Chloronaphthalene	91-58-7		U	72		U	81		U	88		U	69

TABLE B-7
MUD RESERVOIR SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	MR-SS-01			MR-SS-02			MR-SS-03			MR-SS-04		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
2-Chlorophenol	95-57-8		U	370		U	450		U	450		U	520
2-Methylphenol	95-48-7		U	370		U	450		U	450		U	520
2-Nitrophenol	88-75-5		U	370		U	450		U	450		U	520
3,3'-Dichlorobenzidine	91-94-1		U	370		U	450		U	450		U	520
3,3'-Dimethylbenzidine	119-93-7		U	1900		U	2300		U	2300		U	2600
3-Methylphenol & 4-Methylphenol	MEPH1314		U	370		U	450		U	450		U	520
4,6-Dinitro-2-methylphenol	534-52-1		U	1700		U	2000		U	2000		U	2300
4-Bromophenyl phenyl ether	101-55-3		U	370		U	450		U	450		U	520
4-Chloro-3-methylphenol	59-50-7		U	370		U	450		U	450		U	520
4-Chlorophenyl phenyl ether	7005-72-3		U	370		U	450		U	450		U	520
4-Nitrophenol	100-02-7		U	370		U	450		U	450		U	520
bis(2-Chloroethoxy)methane	111-91-1		U	370		U	450		U	450		U	520
bis(2-Chloroethyl) ether	111-44-4		U	76		U	91		U	91		U	100
bis(2-Ethylhexyl) phthalate	117-81-7		U	370		U	450	59		450		U	520
Butyl benzyl phthalate	85-68-7		U	370		U	450	300		450		U	520
Dibenzofuran	132-64-9	42		370		U	450		U	450		U	520
Diethyl phthalate	84-66-2		U	370		U	450		U	450		U	520
Dimethyl phthalate	131-11-3		U	370		U	450		U	450		U	520
Di-n-butyl phthalate	84-74-2		U	370		U	450		U	450		U	520
Di-n-octyl phthalate	117-84-0		U	370		U	450		U	450		U	520
Hexachlorobenzene	118-74-1		U	76		U	91		U	91		U	100
Hexachlorobutadiene	87-68-3		U	76		U	91		U	91		U	100
Hexachlorocyclopentadiene	77-47-4		U	370		U	450		U	450		U	520
Hexachloroethane	67-72-1		U	370		U	450		U	450		U	520
Isophorone	78-59-1		U	370		U	450		U	450		U	520
Nitrobenzene	98-95-3		U	76		U	91		U	91		U	100
Pentachloroethane	76-01-7		U	380		U	450		U	450		U	520
Pentachlorophenol	87-86-5		U	110		U	140		U	140		U	160
Phenol	108-95-2		U	76		U	91		U	91		U	100
Pyridine	110-86-1		U	370		U	450		U	450		U	520

TABLE B-7
MUD RESERVOIR SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	MR-SS-05			MR-SS-06			MR-SS-07			MR-SS-08		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
2-Chlorophenol	95-57-8		U	340		U	410		U	360		U	470
2-Methylphenol	95-48-7		U	340		U	410		U	360		U	470
2-Nitrophenol	88-75-5		U	340		U	410		U	360		U	470
3,3'-Dichlorobenzidine	91-94-1		U	340		U	410		U	360		U	470
3,3'-Dimethylbenzidine	119-93-7		U	1700		U	2100		U	1800		U	2400
3-Methylphenol & 4-Methylphenol	MEPH1314		U	340		U	410		U	360		U	470
4,6-Dinitro-2-methylphenol	534-52-1		U	1600		U	1800		U	1600		U	2100
4-Bromophenyl phenyl ether	101-55-3		U	340		U	410		U	360		U	470
4-Chloro-3-methylphenol	59-50-7		U	340		U	410		U	360		U	470
4-Chlorophenyl phenyl ether	7005-72-3		U	340		U	410		U	360		U	470
4-Nitrophenol	100-02-7		U	340		U	410		U	360		U	470
bis(2-Chloroethoxy)methane	111-91-1		U	340		U	410		U	360		U	470
bis(2-Chloroethyl) ether	111-44-4		U	70		U	83		U	73		U	95
bis(2-Ethylhexyl) phthalate	117-81-7		U	340		U	410		U	360		U	470
Butyl benzyl phthalate	85-68-7	400		340		U	410		U	360		U	470
Dibenzofuran	132-64-9		U	340		U	410		U	360		U	470
Diethyl phthalate	84-66-2		U	340		U	410		U	360		U	470
Dimethyl phthalate	131-11-3		U	340		U	410		U	360		U	470
Di-n-butyl phthalate	84-74-2		U	340		U	410		U	360		U	470
Di-n-octyl phthalate	117-84-0		U	340		U	410		U	360		U	470
Hexachlorobenzene	118-74-1		U	70		U	83		U	73		U	95
Hexachlorobutadiene	87-68-3		U	70		U	83		U	73		U	95
Hexachlorocyclopentadiene	77-47-4		U	340		U	410		U	360		U	470
Hexachloroethane	67-72-1		U	340		U	410		U	360		U	470
Isophorone	78-59-1		U	340		U	410		U	360		U	470
Nitrobenzene	98-95-3		U	70		U	83		U	73		U	95
Pentachloroethane	76-01-7		U	350		U	410		U	360		U	470
Pentachlorophenol	87-86-5		U	100		U	120		U	110		U	140
Phenol	108-95-2		U	70		U	83		U	73		U	95
Pyridine	110-86-1		U	340		U	410		U	360		U	470

TABLE B-7
MUD RESERVOIR SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	MR-SS-09			MR-SS-10			MR-SS-11			MR-SS-12		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
2-Chlorophenol	95-57-8		U	350		U	400		U	430		U	340
2-Methylphenol	95-48-7		U	350		U	400		U	430		U	340
2-Nitrophenol	88-75-5		U	350		U	400		U	430		U	340
3,3'-Dichlorobenzidine	91-94-1		U	350		U	400		U	430		U	340
3,3'-Dimethylbenzidine	119-93-7		U	1800		U	2000		U	2200		U	1700
3-Methylphenol & 4-Methylphenol	MEPH1314		U	350		U	400		U	430		U	340
4,6-Dinitro-2-methylphenol	534-52-1		U	1600		U	1800		U	2000		U	1600
4-Bromophenyl phenyl ether	101-55-3		U	350		U	400		U	430		U	340
4-Chloro-3-methylphenol	59-50-7		U	350		U	400		U	430		U	340
4-Chlorophenyl phenyl ether	7005-72-3		U	350		U	400		U	430		U	340
4-Nitrophenol	100-02-7		U	350		U	400		U	430		U	340
bis(2-Chloroethoxy)methane	111-91-1		U	350		U	400		U	430		U	340
bis(2-Chloroethyl) ether	111-44-4		U	72		U	81		U	88		U	69
bis(2-Ethylhexyl) phthalate	117-81-7	45		350		U	400		U	430	160		340
Butyl benzyl phthalate	85-68-7	30		350		U	400		U	430	2100		340
Dibenzofuran	132-64-9		U	350		U	400		U	430		U	340
Diethyl phthalate	84-66-2		U	350		U	400		U	430		U	340
Dimethyl phthalate	131-11-3		U	350		U	400		U	430		U	340
Di-n-butyl phthalate	84-74-2		U	350		U	400		U	430	190		340
Di-n-octyl phthalate	117-84-0		U	350		U	400		U	430		U	340
Hexachlorobenzene	118-74-1		U	72		U	81		U	88		U	69
Hexachlorobutadiene	87-68-3		U	72		U	81		U	88		U	69
Hexachlorocyclopentadiene	77-47-4		U	350		U	400		U	430		U	340
Hexachloroethane	67-72-1		U	350		U	400		U	430		U	340
Isophorone	78-59-1		U	350		U	400		U	430		U	340
Nitrobenzene	98-95-3		U	72		U	81		U	88		U	69
Pentachloroethane	76-01-7		U	360		U	400		U	440		U	340
Pentachlorophenol	87-86-5		U	110		U	120		U	130		U	100
Phenol	108-95-2		U	72		U	81		U	88		U	69
Pyridine	110-86-1		U	350		U	400		U	430		U	340

TABLE B-8
FORMER EAST POND SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	EP-SS-01			EP-SS-02			EP-SS-03		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
Inorganics (mg/kg)										
Antimony	7440-36-0	0.22	L	1.3	0.1	L	1.1	0.21	L	1.7
Arsenic	7440-38-2	9.1		1.3	8.6		1.1	28.1		1.7
Barium	7440-39-3	55.8		25.6	66.6		22.4	388		33.7
Beryllium	7440-41-7	0.62		0.51	0.7		0.45	0.99		0.67
Cadmium	7440-43-9	60.2		0.64	38.2		0.56	193		0.84
Chromium	7440-47-3	24.4	K	0.64	60.3	K	0.56	136	K	0.84
Cobalt	7440-48-4	3.4	L	6.4	5.3		5.6	11.2		8.4
Copper	7440-50-8	48.7	K	3.2	38.6	K	2.8	185	K	4.2
Cyanide, Total	57-12-5	0.35		0.64	0.65		0.56	1.4		0.84
Lead	7439-92-1	194	L	0.38	106	L	0.34	798	L	0.51
Mercury	7439-97-6	0.45	L	0.042	0.069	L	0.037	0.11	L	0.056
Nickel	7440-02-0	8.4		5.1	17.5		4.5	53.4		6.7
Selenium	7782-49-2	0.8		0.64	0.62		0.56		U	8.4
Silver	7440-22-4	0.74		0.64	0.59		0.56	10		0.84
Sulfide, Total	18496-25-8		U	38.4		U	33.6	94.4		50.5
Thallium	7440-28-0		U	1.3		U	1.1		U	16.8
Tin	7440-31-5	9.1		12.8	6.9		11.2	18.7		16.8
Vanadium	7440-62-2	30.7		6.4	94.6		5.6	523		8.4
Zinc	7440-66-6	5730		25.6	2730		11.2	16000		33.7
PCBs (ug/kg)										
Aroclor 1016	12674-11-2		U	21		U	18		U	28
Aroclor 1221	11104-28-2		U	21		U	18		U	28
Aroclor 1232	11141-16-5		U	21		U	18		U	28
Aroclor 1242	53469-21-9		U	21		U	18		U	28
Aroclor 1248	12672-29-6	3.4		21		U	18	18		28
Aroclor 1254	11097-69-1		U	21		U	18		U	28
Aroclor 1260	11096-82-5	36		21	35		18	300		28
VOCs (ug/kg)										
1,1,1,2-Tetrachloroethane	630-20-6		U	7.9		U	9.6		U	14
1,1,1-Trichloroethane	71-55-6		U	7.9		U	9.6		U	14
1,1,2,2-Tetrachloroethane	79-34-5		U	7.9		U	9.6		U	14
1,1,2-Trichloroethane	79-00-5		U	7.9		U	9.6		U	14
1,1-Dichloroethane	75-34-3		U	7.9		U	9.6		U	14
1,1-Dichloroethene	75-35-4		U	7.9		U	9.6		U	14
1,2-Dichloroethane	107-06-2		U	7.9		U	9.6		U	14
1,2-Dichloropropane	78-87-5		U	7.9		U	9.6		U	14
2-Butanone	78-93-3		U	7.9		U	9.6		U	14
2-Hexanone	591-78-6		U	7.9		U	9.6		U	14
4-Methyl-2-pentanone	108-10-1		U	7.9		U	9.6		U	14
Acetone	67-64-1		U	32		U	38		U	58
Benzene	71-43-2		U	7.9		U	9.6		U	14
Bromoform	75-25-2		UJ	7.9		U	9.6		U	14
Carbon disulfide	75-15-0		U	7.9		U	9.6		U	14
Carbon tetrachloride	56-23-5		U	7.9		U	9.6		U	14
Chlorobenzene	108-90-7		U	7.9		U	9.6		U	14
Chloroethane	75-00-3		U	7.9		U	9.6		U	14
Chloroform	67-66-3		U	7.9		U	9.6		U	14
cis-1,3-Dichloropropene	10061-01-5		U	7.9		U	9.6		U	14
Ethylbenzene	100-41-4		U	7.9		U	9.6		U	14

TABLE B-8
FORMER EAST POND SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

		EP-SS-01			EP-SS-02			EP-SS-03		
Constituent	**CAS #**	**Result**	**Qual**	**RL**	**Result**	**Qual**	**RL**	**Result**	**Qual**	**RL**
Methylene chloride	75-09-2		U	7.9		U	9.6		U	14
Tetrachloroethene	127-18-4		U	7.9		U	9.6		U	14
Toluene	108-88-3		U	7.9		U	9.6		U	14
trans-1,2-Dichloroethene	156-60-5		U	7.9		U	9.6		U	14
trans-1,3-Dichloropropene	10061-02-6		U	7.9		U	9.6		U	14
Trichloroethene	79-01-6		U	7.9		U	9.6		U	14
Vinyl chloride	75-01-4		U	7.9		U	9.6		U	14
Xylenes (total)	1330-20-7		U	24		U	29		U	43
PAHs (ug/kg)										
2-Methylnaphthalene	91-57-6		U	86		U	75		U	110
Acenaphthene	83-32-9		U	86		U	75		U	110
Acenaphthylene	208-96-8		U	86		U	75		U	110
Anthracene	120-12-7		U	86		U	75	51		110
Fluoranthene	206-44-0	30		86	26		75	440		110
Fluorene	86-73-7		U	86		U	75		U	110
Naphthalene	91-20-3		U	86		U	75		U	110
Phenanthrene	85-01-8	20		86		U	75	220		110
Benzo(a)anthracene	56-55-3		U	86	20		75	260		110
Benzo(a)pyrene	50-32-8	24		86		U	75	240		110
Benzo(b)fluoranthene	205-99-2		U	86		U	75	300		110
Benzo(ghi)perylene	191-24-2		U	86		U	75	170		110
Benzo(k)fluoranthene	207-08-9		U	86		U	75	130		110
Chrysene	218-01-9		U	86	21		75	220		110
Dibenz(a,h)anthracene	53-70-3		U	86		U	75		U	110
Indeno(1,2,3-cd)pyrene	193-39-5		U	86		U	75	160		110
Pyrene	129-00-0	38		86	28		75	470		110
Other SVOCs (ug/kg)										
1,2,4-Trichlorobenzene	120-82-1		U	420		U	370		U	560
1,2-Dichlorobenzene	95-50-1		U	86		U	75		U	110
1,3-Dichlorobenzene	541-73-1		U	86		U	75		U	110
1,4-Dichlorobenzene	106-46-7		U	86		U	75		U	110
2,2'-oxybis(1-Chloropropane)	108-60-1		U	86		U	75		U	110
2,4,5-Trichlorophenol	95-95-4		U	420		U	370		U	560
2,4,6-Trichlorophenol	88-06-2		U	420		U	370		U	560
2,4-Dichlorophenol	120-83-2		U	86		U	75		U	110
2,4-Dimethylphenol	105-67-9		U	420		U	370		U	560
2,4-Dinitrophenol	51-28-5		UJ	1900		UJ	1700		UJ	2500
2,4-Dinitrotoluene	121-14-2		U	420		U	370		U	560
2,6-Dinitrotoluene	606-20-2		U	420		U	370		U	560
2-Chloronaphthalene	91-58-7		U	86		U	75		U	110
2-Chlorophenol	95-57-8		U	420		U	370		U	560
2-Methylphenol	95-48-7		U	420		U	370		U	560
2-Nitrophenol	88-75-5		U	420		U	370		U	560
3,3'-Dichlorobenzidine	91-94-1		U	420		U	370		U	560
3,3'-Dimethylbenzidine	119-93-7		U	2100		U	1900		U	2800
3-Methylphenol & 4-Methylphenol	MEPH1314		U	420		U	370		U	560
4,6-Dinitro-2-methylphenol	534-52-1		U	1900		U	1700		U	2500
4-Bromophenyl phenyl ether	101-55-3		U	420		U	370		U	560
4-Chloro-3-methylphenol	59-50-7		U	420		U	370		U	560
4-Chlorophenyl phenyl ether	7005-72-3		U	420		U	370		U	560

TABLE B-8
FORMER EAST POND SURFACE SOIL DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	EP-SS-01			EP-SS-02			EP-SS-03		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
4-Nitrophenol	100-02-7		U	420		U	370		U	560
bis(2-Chloroethoxy)methane	111-91-1		U	420		U	370		U	560
bis(2-Chloroethyl) ether	111-44-4		U	86		U	75		U	110
bis(2-Ethylhexyl) phthalate	117-81-7		U	420		U	370		U	560
Butyl benzyl phthalate	85-68-7		U	420		U	370		U	560
Dibenzofuran	132-64-9		U	420		U	370		U	560
Diethyl phthalate	84-66-2		U	420		U	370		U	560
Dimethyl phthalate	131-11-3		U	420		U	370		U	560
Di-n-butyl phthalate	84-74-2		U	420		U	370		U	560
Di-n-octyl phthalate	117-84-0		U	420		U	370		U	560
Hexachlorobenzene	118-74-1		U	86		U	75		U	110
Hexachlorobutadiene	87-68-3		U	86		U	75		U	110
Hexachlorocyclopentadiene	77-47-4		U	420		U	370		U	560
Hexachloroethane	67-72-1		U	420		U	370		U	560
Isophorone	78-59-1		U	420		U	370		U	560
Nitrobenzene	98-95-3		U	86		U	75		U	110
Pentachloroethane	76-01-7		U	430		U	370		U	560
Pentachlorophenol	87-86-5		U	130		U	110		U	170
Phenol	108-95-2		U	86		U	75		U	110
Pyridine	110-86-1		U	420		U	370		U	560

TABLE B-9
KNOBBY'S DITCH HEAD POND SURFACE WATER DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	KD-SW-01			KD-SW-02		
		Result	RL	Qual	Result	RL	Qual
Inorganics (ug/l)							
Antimony, Dissolved	7440-36-0		10	U		10	U
Arsenic, Dissolved	7440-38-2		10	U		10	U
Barium, Dissolved	7440-39-3	26.5	200	J	27.5	200	J
Beryllium, Dissolved	7440-41-7	0.81	4	B	0.71	4	B
Cadmium, Dissolved	7440-43-9		5	U		5	U
Chromium, Dissolved	7440-47-3		5	U		5	U
Cobalt, Dissolved	7440-48-4	0.89	50	B		50	U
Copper, Dissolved	7440-50-8	1.4	25	L		25	UL
Lead, Dissolved	7439-92-1		3	U		3	U
Mercury, Dissolved	7439-97-6		0.2	U		0.2	U
Nickel, Dissolved	7440-02-0	5.6	40		4.1	40	
Selenium, Dissolved	7782-49-2		5	U		5	U
Silver, Dissolved	7440-22-4		5	U		5	U
Thallium, Dissolved	7440-28-0		10	U		10	U
Tin, Dissolved	7440-31-5	3.8	100	B	3.2	100	B
Vanadium, Dissolved	7440-62-2	2	50		3.7	50	
Zinc, Dissolved	7440-66-6	4.1	20	B	3.7	20	B
Antimony, Total	7440-36-0		10	U		10	U
Arsenic, Total	7440-38-2	2.9	10		2.3	10	
Barium, Total	7440-39-3	26.7	200	J	33.7	200	J
Beryllium, Total	7440-41-7	0.77	4	B	0.6	4	B
Cadmium, Total	7440-43-9		5	U		5	U
Chromium, Total	7440-47-3		5	U		5	U
Cobalt, Total	7440-48-4	0.76	50	B	0.83	50	B
Copper, Total	7440-50-8		25	UL		25	UL
Cyanide, Total	57-12-5	2	10		2.9	10	
Lead, Total	7439-92-1		3	U		3	U
Mercury, Total	7439-97-6		0.2	U		0.2	U
Nickel, Total	7440-02-0	5.2	40		4.9	40	
Selenium, Total	7782-49-2		5	U		5	U
Silver, Total	7440-22-4		5	U		5	U
Sulfide, Total	18496-25-8		3	U		3	U
Thallium, Total	7440-28-0		10	U		10	U
Tin, Total	7440-31-5		100	U		100	U
Vanadium, Total	7440-62-2	2.4	50		4.7	50	
Zinc, Total	7440-66-6	18.4	20		6.7	20	B
PCBs (ug/l)							
Aroclor 1016	12674-11-2		0.38	U		0.38	U
Aroclor 1221	11104-28-2		0.38	U		0.38	U
Aroclor 1232	11141-16-5		0.38	U		0.38	U
Aroclor 1242	53469-21-9		0.38	U		0.38	U
Aroclor 1248	12672-29-6		0.38	U		0.38	U
Aroclor 1254	11097-69-1		0.38	U		0.38	U
Aroclor 1260	11096-82-5		0.38	U		0.38	U
VOCs (ug/l)							
1,1,1,2-Tetrachloroethane	630-20-6		1	U		1	U
1,1,1-Trichloroethane	71-55-6		1	U		1	U
1,1,2,2-Tetrachloroethane	79-34-5		1	U		1	U
1,1,2-Trichloroethane	79-00-5		1	U		1	U
1,1-Dichloroethane	75-34-3		1	U		1	U

TABLE B-9
KNOBBY'S DITCH HEAD POND SURFACE WATER DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	KD-SW-01			KD-SW-02		
		Result	RL	Qual	Result	RL	Qual
1,1-Dichloroethene	75-35-4		1	U		1	U
1,2-Dichloroethane	107-06-2		1	U		1	U
1,2-Dichloropropane	78-87-5		1	U		1	U
2-Butanone	78-93-3		5	U		5	U
2-Hexanone	591-78-6		5	U		5	U
4-Methyl-2-pentanone	108-10-1		5	U		5	U
Acetone	67-64-1		5	U	3	5	
Benzene	71-43-2		1	U		1	U
Bromoform	75-25-2		1	U		1	U
Carbon disulfide	75-15-0		1	U		1	U
Carbon tetrachloride	56-23-5		1	U		1	U
Chlorobenzene	108-90-7		1	U		1	U
Chloroethane	75-00-3		1	U		1	U
Chloroform	67-66-3		1	U		1	U
cis-1,3-Dichloropropene	10061-01-5		1	U		1	U
Ethylbenzene	100-41-4		1	U		1	U
Methylene chloride	75-09-2		1	U		1	U
Tetrachloroethene	127-18-4		1	U		1	U
Toluene	108-88-3	0.45	1	B	0.39	1	B
trans-1,2-Dichloroethene	156-60-5		1	U		1	U
trans-1,3-Dichloropropene	10061-02-6		1	U		1	U
Trichloroethene	79-01-6		1	U		1	U
Vinyl chloride	75-01-4		1	U		1	U
Xylenes (total)	1330-20-7		3	U		3	U
PAHs (ug/l)							
2-Methylnaphthalene	91-57-6		1.9	U		1.9	U
Acenaphthene	83-32-9		1.9	U		1.9	U
Acenaphthylene	208-96-8		1.9	U		1.9	U
Anthracene	120-12-7		1.9	U		1.9	U
Fluoranthene	206-44-0		1.9	U		1.9	U
Fluorene	86-73-7		1.9	U		1.9	U
Naphthalene	91-20-3		1.9	U		1.9	U
Phenanthrene	85-01-8		1.9	U		1.9	U
Benzo(a)anthracene	56-55-3		1.9	U		1.9	U
Benzo(a)pyrene	50-32-8		1.9	U		1.9	U
Benzo(b)fluoranthene	205-99-2		1.9	U		1.9	U
Benzo(ghi)perylene	191-24-2		1.9	U		1.9	U
Benzo(k)fluoranthene	207-08-9		1.9	U		1.9	U
Chrysene	218-01-9		1.9	U		1.9	U
Dibenz(a,h)anthracene	53-70-3		1.9	U		1.9	U
Indeno(1,2,3-cd)pyrene	193-39-5		1.9	U		1.9	U
Pyrene	129-00-0		1.9	U		1.9	U
Other SVOCs (ug/l)							
1,2,4-Trichlorobenzene	120-82-1		1.9	U		1.9	U
1,2-Dichlorobenzene	95-50-1		1.9	U		1.9	U
1,3-Dichlorobenzene	541-73-1		1.9	U		1.9	U
1,4-Dichlorobenzene	106-46-7		1.9	U		1.9	U
2,2'-oxybis(1-Chloropropane)	108-60-1		1.9	U		1.9	U
2,4,5-Trichlorophenol	95-95-4		9.5	U		9.6	U
2,4,6-Trichlorophenol	88-06-2		9.5	U		9.6	U
2,4-Dichlorophenol	120-83-2		1.9	U		1.9	U

TABLE B-9
KNOBBY'S DITCH HEAD POND SURFACE WATER DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	KD-SW-01			KD-SW-02		
		Result	RL	Qual	Result	RL	Qual
2,4-Dimethylphenol	105-67-9		9.5	U		9.6	U
2,4-Dinitrophenol	51-28-5		48	U		48	U
2,4-Dinitrotoluene	121-14-2		9.5	U		9.6	U
2,6-Dinitrotoluene	606-20-2		9.5	U		9.6	U
2-Chloronaphthalene	91-58-7		1.9	U		1.9	U
2-Chlorophenol	95-57-8		9.5	U		9.6	U
2-Methylphenol	95-48-7		9.5	U		9.6	U
2-Nitrophenol	88-75-5		9.5	U		9.6	U
3,3'-Dichlorobenzidine	91-94-1		9.5	U		9.6	U
3,3'-Dimethylbenzidine	119-93-7		48	U		48	U
3-Methylphenol & 4-Methylphenol	MEPH1314		9.5	U		9.6	U
4,6-Dinitro-2-methylphenol	534-52-1		48	U		48	U
4-Bromophenyl phenyl ether	101-55-3		9.5	U		9.6	U
4-Chloro-3-methylphenol	59-50-7		9.5	U		9.6	U
4-Chlorophenyl phenyl ether	7005-72-3		9.5	U		9.6	U
4-Nitrophenol	100-02-7		48	U		48	U
bis(2-Chloroethoxy)methane	111-91-1		9.5	U		9.6	U
bis(2-Chloroethyl) ether	111-44-4		1.9	U		1.9	U
bis(2-Ethylhexyl) phthalate	117-81-7		9.5	U	3	9.6	
Butyl benzyl phthalate	85-68-7		9.5	U		9.6	U
Dibenzofuran	132-64-9		9.5	U		9.6	U
Diethyl phthalate	84-66-2		9.5	U		9.6	U
Dimethyl phthalate	131-11-3		9.5	U		9.6	U
Di-n-butyl phthalate	84-74-2		9.5	U		9.6	U
Di-n-octyl phthalate	117-84-0		9.5	U		9.6	U
Hexachlorobenzene	118-74-1		1.9	U		1.9	U
Hexachlorobutadiene	87-68-3		1.9	U		1.9	U
Hexachlorocyclopentadiene	77-47-4		9.5	U		9.6	U
Hexachloroethane	67-72-1		9.5	U		9.6	U
Isophorone	78-59-1		9.5	U		9.6	U
Nitrobenzene	98-95-3		1.9	U		1.9	U
Pentachloroethane	76-01-7		48	U		48	U
Pentachlorophenol	87-86-5		9.5	U		9.6	U
Phenol	108-95-2		1.9	U		1.9	U
Pyridine	110-86-1		9.5	U		9.6	U
Other (mg/l)							
Hardness, as calcium carbonate	HARDNESS	340	25		370	25	

Notes:

NS - Not screened (screening benchmark based on other form (dissolved or total)

NA = Not available

L = The analyte was positively detected; the reported value may be biased low

J = The analyte was positively detected; the associated numerical value is approximate

B = The analyte was not detected substantially above the level reported in laboratory or field blanks

TABLE B-10
KNOBBY'S DITCH HEAD POND SEDIMENT DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	KD-FS-01			KD-FS-02		
		Result	Qual	RL	Result	Qual	RL
Inorganics (mg/kg)							
Antimony	7440-36-0		U	2.3	0.32		3.4
Arsenic	7440-38-2	8.5		2.3	6.2		3.4
Barium	7440-39-3	123		46.7	63.1		67.9
Beryllium	7440-41-7	2.4		0.93	2		1.4
Cadmium	7440-43-9	5.1		1.2	1		1.7
Chromium	7440-47-3	76.9		1.2	109		1.7
Cobalt	7440-48-4	12.6		11.7	11.6		17
Copper	7440-50-8	211		5.8	71.8		8.5
Cyanide, Total	57-12-5	28.3		11.7	50.5		17
Lead	7439-92-1	75.6		0.7	50.7		1
Mercury	7439-97-6	0.11		0.077	0.1		0.11
Nickel	7440-02-0	27.2		9.3	26.3		13.6
Selenium	7782-49-2	1.4		1.2		U	1.7
Silver	7440-22-4	0.31		1.2	0.54		1.7
Sulfide, Total	18496-25-8	6240		70.1	8990		102
Thallium	7440-28-0		U	2.3		U	3.4
Tin	7440-31-5	42.6		23.4	18.1		33.9
Vanadium	7440-62-2	71.8		11.7	175		17
Zinc	7440-66-6	798		4.7	577		6.8
PCBs (ug/kg)							
Aroclor 1016	12674-11-2		U	39		U	57
Aroclor 1221	11104-28-2		U	39		U	57
Aroclor 1232	11141-16-5		U	39		U	57
Aroclor 1242	53469-21-9		U	39		U	57
Aroclor 1248	12672-29-6		U	39		U	57
Aroclor 1254	11097-69-1		U	39		U	57
Aroclor 1260	11096-82-5	90		39	46		57
VOCs (ug/kg)							
1,1,1,2-Tetrachloroethane	630-20-6		U	12		U	17
1,1,1-Trichloroethane	71-55-6		U	12		U	17
1,1,2,2-Tetrachloroethane	79-34-5		U	12		U	17
1,1,2-Trichloroethane	79-00-5		U	12		U	17
1,1-Dichloroethane	75-34-3		U	12		U	17
1,1-Dichloroethene	75-35-4		U	12		U	17
1,2-Dichloroethane	107-06-2		U	12		U	17
1,2-Dichloropropane	78-87-5		U	12		U	17
2-Butanone	78-93-3	26		12	33		17
2-Hexanone	591-78-6		U	12		U	17
4-Methyl-2-pentanone	108-10-1		U	12		U	17
Acetone	67-64-1	130		47	230		68
Benzene	71-43-2	18		12		U	17

TABLE B-10
KNOBBY'S DITCH HEAD POND SEDIMENT DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	KD-FS-01			KD-FS-02		
		Result	Qual	RL	Result	Qual	RL
Bromoform	75-25-2		U	12		U	17
Carbon disulfide	75-15-0		U	12		U	17
Carbon tetrachloride	56-23-5		U	12		U	17
Chlorobenzene	108-90-7		U	12		U	17
Chloroethane	75-00-3		U	12		U	17
Chloroform	67-66-3		U	12		U	17
cis-1,3-Dichloropropene	10061-01-5		U	12		U	17
Ethylbenzene	100-41-4		U	12		U	17
Methylene chloride	75-09-2	7.6		12	12		17
Tetrachloroethene	127-18-4		U	12		U	17
Toluene	108-88-3	2		12		U	17
trans-1,2-Dichloroethene	156-60-5		U	12		U	17
trans-1,3-Dichloropropene	10061-02-6		U	12		U	17
Trichloroethene	79-01-6		U	12		U	17
Vinyl chloride	75-01-4		U	12		U	17
Xylenes (total)	1330-20-7		U	35		U	51
PAHs (ug/kg)							
2-Methylnaphthalene	91-57-6		U	780		U	1100
Acenaphthene	83-32-9		U	780		U	1100
Acenaphthylene	208-96-8		U	780		U	1100
Anthracene	120-12-7		U	780		U	1100
Fluoranthene	206-44-0	730		780		U	1100
Fluorene	86-73-7		U	780		U	1100
Naphthalene	91-20-3	190		780		U	1100
Phenanthrene	85-01-8	350		780		U	1100
Benzo(a)anthracene	56-55-3	450		780		U	1100
Benzo(a)pyrene	50-32-8	600		780		U	1100
Benzo(b)fluoranthene	205-99-2	790		780		U	1100
Benzo(ghi)perylene	191-24-2	720		780		U	1100
Benzo(k)fluoranthene	207-08-9	240		780		U	1100
Chrysene	218-01-9	520		780		U	1100
Dibenz(a,h)anthracene	53-70-3		U	780		U	1100
Indeno(1,2,3-cd)pyrene	193-39-5	590		780		U	1100
Pyrene	129-00-0	580		780		U	1100
Other SVOCs (ug/kg)							
1,2,4-Trichlorobenzene	120-82-1		U	3900		U	5600
1,2-Dichlorobenzene	95-50-1		U	780		U	1100
1,3-Dichlorobenzene	541-73-1		U	780		U	1100
1,4-Dichlorobenzene	106-46-7		U	780		U	1100
2,2'-oxybis(1-Chloropropane)	108-60-1		U	780		U	1100
2,4,5-Trichlorophenol	95-95-4		U	3900		U	5600
2,4,6-Trichlorophenol	88-06-2		U	3900		U	5600
2,4-Dichlorophenol	120-83-2		U	780		U	1100
2,4-Dimethylphenol	105-67-9		U	3900		U	5600

TABLE B-10
KNOBBY'S DITCH HEAD POND SEDIMENT DATA
SEVERSTAL SPARROWS POINT SITE
SPARROWS POINT, MARYLAND

Constituent	CAS #	KD-FS-01			KD-FS-02		
		Result	Qual	RL	Result	Qual	RL
2,4-Dinitrophenol	51-28-5		U	18000		U	25000
2,4-Dinitrotoluene	121-14-2		U	3900		U	5600
2,6-Dinitrotoluene	606-20-2		U	3900		U	5600
2-Chloronaphthalene	91-58-7		U	780		U	1100
2-Chlorophenol	95-57-8		U	3900		U	5600
2-Methylphenol	95-48-7		U	3900		U	5600
2-Nitrophenol	88-75-5		U	3900		U	5600
3,3'-Dichlorobenzidine	91-94-1		U	3900		U	5600
3,3'-Dimethylbenzidine	119-93-7		U	19000		U	28000
3-Methylphenol & 4-Methylphenol	MEPH1314		U	3900		U	5600
4,6-Dinitro-2-methylphenol	534-52-1		U	18000		U	25000
4-Bromophenyl phenyl ether	101-55-3		U	3900		U	5600
4-Chloro-3-methylphenol	59-50-7		U	3900		U	5600
4-Chlorophenyl phenyl ether	7005-72-3		U	3900		U	5600
4-Nitrophenol	100-02-7		U	3900		U	5600
bis(2-Chloroethoxy)methane	111-91-1		U	3900		U	5600
bis(2-Chloroethyl) ether	111-44-4		U	780		U	1100
bis(2-Ethylhexyl) phthalate	117-81-7	470		3900		U	5600
Butyl benzyl phthalate	85-68-7		U	3900		U	5600
Dibenzofuran	132-64-9		U	3900		U	5600
Diethyl phthalate	84-66-2		U	3900		U	5600
Dimethyl phthalate	131-11-3		U	3900		U	5600
Di-n-butyl phthalate	84-74-2		U	3900		U	5600
Di-n-octyl phthalate	117-84-0		U	3900		U	5600
Hexachlorobenzene	118-74-1		U	780		U	1100
Hexachlorobutadiene	87-68-3		U	780		U	1100
Hexachlorocyclopentadiene	77-47-4		U	3900		U	5600
Hexachloroethane	67-72-1		U	3900		U	5600
Isophorone	78-59-1		U	3900		U	5600
Nitrobenzene	98-95-3		U	780		U	1100
Pentachloroethane	76-01-7		U	3900		U	5600
Pentachlorophenol	87-86-5		U	1200		U	1700
Phenol	108-95-2		U	780		U	1100
Pyridine	110-86-1		U	3900		U	5600
Other							
TOC (mg/kg)	7440-44-0	15100		9890	26500		1650

Appendix C

Rare, Threatened, and Endangered Species Information

URS

June 10, 2010

United States Department of the Interior
Fish and Wildlife Service
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401

Re: Rare, Threatened, and Endangered Species and Natural Communities
Severstal Sparrows Point Site, Sparrows Point, Baltimore County, Maryland

Dear Sir or Madam:

URS is performing a Baseline Ecological Risk Assessment (BERA) for the Severstal Sparrows Point Facility in Sparrows Point, Baltimore County, Maryland. We are requesting a search of the U.S. Fish and Wildlife Service database for records of rare or endangered species and natural communities within the project site. Please find the attached USGS quad map showing the site location. This is an update to the request made on November 5, 2007, with response on June 17, 2008. That response indicated that there were no federally proposed or listed threatened or endangered species known to exist within the project area except for occasional transient individuals.

If any charges apply for this service, they can be invoiced directly to me at the address below.

Thank you very much for your time and consideration in this matter. If you should have any questions, please don't hesitate to call me directly at (215) 367-2653.

Sincerely,

Brett Bowen

Brett C. Bowen
Biologist

Enclosure

URS

June 10, 2010

Maryland Department of Natural Resources
Wildlife and Heritage Service
Tawes State Office Building
580 Taylor Avenue
Annapolis, MD 21401

Re: Rare, Threatened, and Endangered Species and Natural Communities
Severstal Sparrows Point Site, Sparrows Point, Baltimore County, Maryland

Dear Sir or Madam:

URS is performing a Baseline Ecological Risk Assessment (BERA) for the Severstal Sparrows Point Facility in Sparrows Point, Baltimore County, Maryland. We are requesting a search of the Wildlife and Heritage Service database for records of rare, threatened, or endangered species and natural communities within the project area. Please find the attached USGS quad map showing the site location. This is an update to the request made on November 5, 2007, with response on January 23, 2008. That response indicated that there were no State or Federal records of rare, threatened, or endangered species within the project site boundary.

If any charges apply for this service, they can be invoiced directly to me at the address below.

Thank you very much for your time and consideration in this matter. If you should have any questions, please do not hesitate to call me directly at (215) 367-2653.

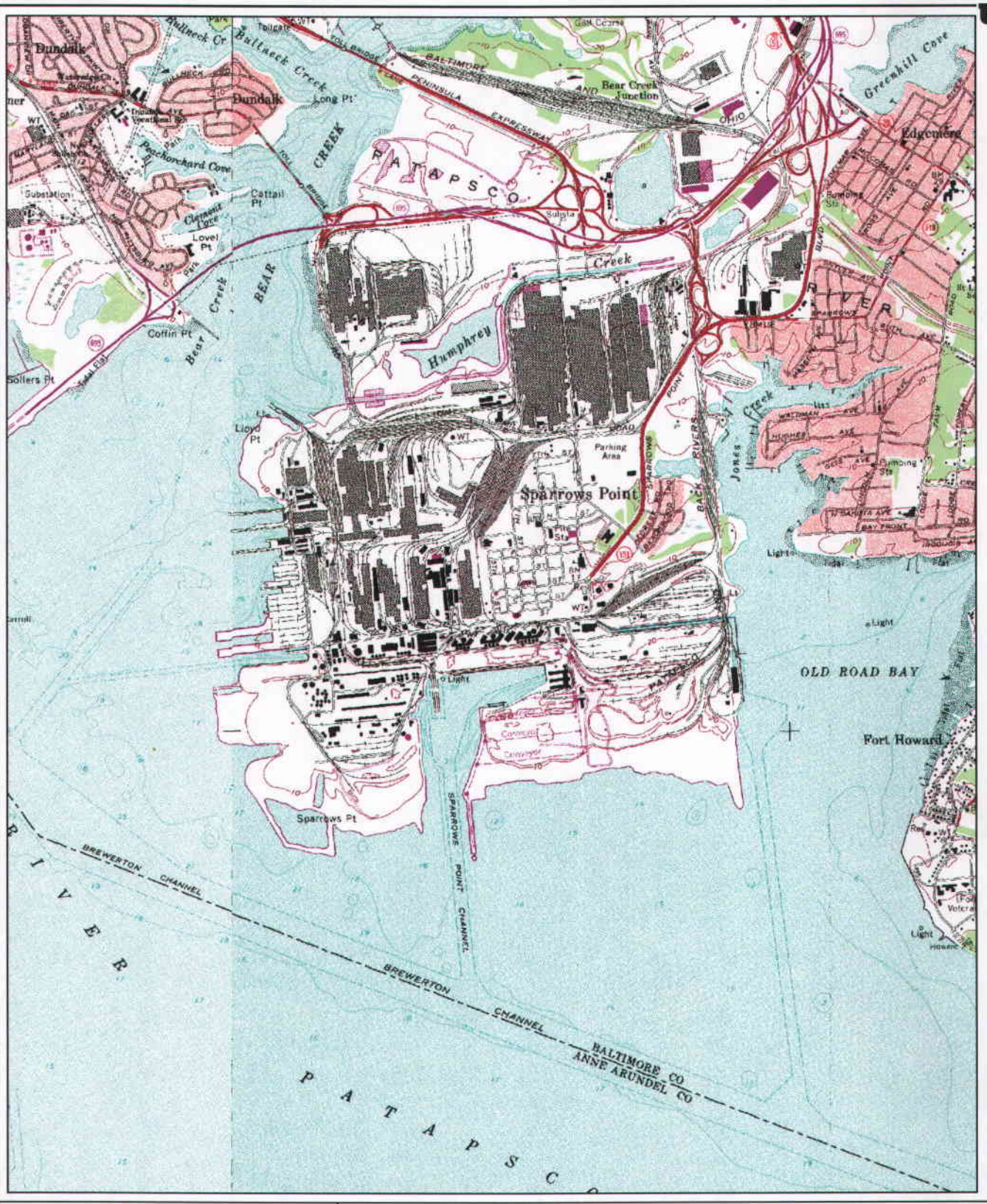
Sincerely,

Brett Bowen

Brett C. Bowen
Biologist

Enclosure

URS Corporation • 335 Commerce Drive • Fort Washington, PA 19034 • Tel: 215-367-2500 • Fax: 215-367-1000



MARYLAND

QUADRANGLE LOCATION

SCALE: 1 INCH=3000 FEET

0 3000 6000

MAP SOURCE

SPARROWS POINT, MD QUADRANGLE,
U.S. GEOLOGICAL SURVEY, 1969
PHOTOREVISED 1974

Job: 13810887.00001	REGIONAL LOCATION PLAN
Prepared by: TFP	SPARROWS POINT, MARYLAND
Checked by: CC	FIGURE 1
Date: 08/01/2005	

Drawing Location & Name: K:\13810877\REGIONAL.dwg

Drawn By & Date/Time: tfpower0 Jun 21, 2006 - 1:30pm

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, Maryland 21401
http://www.fws.gov/chesapeakebay

June 24, 2010

URS Corporation
335 Commerce Drive
Fort Washington, PA 19034

RE: Severstal Sparrows Point Site, Sparrows Point Baltimore County MD

Dear Brett C. Bowen:

This responds to your letter, received, June 14, 2010, requesting information on the presence of species which are federally listed or proposed for listing as endangered or threatened within the vicinity of the above reference project area. We have reviewed the information you enclosed and are providing comments in accordance with section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*).

Except for occasional transient individuals, no federally proposed or listed endangered or threatened species are known to exist within the project impact area. Therefore, no Biological Assessment or further section 7 Consultation with the U.S. Fish and Wildlife Service is required. Should project plans change, or if additional information on the distribution of listed or proposed species becomes available, this determination may be reconsidered.

This response relates only to federally protected threatened or endangered species under our jurisdiction. For information on the presence of other rare species, you should contact Lori Byrne of the Maryland Wildlife and Heritage Division at (410) 260-8573.

Effective August 8, 2007, under the authority of the Endangered Species Act of 1973, as amended, the U.S. Fish and Wildlife Service (Service) removed (delist) the bald eagle in the lower 48 States of the United States from the Federal List of Endangered and Threatened Wildlife. However, the bald eagle will still be protected by the Bald and Golden Eagle Protection Act, Lacey Act and the Migratory Bird Treaty Act. As a result, starting on August 8, 2007, if your project may cause "disturbance" to the bald eagle, please consult the "National Bald Eagle Management Guidelines" dated May 2007.

If any planned or ongoing activities cannot be conducted in compliance with the National Bald Eagle Management Guidelines (Eagle Management Guidelines), please contact the Chesapeake Bay Ecological Services Field Office at 410-573-4573 for technical assistance. The Eagle Management Guidelines can be found at: **http://www.fws.gov/migratorybirds/issues/BaldEagle/NationalBaldEagleManagementGuidelines.pdf.**

In the future, if your project can not avoid disturbance to the bald eagle by complying with the Eagle Management Guidelines, you will be able to apply for a permit that authorizes the take of bald and golden eagles under the Bald and Golden Eagle Protection Act, generally where the take to be authorized is associated with otherwise lawful activities. This proposed permit process will not be available until the Service issues a final rule for the issuance of these take permits under the Bald and Golden Eagle Protection Act.

An additional concern of the Service is wetlands protection. Federal and state partners of the Chesapeake Bay Program have adopted an interim goal of no overall net loss of the Basin's remaining wetlands, and the long term goal of increasing the quality and quantity of the Basin's wetlands resource base. Because of this policy and the functions and values wetlands perform, the Service recommends avoiding wetland impacts. All wetlands within the project area should be identified, and if construction in wetlands is proposed, the U.S. Army Corps of Engineers, Baltimore District, should be contacted for permit requirements. They can be reached at (410) 962-3670.

We appreciate the opportunity to provide information relative to fish and wildlife issues, and thank you for your interests in these resources. If you have any questions or need further assistance, please contact Devin Ray at (410) 573-4531.

Sincerely,

Leopoldo Miranda
Field Supervisor

Appendix D

Calculation of 95 Percent Upper Confidence Level of the Mean (UCL_{95}) Concentrations

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Antimony

General Statistics

Number of Valid Data	18	Number of Detected Data	11
Number of Distinct Detected Data	11	Number of Non-Detect Data	7
		Percent Non-Detects	38.89%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.63	Minimum Detected	-0.46204
Maximum Detected	6.1	Maximum Detected	1.808289
Mean of Detected	3.575455	Mean of Detected	1.097785
SD of Detected	1.836961	SD of Detected	0.701045
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	12.4	Maximum Non-Detect	2.517697
Note: Data have multiple DLs - Use of KM Method is recommend		Number treated as Non-Detect	18
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.948431	Shapiro Wilk Test Statistic	0.878695
5% Shapiro Wilk Critical Value	0.85	5% Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	2.887778	Mean	0.705401
SD	2.104166	SD	0.95186
95% DL/2 (t) UCL	3.750547	95% H-Stat (DL/2) UCL	4.081382
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	0.711682
		SD in Log Scale	0.776644
		Mean in Original Scale	2.654868
		SD in Original Scale	1.872447
		95% Percentile Bootstrap UCL	3.406899
		95% BCA Bootstrap UCL	3.474552
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	2.236782	**Data appear Normal at 5% Significance Level**	
Theta Star	1.598482		
nu star	49.2092		
A-D Test Statistic	0.398985	**Nonparametric Statistics**	
5% A-D Critical Value	0.733562	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.733562	Mean	2.671429
5% K-S Critical Value	0.257002	SD	1.980225
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.520039
		95% KM (t) UCL	3.576092
Assuming Gamma Distribution		95% KM (z) UCL	3.526817
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	3.517243

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Minimum	0.63	95% KM (bootstrap t) UCL	3.581662
Maximum	6.1	95% KM (BCA) UCL	3.90625
Mean	3.376136	95% KM (Percentile Bootstrap) UCL	3.775
Median	3.05	95% KM (Chebyshev) UCL	4.938226
SD	1.628488	97.5% KM (Chebyshev) UCL	5.919071
k star	3.135431	99% KM (Chebyshev) UCL	7.845751
Theta star	1.076769		
Nu star	112.8755	**Potential UCLs to Use**	
AppChi2	89.34968	95% KM (t) UCL	3.576092
95% Gamma Approximate UCL	4.265075	95% KM (Percentile Bootstrap) UCL	3.775
95% Adjusted Gamma UCL	4.363137		
Note: DL/2 is not a recommended method.			

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Barium			
General Statistics			
Number of Valid Observations	18	Number of Distinct Observations	18
Raw Statistics		**Log-transformed Statistics**	
Minimum	13.7	Minimum of Log Data	2.617396
Maximum	400	Maximum of Log Data	5.991465
Mean	108.4778	Mean of log Data	4.145177
Median	55.5	SD of log Data	1.11165
SD	112.9774		
Coefficient of Variation	1.041479		
Skewness	1.437931		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.809009	Shapiro Wilk Test Statistic	0.931914
Shapiro Wilk Critical Value	0.897	Shapiro Wilk Critical Value	0.897
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	154.8018	95% H-UCL	249.4075
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	254.4978
95% Adjusted-CLT UCL	161.9222	97.5% Chebyshev (MVUE) UCL	316.4696
95% Modified-t UCL	156.306	99% Chebyshev (MVUE) UCL	438.2011
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.919677	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	117.9521		
MLE of Mean	108.4778		
MLE of Standard Deviation	113.1158		
nu star	33.10836		
Approximate Chi Square Value (.05)	20.95294	**Nonparametric Statistics**	
Adjusted Level of Significance	0.03574	95% CLT UCL	152.2786
Adjusted Chi Square Value	20.02649	95% Jackknife UCL	154.8018
		95% Standard Bootstrap UCL	152.1063
Anderson-Darling Test Statistic	0.546823	95% Bootstrap-t UCL	177.6458
Anderson-Darling 5% Critical Value	0.765375	95% Hall's Bootstrap UCL	174.9169
Kolmogorov-Smirnov Test Statistic	0.189073	95% Percentile Bootstrap UCL	151.5111
Kolmogorov-Smirnov 5% Critical Value	0.209179	95% BCA Bootstrap UCL	163.5278
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	224.551
		97.5% Chebyshev(Mean, Sd) UCL	274.776
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	373.4332
95% Approximate Gamma UCL	171.4089		
95% Adjusted Gamma UCL	179.3385		
Potential UCL to Use		Use 95% Approximate Gamma UCL	171.4089

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Cadmium			
General Statistics			
Number of Valid Data	18	Number of Detected Data	17
Number of Distinct Detected Data	17	Number of Non-Detect Data	1
		Percent Non-Detects	5.56%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.31	Minimum Detected	-1.17118
Maximum Detected	115	Maximum Detected	4.744932
Mean of Detected	20.14177	Mean of Detected	1.794933
SD of Detected	30.96193	SD of Detected	1.840965
Minimum Non-Detect	3.2	Minimum Non-Detect	1.163151
Maximum Non-Detect	3.2	Maximum Non-Detect	1.163151
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.663949	Shapiro Wilk Test Statistic	0.936954
5% Shapiro Wilk Critical Value	0.892	5% Shapiro Wilk Critical Value	0.892
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	19.11167	Mean	1.721325
SD	30.35375	SD	1.813095
95% DL/2 (t) UCL	31.55759	95% H-Stat (DL/2) UCL	181.2596
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	7.790222	Mean in Log Scale	1.6927
SD	41.3362	SD in Log Scale	1.837911
95% MLE (t) UCL	24.73927	Mean in Original Scale	19.07588
95% MLE (Tiku) UCL	26.64886	SD in Original Scale	30.37599
		95% Percentile Bootstrap UCL	31.59667
		95% BCA Bootstrap UCL	34.23707
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.469376	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	42.9118		
nu star	15.95878		
A-D Test Statistic	0.457088	**Nonparametric Statistics**	
5% A-D Critical Value	0.796007	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.796007	Mean	19.06917
5% K-S Critical Value	0.220602	SD	29.52451
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	7.17323
		95% KM (t) UCL	31.54777
Assuming Gamma Distribution		95% KM (z) UCL	30.86808
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	31.5262
Minimum	1E-09	95% KM (bootstrap t) UCL	42.2223
Maximum	115	95% KM (BCA) UCL	29.91076
Mean	19.02278	95% KM (Percentile Bootstrap) UCL	31.55278

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Median	8.8	95% KM (Chebyshev) UCL	50.33655
SD	30.41034	97.5% KM (Chebyshev) UCL	63.86597
k star	0.277776	99% KM (Chebyshev) UCL	90.4419
Theta star	68.48247		
Nu star	9.999932	**Potential UCLs to Use**	
AppChi2	3.941719	95% KM (Chebyshev) UCL	50.33655
95% Gamma Approximate UCL	48.25978		
95% Adjusted Gamma UCL	53.08583		
Note: DL/2 is not a recommended method.			

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Chromium			
General Statistics			
Number of Valid Observations	18	Number of Distinct Observations	18
Raw Statistics		**Log-transformed Statistics**	
Minimum	49.4	Minimum of Log Data	3.89995
Maximum	11700	Maximum of Log Data	9.367344
Mean	1595.939	Mean of log Data	6.035467
Median	279	SD of log Data	1.565193
SD	3069.366		
Coefficient of Variation	1.923235		
Skewness	2.566856		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.56025	Shapiro Wilk Test Statistic	0.885153
Shapiro Wilk Critical Value	0.897	Shapiro Wilk Critical Value	0.897
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	2854.469	95% H-UCL	5464.962
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	3625.616
95% Adjusted-CLT UCL	3253.609	97.5% Chebyshev (MVUE) UCL	4653.709
95% Modified-t UCL	2927.419	99% Chebyshev (MVUE) UCL	6673.198
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.434968	Data do not follow a Discernable Distribution (0.05)	
Theta Star	3669.097		
MLE of Mean	1595.939		
MLE of Standard Deviation	2419.846		
nu star	15.65884		
Approximate Chi Square Value (.05)	7.722044	**Nonparametric Statistics**	
Adjusted Level of Significance	0.03574	95% CLT UCL	2785.919
Adjusted Chi Square Value	7.191304	95% Jackknife UCL	2854.469
		95% Standard Bootstrap UCL	2735.375
Anderson-Darling Test Statistic	1.902062	95% Bootstrap-t UCL	4150.313
Anderson-Darling 5% Critical Value	0.804845	95% Hall's Bootstrap UCL	3292.913
Kolmogorov-Smirnov Test Statistic	0.333534	95% Percentile Bootstrap UCL	2824.889
Kolmogorov-Smirnov 5% Critical Value	0.215741	95% BCA Bootstrap UCL	3308.722
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	4749.412
		97.5% Chebyshev(Mean, Sd) UCL	6113.923
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	8794.239
95% Approximate Gamma UCL	3236.261		
95% Adjusted Gamma UCL	3475.107		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	8794.239

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Copper			
General Statistics			
Number of Valid Observations	18	Number of Distinct Observations	18
Raw Statistics		**Log-transformed Statistics**	
Minimum	11.5	Minimum of Log Data	2.442347
Maximum	991	Maximum of Log Data	6.898715
Mean	221.6222	Mean of log Data	4.794562
Median	150.5	SD of log Data	1.212394
SD	257.1675		
Coefficient of Variation	1.160387		
Skewness	1.977487		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.742461	Shapiro Wilk Test Statistic	0.959886
Shapiro Wilk Critical Value	0.897	Shapiro Wilk Critical Value	0.897
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	327.0684	95% H-UCL	601.9291
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	572.4256
95% Adjusted-CLT UCL	351.5132	97.5% Chebyshev (MVUE) UCL	717.8442
95% Modified-t UCL	331.7772	99% Chebyshev (MVUE) UCL	1003.491
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.834414	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	265.6021		
MLE of Mean	221.6222		
MLE of Standard Deviation	242.6177		
nu star	30.03892		
Approximate Chi Square Value (.05)	18.5234	**Nonparametric Statistics**	
Adjusted Level of Significance	0.03574	95% CLT UCL	321.325
Adjusted Chi Square Value	17.65737	95% Jackknife UCL	327.0684
		95% Standard Bootstrap UCL	318.1959
Anderson-Darling Test Statistic	0.474373	95% Bootstrap-t UCL	399.1099
Anderson-Darling 5% Critical Value	0.768559	95% Hall's Bootstrap UCL	377.8991
Kolmogorov-Smirnov Test Statistic	0.218884	95% Percentile Bootstrap UCL	327.7833
Kolmogorov-Smirnov 5% Critical Value	0.209784	95% BCA Bootstrap UCL	360.0056
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	485.8367
		97.5% Chebyshev(Mean, Sd) UCL	600.1625
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	824.7334
95% Approximate Gamma UCL	359.3991		
95% Adjusted Gamma UCL	377.0262		
Potential UCL to Use		Use 95% Approximate Gamma UCL	359.3991

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Cyanide			
General Statistics			
Number of Valid Observations	18	Number of Distinct Observations	18
Raw Statistics		**Log-transformed Statistics**	
Minimum	1.2	Minimum of Log Data	0.182322
Maximum	132	Maximum of Log Data	4.882802
Mean	32.91667	Mean of log Data	2.978325
Median	22.7	SD of log Data	1.169517
SD	32.81715		
Coefficient of Variation	0.996977		
Skewness	1.794698		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.82273	Shapiro Wilk Test Statistic	0.968714
Shapiro Wilk Critical Value	0.897	Shapiro Wilk Critical Value	0.897
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	46.37266	95% H-UCL	88.49114
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	86.86599
95% Adjusted-CLT UCL	49.13596	97.5% Chebyshev (MVUE) UCL	108.5552
95% Modified-t UCL	46.918	99% Chebyshev (MVUE) UCL	151.1595
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.959162	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	34.31816		
MLE of Mean	32.91667		
MLE of Standard Deviation	33.61011		
nu star	34.52983		
Approximate Chi Square Value (.05)	22.08827	**Nonparametric Statistics**	
Adjusted Level of Significance	0.03574	95% CLT UCL	45.63973
Adjusted Chi Square Value	21.13477	95% Jackknife UCL	46.37266
		95% Standard Bootstrap UCL	45.17802
Anderson-Darling Test Statistic	0.142951	95% Bootstrap-t UCL	51.83269
Anderson-Darling 5% Critical Value	0.764394	95% Hall's Bootstrap UCL	57.71654
Kolmogorov-Smirnov Test Statistic	0.11439	95% Percentile Bootstrap UCL	46.11667
Kolmogorov-Smirnov 5% Critical Value	0.208969	95% BCA Bootstrap UCL	49.27778
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	66.63308
		97.5% Chebyshev(Mean, Sd) UCL	81.2222
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	109.8797
95% Approximate Gamma UCL	51.45748		
95% Adjusted Gamma UCL	53.77899		
Potential UCL to Use		Use 95% Approximate Gamma UCL	51.45748

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Lead			
General Statistics			
Number of Valid Observations	18	Number of Distinct Observations	18
Raw Statistics		**Log-transformed Statistics**	
Minimum	39.8	Minimum of Log Data	3.683867
Maximum	15400	Maximum of Log Data	9.642123
Mean	1705.389	Mean of log Data	6.349028
Median	908.5	SD of log Data	1.590871
SD	3521.522		
Coefficient of Variation	2.064938		
Skewness	3.855332		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.45048	Shapiro Wilk Test Statistic	0.935984
Shapiro Wilk Critical Value	0.897	Shapiro Wilk Critical Value	0.897
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	3149.316	95% H-UCL	8097.265
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	5195.967
95% Adjusted-CLT UCL	3876.603	97.5% Chebyshev (MVUE) UCL	6678.536
95% Modified-t UCL	3275.025	99% Chebyshev (MVUE) UCL	9590.758
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.511952	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	3331.153		
MLE of Mean	1705.389		
MLE of Standard Deviation	2383.466		
nu star	18.43025		
Approximate Chi Square Value (.05)	9.702526	**Nonparametric Statistics**	
Adjusted Level of Significance	0.03574	95% CLT UCL	3070.668
Adjusted Chi Square Value	9.098223	95% Jackknife UCL	3149.316
		95% Standard Bootstrap UCL	3055.836
Anderson-Darling Test Statistic	0.777897	95% Bootstrap-t UCL	7632.878
Anderson-Darling 5% Critical Value	0.793929	95% Hall's Bootstrap UCL	8384.347
Kolmogorov-Smirnov Test Statistic	0.20553	95% Percentile Bootstrap UCL	3313.6
Kolmogorov-Smirnov 5% Critical Value	0.214074	95% BCA Bootstrap UCL	4135.406
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	5323.408
		97.5% Chebyshev(Mean, Sd) UCL	6888.928
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	9964.089
95% Approximate Gamma UCL	3239.44		
95% Adjusted Gamma UCL	3454.603		
Potential UCL to Use		Use 95% Approximate Gamma UCL	3239.44

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Nickel			
General Statistics			
Number of Valid Observations	18	Number of Distinct Observations	18
Raw Statistics		**Log-transformed Statistics**	
Minimum	4.4	Minimum of Log Data	1.481605
Maximum	337	Maximum of Log Data	5.820083
Mean	84.74444	Mean of log Data	3.899875
Median	54.45	SD of log Data	1.165766
SD	89.44306		
Coefficient of Variation	1.055445		
Skewness	1.86487		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.778061	Shapiro Wilk Test Statistic	0.966837
Shapiro Wilk Critical Value	0.897	Shapiro Wilk Critical Value	0.897
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	121.4187	95% H-UCL	220.4758
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	217.0013
95% Adjusted-CLT UCL	129.3227	97.5% Chebyshev (MVUE) UCL	271.0989
95% Modified-t UCL	122.9632	99% Chebyshev (MVUE) UCL	377.3632
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.922031	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	91.91061		
MLE of Mean	84.74444		
MLE of Standard Deviation	88.25482		
nu star	33.19312		
Approximate Chi Square Value (.05)	21.02047	**Nonparametric Statistics**	
Adjusted Level of Significance	0.03574	95% CLT UCL	119.4211
Adjusted Chi Square Value	20.09239	95% Jackknife UCL	121.4187
		95% Standard Bootstrap UCL	117.8221
Anderson-Darling Test Statistic	0.272394	95% Bootstrap-t UCL	147.8928
Anderson-Darling 5% Critical Value	0.765317	95% Hall's Bootstrap UCL	316.032
Kolmogorov-Smirnov Test Statistic	0.108119	95% Percentile Bootstrap UCL	120.0667
Kolmogorov-Smirnov 5% Critical Value	0.209166	95% BCA Bootstrap UCL	130.7944
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	176.6385
		97.5% Chebyshev(Mean, Sd) UCL	216.4011
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	294.507
95% Approximate Gamma UCL	133.8187		
95% Adjusted Gamma UCL	139.9999		
Potential UCL to Use		Use 95% Approximate Gamma UCL	133.8187

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Selenium

General Statistics

Number of Valid Data	18	Number of Detected Data	13
Number of Distinct Detected Data	12	Number of Non-Detect Data	5
		Percent Non-Detects	27.78%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.92	Minimum Detected	-0.08338
Maximum Detected	16.9	Maximum Detected	2.827314
Mean of Detected	6.655385	Mean of Detected	1.72601
SD of Detected	3.803754	SD of Detected	0.674822
Minimum Non-Detect	0.53	Minimum Non-Detect	-0.63488
Maximum Non-Detect	2.6	Maximum Non-Detect	0.955511
Note: Data have multiple DLs - Use of KM Method is recommend		Number treated as Non-Detect	6
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	12
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	33.33%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.85033	Shapiro Wilk Test Statistic	0.852667
5% Shapiro Wilk Critical Value	0.866	5% Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	5.021389	Mean	1.124919
SD	4.197607	SD	1.195022
95% DL/2 (t) UCL	6.742531	95% H-Stat (DL/2) UCL	7.795851
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	4.550574	Mean in Log Scale	1.346484
SD	4.817406	SD in Log Scale	0.856936
95% MLE (t) UCL	6.525851	Mean in Original Scale	5.216041
95% MLE (Tiku) UCL	6.686848	SD in Original Scale	3.994099
		95% Percentile Bootstrap UCL	6.745648
		95% BCA Bootstrap UCL	7.179732
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	2.442061	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	2.725315		
nu star	63.49358		
A-D Test Statistic	0.580737	**Nonparametric Statistics**	
5% A-D Critical Value	0.738961	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.738961	Mean	5.062222
5% K-S Critical Value	0.23817	SD	4.0305
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.988789
		95% KM (t) UCL	6.782327
Assuming Gamma Distribution		95% KM (z) UCL	6.688636
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	6.713426

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Minimum	0.92	95% KM (bootstrap t) UCL	7.096192
Maximum	16.9	95% KM (BCA) UCL	7.611111
Mean	5.755911	95% KM (Percentile Bootstrap) UCL	7.111111
Median	4.927464	95% KM (Chebyshev) UCL	9.372254
SD	3.59296	97.5% KM (Chebyshev) UCL	11.23721
k star	2.45951	99% KM (Chebyshev) UCL	14.90055
Theta star	2.340268		
Nu star	88.54235	**Potential UCLs to Use**	
AppChi2	67.84829	95% KM (Percentile Bootstrap) UCL	7.111111
95% Gamma Approximate UCL	7.511493		
95% Adjusted Gamma UCL	7.708961		
Note: DL/2 is not a recommended method.			

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Thallium

General Statistics

Number of Valid Data	18	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	14
		Percent Non-Detects	77.78%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	5.4	Minimum Detected	1.686399
Maximum Detected	10.8	Maximum Detected	2.379546
Mean of Detected	8.275	Mean of Detected	2.082086
SD of Detected	2.276511	SD of Detected	0.295385
Minimum Non-Detect	1.1	Minimum Non-Detect	0.09531
Maximum Non-Detect	15	Maximum Non-Detect	2.70805
Note: Data have multiple DLs - Use of KM Method is recommend		Number treated as Non-Detect	18
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.99284	Shapiro Wilk Test Statistic	0.963441
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	4.747222	Mean	1.262483
SD	2.986414	SD	0.913529
95% DL/2 (t) UCL	5.971739	95% H-Stat (DL/2) UCL	8.721515
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	1.559057
		SD in Log Scale	0.34164
		Mean in Original Scale	5.06029
		SD in Original Scale	2.09377
		95% Percentile Bootstrap UCL	5.83356
		95% BCA Bootstrap UCL	6.016367
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	4.220334	**Data appear Normal at 5% Significance Level**	
Theta Star	1.960745		
nu star	33.76267		
A-D Test Statistic	0.234314	**Nonparametric Statistics**	

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

5% A-D Critical Value	0.657094	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.657094	Mean	6.34965
5% K-S Critical Value	0.394501	SD	1.739861
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.573798
		95% KM (t) UCL	7.347833
Assuming Gamma Distribution		95% KM (z) UCL	7.293464
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	7.844338
Minimum	5.4	95% KM (bootstrap t) UCL	7.050966
Maximum	10.8	95% KM (BCA) UCL	9.553333
Mean	8.641292	95% KM (Percentile Bootstrap) UCL	9.361539
Median	8.745536	95% KM (Chebyshev) UCL	8.850778
SD	1.110299	97.5% KM (Chebyshev) UCL	9.933018
k star	46.98548	99% KM (Chebyshev) UCL	12.05887
Theta star	0.183914		
Nu star	1691.477	**Potential UCLs to Use**	
AppChi2	1596.958	95% KM (t) UCL	7.347833
95% Gamma Approximate UCL	9.152746	95% KM (Percentile Bootstrap) UCL	9.361539
95% Adjusted Gamma UCL	N/A		
Note: DL/2 is not a recommended method.			

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Tin

General Statistics			
Number of Valid Observations	18	Number of Distinct Observations	18

Raw Statistics		Log-transformed Statistics	
Minimum	7	Minimum of Log Data	1.94591
Maximum	10000	Maximum of Log Data	9.21034
Mean	1757.517	Mean of log Data	5.373811
Median	120	SD of log Data	2.207836
SD	3360.755		
Coefficient of Variation	1.912218		
Skewness	1.955585		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.573171	Shapiro Wilk Test Statistic	0.921075
Shapiro Wilk Critical Value	0.897	Shapiro Wilk Critical Value	0.897
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	3135.524	95% H-UCL	30452.73
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	6449.014
95% Adjusted-CLT UCL	3450.608	97.5% Chebyshev (MVUE) UCL	8490.554
95% Modified-t UCL	3196.378	99% Chebyshev (MVUE) UCL	12500.77
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.307465	Data appear Lognormal at 5% Significance Level	
Theta Star	5716.149		
MLE of Mean	1757.517		
MLE of Standard Deviation	3169.578		
nu star	11.06875		
Approximate Chi Square Value (.05)	4.620246	**Nonparametric Statistics**	
Adjusted Level of Significance	0.03574	95% CLT UCL	3060.467
Adjusted Chi Square Value	4.226449	95% Jackknife UCL	3135.524
		95% Standard Bootstrap UCL	2983.794
Anderson-Darling Test Statistic	1.499753	95% Bootstrap-t UCL	4197.853
Anderson-Darling 5% Critical Value	0.83693	95% Hall's Bootstrap UCL	2956.08
Kolmogorov-Smirnov Test Statistic	0.275225	95% Percentile Bootstrap UCL	3111.767
Kolmogorov-Smirnov 5% Critical Value	0.220101	95% BCA Bootstrap UCL	3487.806
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	5210.364
		97.5% Chebyshev(Mean, Sd) UCL	6704.414
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	9639.185
95% Approximate Gamma UCL	4210.491		
95% Adjusted Gamma UCL	4602.802		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	9639.185

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Vanadium			
General Statistics			
Number of Valid Observations	18	Number of Distinct Observations	18
Raw Statistics		**Log-transformed Statistics**	
Minimum	21.1	Minimum of Log Data	3.049273
Maximum	485	Maximum of Log Data	6.184149
Mean	105.8722	Mean of log Data	4.368298
Median	88.2	SD of log Data	0.748607
SD	105.3862		
Coefficient of Variation	0.99541		
Skewness	3.017686		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.646365	Shapiro Wilk Test Statistic	0.957804
Shapiro Wilk Critical Value	0.897	Shapiro Wilk Critical Value	0.897
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	149.0837	95% H-UCL	158.4692
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	186.7613
95% Adjusted-CLT UCL	165.6084	97.5% Chebyshev (MVUE) UCL	223.243
95% Modified-t UCL	152.0283	99% Chebyshev (MVUE) UCL	294.9044
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.578951	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	67.05225		
MLE of Mean	105.8722		
MLE of Standard Deviation	84.25539		
nu star	56.84224		
Approximate Chi Square Value (.05)	40.51263	**Nonparametric Statistics**	
Adjusted Level of Significance	0.03574	95% CLT UCL	146.73
Adjusted Chi Square Value	39.19031	95% Jackknife UCL	149.0837
		95% Standard Bootstrap UCL	144.4941
Anderson-Darling Test Statistic	0.642531	95% Bootstrap-t UCL	195.9308
Anderson-Darling 5% Critical Value	0.753714	95% Hall's Bootstrap UCL	334.0235
Kolmogorov-Smirnov Test Statistic	0.182282	95% Percentile Bootstrap UCL	150.8444
Kolmogorov-Smirnov 5% Critical Value	0.206593	95% BCA Bootstrap UCL	166.3
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	214.1463
		97.5% Chebyshev(Mean, Sd) UCL	260.9965
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	353.0248
95% Approximate Gamma UCL	148.5466		
95% Adjusted Gamma UCL	153.5587		
Potential UCL to Use		Use 95% Approximate Gamma UCL	148.5466

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Zinc			
General Statistics			
Number of Valid Observations	18	Number of Distinct Observations	17
Raw Statistics		**Log-transformed Statistics**	
Minimum	194	Minimum of Log Data	5.267858
Maximum	23300	Maximum of Log Data	10.05621
Mean	6454.944	Mean of log Data	8.082859
Median	5945	SD of log Data	1.48349
SD	6028.983		
Coefficient of Variation	0.93401		
Skewness	1.235472		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.875283	Shapiro Wilk Test Statistic	0.890111
Shapiro Wilk Critical Value	0.897	Shapiro Wilk Critical Value	0.897
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	8927.004	95% H-UCL	33144.57
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	24289.74
95% Adjusted-CLT UCL	9234.521	97.5% Chebyshev (MVUE) UCL	31033.21
95% Modified-t UCL	8995.973	99% Chebyshev (MVUE) UCL	44279.44
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.748109	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	8628.343		
MLE of Mean	6454.944		
MLE of Standard Deviation	7462.94		
nu star	26.93194		
Approximate Chi Square Value (.05)	16.09887	**Nonparametric Statistics**	
Adjusted Level of Significance	0.03574	95% CLT UCL	8792.355
Adjusted Chi Square Value	15.29718	95% Jackknife UCL	8927.004
		95% Standard Bootstrap UCL	8723.245
Anderson-Darling Test Statistic	0.517568	95% Bootstrap-t UCL	9631.524
Anderson-Darling 5% Critical Value	0.773261	95% Hall's Bootstrap UCL	10060.03
Kolmogorov-Smirnov Test Statistic	0.172602	95% Percentile Bootstrap UCL	8820.333
Kolmogorov-Smirnov 5% Critical Value	0.210608	95% BCA Bootstrap UCL	9169
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	12649.14
		97.5% Chebyshev(Mean, Sd) UCL	15329.37
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	20594.16
95% Approximate Gamma UCL	10798.53		
95% Adjusted Gamma UCL	11364.46		
Potential UCL to Use		Use 95% Approximate Gamma UCL	10798.53

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
HUMPHREY IMPOUNDMENT
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Total HMW PAHs			
General Statistics			
Number of Valid Observations	18	Number of Distinct Observations	18
Raw Statistics		**Log-transformed Statistics**	
Minimum	276	Minimum of Log Data	5.6204
Maximum	25140	Maximum of Log Data	10.1322
Mean	2672.75	Mean of log Data	6.82249
Median	525	SD of log Data	1.30192
SD	5823.67		
Coefficient of Variation	2.1789		
Skewness	3.7578		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.4418	Shapiro Wilk Test Statistic	0.81659
Shapiro Wilk Critical Value	0.897	Shapiro Wilk Critical Value	0.897
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	5060.62	95% H-UCL	5711.37
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	5042.06
95% Adjusted-CLT UCL	6229.65	97.5% Chebyshev (MVUE) UCL	6365.84
95% Modified-t UCL	5263.25	99% Chebyshev (MVUE) UCL	8966.16
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.52128	Data do not follow a Discernable Distribution (0.05)	
Theta Star	5127.31		
MLE of Mean	2672.75		
MLE of Standard Deviation	3701.89		
nu star	18.766		
Approximate Chi Square Value (.05)	9.94669	**Nonparametric Statistics**	
Adjusted Level of Significance	0.03574	95% CLT UCL	4930.56
Adjusted Chi Square Value	9.33384	95% Jackknife UCL	5060.62
		95% Standard Bootstrap UCL	4816.28
Anderson-Darling Test Statistic	2.0678	95% Bootstrap-t UCL	11179.7
Anderson-Darling 5% Critical Value	0.79294	95% Hall's Bootstrap UCL	12268.8
Kolmogorov-Smirnov Test Statistic	0.29028	95% Percentile Bootstrap UCL	5009.33
Kolmogorov-Smirnov 5% Critical Value	0.21391	95% BCA Bootstrap UCL	6775.19
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	8656
		97.5% Chebyshev(Mean, Sd) UCL	11245
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	16330.5
95% Approximate Gamma UCL	5042.56		
95% Adjusted Gamma UCL	5373.65		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	16330.5

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
COUNTY LANDS 1B
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Antimony

General Statistics

Number of Valid Data	19	Number of Detected Data	13
Number of Distinct Detected Data	13	Number of Non-Detect Data	6
		Percent Non-Detects	31.58%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.11	Minimum Detected	-2.20728
Maximum Detected	17.1	Maximum Detected	2.839079
Mean of Detected	1.919231	Mean of Detected	-0.59912
SD of Detected	4.612681	SD of Detected	1.399486
Minimum Non-Detect	1.1	Minimum Non-Detect	0.09531
Maximum Non-Detect	12.4	Maximum Non-Detect	2.517697
Note: Data have multiple DLs - Use of KM Method is recommend		Number treated as Non-Detect	18
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	94.74%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.423446	Shapiro Wilk Test Statistic	0.903319
5% Shapiro Wilk Critical Value	0.866	5% Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1.813158	Mean	-0.43474
SD	3.95533	SD	1.276839
95% DL/2 (t) UCL	3.386673	95% H-Stat (DL/2) UCL	5.756244
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-0.7437
		SD in Log Scale	1.212113
		Mean in Original Scale	1.441495
		SD in Original Scale	3.83694
		95% Percentile Bootstrap UCL	3.164144
		95% BCA Bootstrap UCL	4.08638
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.441036	Data appear Lognormal at 5% Significance Level	
Theta Star	4.351644		
nu star	11.46693		
A-D Test Statistic	1.410675	**Nonparametric Statistics**	
5% A-D Critical Value	0.789425	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.789425	Mean	1.444495
5% K-S Critical Value	0.249705	SD	3.737183
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.893937
		95% KM (t) UCL	2.994639
Assuming Gamma Distribution		95% KM (z) UCL	2.914891
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	2.9751

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
COUNTY LANDS 1B
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Minimum	0.11	95% KM (bootstrap t) UCL	10.46844
Maximum	17.1	95% KM (BCA) UCL	3.238968
Mean	1.921924	95% KM (Percentile Bootstrap) UCL	3.060486
Median	0.76	95% KM (Chebyshev) UCL	5.341076
SD	3.768179	97.5% KM (Chebyshev) UCL	7.02713
k star	0.627919	99% KM (Chebyshev) UCL	10.33906
Theta star	3.060785		
Nu star	23.86091	**Potential UCLs to Use**	
AppChi2	13.74292	97.5% KM (Chebyshev) UCL	7.02713
95% Gamma Approximate UCL	3.336908		
95% Adjusted Gamma UCL	3.507779		
Note: DL/2 is not a recommended method.			

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
COUNTY LANDS 1B
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Cadmium			
General Statistics			
Number of Valid Observations	19	Number of Distinct Observations	19
Raw Statistics		**Log-transformed Statistics**	
Minimum	0.13	Minimum of Log Data	-2.04022
Maximum	17.6	Maximum of Log Data	2.867899
Mean	2.471053	Mean of log Data	0.178428
Median	1.1	SD of log Data	1.224577
SD	3.930936		
Coefficient of Variation	1.590794		
Skewness	3.483018		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.554262	Shapiro Wilk Test Statistic	0.980737
Shapiro Wilk Critical Value	0.901	Shapiro Wilk Critical Value	0.901
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	4.034863	95% H-UCL	5.9185
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	5.72297
95% Adjusted-CLT UCL	4.72439	97.5% Chebyshev (MVUE) UCL	7.171138
95% Modified-t UCL	4.154964	99% Chebyshev (MVUE) UCL	10.01578
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.72159	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	3.424455		
MLE of Mean	2.471053		
MLE of Standard Deviation	2.908953		
nu star	27.42042		
Approximate Chi Square Value (.05)	16.47751	**Nonparametric Statistics**	
Adjusted Level of Significance	0.03687	95% CLT UCL	3.954412
Adjusted Chi Square Value	15.73744	95% Jackknife UCL	4.034863
		95% Standard Bootstrap UCL	3.929882
Anderson-Darling Test Statistic	0.576285	95% Bootstrap-t UCL	6.422095
Anderson-Darling 5% Critical Value	0.776289	95% Hall's Bootstrap UCL	9.648862
Kolmogorov-Smirnov Test Statistic	0.15566	95% Percentile Bootstrap UCL	4.103684
Kolmogorov-Smirnov 5% Critical Value	0.205628	95% BCA Bootstrap UCL	4.916842
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	6.401988
		97.5% Chebyshev(Mean, Sd) UCL	8.102907
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	11.44403
95% Approximate Gamma UCL	4.112108		
95% Adjusted Gamma UCL	4.305484		
Potential UCL to Use		Use 95% Approximate Gamma UCL	4.112108

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
COUNTY LANDS 1B
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Chromium			
General Statistics			
Number of Valid Observations	19	Number of Distinct Observations	18
Raw Statistics		**Log-transformed Statistics**	
Minimum	19.6	Minimum of Log Data	2.97553
Maximum	223	Maximum of Log Data	5.407172
Mean	80.34737	Mean of log Data	3.940697
Median	27.7	SD of log Data	0.960717
SD	76.17094		
Coefficient of Variation	0.94802		
Skewness	0.857853		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.751052	Shapiro Wilk Test Statistic	0.797379
Shapiro Wilk Critical Value	0.901	Shapiro Wilk Critical Value	0.901
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	110.6498	95% H-UCL	145.5938
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	162.989
95% Adjusted-CLT UCL	112.7656	97.5% Chebyshev (MVUE) UCL	199.3528
95% Modified-t UCL	111.223	99% Chebyshev (MVUE) UCL	270.7824
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.098292	Data do not follow a Discernable Distribution (0.05)	
Theta Star	73.15666		
MLE of Mean	80.34737		
MLE of Standard Deviation	76.66776		
nu star	41.73509		
Approximate Chi Square Value (.05)	27.92708	**Nonparametric Statistics**	
Adjusted Level of Significance	0.03687	95% CLT UCL	109.0909
Adjusted Chi Square Value	26.94053	95% Jackknife UCL	110.6498
		95% Standard Bootstrap UCL	108.4037
Anderson-Darling Test Statistic	1.874185	95% Bootstrap-t UCL	115.9002
Anderson-Darling 5% Critical Value	0.762776	95% Hall's Bootstrap UCL	108.0178
Kolmogorov-Smirnov Test Statistic	0.30105	95% Percentile Bootstrap UCL	110.0737
Kolmogorov-Smirnov 5% Critical Value	0.203133	95% BCA Bootstrap UCL	112.9421
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	156.5183
		97.5% Chebyshev(Mean, Sd) UCL	189.4775
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	254.2196
95% Approximate Gamma UCL	120.0736		
95% Adjusted Gamma UCL	124.4706		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	156.5183

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
COUNTY LANDS 1B
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Copper			
General Statistics			
Number of Valid Observations	19	Number of Distinct Observations	19
Raw Statistics		**Log-transformed Statistics**	
Minimum	13.7	Minimum of Log Data	2.617396
Maximum	2060	Maximum of Log Data	7.630461
Mean	159.1526	Mean of log Data	3.910263
Median	34.1	SD of log Data	1.155979
SD	462.2651		
Coefficient of Variation	2.90454		
Skewness	4.298378		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.313813	Shapiro Wilk Test Statistic	0.817579
Shapiro Wilk Critical Value	0.901	Shapiro Wilk Critical Value	0.901
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	343.0516	95% H-UCL	211.0428
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	213.8115
95% Adjusted-CLT UCL	445.3344	97.5% Chebyshev (MVUE) UCL	266.4071
95% Modified-t UCL	360.4814	99% Chebyshev (MVUE) UCL	369.721
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.490788	Data do not follow a Discernable Distribution (0.05)	
Theta Star	324.2798		
MLE of Mean	159.1526		
MLE of Standard Deviation	227.1783		
nu star	18.64995		
Approximate Chi Square Value (.05)	9.862205	**Nonparametric Statistics**	
Adjusted Level of Significance	0.03687	95% CLT UCL	333.5908
Adjusted Chi Square Value	9.30612	95% Jackknife UCL	343.0516
		95% Standard Bootstrap UCL	330.2896
Anderson-Darling Test Statistic	2.899176	95% Bootstrap-t UCL	1656.36
Anderson-Darling 5% Critical Value	0.798847	95% Hall's Bootstrap UCL	1070.469
Kolmogorov-Smirnov Test Statistic	0.301826	95% Percentile Bootstrap UCL	368.2053
Kolmogorov-Smirnov 5% Critical Value	0.209348	95% BCA Bootstrap UCL	484.0263
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	621.4178
		97.5% Chebyshev(Mean, Sd) UCL	821.4402
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1214.346
95% Approximate Gamma UCL	300.9659		
95% Adjusted Gamma UCL	318.9501		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	1214.346

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
COUNTY LANDS 1B
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Cyanide

General Statistics			
Number of Valid Data	19	Number of Detected Data	17
Number of Distinct Detected Data	16	Number of Non-Detect Data	2
		Percent Non-Detects	10.53%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.16	Minimum Detected	-1.83258
Maximum Detected	13.5	Maximum Detected	2.60269
Mean of Detected	1.712941	Mean of Detected	-0.3253
SD of Detected	3.193945	SD of Detected	1.239111
Minimum Non-Detect	0.56	Minimum Non-Detect	-0.57982
Maximum Non-Detect	0.57	Maximum Non-Detect	-0.56212
Note: Data have multiple DLs - Use of KM Method is recommend		Number treated as Non-Detect	11
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	8
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	57.89%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.503206	Shapiro Wilk Test Statistic	0.916476
5% Shapiro Wilk Critical Value	0.892	5% Shapiro Wilk Critical Value	0.892
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1.562368	Mean	-0.42412
SD	3.044869	SD	1.205167
95% DL/2 (t) UCL	2.773683	95% H-Stat (DL/2) UCL	3.493913
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-0.41208
		SD in Log Scale	1.196816
		Mean in Original Scale	1.565971
		SD in Original Scale	3.04329
		95% Percentile Bootstrap UCL	2.875091
		95% BCA Bootstrap UCL	3.354918
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.615591	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	2.782596		
nu star	20.9301		
A-D Test Statistic	1.09589	**Nonparametric Statistics**	
5% A-D Critical Value	0.780724	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.780724	Mean	1.562924
5% K-S Critical Value	0.217996	SD	2.963598
Data follow Appr. Gamma Distribution at 5% Significance Level		SE of Mean	0.700873
		95% KM (t) UCL	2.778282
Assuming Gamma Distribution		95% KM (z) UCL	2.715757
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	2.774327

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
COUNTY LANDS 1B
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Minimum	0.146081	95% KM (bootstrap t) UCL	5.478054
Maximum	13.5	95% KM (BCA) UCL	2.91
Mean	1.548009	95% KM (Percentile Bootstrap) UCL	2.824887
Median	0.34	95% KM (Chebyshev) UCL	4.617958
SD	3.051537	97.5% KM (Chebyshev) UCL	5.939874
k star	0.587113	99% KM (Chebyshev) UCL	8.536521
Theta star	2.636645		
Nu star	22.31029	**Potential UCLs to Use**	
AppChi2	12.57117	95% KM (Chebyshev) UCL	4.617958
95% Gamma Approximate UCL	2.74728		
95% Adjusted Gamma UCL	2.893941		
Note: DL/2 is not a recommended method.			

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
COUNTY LANDS 1B
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Lead			
General Statistics			
Number of Valid Observations	19	Number of Distinct Observations	19
Raw Statistics		**Log-transformed Statistics**	
Minimum	22.5	Minimum of Log Data	3.113515
Maximum	1640	Maximum of Log Data	7.402452
Mean	257.6526	Mean of log Data	4.886617
Median	110	SD of log Data	1.112062
SD	385.9205		
Coefficient of Variation	1.497832		
Skewness	2.922329		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.604492	Shapiro Wilk Test Statistic	0.960187
Shapiro Wilk Critical Value	0.901	Shapiro Wilk Critical Value	0.901
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	411.1801	95% H-UCL	508.7652
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	529.3363
95% Adjusted-CLT UCL	466.7058	97.5% Chebyshev (MVUE) UCL	657.0221
95% Modified-t UCL	421.073	99% Chebyshev (MVUE) UCL	907.8361
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.777331	**Data appear Lognormal at 5% Significance Level**	
Theta Star	331.4579		
MLE of Mean	257.6526		
MLE of Standard Deviation	292.2345		
nu star	29.53859		
Approximate Chi Square Value (.05)	18.13046	**Nonparametric Statistics**	
Adjusted Level of Significance	0.03687	95% CLT UCL	403.2818
Adjusted Chi Square Value	17.35049	95% Jackknife UCL	411.1801
		95% Standard Bootstrap UCL	398.4432
Anderson-Darling Test Statistic	0.989788	95% Bootstrap-t UCL	638.3071
Anderson-Darling 5% Critical Value	0.77376	95% Hall's Bootstrap UCL	941.5606
Kolmogorov-Smirnov Test Statistic	0.212034	95% Percentile Bootstrap UCL	412.9368
Kolmogorov-Smirnov 5% Critical Value	0.20516	95% BCA Bootstrap UCL	476.2684
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	643.5731
		97.5% Chebyshev(Mean, Sd) UCL	810.5612
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1138.577
95% Approximate Gamma UCL	419.7739		
95% Adjusted Gamma UCL	438.6445		
Potential UCL to Use		Use 95% Chebyshev (MVUE) UCL	529.3363

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
COUNTY LANDS 1B
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Selenium			
General Statistics			
Number of Valid Data	19	Number of Detected Data	16
Number of Distinct Detected Data	12	Number of Non-Detect Data	3
		Percent Non-Detects	15.79%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.66	Minimum Detected	-0.41552
Maximum Detected	8.7	Maximum Detected	2.163323
Mean of Detected	2.35875	Mean of Detected	0.544466
SD of Detected	2.296554	SD of Detected	0.750128
Minimum Non-Detect	0.57	Minimum Non-Detect	-0.56212
Maximum Non-Detect	5.6	Maximum Non-Detect	1.722767
Note: Data have multiple DLs - Use of KM Method is recommend		Number treated as Non-Detect	17
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	2
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	89.47%
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.693513	Shapiro Wilk Test Statistic	0.864551
5% Shapiro Wilk Critical Value	0.887	5% Shapiro Wilk Critical Value	0.887
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	2.293421	Mean	0.499864
SD	2.156122	SD	0.819729
95% DL/2 (t) UCL	3.151173	95% H-Stat (DL/2) UCL	3.386723
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	0.430786
		SD in Log Scale	0.788355
		Mean in Original Scale	2.146988
		SD in Original Scale	2.165338
		95% Percentile Bootstrap UCL	3.025014
		95% BCA Bootstrap UCL	3.211447
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	1.457153	Data do not follow a Discernable Distribution (0.05)	
Theta Star	1.618739		
nu star	46.62889		
A-D Test Statistic	1.447759	**Nonparametric Statistics**	
5% A-D Critical Value	0.752554	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.752554	Mean	2.186667
5% K-S Critical Value	0.218401	SD	2.116859
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.509752
		95% KM (t) UCL	3.070608
Assuming Gamma Distribution		95% KM (z) UCL	3.025133
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	3.059986

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
COUNTY LANDS 1B
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Minimum	1E-09	95% KM (bootstrap t) UCL	3.686886
Maximum	8.7	95% KM (BCA) UCL	3.111278
Mean	2.244722	95% KM (Percentile Bootstrap) UCL	3.037594
Median	1.5	95% KM (Chebyshev) UCL	4.408622
SD	2.165994	97.5% KM (Chebyshev) UCL	5.370064
k star	0.435529	99% KM (Chebyshev) UCL	7.258631
Theta star	5.154017		
Nu star	16.55009	**Potential UCLs to Use**	
AppChi2	8.351656	95% KM (Chebyshev) UCL	4.408622
95% Gamma Approximate UCL	4.448262		
95% Adjusted Gamma UCL	4.735232		
Note: DL/2 is not a recommended method.			

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
COUNTY LANDS 1B
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Thallium

General Statistics

Number of Valid Data	19	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	16
		Percent Non-Detects	84.21%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	1.1	Minimum Detected	0.09531
Maximum Detected	3.8	Maximum Detected	1.335001
Mean of Detected	2.4	Mean of Detected	0.754407
SD of Detected	1.352775	SD of Detected	0.623563
Minimum Non-Detect	1.1	Minimum Non-Detect	0.09531
Maximum Non-Detect	12.4	Maximum Non-Detect	2.517697
Note: Data have multiple DLs - Use of KM Method is recommend		Number treated as Non-Detect	19
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

However, results obtained using 4 to 9 distinct values may not be reliable.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.995883	Shapiro Wilk Test Statistic	0.988094
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1.926316	Mean	0.199456
SD	1.964432	SD	0.95148
95% DL/2 (t) UCL	2.707809	95% H-Stat (DL/2) UCL	3.211176
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-1.22874
		SD in Log Scale	1.131959
		Mean in Original Scale	0.587259
		SD in Original Scale	0.932783
		95% Percentile Bootstrap UCL	0.963724
		95% BCA Bootstrap UCL	1.123031

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	N/A	**Data appear Normal at 5% Significance Level**	
Theta Star	N/A		
nu star	N/A		

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
COUNTY LANDS 1B
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

A-D Test Statistic	N/A	**Nonparametric Statistics**	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	1.378571
5% K-S Critical Value	N/A	SD	0.738897
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.241861
		95% KM (t) UCL	1.797974
Assuming Gamma Distribution		95% KM (z) UCL	1.776397
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	2.158831
Minimum	N/A	95% KM (bootstrap t) UCL	1.72081
Maximum	N/A	95% KM (BCA) UCL	3.8
Mean	N/A	95% KM (Percentile Bootstrap) UCL	3.8
Median	N/A	95% KM (Chebyshev) UCL	2.432819
SD	N/A	97.5% KM (Chebyshev) UCL	2.888993
k star	N/A	99% KM (Chebyshev) UCL	3.785058
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	95% KM (t) UCL	1.797974
95% Gamma Approximate UCL	N/A	95% KM (Percentile Bootstrap) UCL	3.8
95% Adjusted Gamma UCL	N/A		
Note: DL/2 is not a recommended method.			

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
COUNTY LANDS 1B
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Vanadium			
General Statistics			
Number of Valid Observations	19	Number of Distinct Observations	19
Raw Statistics		**Log-transformed Statistics**	
Minimum	24.8	Minimum of Log Data	3.210844
Maximum	1210	Maximum of Log Data	7.098376
Mean	133.9158	Mean of log Data	4.0821
Median	43.7	SD of log Data	0.991601
SD	285.2482		
Coefficient of Variation	2.130056		
Skewness	3.48976		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.406394	Shapiro Wilk Test Statistic	0.698714
Shapiro Wilk Critical Value	0.901	Shapiro Wilk Critical Value	0.901
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	247.3936	95% H-UCL	177.892
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	196.6297
95% Adjusted-CLT UCL	297.5373	97.5% Chebyshev (MVUE) UCL	241.2693
95% Modified-t UCL	256.1256	99% Chebyshev (MVUE) UCL	328.9551
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.655104	Data do not follow a Discernable Distribution (0.05)	
Theta Star	204.419		
MLE of Mean	133.9158		
MLE of Standard Deviation	165.4537		
nu star	24.89397		
Approximate Chi Square Value (.05)	14.53048	**Nonparametric Statistics**	
Adjusted Level of Significance	0.03687	95% CLT UCL	241.5557
Adjusted Chi Square Value	13.84004	95% Jackknife UCL	247.3936
		95% Standard Bootstrap UCL	239.5173
Anderson-Darling Test Statistic	3.59764	95% Bootstrap-t UCL	1700.636
Anderson-Darling 5% Critical Value	0.780099	95% Hall's Bootstrap UCL	848.9043
Kolmogorov-Smirnov Test Statistic	0.38935	95% Percentile Bootstrap UCL	250.9526
Kolmogorov-Smirnov 5% Critical Value	0.206304	95% BCA Bootstrap UCL	317.6316
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	419.164
		97.5% Chebyshev(Mean, Sd) UCL	542.5911
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	785.0397
95% Approximate Gamma UCL	229.4277		
95% Adjusted Gamma UCL	240.8733		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	419.164

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
COUNTY LANDS 1B
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Zinc			
General Statistics			
Number of Valid Observations	19	Number of Distinct Observations	19
Raw Statistics		**Log-transformed Statistics**	
Minimum	108	Minimum of Log Data	4.682131
Maximum	7920	Maximum of Log Data	8.977147
Mean	1405.947	Mean of log Data	6.307774
Median	346	SD of log Data	1.320134
SD	2262.007		
Coefficient of Variation	1.608885		
Skewness	2.170726		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.615278	Shapiro Wilk Test Statistic	0.892207
Shapiro Wilk Critical Value	0.901	Shapiro Wilk Critical Value	0.901
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	2305.822	95% H-UCL	3435.577
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	3081.018
95% Adjusted-CLT UCL	2535.665	97.5% Chebyshev (MVUE) UCL	3888.585
95% Modified-t UCL	2348.894	99% Chebyshev (MVUE) UCL	5474.895
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.581883	Data do not follow a Discernable Distribution (0.05)	
Theta Star	2416.203		
MLE of Mean	1405.947		
MLE of Standard Deviation	1843.11		
nu star	22.11155		
Approximate Chi Square Value (.05)	12.42194	**Nonparametric Statistics**	
Adjusted Level of Significance	0.03687	95% CLT UCL	2259.528
Adjusted Chi Square Value	11.78908	95% Jackknife UCL	2305.822
		95% Standard Bootstrap UCL	2229.857
Anderson-Darling Test Statistic	1.574752	95% Bootstrap-t UCL	2977.846
Anderson-Darling 5% Critical Value	0.788453	95% Hall's Bootstrap UCL	2575.967
Kolmogorov-Smirnov Test Statistic	0.300076	95% Percentile Bootstrap UCL	2327.053
Kolmogorov-Smirnov 5% Critical Value	0.207661	95% BCA Bootstrap UCL	2494.211
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	3667.955
		97.5% Chebyshev(Mean, Sd) UCL	4646.727
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	6569.335
95% Approximate Gamma UCL	2502.642		
95% Adjusted Gamma UCL	2636.989		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	6569.335

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
COUNTY LANDS 1B
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Total LMW PAHs			
General Statistics			
Number of Valid Observations	19	Number of Distinct Observations	19
Raw Statistics		**Log-transformed Statistics**	
Minimum	299	Minimum of Log Data	5.70044
Maximum	46941	Maximum of Log Data	10.7566
Mean	4337.5	Mean of log Data	6.90145
Median	640	SD of log Data	1.35897
SD	11380.5		
Coefficient of Variation	2.62376		
Skewness	3.44007		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.39894	Shapiro Wilk Test Statistic	0.74359
Shapiro Wilk Critical Value	0.901	Shapiro Wilk Critical Value	0.901
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	8864.93	95% H-UCL	6876.41
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	5959.57
95% Adjusted-CLT UCL	10833.7	97.5% Chebyshev (MVUE) UCL	7542.18
95% Modified-t UCL	9208.35	99% Chebyshev (MVUE) UCL	10650.9
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.40546	Data do not follow a Discernable Distribution (0.05)	
Theta Star	10697.8		
MLE of Mean	4337.5		
MLE of Standard Deviation	6811.87		
nu star	15.4074		
Approximate Chi Square Value (.05)	7.54581	**Nonparametric Statistics**	
Adjusted Level of Significance	0.03687	95% CLT UCL	8632.01
Adjusted Chi Square Value	7.06812	95% Jackknife UCL	8864.93
		95% Standard Bootstrap UCL	8529.58
Anderson-Darling Test Statistic	3.49874	95% Bootstrap-t UCL	68532.9
Anderson-Darling 5% Critical Value	0.81484	95% Hall's Bootstrap UCL	52624.5
Kolmogorov-Smirnov Test Statistic	0.37975	95% Percentile Bootstrap UCL	9076.08
Kolmogorov-Smirnov 5% Critical Value	0.21154	95% BCA Bootstrap UCL	11547.5
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	15718
		97.5% Chebyshev(Mean, Sd) UCL	20642.4
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	30315.4
95% Approximate Gamma UCL	8856.53		
95% Adjusted Gamma UCL	9455.09		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	30315.4

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
COUNTY LANDS 1B
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Total HMW PAHs			
General Statistics			
Number of Valid Observations	19	Number of Distinct Observations	19
Raw Statistics		**Log-transformed Statistics**	
Minimum	286.5	Minimum of Log Data	5.65774
Maximum	105900	Maximum of Log Data	11.5703
Mean	8555.24	Mean of log Data	7.32198
Median	973	SD of log Data	1.52097
SD	24635		
Coefficient of Variation	2.87953		
Skewness	3.85527		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.37337	Shapiro Wilk Test Statistic	0.82024
Shapiro Wilk Critical Value	0.901	Shapiro Wilk Critical Value	0.901
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	18355.6	95% H-UCL	16411.2
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	12051.4
95% Adjusted-CLT UCL	23192.6	97.5% Chebyshev (MVUE) UCL	15408.8
95% Modified-t UCL	19188.7	99% Chebyshev (MVUE) UCL	22003.8
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.35728	Data do not follow a Discernable Distribution (0.05)	
Theta Star	23945.8		
MLE of Mean	8555.24		
MLE of Standard Deviation	14313		
nu star	13.5765		
Approximate Chi Square Value (.05)	6.28242	**Nonparametric Statistics**	
Adjusted Level of Significance	0.03687	95% CLT UCL	17851.4
Adjusted Chi Square Value	5.85248	95% Jackknife UCL	18355.6
		95% Standard Bootstrap UCL	17653
Anderson-Darling Test Statistic	3.00752	95% Bootstrap-t UCL	118614
Anderson-Darling 5% Critical Value	0.82629	95% Hall's Bootstrap UCL	93264.6
Kolmogorov-Smirnov Test Statistic	0.32621	95% Percentile Bootstrap UCL	19259.9
Kolmogorov-Smirnov 5% Critical Value	0.21301	95% BCA Bootstrap UCL	25265.9
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	33190.3
		97.5% Chebyshev(Mean, Sd) UCL	43849.9
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	64788.6
95% Approximate Gamma UCL	18488.1		
95% Adjusted Gamma UCL	19846.3		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	64788.6

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
MUD RESERVOIR
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Antimony			
General Statistics			
Number of Valid Observations	12	Number of Distinct Observations	12
Raw Statistics		**Log-transformed Statistics**	
Minimum	0.17	Minimum of Log Data	-1.77196
Maximum	9.1	Maximum of Log Data	2.208274
Mean	1.886667	Mean of log Data	0.010881
Median	0.745	SD of log Data	1.102907
SD	2.626838		
Coefficient of Variation	1.392317		
Skewness	2.347743		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.643621	Shapiro Wilk Test Statistic	0.952997
Shapiro Wilk Critical Value	0.859	Shapiro Wilk Critical Value	0.859
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	3.248491	95% H-UCL	5.21481
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	4.310039
95% Adjusted-CLT UCL	3.683104	97.5% Chebyshev (MVUE) UCL	5.427565
95% Modified-t UCL	3.334146	99% Chebyshev (MVUE) UCL	7.622729
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.755195	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	2.498253		
MLE of Mean	1.886667		
MLE of Standard Deviation	2.17103		
nu star	18.12467		
Approximate Chi Square Value (.05)	9.481025	**Nonparametric Statistics**	
Adjusted Level of Significance	0.02896	95% CLT UCL	3.133964
Adjusted Chi Square Value	8.54206	95% Jackknife UCL	3.248491
		95% Standard Bootstrap UCL	3.109506
Anderson-Darling Test Statistic	0.777847	95% Bootstrap-t UCL	7.452752
Anderson-Darling 5% Critical Value	0.75912	95% Hall's Bootstrap UCL	9.112621
Kolmogorov-Smirnov Test Statistic	0.233929	95% Percentile Bootstrap UCL	3.258333
Kolmogorov-Smirnov 5% Critical Value	0.253011	95% BCA Bootstrap UCL	3.644167
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	5.192032
		97.5% Chebyshev(Mean, Sd) UCL	6.622267
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	9.431685
95% Approximate Gamma UCL	3.6067		
95% Adjusted Gamma UCL	4.003157		
Potential UCL to Use		Use 95% Approximate Gamma UCL	3.6067

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
MUD RESERVOIR
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Barium			
General Statistics			
Number of Valid Observations	12	Number of Distinct Observations	12
Raw Statistics		**Log-transformed Statistics**	
Minimum	26.5	Minimum of Log Data	3.277145
Maximum	380	Maximum of Log Data	5.940171
Mean	115.025	Mean of log Data	4.255262
Median	45.8	SD of log Data	0.974245
SD	128.6115		
Coefficient of Variation	1.118118		
Skewness	1.401334		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.698499	Shapiro Wilk Test Statistic	0.830388
Shapiro Wilk Critical Value	0.859	Shapiro Wilk Critical Value	0.859
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	181.7007	95% H-UCL	263.0816
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	247.9595
95% Adjusted-CLT UCL	192.1414	97.5% Chebyshev (MVUE) UCL	308.7706
95% Modified-t UCL	184.2039	99% Chebyshev (MVUE) UCL	428.222
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.924731	Data do not follow a Discernable Distribution (0.05)	
Theta Star	124.3876		
MLE of Mean	115.025		
MLE of Standard Deviation	119.6147		
nu star	22.19354		
Approximate Chi Square Value (.05)	12.48347	**Nonparametric Statistics**	
Adjusted Level of Significance	0.02896	95% CLT UCL	176.0934
Adjusted Chi Square Value	11.38571	95% Jackknife UCL	181.7007
		95% Standard Bootstrap UCL	174.0535
Anderson-Darling Test Statistic	1.224499	95% Bootstrap-t UCL	215.3828
Anderson-Darling 5% Critical Value	0.753171	95% Hall's Bootstrap UCL	162.9486
Kolmogorov-Smirnov Test Statistic	0.277511	95% Percentile Bootstrap UCL	173.0333
Kolmogorov-Smirnov 5% Critical Value	0.251451	95% BCA Bootstrap UCL	193.0917
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	276.8576
		97.5% Chebyshev(Mean, Sd) UCL	346.8827
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	484.4335
95% Approximate Gamma UCL	204.4953		
95% Adjusted Gamma UCL	224.2119		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	276.8576

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
MUD RESERVOIR
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Cadmium

General Statistics

Number of Valid Data	12	Number of Detected Data	7
Number of Distinct Detected Data	7	Number of Non-Detect Data	5
		Percent Non-Detects	41.67%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.24	Minimum Detected	-1.42712
Maximum Detected	12.3	Maximum Detected	2.509599
Mean of Detected	2.367143	Mean of Detected	-0.25416
SD of Detected	4.436142	SD of Detected	1.457564
Minimum Non-Detect	0.6	Minimum Non-Detect	-0.51083
Maximum Non-Detect	1.6	Maximum Non-Detect	0.470004
Note: Data have multiple DLs - Use of KM Method is recommend		Number treated as Non-Detect	10
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	2
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	83.33%

Warning: There are only 7 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.5673	Shapiro Wilk Test Statistic	0.820509
5% Shapiro Wilk Critical Value	0.803	5% Shapiro Wilk Critical Value	0.803
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1.582083	Mean	-0.48699
SD	3.419709	SD	1.147424
95% DL/2 (t) UCL	3.354954	95% H-Stat (DL/2) UCL	3.46673
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-0.5877
		SD in Log Scale	1.154343
		Mean in Original Scale	1.526577
		SD in Original Scale	3.437116
		95% Percentile Bootstrap UCL	3.466617
		95% BCA Bootstrap UCL	4.522176
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.414968	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	5.704396		
nu star	5.809555		
A-D Test Statistic	0.905627	**Nonparametric Statistics**	

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
MUD RESERVOIR
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

5% A-D Critical Value	0.747873	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.747873	Mean	1.514583
5% K-S Critical Value	0.32615	SD	3.296271
Data follow Appr. Gamma Distribution at 5% Significance Level		SE of Mean	1.02826
		95% KM (t) UCL	3.361221
Assuming Gamma Distribution		95% KM (z) UCL	3.205921
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	3.300532
Minimum	0.24	95% KM (bootstrap t) UCL	19.79389
Maximum	12.3	95% KM (BCA) UCL	3.445
Mean	2.375461	95% KM (Percentile Bootstrap) UCL	3.42
Median	2.238152	95% KM (Chebyshev) UCL	5.996667
SD	3.276892	97.5% KM (Chebyshev) UCL	7.936068
k star	0.729031	99% KM (Chebyshev) UCL	11.74565
Theta star	3.258381		
Nu star	17.49675	Potential UCLs to Use	
AppChi2	9.028181	95% KM (BCA) UCL	3.445
95% Gamma Approximate UCL	4.603678		
95% Adjusted Gamma UCL	5.121613		
Note: DL/2 is not a recommended method.			

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
MUD RESERVOIR
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Chromium			
General Statistics			
Number of Valid Observations	12	Number of Distinct Observations	12
Raw Statistics		**Log-transformed Statistics**	
Minimum	18.3	Minimum of Log Data	2.906901
Maximum	550	Maximum of Log Data	6.309918
Mean	118.9083	Mean of log Data	4.3305
Median	70.95	SD of log Data	0.930124
SD	145.7405		
Coefficient of Variation	1.225654		
Skewness	2.718869		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.646976	Shapiro Wilk Test Statistic	0.9645
Shapiro Wilk Critical Value	0.859	Shapiro Wilk Critical Value	0.859
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	194.4642	95% H-UCL	256.1095
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	250.6905
95% Adjusted-CLT UCL	223.3932	97.5% Chebyshev (MVUE) UCL	310.8371
95% Modified-t UCL	199.9677	99% Chebyshev (MVUE) UCL	428.9835
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.998266	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	119.1149		
MLE of Mean	118.9083		
MLE of Standard Deviation	119.0116		
nu star	23.95839		
Approximate Chi Square Value (.05)	13.81701	**Nonparametric Statistics**	
Adjusted Level of Significance	0.02896	95% CLT UCL	188.1101
Adjusted Chi Square Value	12.65476	95% Jackknife UCL	194.4642
		95% Standard Bootstrap UCL	184.7504
Anderson-Darling Test Statistic	0.534853	95% Bootstrap-t UCL	316.2673
Anderson-Darling 5% Critical Value	0.750969	95% Hall's Bootstrap UCL	436.4316
Kolmogorov-Smirnov Test Statistic	0.161883	95% Percentile Bootstrap UCL	191.4167
Kolmogorov-Smirnov 5% Critical Value	0.250896	95% BCA Bootstrap UCL	226.425
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	302.2944
		97.5% Chebyshev(Mean, Sd) UCL	381.6458
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	537.516
95% Approximate Gamma UCL	206.1844		
95% Adjusted Gamma UCL	225.121		
Potential UCL to Use		Use 95% Approximate Gamma UCL	206.1844

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
MUD RESERVOIR
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Copper			
General Statistics			
Number of Valid Observations	12	Number of Distinct Observations	12
Raw Statistics		**Log-transformed Statistics**	
Minimum	19.5	Minimum of Log Data	2.970415
Maximum	240	Maximum of Log Data	5.480639
Mean	99.90833	Mean of log Data	4.210229
Median	82.7	SD of log Data	0.985829
SD	81.91071		
Coefficient of Variation	0.819859		
Skewness	0.588919		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.861224	Shapiro Wilk Test Statistic	0.875191
Shapiro Wilk Critical Value	0.859	Shapiro Wilk Critical Value	0.859
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	142.3731	95% H-UCL	258.5247
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	241.1084
95% Adjusted-CLT UCL	143.0972	97.5% Chebyshev (MVUE) UCL	300.5652
95% Modified-t UCL	143.0431	99% Chebyshev (MVUE) UCL	417.3565
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.114885	**Data appear Normal at 5% Significance Level**	
Theta Star	89.6131		
MLE of Mean	99.90833		
MLE of Standard Deviation	94.6208		
nu star	26.75725		
Approximate Chi Square Value (.05)	15.96371	**Nonparametric Statistics**	
Adjusted Level of Significance	0.02896	95% CLT UCL	138.8019
Adjusted Chi Square Value	14.70374	95% Jackknife UCL	142.3731
		95% Standard Bootstrap UCL	136.6645
Anderson-Darling Test Statistic	0.592596	95% Bootstrap-t UCL	149.8999
Anderson-Darling 5% Critical Value	0.747477	95% Hall's Bootstrap UCL	137.4581
Kolmogorov-Smirnov Test Statistic	0.205124	95% Percentile Bootstrap UCL	137.8917
Kolmogorov-Smirnov 5% Critical Value	0.250016	95% BCA Bootstrap UCL	141.675
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	202.9771
		97.5% Chebyshev(Mean, Sd) UCL	247.575
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	335.1789
95% Approximate Gamma UCL	167.4593		
95% Adjusted Gamma UCL	181.809		
Potential UCL to Use		Use 95% Student's-t UCL	142.3731

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
MUD RESERVOIR
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Lead			
General Statistics			
Number of Valid Observations	12	Number of Distinct Observations	12
Raw Statistics		**Log-transformed Statistics**	
Minimum	33.7	Minimum of Log Data	3.517498
Maximum	622	Maximum of Log Data	6.43294
Mean	155.1	Mean of log Data	4.65769
Median	106.9	SD of log Data	0.885048
SD	165.2762		
Coefficient of Variation	1.065611		
Skewness	2.353267		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.717224	Shapiro Wilk Test Statistic	0.953282
Shapiro Wilk Critical Value	0.859	Shapiro Wilk Critical Value	0.859
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	240.7837	95% H-UCL	321.5261
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	325.8989
95% Adjusted-CLT UCL	268.2101	97.5% Chebyshev (MVUE) UCL	402.2216
95% Modified-t UCL	246.1856	99% Chebyshev (MVUE) UCL	552.1428
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.134034	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	136.7684		
MLE of Mean	155.1		
MLE of Standard Deviation	145.6461		
nu star	27.21682		
Approximate Chi Square Value (.05)	16.31957	**Nonparametric Statistics**	
Adjusted Level of Significance	0.02896	95% CLT UCL	233.5778
Adjusted Chi Square Value	15.04404	95% Jackknife UCL	240.7837
		95% Standard Bootstrap UCL	232.835
Anderson-Darling Test Statistic	0.418942	95% Bootstrap-t UCL	344.2957
Anderson-Darling 5% Critical Value	0.746903	95% Hall's Bootstrap UCL	583.4747
Kolmogorov-Smirnov Test Statistic	0.142816	95% Percentile Bootstrap UCL	238
Kolmogorov-Smirnov 5% Critical Value	0.249871	95% BCA Bootstrap UCL	272.95
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	363.068
		97.5% Chebyshev(Mean, Sd) UCL	453.0559
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	629.8197
95% Approximate Gamma UCL	258.6667		
95% Adjusted Gamma UCL	280.5982		
Potential UCL to Use		Use 95% Approximate Gamma UCL	258.6667

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
MUD RESERVOIR
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Selenium			
General Statistics			
Number of Valid Data	12	Number of Detected Data	10
Number of Distinct Detected Data	9	Number of Non-Detect Data	2
		Percent Non-Detects	16.67%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.37	Minimum Detected	-0.99425
Maximum Detected	6.3	Maximum Detected	1.84055
Mean of Detected	3.127	Mean of Detected	0.91578
SD of Detected	1.775313	SD of Detected	0.824526
Minimum Non-Detect	2.6	Minimum Non-Detect	0.955511
Maximum Non-Detect	2.7	Maximum Non-Detect	0.993252
Note: Data have multiple DLs - Use of KM Method is recommend		Number treated as Non-Detect	5
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	7
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	41.67%
UCL Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.979141	Shapiro Wilk Test Statistic	0.872503
5% Shapiro Wilk Critical Value	0.842	5% Shapiro Wilk Critical Value	0.842
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	2.826667	Mean	0.810022
SD	1.752372	SD	0.785689
95% DL/2 (t) UCL	3.735144	95% H-Stat (DL/2) UCL	5.367467
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	2.939455	Mean in Log Scale	0.7644
SD	1.665231	SD in Log Scale	0.825367
95% MLE (t) UCL	3.802756	Mean in Original Scale	2.773755
95% MLE (Tiku) UCL	3.923119	SD in Original Scale	1.805359
		95% Percentile Bootstrap UCL	3.576255
		95% BCA Bootstrap UCL	3.609588
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	1.734487	Data appear Normal at 5% Significance Level	
Theta Star	1.802838		
nu star	34.68975		
A-D Test Statistic	0.331428	**Nonparametric Statistics**	
5% A-D Critical Value	0.734279	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.734279	Mean	2.7875
5% K-S Critical Value	0.26929	SD	1.727947
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.532462
		95% KM (t) UCL	3.74374
Assuming Gamma Distribution		95% KM (z) UCL	3.663322
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	3.747883

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
MUD RESERVOIR
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Minimum	0.37	95% KM (bootstrap t) UCL	3.819519
Maximum	6.3	95% KM (BCA) UCL	3.725
Mean	2.896837	95% KM (Percentile Bootstrap) UCL	3.675
Median	2.8	95% KM (Chebyshev) UCL	5.108447
SD	1.693413	97.5% KM (Chebyshev) UCL	6.112723
k star	1.977886	99% KM (Chebyshev) UCL	8.085429
Theta star	1.464613		
Nu star	47.46926	**Potential UCLs to Use**	
AppChi2	32.65715	95% KM (t) UCL	3.74374
95% Gamma Approximate UCL	4.210738	95% KM (Percentile Bootstrap) UCL	3.675
95% Adjusted Gamma UCL	4.46592		
Note: DL/2 is not a recommended method.			

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
MUD RESERVOIR
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Tin			
General Statistics			
Number of Valid Observations	12	Number of Distinct Observations	12
Raw Statistics		**Log-transformed Statistics**	
Minimum	6	Minimum of Log Data	1.79176
Maximum	1100	Maximum of Log Data	7.003066
Mean	258.2	Mean of log Data	4.716587
Median	179.5	SD of log Data	1.58555
SD	312.6216		
Coefficient of Variation	1.210773		
Skewness	1.993557		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.778341	Shapiro Wilk Test Statistic	0.951184
Shapiro Wilk Critical Value	0.859	Shapiro Wilk Critical Value	0.859
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	420.2716	95% H-UCL	2754.866
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1035.156
95% Adjusted-CLT UCL	462.1357	97.5% Chebyshev (MVUE) UCL	1342.507
95% Modified-t UCL	428.9276	99% Chebyshev (MVUE) UCL	1946.237
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.594957	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	433.981		
MLE of Mean	258.2		
MLE of Standard Deviation	334.7445		
nu star	14.27897		
Approximate Chi Square Value (.05)	6.762774	**Nonparametric Statistics**	
Adjusted Level of Significance	0.02896	95% CLT UCL	406.6416
Adjusted Chi Square Value	5.990375	95% Jackknife UCL	420.2716
		95% Standard Bootstrap UCL	399.6738
Anderson-Darling Test Statistic	0.181031	95% Bootstrap-t UCL	552.3112
Anderson-Darling 5% Critical Value	0.767983	95% Hall's Bootstrap UCL	1061.783
Kolmogorov-Smirnov Test Statistic	0.147153	95% Percentile Bootstrap UCL	418.2333
Kolmogorov-Smirnov 5% Critical Value	0.255287	95% BCA Bootstrap UCL	458.6
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	651.5736
		97.5% Chebyshev(Mean, Sd) UCL	821.7867
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1156.137
95% Approximate Gamma UCL	545.1652		
95% Adjusted Gamma UCL	615.4588		
Potential UCL to Use		Use 95% Approximate Gamma UCL	545.1652

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
MUD RESERVOIR
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Vanadium			
General Statistics			
Number of Valid Observations	12	Number of Distinct Observations	12
Raw Statistics		**Log-transformed Statistics**	
Minimum	24.4	Minimum of Log Data	3.194583
Maximum	170	Maximum of Log Data	5.135798
Mean	75.61667	Mean of log Data	4.184365
Median	59.9	SD of log Data	0.564069
SD	42.05812		
Coefficient of Variation	0.556202		
Skewness	1.011887		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.918032	Shapiro Wilk Test Statistic	0.978845
Shapiro Wilk Critical Value	0.859	Shapiro Wilk Critical Value	0.859
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	97.42074	95% H-UCL	112.331
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	131.2419
95% Adjusted-CLT UCL	99.37654	97.5% Chebyshev (MVUE) UCL	155.2152
95% Modified-t UCL	98.01183	99% Chebyshev (MVUE) UCL	202.3062
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.828057	**Data appear Normal at 5% Significance Level**	
Theta Star	26.73803		
MLE of Mean	75.61667		
MLE of Standard Deviation	44.96488		
nu star	67.87337		
Approximate Chi Square Value (.05)	49.91156	**Nonparametric Statistics**	
Adjusted Level of Significance	0.02896	95% CLT UCL	95.58705
Adjusted Chi Square Value	47.56789	95% Jackknife UCL	97.42074
		95% Standard Bootstrap UCL	94.52934
Anderson-Darling Test Statistic	0.22394	95% Bootstrap-t UCL	103.8899
Anderson-Darling 5% Critical Value	0.736781	95% Hall's Bootstrap UCL	105.0271
Kolmogorov-Smirnov Test Statistic	0.175531	95% Percentile Bootstrap UCL	96.1
Kolmogorov-Smirnov 5% Critical Value	0.246706	95% BCA Bootstrap UCL	96.80833
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	128.5386
		97.5% Chebyshev(Mean, Sd) UCL	151.438
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	196.4194
95% Approximate Gamma UCL	102.8291		
95% Adjusted Gamma UCL	107.8955		
Potential UCL to Use		Use 95% Student's-t UCL	97.42074

APPENDIX D
CALCULATED 95% UPPER CONFIDENCE LEVEL OF THE MEAN CONCENTRATIONS
MUD RESERVOIR
SEVERSTAL SPARROWS POINT
SPARROWS POINT, MARYLAND

Zinc			
General Statistics			
Number of Valid Observations	12	Number of Distinct Observations	12
Raw Statistics		**Log-transformed Statistics**	
Minimum	28.5	Minimum of Log Data	3.349904
Maximum	2000	Maximum of Log Data	7.600903
Mean	365.925	Mean of log Data	5.114375
Median	158.5	SD of log Data	1.286087
SD	560.1125		
Coefficient of Variation	1.530676		
Skewness	2.63991		
Relevant UCL Statistics			
Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.626699	Shapiro Wilk Test Statistic	0.957839
Shapiro Wilk Critical Value	0.859	Shapiro Wilk Critical Value	0.859
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	656.3026	95% H-UCL	1455.529
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	943.0446
95% Adjusted-CLT UCL	763.5452	97.5% Chebyshev (MVUE) UCL	1203.332
95% Modified-t UCL	676.8394	99% Chebyshev (MVUE) UCL	1714.618
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.624417	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	586.0269		
MLE of Mean	365.925		
MLE of Standard Deviation	463.0787		
nu star	14.986		
Approximate Chi Square Value (.05)	7.251816	**Nonparametric Statistics**	
Adjusted Level of Significance	0.02896	95% CLT UCL	631.8823
Adjusted Chi Square Value	6.447345	95% Jackknife UCL	656.3026
		95% Standard Bootstrap UCL	626.595
Anderson-Darling Test Statistic	0.57023	95% Bootstrap-t UCL	1128.143
Anderson-Darling 5% Critical Value	0.765299	95% Hall's Bootstrap UCL	1475.014
Kolmogorov-Smirnov Test Statistic	0.237192	95% Percentile Bootstrap UCL	646.6083
Kolmogorov-Smirnov 5% Critical Value	0.254727	95% BCA Bootstrap UCL	823.025
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1070.718
		97.5% Chebyshev(Mean, Sd) UCL	1375.682
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1974.726
95% Approximate Gamma UCL	756.1903		
95% Adjusted Gamma UCL	850.5444		
Potential UCL to Use		Use 95% Approximate Gamma UCL	756.1903

Appendix E

Derivation of Wildlife Toxicity Reference Values

APPENDIX E

Derivation of Wildlife NOAELs and LOAELs from Eco-SSLs - Antimony
Growth and Reproduction Endpoints

Avian NOAEL (mg/kg-day)	Avian LOAEL (mg/kg-day)	Mammalian NOAEL (mg/kg-day)	Mammalian LOAEL* (mg/kg-day)
None	None	0.059	0.59
		835	42
		0.533	161
		0.664	0.059
		5.6	0.678
		67	
		106	
		1410	
		13.3	

*Mammalian geometric mean LOAEL lower than geometric mean NOAEL. LOAEL estimated by multiplying NOAEL by a factor of 5 (Lewis et al. 1990)

APPENDIX E

Derivation of Wildlife NOAELs and LOAELs from Eco-SSLs - Cadmium
Growth and Reproduction Endpoints

Avian NOAEL (mg/kg-day)	Avian LOAEL (mg/kg-day)	Mammalian NOAEL (mg/kg-day)	Mammalian LOAEL (mg/kg-day)
0.593	2.37	0.0069	15.6
0.593	2.37	0.0939	4.88
0.799	2.4	0.651	10
1.53	21.1	0.89	10
1.53	21.1	1	2.28
4.2	2.4	1	4.5
0.125	3.71	1.1	40.0
0.26	7.65	1.57	54
0.708	10.4	2.53	10
0.826	7.08	4	18.4
0.858	3.3	4	75
1.25	4.66	5.4	0.661
1.55	3.44	6	1.42
1.72	3.44	6.13	1.45
1.72	37.6	6.44	1.87
4.2	1.05	7.41	2.14
4.24	4.26	11.4	3.93
5.76	4.8	12.5	4.61
6.44	4.9	13.9	5.6
12.5	5.63	25	5.82
1.47	9.57	41.1	6.3
	9.75	50	7.28
	12.2	50	236
	12.8	0.0069	1.0
	13	0.00792	1.0
	13.8	0.00884	1.6
	14.7	0.0187	1.3
	6.35	0.0584	4.0
		0.0793	0.9
		0.1	1.2
		0.1	1.6
		0.179	7.7
		0.207	10.0
		0.268	5.2
		0.323	10.8
		0.400	6.1
		0.448	10.6
		0.478	10.0
		0.579	15.4
		0.581	12.1
		0.593	8.7
		0.645	44.4
		0.770	54.0
		0.890	15.2
		0.890	17.1
		1.00	85.9
		1.04	100
		1.08	0.1

APPENDIX E

Derivation of Wildlife NOAELs and LOAELs from Eco-SSLs - Cadmium
Growth and Reproduction Endpoints

Avian NOAEL (mg/kg-day)	Avian LOAEL (mg/kg-day)	Mammalian NOAEL (mg/kg-day)	Mammalian LOAEL (mg/kg-day)
		1.36	0.1
		1.78	1.0
		1.84	2.0
		1.85	3.0
		2.22	3.2
		2.53	3.4
		2.65	3.9
		2.78	4.1
		3.00	4.6
		3.08	5.1
		3.73	5.2
		4.05	5.4
		4.36	5.7
		4.44	5.8
		4.97	6.1
		4.99	6.9
		5.40	9.5
		5.54	9.7
		6.1	10.0
		7.2	10.4
		7.4	13.2
		8.5	14.7
		8.5	16.8
		8.6	20.7
		10.5	75.8
		11.8	103
		12.5	571
		12.5	**6.9**
		12.6	
		16.9	
		21.3	
		31.3	
		43.0	
		50.0	
		1.86	

APPENDIX E

Derivation of Wildlife NOAELs and LOAELs from Eco-SSLs - Chromium
Growth and Reproduction Endpoints

Avian NOAEL (mg/kg-day)	Avian LOAEL (mg/kg-day)	Mammalian NOAEL (mg/kg-day)	Mammalian LOAEL (mg/kg-day)
0.238	2.78	0.00663	9.62
0.483	75.4	0.00933	36.2
0.494	9.91	0.537	91.9
0.569	28.7	0.595	228
0.744	**15.6**	0.927	92.1
0.988		8.09	**58.3**
37.7		44.6	
0.483		228	
1.45		1770	
6.42		**2.4**	
85.9			
359			
2.66			

APPENDIX E

Derivation of Wildlife NOAELs and LOAELs from Eco-SSLs - Copper
Growth and Reproduction Endpoints

Avian NOAEL (mg/kg-day)	Avian LOAEL (mg/kg-day)	Mammalian NOAEL (mg/kg-day)	Mammalian LOAEL (mg/kg-day)
4.05	12.1	3.4	9.62
13.9	19.5	6.51	136
15.6	23.3	50.7	136
16.7	34	90.9	5.51
17	25.5	90.9	41.2
18	28	107	9.34
19.4	29	304.0	19.6
20.5	30.7	358	26.9
21.6	44.8	48300	27.6
22.4	45	0.812	51.6
22.5	29.9	0.852	45.7
23.2	54.4	1.33	101
23.9	40.6	1.48	99.6
27.2	47.5	2.07	64
27.5	40.1	3.6	165
29.1	50	4.25	183
30.4	318	4.37	293
33.4	19.7	5.43	358
35.2	22.6	5.51	400
40	536	5.6	988
43.3	4.68	5.89	1740
239	7.67	6.67	3400
1.92	46.6	6.9	4670
2.34	42.9	7.19	47500
2.7	42.9	7.34	1.47
2.75	19	7.36	3
2.97	51.6	7.37	5.78
3.83	24.3	7.63	7.46
4.15	26.6	7.66	15.5
4.43	28.7	7.68	23.5
4.65	28.7	7.72	39.8
4.75	28.7	7.8	106.0
5.43	28.7	8.08	122
5.56	28.7	8.21	274
5.82	25.8	8.29	285
6.28	24.7	8.43	**85.3**
7.55	33.4	8.44	
7.63	25.8	8.5	
8.19	31.1	8.68	
8.4	35.5	9.6	
8.59	28	9.93	
8.59	37.1	10.2	
9.52	30.5	10.3	
9.72	30.7	12	
10.2	42.7	12.4	
11.1	42.9	12.7	
11.5	34	13.8	
11.9	44.8	16.2	

APPENDIX E

Derivation of Wildlife NOAELs and LOAELs from Eco-SSLs - Copper
Growth and Reproduction Endpoints

Avian NOAEL (mg/kg-day)	Avian LOAEL (mg/kg-day)	Mammalian NOAEL (mg/kg-day)	Mammalian LOAEL (mg/kg-day)
12.2	34.1	16.4	
12.6	30.7	16.5	
13.3	29.9	16.7	
13.4	31	17.2	
14.2	35.2	17.5	
14.2	40.4	17.8	
14.3	35.3	22.9	
14.3	57.4	27.7	
14.3	59.3	28.4	
14.3	43.3	33.4	
14.3	51.9	33.8	
14.3	63.9	37.1	
14.3	74.2	43.1	
14.3	55.9	45.8	
15.7	109	49.8	
16.5	120	50	
16.7	2.69	59	
17.2	4.88	73.4	
17.5	10.3	75.7	
17.8	14.3	82.5	
17.8	17.5	91.7	
18	21.3	146	
18.2	22.6	179	
18.3	22.7	229.0	
18.3	26.4	259	
18.4	26.4	494	
18.5	31.4	690	
18.6	34.9	812	
19.6	35.2	1430	
19.7	35.5	2110	
20.5	35.5	19500	
20.9	42.9	**25.0**	
21.3	50.1		
21.5	55.2		
21.5	57.2		
21.6	59		
21.7	60		
21.9	75.5		
22.4	85.9		
22.7	92.9		
23	138		
23.2	**34.9**		
23.3			
23.9			
24.7			
26.4			
26.6			
26.9			

APPENDIX E

Derivation of Wildlife NOAELs and LOAELs from Eco-SSLs - Copper
Growth and Reproduction Endpoints

Avian NOAEL (mg/kg-day)	Avian LOAEL (mg/kg-day)	Mammalian NOAEL (mg/kg-day)	Mammalian LOAEL (mg/kg-day)
27.9			
28.4			
28.7			
28.7			
29.5			
29.7			
30.4			
30.7			
33			
34.1			
34.6			
35.2			
35.5			
35.5			
36.3			
36.6			
37.1			
40.1			
41			
43.3			
49.5			
50			
50.1			
50.9			
56.8			
60			
65.4			
82			
103			
143			
18.5			

APPENDIX E

Derivation of Wildlife NOAELs and LOAELs from Eco-SSLs - Lead
Growth and Reproduction Endpoints

Avian NOAEL (mg/kg-day)	Avian LOAEL (mg/kg-day)	Mammalian NOAEL (mg/kg-day)	Mammalian LOAEL (mg/kg-day)
0.194	1.94	0.71	7
1.63	3.26	1	5
2.69	4.04	2.6	26
5.63	126	3	6
12	135	4.5	10
12.6	0.11	5	74.9
67.4	0.194	5.5	45
125	3.26	7.5	170
1.56	11.8	8.9	180
2.77	93.1	9.1	63.2
4.64	377	12.4	111
5.93	15.6	18	54.6
6.14	59.3	25.4	82
7.1	61.4	27.5	285
11.1	71	31.6	270
11.2	111	32.5	150
12.6	112	33.3	1440
13.5	126	41	506
14.2	67.4	47.3	506
20	125	56	552
25	123	64.8	587
28.4	38.2	64.9	1500
34.5	53.1	90.1	2
54.3	64.3	100	2.49
61.3	76.3	115	3.62
66.9	124	116	5.5
10.9	152	120	6.76
	163	144	16.6
	200	202	46.4
	262	202	49.6
	270	276	50
	273	294	55.5
	282	441	61.2
	44.6	600	78.6
		601	99.8
		639	137
		0.15	154
		0.5	171
		1	175
		1.27	178
		1.99	198
		2.4	200
		2.98	218
		4.7	221
		4.71	222
		5.64	230
		5.8	258
		7.79	330

APPENDIX E

Derivation of Wildlife NOAELs and LOAELs from Eco-SSLs - Lead
Growth and Reproduction Endpoints

Avian NOAEL (mg/kg-day)	Avian LOAEL (mg/kg-day)	Mammalian NOAEL (mg/kg-day)	Mammalian LOAEL (mg/kg-day)
		9.1	354
		10	360
		10.6	362
		10.7	364
		10.7	381
		15.1	381
		15.4	381
		15.5	404
		16.1	420
		16.3	437
		18	579
		18.3	600
		18.9	635
		24.3	646
		32.5	651
		32.7	750
		38.5	762
		43	828
		50	833
		71.5	991
		75	1370
		100	1770
		120	1990
		136	2570
		137	2570
		139	2840
		169	3630
		171	6170
		180	5
		187	13
		200	8.9
		200	28.2
		218	29
		230	532
		285	50.4
		362	163
		364	180
		400	178
		400	225
		431	383
		441	1360
		534	508
		632	373
		651	460
		750	800
		1260	800
		1500	1264

APPENDIX E

Derivation of Wildlife NOAELs and LOAELs from Eco-SSLs - Lead
Growth and Reproduction Endpoints

Avian NOAEL (mg/kg-day)	Avian LOAEL (mg/kg-day)	Mammalian NOAEL (mg/kg-day)	Mammalian LOAEL (mg/kg-day)
		40.7	2530
			3.3
			15
			28.7
			29
			29
			29.5
			29.9
			30.4
			46.4
			50
			61.5
			100
			173
			200
			272
			328
			354
			371
			400
			400
			404
			442
			638
			748
			991
			1000
			1430
			1600
			2390
			2400
			2650
			188.1

APPENDIX E

Derivation of Wildlife NOAELs and LOAELs from Eco-SSLs - Nickel

Growth and Reproduction Endpoints

Avian NOAEL (mg/kg-day)	Avian LOAEL (mg/kg-day)	Mammalian NOAEL (mg/kg-day)	Mammalian LOAEL (mg/kg-day)
149	8.16	1.1	3.31
0.136	11.5	1.35	2.71
0.195	17.9	1.7	3.4
5.76	30.2	9.3	171
8.95	31.5	45.3	327
22.9	8.95	85.3	0.551
28.3	10.7	15.0	0.8
31	23.9	112	1.33
6.7	71.8	164	1.35
	18.6	205	1.59
		0.0844	4.7
		0.101	25
		0.335	6.8
		1.17	22
		1.33	6.55
		1.36	14.6
		1.47	91.1
		1.64	47.4
		2.97	23.4
		4.56	309
		4.56	112.0
		5.44	171
		5.89	148.0
		6.75	281
		7	8.2
		7.78	24.7
		9.11	208
		8.3	**17.5**
		9.49	
		11.4	
		11.7	
		12.5	
		20	
		29.4	
		45	
		45.3	
		85.3	
		107	
		7.3	

APPENDIX E

Derivation of Wildlife NOAELs and LOAELs from Eco-SSLs - Selenium
Growth and Reproduction Endpoints

Avian NOAEL (mg/kg-day)	Avian LOAEL (mg/kg-day)	Mammalian NOAEL (mg/kg-day)	Mammalian LOAEL (mg/kg-day)
0.092	0.368	0.072	0.145
0.212	0.425	0.108	0.768
0.214	0.429	0.173	0.776
0.219	0.438	0.384	0.763
0.247	0.412	0.388	1.51
0.273	0.546	0.393	6.03
0.284	1.29	0.5	25.4
0.292	2.58	0.735	6.39
0.378	0.0911	0.78	0.089
0.644	0.0988	0.945	0.13
0.89	0.12	1.21	0.296
0.896	0.127	1.6	0.434
1.03	0.355	2.28	0.504
1.37	0.456	2.54	0.55
3.64	0.524	3.2	0.749
0.0632	0.546	3.2	4.18
0.074	0.58	7	4.57
0.0859	0.614	0.053	5.01
0.18	0.675	0.0642	0.265
0.204	0.702	0.0838	0.763
0.213	0.78	0.0869	0.157
0.284	0.826	0.09	0.273
0.292	0.898	0.11	0.215
0.319	1.19	0.112	0.273
0.371	4.49	0.137	0.304
0.379	0.37	0.143	0.221
0.429	0.721	1.46	0.33
0.429	0.408	0.151	0.51
0.617	0.426	0.153	0.548
0.69	0.859	0.155	0.435
0.718	1.23	0.163	0.47
0.909	1.73	0.165	0.34
1.06	1.44	0.17	0.58
1.13	4.53	0.173	0.521
1.23	4.94	0.175	0.54
1.38	2.9	0.181	0.712
1.42	3.48	0.183	0.489
1.45	4.26	0.189	0.564
1.74	8.32	0.191	0.747
2.13	11.5	0.198	0.523
3.04	11.9	0.202	0.768
4.16	0.0912	0.214	0.776
5.75	0.127	0.217	0.763
6.34	0.13	0.217	0.567
7.31	0.18	0.217	0.577
0.61	0.275	0.227	0.869
	0.306	0.236	0.869
	0.5	0.24	0.869

APPENDIX E

Derivation of Wildlife NOAELs and LOAELs from Eco-SSLs - Selenium
Growth and Reproduction Endpoints

Avian NOAEL (mg/kg-day)	Avian LOAEL (mg/kg-day)	Mammalian NOAEL (mg/kg-day)	Mammalian LOAEL (mg/kg-day)
	0.5	0.254	1.31
	0.629	0.261	0.904
	0.788	0.265	1.54
	0.855	0.274	1.21
	0.859	0.277	0.88
	0.896	0.296	1.51
	1.08	0.318	1.23
	1.2	0.356	1.21
	1.38	0.367	1.62
	1.55	0.367	1.59
	1.72	0.368	1.59
	1.78	0.371	2.27
	2.27	0.374	6.39
	2.76	0.375	20
	3.64	0.384	0.0908
	0.82	0.384	0.0968
		0.388	0.156
		0.393	0.163
		0.407	0.166
		0.425	0.205
		0.426	0.209
		0.432	0.215
		0.435	0.232
		0.435	0.235
		0.435	0.254
		0.438	0.267
		0.452	0.274
		0.464	0.276
		0.49	0.282
		0.5	0.303
		0.515	0.307
		0.61	0.323
		0.652	0.345
		0.68	0.352
		0.735	0.378
		0.78	0.39
		0.781	0.411
		0.784	0.42
		0.81	0.425
		0.945	0.441
		0.996	0.454
		0.996	0.49
		1.09	0.493
		1.14	0.498
		1.26	0.521
		1.6	0.543

APPENDIX E

Derivation of Wildlife NOAELs and LOAELs from Eco-SSLs - Selenium
Growth and Reproduction Endpoints

Avian NOAEL (mg/kg-day)	Avian LOAEL (mg/kg-day)	Mammalian NOAEL (mg/kg-day)	Mammalian LOAEL (mg/kg-day)
		1.96	0.55
		3.2	0.57
		3.2	0.589
		4.57	0.653
		4.57	0.667
		10	0.704
		10	0.754
		0.45	0.767
			0.769
			0.794
			0.794
			0.794
			0.794
			0.809
			0.817
			0.823
			0.903
			0.968
			0.984
			0.988
			1.02
			1.11
			1.59
			1.59
			1.79
			1.94
			3.54
			3.74
			4.18
			0.66

APPENDIX E

Derivation of Wildlife NOAELs and LOAELs from Eco-SSLs - Zinc
Growth and Reproduction Endpoints

Avian NOAEL (mg/kg-day)	Avian LOAEL (mg/kg-day)	Mammalian NOAEL (mg/kg-day)	Mammalian LOAEL (mg/kg-day)
13.8	98.8	8.23	82.3
14.4	105	8.89	75.9
24.7	66.5	9.64	452
55	76.7	14.4	2514
57.3	123	30	4927
63.9	84.8	34	4878
64.1	31.2	37.9	12.2
67.8	88	41.2	81.1
106	101	42.1	232
14.4	205	42.5	326
15	367	60	326
16.1	988	88	353
21.5	988	89.6	424
38.7	86.6	97.8	103
35.4	105	101	87.1
36.6	111	110	2514
43.3	106	167	4927
55	111	181	4878
55.1	112	234	2838
55.3	150	347	8.71
63.2	114	458	16.1
70.6	172	479	28.2
74.3	174	975	75.7
74.7	185	2486	81.1
75	145	4.33	89.1
75.7	149	4.78	424
85.9	194	9.64	667
86.8	286	10.3	956
92.3	297	11.7	968
96.9	232	13.5	**297.6**
99.1	237	14.4	
103	354	14.9	
103	503	15.7	
129	480	15.7	
129	21.6	18	
142	31	20.2	
143	39	28.9	
148	65.7	30	
155	88	30.4	
158	101	30.6	
177	126	33.2	
252	132	34	
367	143	42.1	
66.5	252	42.5	
	190	43.5	
	284	63.7	
	315	56	
	433	60	

APPENDIX E

Derivation of Wildlife NOAELs and LOAELs from Eco-SSLs - Zinc
Growth and Reproduction Endpoints

Avian NOAEL (mg/kg-day)	Avian LOAEL (mg/kg-day)	Mammalian NOAEL (mg/kg-day)	Mammalian LOAEL (mg/kg-day)
	757	88	
	914	97.5	
	988	99.1	
	1370	103	
	171.4	106	
		110	
		234	
		282	
		295	
		458	
		470	
		479	
		597	
		825	
		845	
		846	
		1419	
		1684	
		2486	
		78.3	

APPENDIX E

Derivation of Wildlife NOAELs and LOAELs from Eco-SSLs - HMW PAHs
Growth and Reproduction Endpoints

Avian NOAEL (mg/kg-day)	Avian LOAEL (mg/kg-day)	Mammalian NOAEL (mg/kg-day)	Mammalian LOAEL (mg/kg-day)
None	None	10	40
		13.3	26.4
		3.09	45.9
		5	12.4
		10	50
		11.8	24
		13.3	26.4
		21.1	63.4
		28.5	98
		31.7	118
		49	20.7
		53.9	27.3
		125	50
		18.0	**38.4**