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May 22, 2015

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BoRit Asbestos Superfund Site, Operable Unit 1, Ambler, PA
(DCN: 3330-029-RT-RIRT-02825)

Dear Ms. Lowe:

In accordance with the reporting requirements for the EPA Region 3 Work Assignment 029-RICO-A3EN, CDM Federal Programs Corporation (CDM Smith) is pleased to submit three copies of the Final Remedial Investigation Addendum for Operable Unit 1 (OU-1) for the BoRit Asbestos Superfund Site in Ambler, Pennsylvania.

If you have any questions or comments regarding this submittal, please feel free to call me at (717) 437-3701.

Very truly yours,

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US Environmental Protection Agency Region 3

Final Remedial Investigation Addendum

**BoRit Asbestos Superfund Site,
Operable Unit 1
Ambler, Pennsylvania**

May 22, 2015



**Response Action Contract
for Remedial Planning and Oversight Activities at Sites
in EPA Region 3**

U.S. EPA Contract No. EP-S3-07-06

FINAL REMEDIAL INVESTIGATION ADDENDUM

**for
BoRit Asbestos Superfund Site
Operable Unit 1
Ambler, Pennsylvania**

**Work Assignment No.: 029-RICO-A3EN
Document Control No.: 3330-029-RT-RIRT-02825**

May 22, 2015

Prepared for:

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Acronyms

%	percent
°F	Degrees Fahrenheit
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
µm	micrometer
ABS	activity-based sampling
ACM	asbestos-containing material
bgs	below ground surface
CDM Smith	CDM Federal Programs Corporation
CFC-11	trichlorofluoromethane
1,1-DCE	1,1-dichloroethene
cis-1,2-DCE	cis-1,2-Dichloroethylene
CSC	Center for Sustainable Communities
CSM	conceptual site model
CTE	central tendency exposure
cy	cubic yard
DPT	direct push drilling technology
EM	Electromagnetic
EPA	United States Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FSDS	field sample data sheets
f/cc	fiber per cubic centimeter
ft	feet
GIS	Geographic Information System
HHRA	Human Health Risk Assessment
HI	hazard index
HRS	Hazard Ranking System
HQ	Hazardous Quotient
IUR	inhalation unit risk
K&M	Keasby & Mattison
MCL	Maximum Contaminant Level
MEK	2-butanone
MFL	million fibers per liter
MG	million gallons
mg/kg	milligram per kilogram
MIBK	4-methyl-2-pentanone
mL	milliliter
Mt.	Mount

Acronyms (continued)

MTBE	methyl tert-butyl ether
MW	monitoring well
NA	not applicable
NAVD88	North American Vertical Datum 1988
ND	not detected
NESHAP	National Emissions Standards for Hazardous Air Pollutants
ng/kg	nanogram per kilogram
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
NRWQC	National Recommended Water Quality Criteria
ORNL	Oak Ridge National Laboratory
OSC	On-Scene Coordinator
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OU-1	Operable Unit 1
PA	Pennsylvania
PA DCNR	Pennsylvania Department of Conservation and Natural Resources
PADEP	Pennsylvania Department of Environmental Protection
PADER	Pennsylvania Department of Environmental Resources
PAH	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PCM	phase contrast microscopy
PCME	phase contrast microscopy equivalent
PDOH	Pennsylvania Department of Health
PFBC	Pennsylvania Fish and Boat Commission
PK	piezometers
PLM	Polarized Light Microscopy
PRG	preliminary remediation goal
PVC	Polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
RAC	Response Action Contract
RI/FS	Remedial Investigation/Feasibility Study
RME	reasonable maximum exposure
RSL	Regional Screening Levels
s/cc	structures per cubic centimeter
SG	staff gauge
SL	screening level
the Site	BoRit Asbestos Superfund Site
SLERA	Screening Level Ecological Risk Assessment

Acronyms (continued)

SMP	Sample Management Plan
SOP	Standard Operating Procedure
START	Superfund Technical Assessment and Response Team
SVOC	semi-volatile organic compound
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TCE	trichloroethene
TEM	transmission electron microscopy
TEQ	toxicity equivalent quotient
TWF	time weighing factor
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UV	Ultraviolet
VCP	vitified clay pipe
VOC	volatile organic compound
WA	Work Assignment
Weston	Weston Solutions, Inc.
WWP	Wissahickon Waterfowl Preserve

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Executive Summary

The United States Environmental Protection Agency (EPA) Region 3 has contracted CDM Federal Programs Corporation (CDM Smith) to conduct a Remedial Investigation/Feasibility Study (RI/FS) for the BoRit Asbestos Superfund Site Operable Unit 1 (OU-1) in Ambler, PA (the Site) under Work Assignment (WA) 029-RICO-A3EN of the EPA Region 3 Response Action Contract (RAC) 2 Contract EP-S3-07-06.

The RI field investigation was performed in a phased approach. The Phase 1 field investigation, conducted from November 2009 through January 2010, provided information on the nature and extent of waste material and other contaminants in the Site soil, surface water, and sediment. Analytical results were presented in the *Phase 1 Data Evaluation Report* dated June 18, 2010 (CDM Smith 2010a). The Phase 2 field investigation expanded the delineation of waste in these media. In addition, groundwater samples, activity-based sampling (ABS) samples, ambient air samples, and geotechnical samples were collected during Phase 2 field investigations conducted in Summer and Fall 2010 and Summer 2011. In addition, ambient air data were collected from November 2010 through October 2011. Groundwater and soil dioxin data were first presented in the *Preliminary Phase 2 Groundwater Report*, dated February 25, 2011 (CDM Smith 2011). All analytical and geotechnical results from the Phase 2 investigations (including finalized groundwater and soil dioxin data) were presented in the *Final Phase 2 Data Evaluation Report* dated August 20, 2013 (CDM 2013a). The Phase 3 field investigation was conducted from February through July 2013 to collect background soil samples, install an upgradient offsite monitoring well, and collect additional rounds of groundwater and seep samples.

In 2013, CDM Smith completed the *Final RI Report* (CDM Smith 2013b) to document the three phases of the RI. The RI data collected by CDM Smith for EPA were used to characterize the Site and to define the nature and extent of source material and Site-related contaminants in soil, sediment, surface water, groundwater, and seeps. CDM Smith also completed a human health risk assessment (HHRA) (CDM Smith 2013b Appendix A) and a screening level ecological risk assessment (SLERA) (CDM Smith 2013b Appendix B) to characterize potential human health and ecological risks associated with the Site in the absence of any remedial action.

In 2013 and 2014, additional data were collected to further characterize the Site setting and to better understand potential fate and transport of Site contaminants. The information presented in this Executive Summary summarizes the information and data presented in the Final RI Report. In addition this Executive Summary includes updated information to reflect and consider the post-RI data collected in 2013 and 2014 and presented in this RI Addendum Report.

The EPA Removal Program has been working at the Site before, during, and after the post-RI field work. However, the vast majority of samples collected as part of the RI and post-RI field efforts were collected prior to or were not directly impacted by ongoing EPA Removal Program work. Therefore, the results summarized in this RI Addendum Report represent baseline, i.e., un-remediated conditions.

ES.1 Objective of the Remedial Investigation

The overall objective of the RI was to 1) determine the nature and extent of the disposed waste and related contamination at the Site and 2) determine if the contamination at the Site poses a threat to human health and/or the environment. The threat to human health and the environment was assessed through completion of a HHRA and a SLERA, which were submitted respectively as Appendices A and B to the *Final RI Report* (CDM Smith 2013b). The objectives of the RI field investigations were to provide data to be used to define the nature and extent of contamination, to develop a conceptual site model (CSM), and to support the risk assessments.

ES.2 Objective of the Post-RI Field Investigations

The overall objectives of the post-RI field investigations were to collect additional data to further define the nature and extent of contamination and to update the CSM. Specifically, post-RI activities included the following:

- A Reservoir temperature study to investigate Reservoir and groundwater communication
- Wet and dry synoptic events
- A Reservoir Bench Study to investigate the impact of sediment disturbance activities on the transport of asbestos from Reservoir sediment to surface water

In addition, the United States Army Corps of Engineers (USACE) conducted additional investigations focused on Reservoir hydraulics and berm stability. The USACE and EPA's Superfund Technical Assessment and Response Team (START) contractor performed the 2014 Reservoir sediment investigation that focused on the nature and extent of contamination in Reservoir bottom sediments.

ES.3 Site Location and Description

The Site includes three adjacent parcels near the intersection of West Maple Street and Butler Pike in Ambler Borough, Montgomery County, Pennsylvania:

- The Asbestos Pile parcel, located in Ambler Borough, is approximately 2.5 acres and contains an asbestos waste pile;
- The Park parcel, located in Whitpain Township, is approximately 11 acres and contains a former asbestos disposal area (now the closed Whitpain Wissahickon Park); and
- The Reservoir parcel, primarily located in Upper Dublin Township, is approximately 15 acres and contains a reservoir. The Reservoir is man-made and is not used as a drinking water supply. Historically, the Reservoir was filled by a former pond on the Wissahickon Creek located northwest of Mount (Mt.) Pleasant Avenue. The water from the pond was regulated by a gate valve that allowed water to flow under Mt. Pleasant Avenue and connect to a 24-inch pipe that ultimately discharged into the Reservoir. Currently, the 24-inch pipe runs from the intersection of Mt. Pleasant Avenue to the newly constructed 6-foot diameter manhole that replaced a former control valve structure at the Reservoir. In April 2014, the results of a trace dye test, initiated at the manhole located at the intersection of Mt. Pleasant Avenue and West Maple Street, indicated that the 24-inch pipe under West Maple Street still contributes some flow to the Reservoir. However, it was also noted that the pipe was full of dirt and debris and that, even

with a large amount of water, it took several hours for the dye to reach the Reservoir. Additional information regarding the Reservoir hydraulics is included in Section ES.7.2.

The Site also includes portions of Wissahickon Creek, Rose Valley Creek, and Tannery Run which flow adjacent to the three Site parcels. Some investigations performed as part of the RI work occurred on nearby residential, recreational, and commercial properties outside the Site boundary. The Site map is shown on **Figure ES-1**.

ES.4 Site History

The Site history presented in this section is a summary of historical information presented in the *Final RI Report* (CDM Smith 2013b), and the *USACE Reservoir Hydraulics and Berm Stability Investigation* (USACE 2013), coupled with information provided by the EPA On-Scene Coordinator (OSC) for the EPA Removal Program.

The BoRit Asbestos Superfund Site is a result of disposal operations by the former Keasby & Mattison (K&M) Company and succeeding companies (Certainteed Corporation and Nicolet Industries). K&M produced asbestos products (including paper, millboard, electrical insulation, brake linings, piping, conveyor belts, high pressure packings, roofing shingles, and cement siding) from 1897 to 1962 at their Ambler, Pennsylvania facility. In 1962, K&M ceased operations, and Certainteed Corporation and Nicolet Industries purchased different portions of the K&M facility. Certainteed Corporation primarily manufactured asbestos-cement pipe, and Nicolet Industries manufactured automobile parts, laboratory table tops, and other products. Certainteed Corporation ceased operations in 1974, and Nicolet Industries operated at least until October 1987, producing only asbestos-containing rubber gaskets by 1987 (CDM Smith 1988).

Reservoir Parcel

The Reservoir parcel was used to provide process water for K&M facility operations. The Reservoir appears in 1921 and 1930 Sanborn Fire Insurance maps and a 1937 aerial photograph. The berm around the Reservoir was constructed of asbestos shingles, millboard, and soil. Asbestos product waste, particularly water pipe and tiles, were observed surrounding the Reservoir and the stream banks.

Park Parcel

Similarly, starting as early as 1937, K&M disposed of an estimated 195,000 cubic yards (cy) of out-of-specification asbestos manufacturing products and other solid wastes on the Park parcel. Although used as a public park from at least 1973, the Park parcel was officially closed to the public in September 1984.

Asbestos Pile Parcel

Based on observations from a 1930s historical aerial photograph, K&M began disposing a slurry of spent magnesium and calcium, as well as waste asbestos products, in a former reservoir located in what is now known as the Asbestos Pile parcel. Prior to the EPA Removal Action, the elevation of the waste in the Asbestos Pile parcel was approximately 20 to 30 feet above the surrounding land. By 1965, the Asbestos Pile was vegetated, and the property reportedly was first fenced in approximately 1986. For short periods of time in the 1980s and 1990s, portions of the Asbestos Pile parcel were used as a trash transfer station or trash storage location and for local Fire Department training.

Regulatory History

The EPA and the Pennsylvania Department of Environmental Resources (PADER), now the Pennsylvania Department of Environmental Protection (PADEP) conducted sampling in late 1983 and in the spring of 1984, respectively. Asbestos, specifically chrysotile, was identified as the primary contaminant on the BoRit Site.

EPA performed a preliminary assessment of the BoRit Asbestos Pile parcel in March 1987. For approximately 20 years, PADEP managed the parcel according to National Emissions Standards for Hazardous Air Pollutants (NESHAP) regulations, which require the parcel to be fenced, have a vegetated cover, and have signs indicating the presence of asbestos.

In April 2006, EPA's Site Assessment Program conducted sampling and detected asbestos in the air, soil, surface water, and sediments at the Site. EPA re-evaluated the BoRit parcels in September 2008, resulting in a Hazard Ranking System (HRS) score, which prompted proposal to the National Priorities List (NPL) on September 3, 2008. The BoRit Asbestos Superfund Site received final listing on the NPL on April 9, 2009.

EPA Removal Program

In December 2008, the EPA Removal Program initiated work to address the most immediate environmental concerns at the Site. The actions performed or planned under the EPA Removal Program through August 2014 are provided in detail under Section 1.3 of the RI Addendum Report.

ES.5 Remedial Investigation Activities

All RI sample data collection was performed in accordance with sampling designs and methods described in the EPA-approved Site Management Plans (SMP) and SMP Addenda for these phases of work.

Phase 1 remedial investigation activities included the following:

- A geophysical electromagnetic (EM)/metallic survey of the Park parcel and the Asbestos Pile parcel;
- A bathymetric survey of the Reservoir basin;
- Sediment and surface water sampling in the Reservoir basin;
- Direct push drilling technology (DPT) and hand-augered soil borings to characterize waste disposal down to native soil;
- The collection of samples for chemical and asbestos analysis from a selected subset of boring locations and depths;
- Piezometer installation and collection of grab groundwater samples at three Park parcel locations and three Asbestos Pile parcel locations;
- Floodplain soil (0 to 3 inches and 6 to 24 inches below ground surface [bgs]) sampling along Wissahickon Creek, Tannery Run, and Rose Valley Creek;

- Sediment and surface water sampling along Wissahickon Creek, Tannery Run, and Rose Valley Creek; and
- Surface soil sampling (0 to 3 inches bgs) at the Park, Reservoir, and Asbestos Pile parcels, as well as on the west side of Wissahickon Creek.

Phase 2 remedial investigation activities included the following:

- Collection of surface soil samples from:
 - Locations where surface runoff is believed to exit the Site between the fence line and the roadway;
 - Previously-sampled composite soil sample locations where asbestos levels greater than 12 percent were found in the cover/waste interface layer;
 - Locations in the Park parcel on the stream bank cap along Wissahickon Creek and Rose Valley Creek;
 - Locations at the West Side Park (Kid's Park) adjacent to the Site at the corner of Oak Street and West Maple Street;
 - Locations, at three depth intervals (0 to 3 inches bgs, 0 to 6 inches bgs, and 6 to 24 inches bgs), at the former fire training area at the Asbestos Pile;
 - Locations, at three depth intervals (0 to 3 inches bgs, 0 to 6 inches bgs, and 6 to 24 inches bgs), at the slag area at the Asbestos Pile parcel;
 - Locations associated with ABS on the Park parcel;
 - Locations associated with ABS on the Asbestos Pile parcel;
 - One location associated with ABS on the Reservoir parcel; and
 - Residential yards.
- A visual investigation of the banks of Wissahickon Creek, near walking trails, to evaluate the potential extent of asbestos-containing material (ACM) washed downstream from the Site;
- Collection of a Reservoir seep water sample from one location on the Reservoir parcel;
- ABS with associated air samples on the Park parcel, Reservoir parcel, Asbestos Pile parcel, walking trails, and at selected residential properties;
- Utility clearing of all proposed boring locations at the Park parcel, Asbestos Pile parcel, Reservoir parcel berm (along the roadway between the Asbestos Pile parcel and the Reservoir parcel), and floodplain areas;
- Subsurface soil sampling at each monitoring well location approximately 3 inches below the waste and native layer interface;
- Installation and sampling of monitoring wells on the three Site parcels;

- A geotechnical evaluation of slope stability and settlement of the Asbestos Pile parcel;
- Installation of piezometers in three of the geotechnical boreholes at the Asbestos Pile parcel;
- Hydrologic studies (a comprehensive round of measurements at monitoring wells, piezometers, and staff gauges) conducted at the Site parcels, the Reservoir, and nearby creeks; and
- An ecological survey of the Site, conducted to identify the terrestrial and aquatic habitats on the Site and to determine the potential plant and wildlife receptors inhabiting these areas. The findings of the survey are presented in the SLERA.

Phase 3 remedial investigation activities included the following:

- Collection of surface soil samples from background areas;
- Installation of a monitoring well (MW-07) upgradient and outside the Site boundary;
- Collection of three rounds of groundwater samples from the onsite shallow bedrock monitoring wells;
- Collection of three rounds of Reservoir seep samples; and
- Collection of two rounds of groundwater samples from the upgradient offsite monitoring well (MW-07).

ES.6 Post-RI Field Investigation Activities

Post-RI field activities included the following:

- USACE Reservoir Hydraulics and Berm Stability Investigation;
- 2014 Reservoir Sediment Investigation;
- Wet and Dry Synoptic Events;
- USACE August 2014 Site Visit and Observations;
- Reservoir Temperature Study; and
- Reservoir Bench Study.

ES.7 Physical Characteristics of the Study Area

ES.7.1 Topography and Drainage

The Borough of Ambler, Whitpain Township, and Upper Dublin Township are situated in the Triassic Lowland section of the Piedmont physiographic province. As shown on the United States Geological Survey (USGS) topographic map of the area, elevations within the vicinity of the Site vary from approximately 220 feet at the Asbestos Pile to approximately 170 feet in Wissahickon Creek. All elevations are in the North American Vertical Datum 1988 (NAVD88). Although significant re-grading has occurred on the Site since 2009 as a result of EPA's Removal Program activities, the relative topography has not been significantly altered. The Asbestos Pile remains the highest point of land within the Site, and the creeks are the lowest.

ES.7.2 Site Geology and Hydrogeology

With the exception of the creek bottoms, the stratigraphy throughout the Site includes various unconsolidated materials (including historical fill, waste, and native soil) overlying bedrock of the Stockton Formation. The historical fill consists of placed soil (not native) containing mixtures of silt, sand, and gravel with minimal clay in some areas and occasional debris (concrete and brick). Historical fill was not present in the Asbestos Pile itself, although it was detected in the northern part of the Asbestos Pile parcel. The waste consists of ACM mixed in some locations with sand and silt. The ACM, primarily composed of chrysotile, consists of white, dark gray, and sometimes red fibrous material including some very dense fibrous material. In some locations, layers of fill are found inter-layered with waste. In the Asbestos Pile, many borings showed a very soft and moist fibrous waste product. Below the waste layer, native soil was detected overlying the Stockton Formation. The depth to the native soil ranged from 1.5 feet to 36 feet. Borings at the monitoring well locations detected native soil at depths ranging from 2 to 20 feet; native soil in these locations consisted of sand, silty sand, silts, and clays. Additionally, the upper two feet of floodplain soils were sampled and logged and consisted of clean to silty medium sand, silt, clayey silt, and clay. The location map for Cross Section I-I' and Cross Section I-I' are presented in **Figures ES-2 and ES-3**, respectively. Cross Section I-I' spans the length of the Site from the Park parcel across the Reservoir to the Asbestos Pile parcel.

Where bedrock was encountered, the depth to bedrock ranges between 14 and 29 feet bgs. The highest bedrock elevation (182 feet) occurs northeast of the Pile within the Asbestos Pile parcel. The lowest observed bedrock elevations occur at the bed of the Wissahickon Creek (about 170 feet) and its two local tributaries. Although depth to bedrock was not observed beneath the Asbestos Pile or the Reservoir, the Asbestos Pile is located in another former reservoir (possibly, originally a quarry); therefore, the depth to bedrock is expected to be deeper in these areas. The Stockton formation encountered on the Site is described as primarily reddish-brown medium-grained sandstone.

The shallow groundwater is found in the fractured upper bedrock, with discontinuous occurrences in the overburden material in the Park parcel near Wissahickon Creek and in the Asbestos Pile parcel. The horizontal groundwater gradient in the shallow bedrock is from northeast to southwest across the Park parcel, which suggests discharge to Wissahickon Creek. A local gradient also suggests that a component of Site groundwater discharges to Rose Valley Creek. This gradient pattern is typical in the near-creek settings of the region. The shallow groundwater is expected to flow upward toward these discharge points. Multiple groundwater synoptic rounds were conducted as part of the RI field activities; a typical potentiometric map from October 2011 (the latest during the RI) is included as **Figure ES-4**. The Site background monitoring well (MW) (labeled MW-07) was not installed until May 2013; therefore, the water level for MW-07 is not shown on Figure ES-4.

The wet and dry synoptic events, which included all Site monitoring wells, were conducted in July and August of 2014, respectively. The potentiometric maps for these post-RI events are depicted on **Figures ES-5 and ES-6**, respectively. The potentiometric contour maps for both the wet and dry synoptic events include water levels measured at MW-07, the background well located east of the Park parcel. The contours for the more recent synoptic events show the same general northeast to southwest gradient as depicted in Figure ES-4. In the northern part of the Park parcel during the dry event, the gradient is slightly more north to south. Figures ES-5 and ES-6 demonstrate that, in the southern half or deep portion of the Reservoir, the potentiometric surface is above the Reservoir bottom. Contours developed for the wet synoptic event (Figure ES-5) show the groundwater surface

intersecting the Reservoir bottom at an elevation of approximately 182 feet (in an area northwest of MW-04). Contours developed for the dry synoptic event (Figure ES-6) show the groundwater surface intersecting the deepest section of the Reservoir at an elevation of approximately 174 feet. Figures ES-5 and ES-6 suggest that, in the southern half of the Reservoir, communication between surface water and groundwater is likely if a barrier (i.e. a continuously thick and low permeability unit) between the two water types is not present. The location of potential groundwater seepage is influenced by changes in the potentiometric surface due to precipitation.

The overburden groundwater is found both within and below the waste material, but the sporadic occurrences of groundwater in the overburden suggest this water is discontinuous. Perched groundwater was encountered in some borings on the Asbestos Pile parcel. There is the potential that the groundwater surface occurs in the overburden at depths beneath the borings where groundwater was not encountered.

The vertical gradient between the overburden and the shallow bedrock groundwater is slightly downward. However, downward flow is expected to be slowed or prohibited by the clays, silts, and silty and clayey sands that are found immediately above the bedrock. Rather than downward, flow in the overburden is more likely to be horizontal toward Wissahickon Creek.

Reservoir Hydraulics

The surface water in the Reservoir is higher than the surrounding water table; therefore, where there is communication between surface water and groundwater, a surcharge of water is placed on the saturated zone at this surface water body. This additional pressure head is inferred to create a downward vertical gradient beneath the Reservoir, but upward vertical gradients at discharge locations would still be expected. Where the overburden and/or bedrock has a high horizontal to vertical anisotropy ratio, surface water would be expected to follow the pressure gradient from the Reservoir into the overburden and bedrock, with less downward and more horizontal transmission of subsurface flow.

In addition to this downward vertical gradient due to the Reservoir, shallow bedrock groundwater at the east side of the Site does not appear to discharge to the nearby creek (Tannery Run), because the water level in this creek is above the groundwater level measured in the nearby MW-06.

To better understand the hydraulics of the Reservoir, the USACE undertook a water level investigation for EPA as part of a Reservoir Hydraulics and Berm Stability Investigation (USACE 2013). USACE analysis of water level data did not indicate a direct connection between the Reservoir and the shallow groundwater, and anomalies in the groundwater levels were not noted in the Reservoir water level data. With the exception of a few anomalies, all significant water level increases seemed to be directly correlated to rainfall. This correlation indicates that the only significant inflow to the Reservoir is likely to be rainfall (USACE 2013). The USACE also notes that small outfalls into the Reservoir may also act as a source of inflow to the Reservoir, but volumes are not significant enough to be separated or distinguished from noisy background data (USACE 2013). In addition, the Reservoir experiences a slow loss of water between rain events, possibly due to a combination of evaporation and seepage to groundwater (USACE 2013).

In July 2014, CDM Smith conducted a Reservoir temperature study for EPA to determine if there were locations within the Reservoir where inflow of groundwater may be occurring. The detection of cooler

isolated locations of water within a water body could be attributed to a cooler influent, such as groundwater. Groundwater temperatures recorded in Site monitoring wells during previous sampling activities generally ranged between 50 degrees Fahrenheit (°F) to 55°F.

Figure ES-7 illustrates the results of the Reservoir temperature study. The July 2014 Reservoir temperature study was conducted in the pooled water that still remained in the Reservoir after a substantial portion of the Reservoir had been drained as part of the EPA Removal Program effort. Several locations where cooler temperatures were recorded are clustered in the central portion of the study area. The temperature in this cool cluster ranged from 75.2°F to 77°F, which is below the range measured outside the cluster (77.1°F to 81°F) but above the ambient air temperature on the day of the study (72°F). The cooler temperature cluster was also well above the range of temperatures recorded in Site monitoring wells. The shallow depth and relatively small volume of water in the study area could be leading to a relatively quick increase in temperature of influent groundwater, which means that identification of influent groundwater based on temperature could be somewhat masked. Therefore the results of the July 2014 temperature study should be considered in conjunction with recent synoptic events (July and August 2014) and with the data and observations described below.

On August 13, 2014, a Site visit/on-site meeting was conducted at the request of the EPA to investigate the potential of the EPA Removal Program's new stormwater management system (installed adjacent to / in the Reservoir in July 2014) to impact hydraulic conditions in the Reservoir (USACE 2014). Observations, areas inspected at the Site, and discussion that occurred during this meeting are summarized in the *BoRit Superfund Site, Ambler, PA – Trip Report of Flow Paths to the Reservoir* (USACE 2014). **Figure ES-8** highlights Site features and potential sources of inflow to the Reservoir that were discussed during this meeting. The inspection team included personnel from EPA, USACE, the Whitpain Township Public Works Department, and the BoRit EPA Removal contractor. EPA specifically wanted to discuss whether the EPA Removal Program's new stormwater management system could change the future water level of the Reservoir (USACE 2014).

While inspecting the BoRit Reservoir area on August 13, 2014, the existence and extent of the clay layer on the bottom of the Reservoir was discussed. It was noted that, during the excavation of the new pipe outlet pit in the northeast corner of the Reservoir, stiff clay typically was encountered from approximately 0.5 feet bgs to about 3 feet bgs. However, during the August 5, 2014 Reservoir sediment sampling, the clay layer was not encountered in the deeper half at the western, southwestern side of the Reservoir. Two of three auger borings completed in the deeper portion of the Reservoir by USACE were completed to a red silty fine sand overlain by a soft organic silt layer (RVS-33) and a gravelly sand that were overlain by a stiff silt layer (RVS-35). USACE's third auger boring was completed to a stiff silt layer (RVS-32). Boring logs from MW-03 and BOB-2 (located on the Reservoir berm in the southwestern corner of the Reservoir) do not show the presence of a clay layer; rather, there is a granular soil layer over bedrock in these areas. The USACE 2014 Trip Report concludes that, if clay is not continuous under the Reservoir, as the USACE auger borings suggest, it is difficult to explain how the Reservoir maintains a surface water level above the measured groundwater level at locations immediately adjacent to the Reservoir (USACE 2014). The only known Reservoir inflow, in addition to rainfall, is the pipeline along West Maple Street, which was noted to be nearly full of debris and dirt during the trace dye test that was performed by Whitpain Township on April 14, 2014 (USACE 2014). During the trace dye test, dye was injected into the existing American Legion manhole, and it eventually discharged from the existing north vitrified clay pipe (VCP) into the

Reservoir two hours later, after Whitpain Township flushed approximately 4,000 gallons of water into the American Legion manhole (USACE 2014).

In August 2014, the EPA Removal Program completed draining the Reservoir in order to conduct the remaining Removal Program work. On August 12, 2014, after a period of dry weather with no rainfall accumulating in the Reservoir, CDM Smith observed isolated pockets of water in the southern corner of the Reservoir where the Removal Program had drained water from the Reservoir. Water pathways were also visible within the sediment in the southern portion of the Reservoir. EPA observed the accumulation of standing water in the southern corner of the Reservoir after both dry and wet weather (August 20, 2014). The accumulation of water in this area of the Reservoir, which aligns with the area where CDM Smith conducted the temperature study in late July 2014, may be due to groundwater inflow to the Reservoir. Groundwater influence is typically not measurable when the Reservoir is full. When the Reservoir is dry, the surcharge of water placed on the saturated zone at this surface water body and the additional pressure head, inferred to create a downward vertical gradient beneath the Reservoir, are removed, which would then allow for an upward or horizontal inflow of groundwater in areas where geology allows communication. The accumulation of standing water in this area of the Reservoir could also be due to the release of water from sediment pore spaces or the presence of a zone of perched groundwater. Subsequent observations made of the drained Reservoir after July 2014 noted that water continues to collect in the southern portion of the Reservoir, but not at a rapid rate. On January 15, 2015, personnel from EPA's START contractor observed water flowing and accumulating on top of clean cover material and fabric that has been placed on the west side of the Reservoir by the EPA Removal Program. Several possible explanations for this source of inflowing water include the spring located on the west side of the Reservoir adjacent to Wissahickon Creek, the 24-inch North Pipe under West Maple Street, or snow and ice melt (Weston 2015). However the EPA's START contractor did not indicate the direction of the flowing water.

Figure ES-8 also shows an area of standing water in a pit in the northeastern corner of the Reservoir. This area of standing water is located above the polyvinyl chloride (PVC) pipe that extends from the new Reservoir manhole. One theory on the origin of this standing water is that groundwater flows into the old VCP (the "North VCP Pipe") under West Maple Street via cracks in the North Pipe VCP and flows via the North VCP Pipe to the manhole. However the PVC pipe extending from the Reservoir manhole was capped in July 2014 to prevent water from flowing into the Reservoir during draining. The elevation of the standing water in the northeast corner of the Reservoir, coupled with groundwater elevations in the area, suggests that this water could be groundwater coming into the Reservoir through the Reservoir bottom. However, data suggest that a clay layer is present under this portion of the Reservoir, which would limit communication.

Consideration of all the available data and Site observations suggests that, while there is some hydraulic communication between groundwater and Reservoir surface water, it appears that the extent and degree of communication is limited. Groundwater inflow/recharge to the Reservoir can be considered a secondary contributor to the surface water, and surface water outflow to groundwater is sufficiently small as to not be measurable in monitoring wells.

ES.7.3 Floodplain

The Federal Emergency Management Agency (FEMA) identifies geographic areas prone to flood risks or flood hazard zones. Temple University's Center for Sustainable Communities (CSC) recently

prepared a stormwater management plan for urban watersheds in southeastern Pennsylvania (CSC 2014). The plan presents the results of watershed studies conducted to update 1996 FEMA flood hazard zones at the BoRit Site, specifically the 100-year and 500-year floodplains (CSC 2014). The preliminary extent of the 100-year floodplain updated by CSC is shown in **Figure ES-9**. As of January 2014, updated floodplain maps are currently under review by the USACE. CSC's preliminary floodplain maps were generated based on hydrologic and hydraulic models employed to determine peak flows and flood elevations (CSC 2014). The 100-year flood zone was identified to be an area surrounding the three creeks that intersect the BoRit Site: Wissahickon Creek, Rose Valley Creek, and Tannery Run. The northern area of the Asbestos Pile extends into the 100-year floodplain. Relative to the 1996 FEMA maps, recent updates to the 100-year flood zone show the 100-year flood extent increasing in area to surround the entire perimeter of the Reservoir and extending northwest up West Maple Street. The CSC's stormwater management plan for Ambler area watersheds also provides Site-specific recommendations which include channelization for Rose Valley Creek in West Ambler to significantly reduce the 100-year floodplain immediately northwest of the Reservoir parcel. The CSC's stormwater management plan also recommends consideration of flooding and stormwater management issues while EPA remediation efforts continue on the Site (CSC 2014).

ES.8 Sampling Results

ES.8.1 Screening Criteria

The sample analytical results were screened against the following risk-based screening criteria:

- Chemical contaminants in soil, sediment, groundwater, and surface water analytical data were screened against the EPA Region 3 *Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites* (EPA 2013). RSLs are conservative values developed using EPA Superfund risk assessment guidance and are generic, i.e., they are calculated without site-specific information. RSLs are compared to maximum site concentrations for the purpose of determining which chemicals should be evaluated further in the HHRA. RSL exceedances do not necessarily indicate the presence of unacceptable risk; they are used to help identify areas, contaminants, and conditions that require further attention. Groundwater data were screened against tap water RSLs. Soil data was screened against residential soil RSLs. Groundwater and soil cancer RSLs were used as presented on the RSL table (corresponding to a 1E-06 risk level). Groundwater and soil non-cancer RSLs were adjusted (divided by 10 to obtain a hazard quotient [HQ] =0.1) to account for the assumption of multiple chemicals with non-cancer toxicity values based on the same toxic endpoint. Groundwater and soil non-carcinogen Oak Ridge National Laboratory [ORNL] criteria were adjusted (divided by 10) to account for any additive effects. Sediment and surface water data were screened against a value 10 times the soil or tap water RSLs to account for the presumed lower exposure to these media;
- Dioxin total toxicity equivalent quotients (TEQs) are based on the 2005 World Health Organization scheme. For dioxins detected in soil, the total TEQ was compared to the RSL for 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD);
- Soil data for asbestos were screened against criteria in EPA's Office of Solid Waste and Emergency Response (OSWER) *Framework for Investigating Asbestos-Contaminated Superfund Sites*, dated September 2008 (EPA 2008). Soil samples were screened to 1 percent asbestos. The 1 percent threshold is used in Occupational Safety and Health Administration (OSHA) regulations (29 CFR 1910.1001) and in EPA NESHAP to define ACM. The 1 percent screening value is not a risk-based value; studies have shown that soil with less than 1 percent asbestos can release sufficient asbestos

fibers to air to present a risk to human health (EPA 2008). ABS air samples were screened against a preliminary remediation goal (PRG) of 0.04 fibers/cubic centimeters (f/cc) calculated by the EPA Region 3 toxicologist specifically for a raking/lawn maintenance scenario at the BoRit Site. This PRG was used to screen all personal ABS air data;

- The EPA Region 3 toxicologist also provided a screening level of 0.001 f/cc asbestos for ambient air (EPA 2012). This screening level is derived based on an assumed exposure (time weighting factor [TWF] = $24/24 \times 350/365 = 0.96$). The starting age of exposure is assumed to be birth (0 years), with an exposure duration of 30 years. Thus, the resulting age-dependent and duration-dependent inhalation unit risk (IUR) is 0.17 risk per fibers/cc. This ambient air residential screening level is based on a target cancer risk of $1\text{E-}04$ (EPA 2008); and
- The EPA's National Recommended Water Quality Criteria (NRWQC) includes the 7 MFL drinking water MCL as a surface water quality criteria for asbestos for the protection of human health (EPA 2015). Although the Reservoir does not serve as a drinking water source, the NRWQC was used as a screening level for the Reservoir surface water.

It should be noted that chromium exceedances may be due to the relatively low value of the RSL, which is a risk-based value based on the toxicity of the most toxic species of chromium, hexavalent chromium. Speciation studies were not conducted on the chromium found in BoRit soil, waste, groundwater, and surface water samples; however, it is not likely that all of the chromium in these samples is hexavalent chromium.

Asbestos and groups of chemical analytes detected in various Site media are shown on **Table ES-1**. Groups of chemical analytes present above screening values are also indicated on this table.

ES.8.2 Summary of Park Parcel Contamination – Waste, Soil, and Air

Significant investigation findings of Park parcel media include the following:

- ACM waste up to 13 feet deep was found across the Park parcel covered with an average of 0.8 feet of surface soil in all but one direct push boring (98 percent). No native soil samples below the waste contained more than 1 percent asbestos; generally, concentrations of asbestos decreased two orders of magnitude from the waste layer to the native soil;
- Although surface soil samples collected from planned ABS locations, prior to performing ABS, contained less than the soil screening level (1 percent) for asbestos, the air samples collected during ABS exceeded EPA's defined Site-specific ABS PRG of 0.04 f/cc (EPA 2011);
- In addition to asbestos, the Park Parcel waste was found to contain volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) (mostly polynuclear aromatic hydrocarbons [PAHs] and phthalates) at concentrations above the RSLs (EPA 2013). The number and concentrations of VOCs and SVOCs decrease sharply in the native soil samples, indicating that these organic contaminants were most likely deposited with the waste. The highest concentrations of PAHs were associated with a bucket of tar-like material found in one boring. Low levels of pesticides were present in all Park parcel media at levels well below the RSLs; and
- Inorganics exceeding the soil screening levels at the Park parcel include: aluminum, arsenic, cobalt, iron, lead, manganese, mercury, nickel, and vanadium. Aluminum, lead, and nickel were

more commonly found in waste samples; however, they were observed at lower concentrations in the cover soil layer above the waste and in the native soil layer below the waste.

ES.8.3 Summary of Reservoir Parcel Contamination – Waste, Soil, Air, Surface Water, Seep Water, and Sediment

Significant investigation findings of the Reservoir parcel media include the following:

- The ACM waste is found in the berm of the Reservoir. Visible ACM was found in all direct push and hand auger borings in the Reservoir berm, except those along West Maple Street and isolated locations on the southern corner of the Reservoir and mid-way along the south side of the Reservoir. One native soil sample contained asbestos above 1 percent, which is assumed to be contamination from surrounding waste;
- Organic compounds that exceeded the soil RSLs included PAHs in surface soil, cover/waste interface samples, and waste samples. There were no organic compounds at concentrations above RSLs in the native soil samples;
- Inorganics exceeding the soil screening levels in soils at the Reservoir parcel include: aluminum, antimony, arsenic, cobalt, chromium, copper, iron, lead, manganese, mercury, vanadium, and zinc;
- Asbestos was detected in nine Reservoir surface water samples collected from four locations at concentrations ranging from 1.9 MFL to 640 MFL. Three Reservoir surface water locations had asbestos concentrations greater than the screening level of 7 MFL;
- Asbestos was detected in the seep samples at concentrations ranging from 1.5 MFL to 5.1 MFL;
- Three unfiltered surface water samples from the Reservoir exceeded the surface water screening levels for inorganics including arsenic, chromium, and lead;
- No organic compounds exceeded the screening levels for surface water at the Reservoir;
- While asbestos was found in 14 Reservoir sediment samples, no sediment samples exceeded the asbestos screening level of 1 percent. In 2014, Reservoir bottom sediment was re-sampled at or near the previously sampled locations after the Reservoir had been drained as part of EPA Removal Program work at the Site. Sample results ranged from 0 to 0.75 percent asbestos;
- Three sediment samples collected from the southeast part of the Reservoir exceeded the screening level for one PAH (benzo(a)pyrene). For the 2014 Reservoir sediment investigation sediment samples, four VOCs (including 2-butanone (MEK), 4-methyl-2-pentanone (MIBK), acetone, and carbon disulfide) and two SVOCs (diethyl phthalate and dimethyl phthalate) were detected. However no organic compounds exceeded their respective screening levels;
- Inorganics exceeding the soil screening levels for sediment at the Reservoir include: arsenic, chromium, and vanadium: For the 2014 Reservoir sediment investigation sediment samples, chromium and arsenic were the only compounds to exceed soil screening levels; and
- The surface soil collected at the ABS location prior to performing ABS did not exceed the soil screening level (1 percent) for asbestos. The air samples collected during the ABS scenario did not exceed the Site-specific ABS PRG of 0.04 f/cc.

ES.8.4 Summary of Asbestos Pile Parcel Contamination – Waste, Soil, and Air

Significant investigation findings of the Asbestos Pile parcel media include the following:

- The Asbestos Pile itself is composed of ACM waste, with the ACM waste present on the edges of the Asbestos Pile parcel occurring in thin layers. Asbestos exceeded the soil screening level of 1 percent in 73 percent of the soil samples. The average thickness of the waste material is 16.6 feet; however, 40.5 feet of ACM were encountered in the north central part of the Pile. In the majority of the Asbestos Pile, no cover material existed above the ACM prior to EPA Removal Program activities;
- PAHs exceeded the soil RSLs in soil characterization borings throughout all subareas of the Asbestos Pile parcel;
- Inorganics exceeding the soil screening levels include: aluminum, arsenic, cobalt, iron, lead, manganese, nickel, and vanadium. Minimal differences were noted between inorganic analytical data from the cover, waste, and native soil samples within a single boring;
- Surface soil samples collected beneath fallen electrical transformers contained one polychlorinated biphenyl (PCB), aroclor-1260, in two of the three surface soil samples. One PCB detection exceeded the RSL;
- Samples from the fire training area contained six PAHs at concentrations exceeding their respective RSLs;
- The dioxin TEQ in each fire training area sample exceeded the RSL of 4.5 nanograms per kilogram (ng/kg);
- The soil samples from two slag area locations had asbestos detections below the screening level, five PAHs exceeding the respective RSLs, and dioxin TEQ exceeding the respective RSL;
- Slag area soils contained aluminum, arsenic, chromium, iron, manganese, and thallium at concentrations greater than respective RSLs; and
- All surface soil samples collected from Asbestos Pile parcel ABS scenario locations prior to performing ABS contained asbestos at levels greater than the soil screening level of 1 percent. Air samples collected during each ABS scenario conducted at the Asbestos Pile parcel exceeded the Site-specific ABS PRG of 0.04 f/cc.

ES.8.5 Summary of Site Groundwater Contamination

Asbestos was detected in samples from five of the six on-site groundwater monitoring wells, and all concentrations were less than the MCL of 7 MFL. Note that the upgradient off-site monitoring well MW-07 was installed in May 2013, which was after the sample collection for asbestos analysis had been conducted in February 2013. No groundwater samples for asbestos analysis were collected when MW-07 was sampled in May and July 2013 because asbestos was already established as a Site-related contaminant.

Organic compounds found in groundwater at concentrations exceeding the RSLs were also found in the ACM waste material. Fifteen of the sixteen VOCs detected in groundwater samples were found in two of the on-site wells. Of these compounds, 1,2,3-trichlorobenzene, carbon tetrachloride, chloroform, tetrachloroethene (PCE), and trichloroethene (TCE) were found at concentrations exceeding the respective RSLs in well PK-MW02PK, located at the southwest corner of the Park parcel.

All of the compounds exceeding RSLs are common solvents used for many industrial processes. Three of these compounds (carbon tetrachloride, PCE, and TCE) were also found in the upgradient off-site monitoring well MW-07 at concentrations that exceed the RSLs and also at concentrations greater than the on-site wells. One VOC found in Site groundwater, trichlorofluoromethane (CFC-11), was not detected in any soil sample or in the upgradient off-site monitoring well.

PAHs, found above soil RSLs in many samples, were not detected in the upper bedrock aquifer monitoring wells. One SVOC, bis(2-ethylhexyl)phthalate, was detected in groundwater at concentrations above the RSL for one round of sampling only (November 2010). This compound was also detected in Site surface soil and ACM waste samples.

No pesticides or PCBs were detected in shallow bedrock groundwater samples.

Total and dissolved metals and cyanide were analyzed in monitoring well groundwater samples. Inorganics that exceeded the RSLs in both total and dissolved metal samples included barium, cobalt, thallium, arsenic, manganese, and cadmium. Inorganics that exceeded the RSLs in total metal samples included cyanide, chromium, vanadium, aluminum, and iron. The only inorganic that exceeded its respective RSL exclusively for dissolved metal samples was selenium.

ES.8.6 Summary of Site Creeks Contamination

Asbestos was not detected in sediment from heavy depositional areas, i.e., those with greater than 6 inches of sediment, in Wissahickon Creek; however, asbestos was detected at levels below the screening level of 1 percent in normal depositional areas (less than 6 inches of sediment). No asbestos was detected in sediment from Rose Valley Creek or Tannery Run.

Although two VOCs were detected in Wissahickon Creek sediment, both were found at concentrations below RSLs. Several SVOCs were detected in sediment from each creek; however, only benzo(a)pyrene exceeded the screening level in sediments from each of the three creeks. An upstream sample in Wissahickon Creek also contained benzo(a)pyrene at concentrations exceeding the RSL, indicating a potential upstream source for SVOC contamination.

Pesticides were found in sediments from the three creeks; none exceeded RSLs. PCBs were detected in Wissahickon Creek sediments and Rose Valley Creek sediments; however, no PCBs were detected above RSLs.

Three metals (arsenic, chromium, and manganese) exceeded the soil RSLs in Wissahickon Creek sediment samples. Chromium concentrations exceeded the RSL in all samples. One of the samples that exceeded the arsenic RSL was the upstream sample, indicating that an upstream source for arsenic may exist, or naturally-occurring concentrations of arsenic exceed RSLs.

Asbestos was detected in four surface water samples from Wissahickon Creek, exceeded the NRWQC of 7 MFL for surface water from two locations. Asbestos was not detected in surface water from Rose Valley Creek or Tannery Run.

Seven VOCs were detected in Wissahickon Creek surface water, and one VOC was detected in Rose Valley Creek and Tannery Run surface water. None of the VOCs were detected at concentrations above the surface water screening levels.

Three SVOCs, all PAHs, were detected in one surface water sample from Wissahickon Creek. Concentrations of dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene exceeded the RSLs. No SVOCs were detected in surface water from Rose Valley Creek or Tannery Run.

One pesticide was detected in surface water from each creek. None of the pesticide concentrations exceeded screening levels.

The total chromium concentration in surface water samples from Wissahickon Creek and Tannery Run exceeded the screening level. Note that the RSL for chromium is based on hexavalent chromium (i.e. Cr⁺⁶), a more toxic form of chromium than is expected to be present in surface water at the Site.

ES.8.7 Summary of Site Floodplain Soil Contamination

No shallow floodplain samples (0 to 3 inches) contained more than the screening level of 1 percent asbestos; three soil samples collected from the deep floodplain soils (6 to 24 inches) exceeded 1 percent asbestos. Asbestos was not detected above the screening level of 1 percent on the west side of Wissahickon Creek or in creek banks following EPA's Removal Program bank stabilization. The higher concentrations of asbestos in the deeper samples at these locations indicate that material deposited during more recent flooding events contained less asbestos.

Four feet of asbestos waste were encountered in the Tannery Run bank boring; although, the grab sample of the waste did not contain greater than 1 percent asbestos. The vertical extent of the waste in this location was not determined; however, subsequent to sampling, the stream bank was stabilized as part of EPA's Removal Program activities.

Inorganics exceeding the RSLs in floodplain soils included aluminum, arsenic, chromium, cobalt, iron, manganese, and vanadium.

Shallow floodplain samples contained five PAHs at concentrations exceeding soil RSLs. The highest concentrations of PAHs were in the most upstream floodplain samples. Three PAHs were also detected at concentrations exceeding RSLs on the west side of Wissahickon Creek.

ES.8.8 Summary of Off-Site Air Sampling for Asbestos

All ABS and ambient air samples were analyzed by transmission electron microscopy (TEM), which can classify particles according to mineral type. However, the toxicity data used as the basis of the asbestos inhalation unit risk value are based on analyses performed using phase contrast microscopy (PCM), which can only classify particles by size and shape (i.e. PCM cannot differentiate asbestos from non-asbestos nor can PCM differentiate different types of asbestos). Thus, TEM analysis results are reported as PCM-equivalent (PCME) structures per cubic centimeter (s/cc), which is equivalent to PCM f/cc to ensure comparability to the toxicity data. PCME is deemed equivalent because, similar to PCM, it only includes structures greater than 5 micrometers (µm) in length, with a width greater than or equal to 0.25 µm, and an aspect ratio (length:width) greater than or equal to 3:1. All ABS and ambient air concentrations discussed within this RI Addendum Report are reported as PCME.

ABS: Residential Areas and Walking Trails

No residential 30-point composite soil samples collected from residential ABS locations, prior to performing ABS, exceeded the soil screening level (1 percent) for asbestos. Additionally, no personal

or perimeter air samples collected during any residential raking/lawn maintenance ABS contained asbestos above the Site-specific ABS PRG of 0.04 f/cc.

No walking trail 30-point composite soil samples collected from walking trail ABS locations, prior to performing ABS, exceeded the soil screening level (1 percent) for asbestos. Additionally, no personal or perimeter air samples collected during the walking trail ABS activities contained asbestos above the ABS PRG of 0.04 f/cc.

Ambient Air

Ambient air samples were collected at least monthly at seven locations outside the perimeter of the Site from November 2010 to October 2011. Asbestos was detected well below the Site-specific ambient air PRG of 0.001 f/cc (EPA 2012) at two locations (0.00075 and 0.00079 s/cc) and just above the PRG at a third location (0.0012 s/cc) over the course of monthly sampling. No repeated detections of asbestos occurred at any of the locations.

It should be noted that Sample CM01-AA-HD12, which included the asbestos concentration just above the PRG, was collected in September of 2011. Sample CM01-AA-HD12 was collected on the west bank of Wissahickon Creek directly across from the western corner of the Reservoir. Based on EPA Removal Program Reports, activities conducted on the Site during September 2011 included stream bank stabilization of Wissahickon Creek adjacent to the Asbestos Pile, excavation of ACM on the Asbestos Pile, and Rose Valley Creek Reconstruction. EPA Removal Program efforts on the Asbestos Pile included clearing of vegetation and excavation of material on the front side of the Pile near West Maple Street. During excavation, ACM waste was relocated to different areas on the Asbestos Pile to establish the desired subgrade prior to application of geotextile, clean fill, and topsoil. The slight exceedance of asbestos ambient air PRG at location CM01-AA-HD12 is most likely associated with these EPA Removal Program excavation activities on the Site.

ES.8.9 Summary of Background Soil

Background surface soil was collected from ten locations, assumed to be outside of the influence of Site activities. These background soil samples were analyzed for SVOCs and metals. The analytical data were evaluated to provide a benchmark of concentrations of naturally-occurring and anthropogenic contaminants. Fifteen SVOCs were detected in background soil samples. Only dimethyl phthalate was detected in all ten samples. All of the other organic compounds were detected in four or fewer samples. The maximum concentrations of all PAH compounds detected were from a single sample. The average concentrations of five of the PAHs exceeded the respective RSLs: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

Twenty-one metals were detected in background surface soil samples. Metals that exceeded the respective soil RSLs included aluminum, arsenic, chromium, cobalt, iron, and manganese. It should be noted that, although arsenic was detected above the RSL observations of this naturally-occurring inorganic in background (and on-site) soil samples fall within the range that would be expected for the northeastern United States (Shacklett and Boerngen 1984).

ES.8.10 Summary of Background Groundwater

Industrial areas can pose a challenge to determining background levels. Ambient conditions may include elevated concentrations of common contaminants from sources not associated with the Site.

For example, some common contaminants in background samples in industrial and urban areas include elevated levels of metals in soils and TCE and PCE in urban aquifers. In addition, as described earlier, metals also occur as constituents of minerals and can be present in non-impacted soils at concentrations greater than the RSLs and could therefore also be present at elevated levels in associated groundwater.

One upper bedrock groundwater monitoring well (MW-07) was installed off the Site as an up-gradient well to represent conditions not impacted by historical Site activities. MW-07 was installed during the RI to provide context to the constituents found on the Site in groundwater from that aquifer.

Eight metals were detected in at least one sample from MW-07: barium, calcium, magnesium, sodium, chromium, lead, and zinc. Only chromium, found in one sample, was detected at a concentration above the RSL. Note that the RSL for chromium is based on hexavalent chromium (i.e. chromium⁺⁶), a more toxic form of chromium than is expected to be present in groundwater at the Site.

Five organic compounds were detected in samples collected from MW-07: carbon tetrachloride, cis-1,2-dichloroethene (cis-1,2-DCE), PCE, TCE, and methyl tert-butyl ether (MTBE). Four organic compounds detected in samples from both sampling events (carbon tetrachloride, cis-1,2-DCE, PCE, and TCE) were detected at concentrations that exceeded the RSLs.

ES.9 Updated Conceptual Site Model

A CSM essentially tells the story of when and where a site was contaminated, what media were affected, where the contamination migrated (pathways), and who and what is or can be potentially harmed from the contamination (receptors). In addition, a CSM provides a framework for assessing risks from contaminants, developing remedial strategies, determining source control requirements, and identifying methods to address unacceptable risks. Development of the CSM is an evolving process; as more is learned about the site, the CSM is modified to reflect that knowledge. A CSM has been developed for the BoRit Site based on the Site's history (e.g., past uses), physical characteristics (e.g., topography and hydrogeology), and results of various investigations. **Figure ES-10** presents a flow diagram of the CSM that illustrates potential migration of contaminants from source material to receptors for consideration in the development of remedial alternatives.

ES.9.1 Asbestos

ES.9.1.1 Primary Source

Asbestos is the dominant environmental concern at the BoRit Site. The primary source of contamination, most significantly the chrysotile asbestos-containing waste, comprises the waste layer and contaminated soil found in the Park parcel, the berm of the Reservoir parcel, and the pile area of the Asbestos Pile parcel. The asbestos contamination is the result of historical disposal practices at these three Site parcels.

ES.9.1.2 Primary Release/Transport Mechanisms

The primary release/transport mechanisms for the ACM and soil contamination include dust-re-suspension and surface runoff. Although many areas of landfilled waste were at one time covered by fill/soil, that cover has eroded in some areas. In summary, several asbestos-containing areas across the Site are not covered, and, therefore, re-suspension and runoff mechanisms exist.

ES.9.1.3 Exposure Media

Air is the primary exposure medium of asbestos released via dust re-suspension. Results of the ABS raking scenarios performed at the Park and the Asbestos Pile parcels indicate that, even when the soil concentration of asbestos is less than 1 percent, the ABS activity can release sufficient asbestos to air to exceed the Site-specific ABS PRG for air. Once disturbed and airborne, asbestos fibers will be transported through advection of air currents until they settle.

The primary exposure media for asbestos transported via surface runoff include soil, surface water, and sediment.

Asbestos was found in the surface water and sediment of Wissahickon Creek, indicating that asbestos fibers were directly eroded by normal or flood stream flow or adsorbed to fine particles that were eroded from upland areas and washed into the creeks via precipitation surface run-off.

As in air, the asbestos fibers in water will travel downstream with the currents until they can settle out. During flooding events, sediment with entrained asbestos fibers can be re-distributed and washed into floodplain soils. Concentrations of asbestos were found to be higher in deep floodplain soils than in shallow floodplain soils, indicating that, over time, less asbestos has been deposited during flooding events. Asbestos fibers deposited in the floodplain during flooding events could become airborne if disturbed after the floodplain soil has dried.

A related transport mechanism/pathway that can occur at the BoRit Site is the release of asbestos fibers from the sediment at the Reservoir bottom to Reservoir surface water after the sediment has been disturbed. Examples of sediment-disturbing activities include re-filling the Reservoir after it has been drained or has otherwise dried out, impact of the natural freeze-thaw cycle, and aquatic animal activities.

To evaluate the potential impact of sediment-disturbing activities on the release of asbestos from Reservoir sediment into Reservoir surface water, a bench study was conducted in August 2014.

Figure ES-11 presents the results of that bench study. The EPA's NRWQC includes the 7 MFL drinking water MCL as a surface water quality criteria for asbestos for the protection of human health (EPA 2015). Although the Reservoir does not serve as a drinking water source, the NRWQC was used as a screening level for the Reservoir surface water. The Reservoir bench study results demonstrate that, even when asbestos concentrations in sediment are less than the 1 percent screening level (EPA 2008), a disturbance of the sediment results in surface water concentrations that exceed the MCL for an extended period of time. Overall, the Reservoir bench study demonstrated that surface water asbestos concentrations exceeded the 7 MFL MCL immediately following the disturbance activity and decreased overtime but asbestos concentrations remained above the MCL at the conclusion of the Reservoir bench study.

In addition to transport to soil, surface water, and sediment via surface runoff, asbestos can be transported to groundwater. Low levels of asbestos in five Site shallow bedrock aquifer monitoring wells indicate that asbestos fibers can flow with groundwater through the bedrock fractures. The detections of asbestos in Site groundwater were below the MCL. Because the Site groundwater velocities are very low, the transport of asbestos fibers in the Site groundwater is minimal. At the Site, much of the bedrock is overlain by silty and clayey sands, silts, and clays that are likely inhibiting the migration of asbestos to groundwater in the bedrock aquifer.

The possibility of hydraulic communication between groundwater and Reservoir surface water could potentially suggest a pathway to pass asbestos contamination between Site groundwater and surface water. However, the limited extent of that communication, coupled with the low concentrations of asbestos detected in Site groundwater, indicates that this is not a significant transport mechanism/pathway for asbestos at the Site.

ES.9.1.4 Exposure Receptors

Future use plans for the Park parcel include a public park and open space (RR&M 2014). The Wissahickon Waterfowl Preserve (WWP) plans to maintain ownership of the Reservoir parcel and Asbestos Pile and continue to use the property as a waterfowl preserve. Based on the current and potential future land use (recreational, nonresidential), people who are most likely to be exposed to asbestos via air inhalation include:

- On-site maintenance workers maintaining each of the BoRit Site parcels;
- On-site commercial workers carrying out activities associated with developing/maintaining recreational use of the BoRit Site parcels; and
- On-site recreational users.

Potential ecological receptors include both terrestrial and aquatic receptors.

ES.9.2 Non-Asbestos Contaminants

ES.9.2.1 Primary Source

Other contaminants detected in the ACM waste include VOCs, SVOCs, pesticides, and metals. In addition, three specific potential sources of contamination were investigated. These consisted of the fire training area on the Asbestos Pile parcel, the former transformers on the Reservoir and Asbestos Pile parcels, and the slag area on the Asbestos Pile parcel. The presence of dioxins was observed at the fire training area, and PCBs were noted at the location of the transformers.

ES.9.2.2 Primary Release/Transport Mechanisms and Exposure Media

The primary release/transport mechanism for the non-asbestos contamination present in ACM and soil is surface runoff. Primary exposure media include soil, groundwater, surface water, and sediment.

VOCs

Because VOCs are present below the land surface, surface water run-off is not an issue. However, VOCs are highly mobile and would be expected to dissolve in precipitation that infiltrates the waste and travel with the infiltrating water to the native soils and groundwater below. VOCs were found consistently in one onsite shallow bedrock monitoring well, MW-02. The source of the nine VOCs found in one or more sample from this well may be the waste in the Park parcel, as this well is located on the downgradient edge of the parcel. However, samples from MW-07, an upgradient off-site well that was installed and sampled twice during the RI, had detections of five of those same VOCs: carbon tetrachloride, cis-1,2-DCE, MTBE, PCE, and TCE. These VOCs detected in MW-07 were found at low concentrations in on-site soil/waste; however, due to the elevated concentrations found in groundwater, on-site soil/waste are not believed to be a large contributor to contamination in the shallow bedrock aquifer.

The groundwater discharges to the creeks, and seven VOCs were detected in the surface water of Wissahickon Creek and one VOC was detected in the surface water of Rose Valley Creek and Tannery Run. The presence of VOCs in creek water may also be from upstream sources. One VOC, TCE, was detected in the most upstream surface water sample collected from Wissahickon Creek approximately 500 feet north of the Site boundary. VOCs dissolved in the surface water can be expected to volatilize and travel downstream with the surface water; they do not easily partition to the fine-grained mineral or organic sediments.

SVOCs

SVOCs generally adsorb to soil and organic material and therefore do not easily desorb with infiltrating precipitation. SVOCs in surface soil and waste can erode from the upland areas and enter streams adsorbed to fine-grained soil and organic matter. Because SVOCs have high partition coefficients, the contaminants will likely adsorb onto particles and remain on the particles and then settle out at depositional areas downstream. SVOCs were found in all the creek sediment samples. However, the source of SVOCs in Site creek sediments could be upstream sources on the creeks, including road and parking area runoff. Benzo(a)pyrene was the only SVOC in sediments that exceeded the RSL, and it was found in the upstream sample at a concentration of 540 milligrams per kilogram (mg/kg). This concentration is higher than some of the samples collected adjacent to the Site. Similarly, more PAHs were found above RSLs in the surface soils at the Park and Asbestos Pile parcels than in the wastes in those parcels. Additionally, concentrations of SVOCs were higher in the surface soil than in the waste at the Asbestos Pile parcel. It is likely that some of the PAHs in the surface soils on all parcels are due to deposition of airborne products of off-site combustion, as PAHs were also found in background surface soil samples. This airborne off-site source would explain the higher PAH concentrations in the surface soils than in the wastes and native soils.

Pesticides/PCBs/Dioxins

Pesticides do not dissolve easily, and they adhere to fine-grained and organic material. Pesticides were found at low levels in native soils, surface water from all surface water bodies, and turbid overburden groundwater; however, pesticides were not detected in groundwater samples from bedrock monitoring wells. Pesticides present in waste material and cover soil of upland areas will adsorb to fine-grained particulate matter and migrate on the particle via runoff and overland flow to the Reservoir and creeks. However, pesticides were found in similar numbers and concentrations in upstream sediment samples. The ubiquitous presence of pesticides suggests their presence may not be attributable to the waste material disposed on the Site.

Surface soil samples collected near the former electrical transformers indicated that PCB contamination at those locations is limited, because only one RSL exceedance was observed. Although deeper samples were not collected in the area where the PCB concentration exceeded the RSL, the tendency for PCBs to adsorb to fine-grained material and the generally low PCB concentrations detected in surface soils do not suggest the likelihood of extensive vertical migration of PCBs.

Dioxin was detected in soil samples collected from the fire training areas and the slag area on the Asbestos Pile parcel. Concentrations detected in the deepest soil investigated at these locations (6" to 24") exceeded RSLs. However, dioxins are not considered to be highly mobile in soil because they can

adsorb to organic material and fine-grained material (silts and clays). Therefore, extensive vertical migration of dioxins in these areas would not be expected.

Metals

As noted previously, metals were detected in the ACM waste. However, metals also occur as constituents of minerals and can be present in non-impacted soils at concentrations greater than the RSLs. Six metals were found in soil on the Site as well as background surface soil samples at concentrations exceeding RSLs: aluminum, arsenic, chromium, cobalt, iron and manganese. A non-statistical comparison of the suite of metals and the ranges of concentrations of metals in the different soil strata at the Site was conducted to evaluate whether the waste layer was a potential source of metals to the environment. The following observations were made:

- The highest aluminum concentration on each parcel (other than from the slag area on the Asbestos Pile parcel, discussed, below) was detected in a waste sample from that parcel. Concentrations of aluminum in the waste samples at the Asbestos Pile and Reservoir parcels were only modestly higher than those from other strata;
- The maximum chromium concentration on each parcel was detected in a waste sample;
- In general, chromium concentrations across all strata were highest at the Asbestos Pile parcel;
- Some metals were found at concentrations exceeding the RSLs in wastes samples: nickel and zinc (Park parcel), antimony and copper (Reservoir parcel) and copper (Asbestos Pile parcel);
- On the Asbestos Pile parcel, nickel exceeded the RSL in surface soil, waste and native soil; and
- Mercury was only detected above the RSL in surface soil samples (from the Park and Reservoir parcels).

Based on these observations, the disposed waste may be a source for aluminum, antimony, chromium, copper, nickel, and zinc.

Metals will generally adsorb to fine-grained and organic materials, although their solubility and potential to precipitate are commonly a function of redox and pH conditions. To some extent the presence of metals in the groundwater samples appears to correlate to the turbidity (presence of particulates such as clay). For example, in MW-04, concentrations of aluminum exceeding the RSL are likely due to naturally-occurring aluminum present in clay particles present in the unfiltered, turbid sample. Similar patterns can be seen in the concentration of other metals in MW-04 (arsenic and vanadium) where arsenic and vanadium were only detected in the most turbid samples. MW-02 also shows some correlation between higher concentrations of metals and turbidity.

ES.9.2.3 Exposure Receptors

Based on the current and potential future land use (recreational, nonresidential) at the Site, the people who are most likely to be exposed to Site-related chemical contaminants via ingestion or dermal contact with soil, sediment, or surface water include:

- On-site maintenance workers maintaining each of the BoRit Site parcels;
- On-site commercial workers carrying out activities associated with developing/maintaining recreational use of parcels comprising the BoRit Site; and
- On-site recreational users.

While groundwater is included as a potential exposure media in the CSM, the Pennsylvania Department of Health (PDH) concluded that Site groundwater does not currently influence public drinking water sources. In addition the potential future land use of the Site is considered recreational and non-residential. Therefore, groundwater exposure routes and potential receptors were not included in the CSM diagram (Figure ES-10).

Potential ecological receptors include both terrestrial and aquatic receptors.

ES.10 Risk Assessment

As part of the RI/FS, CDM Smith conducted a HHRA and a SLERA to characterize the potential risk to human and ecological receptors, respectively, associated with Site media in the absence of any remedial action (CDM Smith 2013b).

ES.10.1 Human Health Risk Assessment

The potential human health cancer risk from asbestos and cancer and non-cancer risks from chemicals are summarized in **Table ES-2**.

ES.10.1.1 Asbestos

The potential receptors evaluated for risk from asbestos on the three on-site exposure areas (Park parcel, Asbestos Pile parcel, and Reservoir parcel), and off-site areas are as follows:

On-site:

- Current/Future Maintenance Worker at all three exposure areas;
- Future Recreational Visitor at all three exposure areas; and
- Future Commercial Worker at the Park parcel and Asbestos Pile parcel exposure areas.

Off-site:

- Current/Future Residents and
- Current/Future Recreational Visitor.

Asbestos was detected in all surface soil samples collected for ABS scenarios. Human health risks from asbestos were based on exposures to asbestos in ABS air during soil disturbance activities. Risks were also calculated based on exposures to asbestos in ambient air. Only the surface soil samples collected from the Asbestos Pile parcel contained asbestos greater than the 1 percent screening level. With the exception of the Asbestos Pile parcel and the Park parcel, cancer risks are below one in ten thousand (1E-04) for all exposure areas and receptors.

For the Asbestos Pile parcel and the Park parcel, cancer risks are at or above 1E-04 for the maintenance worker. These results suggest that, if maintenance workers frequently engage in active soil disturbance activities within these two Site parcels, the resulting asbestos concentrations in air have the potential to result in unacceptable cancer risks.

Asbestos in soil in off-site areas was only detected in one residential yard and at the walking trail, downstream of the Site. The ABS air results for soil disturbance activities at off-site areas indicate that exposure to asbestos, when present, is not likely to result in unacceptable risks.

EPA has not yet developed national guidance for evaluating the risk of non-cancer effects from inhalation exposure to asbestos. Therefore, no quantitative evaluation of non-cancer risks from airborne asbestos exposure could be performed.

ES.10.1.2 Organics and Inorganics

The HHRA concluded that there are several chemicals detected in Site media that are at levels that may have adverse effects to human receptors. They are:

- PAHs in surface water from Wissahickon Creek - risks to the current/future recreational user (swimmer) exposed to contaminated surface water using reasonable maximum exposure (RME) values exceeded EPA's target cancer risk range of 1E-04 to 1E-06 for benzo(a)pyrene and indeno(1,2,3-cd)pyrene. When a more typical exposure is considered under the central tendency exposure (CTE) scenario, risks to the swimmer still exist due to exposure to both PAHs.
- PAHs, pesticides/PCBs, and metals in sediment from Wissahickon Creek – risks to the current/future recreational user (swimmer) and fisher exposed to contaminated sediment using RME values exceeded EPA's target cancer risk range of 1E-04 to 1E-06 for benzo(a)pyrene for both receptors and aldrin, dieldrin, aroclors 1254 and 1260, arsenic, and chromium for the fisher. When a more typical exposure is considered under the CTE scenario, risks to both receptors still exist and are driven by exposure to benzo(a)pyrene for the swimmer and to dieldrin, aroclor-1254, arsenic, and chromium for the fisher. Non-cancer hazards also exist under the RME and CTE scenarios for the fisher, and they are driven by dieldrin exposure.
- VOCs, SVOCs, and metals in the shallow bedrock aquifer – cancer risks to the hypothetical future residential receptor exposed to contaminated tap water originating from the shallow aquifer using RME values exceeded EPA's target cancer risk range of 1E-04 to 1E-06. Compounds that contribute to this risk include carbon tetrachloride, chloroform, PCE, TCE, bis(2-ethylhexyl)phthalate, arsenic, and chromium. When a more typical exposure is considered under the CTE scenario, risks drop to within EPA's target risk range. Non-cancer hazards also exist under the RME scenario, and they are associated with aluminum, arsenic, manganese, thallium, vanadium, and PCE. When a more typical exposure is considered under the CTE scenario, the hazard index (HI) still exceeds EPA's acceptable threshold of unity (one) for target organs potentially affected by exposure to PCE, manganese, and thallium.

Cancer risks and non-cancer hazards were within or below EPA's acceptable target risk range or at or below EPA's target threshold, respectively, for receptor exposure to:

- sediment and surface water from Tannery Run, Rose Valley Creek, and the Reservoir parcel and
- Site-wide soils.

A number of uncertainties arise during the process of estimating human exposure and risk to asbestos and chemicals which limit the confidence in the risk conclusions. These uncertainties should be considered when making risk management decisions for the Site.

ES.10.2 Screening Level Ecological Risk Assessment

CDM Smith conducted a SLERA to evaluate the potential for ecological risks from asbestos and chemicals to environments present within the study area at the Site in the absence of any remedial action (CDM Smith 2013b). Prior to performing the assessment, CDM Smith contacted the United States Fish and Wildlife Service (USFWS) and Commonwealth of Pennsylvania (PA) agencies to identify threatened and endangered species that may exist at or near the Site. The USFWS reported that there were no known occurrences of any federally listed or sensitive environments at the Site or surrounding areas. The Pennsylvania Game Commission reported no known occurrences of birds or mammal species of concern within the vicinity of the Site. The Pennsylvania Fish and Boat Commission (PFBC) reported that the state threatened red-bellied turtle is known to be found within the area of the Site, and may inhabit Site aquatic environments. During the habitat evaluation, no red-bellied turtles were observed. The Pennsylvania Department of Conservation and Natural Resources (PA DCNR) reported that no plant species of concern are known to be found within the Site.

The SLERA identified nine assessment endpoints that were used to evaluate risk to ecological receptors. Risk from exposure to Site media (soils, creek, and Reservoir surface water and sediment, and an on-site seep) were evaluated via two exposure scenarios, direct contact and/or dietary exposure. Both exposure scenarios utilized the maximum concentration of contaminants detected in each medium. For those assessment endpoints evaluated via direct contact, risks were determined through a comparison of maximum concentrations of chemicals and asbestos detected in each medium to chemical-specific and media-specific ecological screening levels. Assessment endpoints aimed at the protection of upper trophic level receptors via food chain uptake, were evaluated using food chain exposure models which compare a daily dietary dose of a specific contaminant to its respective literature-based dietary toxicity reference value.

During preparation of the Remedial Alternatives Screening Memorandum, the asbestos SLERA data were reviewed again, and it was observed that the soil sample data set used in the asbestos portion of the SLERA was compiled using a different sample depth criterion than had been used to compile the soil sample data set for the non-asbestos portion of the SLERA. The soil asbestos data set had been compiled by including all samples with a depth equal to or less than two feet, while the soil data set for non-asbestos included only those samples from depths less than two feet. During the FS process, the asbestos soil data were re-evaluated by applying the sample depth screening criteria that had been applied to the non-asbestos sample data set, as that screening depth criterion is likely to be most appropriate for burrowing mammals. As a result of the re-evaluation, the soil asbestos data set was revised to include a total of 80 samples collected in soil less than 2 feet. Asbestos (chrysotile) was detected in 51 of the 80 soil samples. The minimum (0.1 percent) and maximum (20 percent) detected asbestos concentrations and resulting overall findings remain unchanged from what was reported in the SLERA. Note that results from samples collected from residences, the Kid's Park, and walking trails were not included in the SLERA or the re-evaluation, because these locations are highly utilized and are not suitable for ecological habitat.

The results of the SLERA indicated that several chemicals and asbestos detected in Site media are at levels that may cause adverse effects to ecological receptors; however, the majority of risks noted were related to direct exposure to contaminants in Site media. Risks from dietary exposure were limited.

- For those terrestrial receptors in direct contact with soil, risk drivers primarily include several metals, PAHs, dioxins/furans, and to a lesser extent, pesticides;
- For those receptors in direct contact with creek and Reservoir sediment, PAHs were the most common ecological risk driver. Pesticides and metals also pose a risk to receptors in both of these water bodies. Aroclor-1254 poses a risk to receptors in creek sediments only;
- Asbestos and metals were the primary risk drivers in surface water for both the creek and the Reservoir; however, fewer metals posed a risk in creek surface water when compared to the Reservoir; and
- Risks from dietary exposure to arsenic and asbestos in Site soil were noted for insectivorous birds and mammals, respectively.

No risks from dietary exposure of chemicals in creek or Reservoir sediment were noted for piscivorous birds or mammals; and potential risks were identified for aquatic receptors for a limited set of metals and asbestos in seep water from the Reservoir parcel.

Section 1

Introduction

The United States Environmental Protection Agency (EPA) Region 3 has contracted CDM Federal Programs Corporation (CDM Smith) to conduct a Remedial Investigation/Feasibility Study (RI/FS) for the BoRit Asbestos Superfund Site Operable Unit 1 (OU-1) in Ambler, PA (the Site) under Work Assignment (WA) 029-RICO-A3EN of the EPA Region 3 Response Action Contract (RAC) 2 contract EP-S3-07-06.

In 2013, CDM Smith completed the *Final RI Report* (CDM Smith 2013b) to document Site conditions and to fill data gaps that had been identified from review of previous investigations. Following the completion of the *Final RI Report*, additional data were collected to further characterize the Site setting and to better understand the potential fate and transport of Site contaminants. This RI Addendum Report provides a description of the results for the post-RI data collection activities completed at the Site. The following post-RI activities are summarized in this RI Addendum Report:

- Wet and Dry Synoptic Events
- Reservoir Temperature Study
- Reservoir Bench Study
- 2014 Reservoir Sediment Investigation
- United States Army Corps of Engineers (USACE) Reservoir Hydraulics and Berm Stability Investigation
- USACE August 2014 Site Visit and Observations

1.1 Purpose and Organization of Report

The purpose of this RI Addendum Report is to present a summary description of procedures and resulting data for studies undertaken after completion of the Final RI Report. The RI Addendum Report also provides updated descriptions of the Site Setting, the extent of contamination, and the conceptual site model (CSM) based on consideration of post-RI data. This RI Addendum Report consists of the following sections:

- **Updated RI Executive Summary:** incorporates updates to the RI Executive Summary to reflect amendments to the description of the Site setting, the nature and extent of contamination, and the CSM resulting from a review and consideration of post-RI data.
- **Section 1 – Introduction:** provides a description of current Site conditions.
- **Section 2 – Wet and Dry Synoptic Events:** presents a description of the procedures and results of the wet and dry synoptic events completed in July and August, 2014, respectively, and discusses the impact on/changes to the understanding of Site geology/hydrogeology.

- **Section 3 – Reservoir Temperature Study:** presents a description of procedures and results of the Reservoir temperature study conducted on July 29, 2014 and discusses its impact on the understanding of the Reservoir hydraulics.
- **Section 4 – Reservoir Bench Study:** presents a description of procedures, results, and an evaluation of results of the Reservoir bench study conducted in August 2014. A summary of related Quality Assurance/Quality Control (QA/QC) results is also presented.
- **Section 5 – Reservoir Investigations:** presents a summary of the 2013 USACE Reservoir Hydraulics and Berm Stability Investigation Report and the August 2014 Site Visit and Observations. This section also presents description of procedures, results, and an evaluation of borehole logging and analytical results from the 2014 Reservoir sediment investigation activities conducted in March and August 2014. A summary of related QA/QC results is also presented.
- **Section 6 – Updated Conceptual Site Model:** provides an updated CSM that reflects a consideration of information and data that were available or collected after the *Final RI Report* had been submitted.
- **Section 7 – References:** provides a list of references used to prepare the RI Addendum Report.

Several Appendices are included with this RI Addendum. **Appendix A** presents logbook entries and field sample data sheets (FSDS). **Appendix B** includes photographic documentation of the Reservoir during and after dewatering for the months of July and August 2014 and January 2015. **Appendix C** includes hand auger boring logs and analytical data collected from the 2014 Reservoir Sediment Investigation. **Appendix D** presents the QA summary of all post-RI data presented and discussed in this RI Addendum Report. **Appendix E** (included as a CD ROM) includes all Validation and Verification Reports for data presented in this RI Addendum as well as asbestos data presented and discussed in the Final RI Report.

1.2 Site Location and Description

The Site includes three adjacent parcels near the intersection of West Maple Street and Butler Pike in Ambler Borough, Montgomery County, Pennsylvania:

- The Asbestos Pile parcel, located in Ambler Borough, is approximately 2.5 acres and contains an asbestos waste pile;
- The Park parcel, located in Whitpain Township, is approximately 11 acres and contains a former asbestos disposal area (now the closed Whitpain Wissahickon Park); and
- The Reservoir parcel, primarily located in Upper Dublin Township, is approximately 15 acres and contains a reservoir. The Reservoir is man-made and is not used for drinking water supply. Historically, the Reservoir was filled by a former pond on the Wissahickon Creek located northwest of Mount (Mt.) Pleasant Avenue. The water from the pond was regulated by a gate valve that allowed water to flow under Mt. Pleasant Avenue and into a 24-inch pipe that ultimately discharged into the Reservoir. Currently, the 24-inch pipe runs from the intersection of Mt. Pleasant Avenue to the newly constructed 6-foot diameter manhole that replaced a former control valve structure at the Reservoir. In April 2014, the results of a trace dye test, initiated at the manhole located at the intersection of Mt. Pleasant Avenue and West Maple

Street, indicate that the 24-inch pipe under West Maple Street still contributes some flow to the Reservoir. However, it was also noted that the pipe was full of dirt and debris and that, even with a large amount of water, it took several hours for the dye to reach the Reservoir. Additional information regarding the Reservoir hydraulics is included in Section ES.7.2 of the Executive Summary.

The Site also includes portions of Wissahickon Creek, Rose Valley Creek, and Tannery Run which flow adjacent to the three parcels. Some investigations performed as part of the RI work occurred on nearby residential, recreational, and commercial properties outside the Site boundary. The Site map is shown on **Figure 1-1**.

1.3 Current Conditions and Future Use

Currently, all three parcels have either undergone an EPA Removal Action or are currently undergoing Removal Action in order to cover asbestos containing material (ACM) in accordance with National Emissions Standards for Hazardous Air Pollutants (NESHAP). All three Site parcels are unused and vacant. Through February 2015, the EPA Removal Program has completed the following removal actions at the BoRit Asbestos Superfund Site:

- Stabilization of the banks of Wissahickon Creek adjacent to the Park parcel and from the old dam to the confluence with Tannery Run, including clearing the banks of ACM debris and covering the banks with clean fill, a geotextile, geocells, and seeded topsoil (EPA 2010);
- Stabilization of Rose Valley Creek and the adjacent berm of the Reservoir and the floodplain. Work included construction of a 104-foot long stone retaining wall on the left side of the head wall and a 6-foot long reinforced concrete wall on the right side of the headwall. Work also included clearing ACM and other debris and placement of clean fill and heavy duty erosion mats on the stream bank slopes. Vegetation was cleared along the banks of Rose Valley Creek, the Reservoir berm parallel to the creek, and the floodplain. The Rose Valley Creek bed was cleared of ACM debris, and soft areas were excavated and filled with #57 stone and rip rap. Concrete cable mats were placed from the headwall to the confluence with Wissahickon Creek. Significant damage to the stabilization of Rose Valley Creek was sustained during tropical storms Irene and Lee in September 2011. EPA began repairs during the summer of 2012 and completed the repairs in December 2012;
- Stabilization of 600 feet (ft) of the Reservoir berm along Wissahickon Creek adjacent to the Reservoir, including covering the slopes with compacted clean fill and topsoil;
- Stabilization of the creek and the creek bed along 720 ft of Tannery Run. The creek was cleared of ACM debris, and concrete cable mats were placed on the side slopes from West Maple Street to the headwall location, approximately 287 ft downstream. The channel bed, from the headwall to Wissahickon Creek, was lined with geotextile fabric and built up with stone. Piping that contains the flow was placed from the headwall to the confluence of Wissahickon Creek, thus preventing further erosion;
- Stabilization of the Asbestos Pile parcel, included clearing trees and ACM debris around the Asbestos Pile and constructing access roads (#57 stone over geotextile fabric). The Asbestos Pile itself was then cleared of trees and re-graded. Trees were chipped and chips were used for re-grading. Stumps were collected and taken off site for disposal. Following re-grading, the

Asbestos Pile was covered with geotextile material, two ft of clean material, topsoil, and then hydroseeded;

- The Park parcel area will be covered similar to the Asbestos Pile parcel. Cover of the Park parcel will include geotextile fabric, a minimum of two ft of clean material, topsoil, and vegetation. All trees have been removed from the Park parcel. Some waste was consolidated from areas of the Park into two waste cells located on the south end of the Park. These waste cells will be covered with fabric, two ft of clean material, and vegetated topsoil. As of August 2014, stabilization work at the Park parcel stopped as EPA Removal Program efforts are focused on addressing the Reservoir parcel;
- Work to stabilize the Reservoir started in the fall of 2013 and remains in progress (February 2015). The EPA Removal Program plan calls for the Reservoir to be completely drained and the berms of the Reservoir to be covered with a geotextile fabric and a minimum of two ft of clean material. In preparation for the draining of the Reservoir, the trees were removed and clean fill was placed on the West Maple Street side of the Reservoir to stabilize and widen the area for brush clearing operations. Brush and trash from the West Maple Street side of the Reservoir were removed. Draining of the Reservoir was completed on July 31, 2014. Approximately 29 million gallons (MG) of Reservoir surface water were pumped, treated, and discharged to Wissahickon Creek. Beginning in August 2014, water has been pumped intermittently to remove additional collected water. In February 2015, the EPA Removal Program moved concrete barriers along the Reservoir road to begin stabilization work on the eastern Reservoir berm adjacent to the Asbestos Pile.

The stabilization work by EPA's Removal Program was initially performed to address the issue of erosion of creek banks and waste. All creek banks that border ACM waste disposal areas have been armored, and a portion of Tannery Run has been routed through a pipe to prevent further erosion from the creek flow. The stabilization of the creek banks performed by the EPA Removal Program is designed to prevent or minimize future contamination of surface water and sediment in the creeks surrounding the Site and therefore also the floodplain soils. In addition, EPA's Removal Program cut back slopes on the Asbestos Pile to a stable 3 horizontal:1 vertical gradient and covered the Asbestos Pile and portions of the Reservoir berm with geotextile and cover soil to prevent further disturbance and asbestos exposure. In addition, some waste on the Park parcel has been consolidated into two waste cells located on the south end of the Park parcel and covered with fabric, clean material, and topsoil. The EPA Removal Program plans to vegetate these waste cells in 2015. Other areas of the Park parcel will also be covered with fabric, two ft of clean material, and vegetated topsoil.

Temporary engineering controls have been implemented by the EPA Removal Program to prevent Site access. Specifically, permanent chain-link fences extend along the West Maple Street side of the Asbestos Pile parcel and the Reservoir parcel. A temporary chain-link fence is installed at the Park parcel along West Maple Street. Future use plans for the Park parcel include a public park and open space. Whitpain Township would maintain ownership of the Park parcel and oversee the administration of the public park (RR&M 2014). The Wissahickon Waterfowl Preserve (WWP) would maintain ownership of the Reservoir parcel and continue to use the property as a waterfowl preserve. The WWP plans to install amenities along West Maple Street that would promote birding and improve the aesthetic value of the area (Whitpain Township 2012).

Section 2

Wet and Dry Synoptic Events

2.1 Rationale

Two water level synoptic events were performed in 2014 to further evaluate the hydraulic connection between the Reservoir and groundwater. One event coincided with wet weather and one event coincided with dry weather. Water levels were measured in monitoring wells (MW) MW-1A, MW-02, MW-03, MW-04-, MW-05, MW-06, MW-07, and piezometers (PK) PKPZ-02 and PK-PZ03. In addition, water levels were measured in staff gauges (SG) located in Wissahickon Creek (SG-1 and SG-5), Rose Valley Creek (SG-4), and Tannery Run (SG-2).

2.2 Procedure

Static water levels for the wet and dry synoptic events were measured in accordance with CDM Federal Programs Corporation Standard Operating Procedure (SOP) 1-6, Water Level Measurement as described in *Addendum 2 to the Final Site Management Plan for RI Phase 2 Field Investigation* (CDM Smith 2014a). Precipitation data were obtained from Weather Underground for the Wings Field Airport weather station (station ID KLOM) which is located approximately three miles southwest of the Site. The wet event was conducted on July 29, 2014. The recorded rainfall two days leading up to the wet event (July 27 and July 28, 2014) totaled 0.70 inches (Weather Underground 2015). The dry event was conducted on August 11, 2014, and no rainfall occurred from August 4 to August 11, 2014 (Weather Underground 2015). Weather data were also evaluated from the National Oceanic and Atmospheric Administration (NOAA). NOAA weather stations closest to the Site include Blue Bell (approximately 2 miles west of Ambler) and Fort Washington (approximately 1.5 miles southeast of Ambler). The total precipitation reported between July 27 and July 28, 2014 was 1.23 inches and 1.55 inches for Blue Bell and Fort Washington NOAA weather stations, respectively (NOAA 2015). No precipitation was reported for the Blue Bell or Fort Washington NOAA weather stations between August 4 and August 11, 2014 (NOAA 2015).

A water level indicator was used to measure the depth to water in the wells. Measurements were recorded in a log book, and log book entries are included in **Appendix A**. Piezometer PKPZ-01 could not be located and a water level was not measured. Stockpiled soil was located in the general vicinity of PKPZ-01, and it is believed that PKPZ-01 was buried by EPA Removal Program activities on the Site. Water levels for Wissahickon Creek, Rose Valley Creek, and Tannery Run were measured using existing staff gauges. If water levels were below the staff gauge datum, the measuring tape on the water level indicator was used to measure the depth below the datum base line. A water level was not measured for SG-3, which is located on the northwest berm of the Reservoir. Both wet and dry synoptic events occurred while the EPA Removal Program was pumping the Reservoir, and, as a result, the water level of the Reservoir was significantly below the base of SG-3 at this time.

2.3 Results

The wet and dry synoptic event water levels measured in July and August 2014 are tabulated in **Table 2-1**. The potentiometric maps for these events are depicted on **Figures 2-1** and **2-2**, respectively. The potentiometric contour maps for both the wet and dry events include water levels measured at MW-07, the background well located east of the Park parcel. The contours for both wet and dry synoptic

events show the same general northeast to southwest gradient as depicted in the previous synoptic event completed in October 2011, Figure 4-16, of the *Final RI Report* (CDM Smith 2013b).

In the northern part of the Park parcel, during the dry event, the gradient is slightly more north to south. Figures 2-1 and 2-2 demonstrate that, in the southern half or deep portion of the Reservoir, the potentiometric surface is above the Reservoir bottom. Contours developed for the wet synoptic event show the groundwater surface intersecting the Reservoir bottom at an elevation of approximately 182 feet (in an area northwest of MW-04). Contours developed for the dry synoptic event show the groundwater surface intersecting the deepest section of the Reservoir at an elevation of approximately 174 feet. Figures 2-1 and 2-2 suggest that, in the southern half of the Reservoir, communication between surface water and groundwater is likely if a barrier (i.e. a continuously thick and low permeability unit) between the two water types is not present. The location of potential groundwater seepage is influenced by changes in the potentiometric surface due to precipitation.

Section 3

Reservoir Temperature Study

3.1 Rationale

The Reservoir temperature study was conducted to determine if surface water temperatures indicated groundwater seepage into the Reservoir. The Reservoir temperature study was conducted on July 29, 2014, which was during the period when the Reservoir was being drained as part of the EPA Removal Program effort. As a result, during the time of the Reservoir temperature study, a substantial portion of the Reservoir had been drained.

3.2 Procedure

The Reservoir temperature study was conducted following procedures outlined in *Addendum 2 to the Final Site Management Plan for RI Phase 2 Field Investigations* (CDM Smith 2014a). The Reservoir temperature study was performed using the boat located at the Site for the EPA Removal Program activities. The method for the Reservoir temperature study directed temperature readings to be collected on a grid using approximately 25-foot spacing (CDM Smith 2014a). During performance of the Reservoir temperature study, collection of temperatures did not follow an exact grid pattern due to the boat drifting. However this did not appear to impact the overall objective of the Reservoir temperature study. At each grid node, temperature readings were collected using a YSI 60 pH/temperature meter with a 25-foot cable. At each location, the mid-depth and total depth of the water column were measured and recorded. Subsequently, the temperature at the mid-depth and at the bottom of the water column were collected and recorded. A hand held Garmin eTrex Legend H Geographic Information System (GIS) unit was used to record the coordinates for each location. Temperature readings were also collected at staff gauge locations for Wissahickon Creek, Rose Valley Creek, and Tannery Run for comparison to the Reservoir surface water. A photographic log was maintained to compare water levels in the Reservoir during and after pumping. The Reservoir photograph log is presented in **Appendix B**.

3.3 Results

Figure 3-1 illustrates the results of the Reservoir temperature study. Several locations where cooler temperatures were recorded are clustered in the central portion of the study area. The temperature in the cool cluster ranged from 75.2 degrees Fahrenheit (°F) to 77°F, which is below the range measured outside the cluster (77.1°F to 81°F), but above the ambient air temperature on the day of the study (72°F). The cooler temperature cluster was also well above the range of temperatures recorded for Site monitoring wells. The shallow depth and relatively small volume of water in the study area could have led to a relatively quick increase in temperature of influent groundwater, which means that identification of influent groundwater based on temperature could be somewhat masked. Therefore, the results of the Reservoir temperature study should be considered in conjunction with recent wet and dry synoptic events (July and August 2014), photo documentation, and the data and observations made during EPA's August 13, 2014 Site visit/on-site meeting and subsequent Site visits. The August 13, 2014 Site visit was conducted at the request of the EPA to investigate the potential of the EPA Removal Program's new stormwater management system installed adjacent to/in the Reservoir to impact future hydraulic conditions in the Reservoir (USACE 2014).

Appendix B includes a photo documentation log of photographs taken by CDM Smith, EPA, and EPA's Superfund Technical Assessment and Response Team (START) contractor. Photographs of the Reservoir were taken between July 17, 2014 (just before the Reservoir was emptied on July 31, 2014) and January 15, 2014. Photographs taken on August 11, 2014 show the Reservoir completely dry. Photographs taken on August 20, 2014 show the presence of water that had accumulated in the southern corner of the Reservoir. The location of the pooled water observed on August 20, 2014 coincides with the location of cooler temperatures recorded during the Reservoir temperature study. However, this coincidence does not prove that the ponded water is groundwater. The presence of water in the Reservoir could also be attributed to surface water runoff.

Section 4

Reservoir Bench Study

4.1 Rationale

As part of EPA Removal Program activities at the Site, contaminated water in the Reservoir was pumped out, treated, and discharged into Wissahickon Creek. Pumping of the Reservoir was completed on July 31, 2014. Prior to the EPA Removal Program refilling the Reservoir with Wissahickon Creek surface water, the EPA Remedial Program wanted to evaluate whether the placement of a cover over the Reservoir bottom sediment was necessary to prevent re-suspension of asbestos and to mitigate asbestos re-contamination of surface water and sediment. As a result, EPA authorized CDM Smith to conduct a Reservoir bench study in August 2014 to evaluate the potential impact of sediment-disturbing activities on the release of asbestos from the Reservoir sediment into Reservoir surface water. Examples of sediment-disturbing scenarios include the re-filling of the Reservoir after it has been drained, or has otherwise dried out, the impact of the natural freeze-thaw cycle, and the impact of aquatic animal activities. Results from the Reservoir bench study will aid EPA in deciding whether a cover is needed on the Reservoir bottom to prevent asbestos fibers from being released into the Reservoir surface water as the Reservoir is being re-filled and after it has been re-filled.

4.2 Procedure

The Reservoir bench study was performed following the procedures outlined in the Site-Specific Standard Operating Procedure (SOP), CDM Smith-BoRit-6, Revision 0, *Bench Study - Asbestos Release from Reservoir Sediment* (CDM Smith 2014b). Two 18-gallon plastic bins were used in the Reservoir bench study. The first bin, the low asbestos zone bin, represented areas of low detections of asbestos in previous Reservoir surface water sampling, where asbestos concentrations did not exceed the 7 million fibers per liter (MFL) Maximum Contaminant Level (MCL). Previous areas of low detections of asbestos in Reservoir surface water corresponded to surface water locations RVSU-01 and RVSU-02, as shown in Figure 5-9 of the *Final RI Report* (CDM Smith 2013b). Asbestos concentrations for these locations are reported in Table 5-8a of the *Final RI Report* (CDM Smith 2013b). The second bin, the high asbestos zone bin, represented areas of high detections of asbestos in previous Reservoir surface water sampling, where asbestos concentrations exceeded the 7 MFL MCL. Previous areas of high detections of asbestos in Reservoir surface water corresponded to surface water locations RVSU-03, RVSU-04, and RVSU-05, as shown in Figure 5-9 of the *Final RI Report* (CDM Smith 2013b). Table 5-8a in the *Final RI Report* presents asbestos concentrations detected for both areas of low and high detections (CDM Smith 2013b).

4.2.1 Sediment Collection

Sediment for the Reservoir bench study was collected on August 5, 2014 using disposable plastic scoops in accordance with SOP 1-11, rev. 9, *Sediment Sampling*. Sediment was collected in two 5-gallon buckets, for the low asbestos bin and the high asbestos bin. For sediment representing areas of low detections of asbestos in previous Reservoir surface water sampling (asbestos detections were below the 7 MFL MCL), sediment was collected from surface water location RVSU-02 in one 5-gallon bucket.

Sediment was not collected from surface water location RVSU-01 as directed in the Site Specific SOP CDM Smith-BoRit-6, because the location had been covered by the EPA Removal Program activities at the Reservoir. For sediment representing areas of high detections of asbestos in previous Reservoir surface water sampling (asbestos detections exceeded the 7 MFL MCL), sediment was collected from surface water locations RVSU-03, RVSU-04, and RVSU-05 and composited in one 5-gallon bucket.

Three composite sediment samples, including one duplicate, were collected from the two 5-gallon buckets containing sediment for the low asbestos zone bin and the high asbestos zone bin. The sediment samples were collected in 8-ounce glass jars and sent for Polarized Light Microscopy (PLM) analysis prior to performing the Reservoir bench study. The purpose of collecting these sediment samples was to verify that asbestos was present in the Reservoir sediment collected to perform the Reservoir bench study.

The 5-gallon buckets containing sediment collected for the low and high asbestos zone bins were labeled to identify their sample locations and stored at room temperature in the on-site field trailer until results for PLM analysis were received on August 11, 2014. The remaining activities for the Reservoir bench study were conducted on August 11, 2014. Analytical results for the sediment samples are presented in Section 4.3. As expected for the low asbestos zone bin, asbestos (chrysotile) was detected at a concentration less than the 1 percent Screening Level (SL) for sediment sample BL-SD-080514. For the high asbestos zone bin, asbestos (chrysotile) was detected at a concentration greater than the low asbestos zone bin but below the 1 percent SL for sediment sample BH-SD-080514. A duplicate sediment sample, BH-SD-080514A, was also collected for the high asbestos zone bin and asbestos (chrysotile) was detected at a concentrations above the 1 percent SL.

4.2.2 Creek Surface Water Collection

Approximately ten gallons of Wissahickon Creek surface water were collected for use in the Reservoir bench study using two 5-gallon buckets. The sample location of the Wissahickon Creek surface water is shown in **Figure 4-1**. Because the Reservoir will be re-filled with surface water from Wissahickon Creek once EPA Removal Program and/or Remedial Program work is complete, surface water was collected and used to conduct the Reservoir bench study. Buckets were filled by submerging them in surface water and positioning the opening to face up stream. To verify the composition of the Wissahickon Creek surface water, a surface water sample (WC-SW-081114) was collected directly into one 500-milliliter polyethylene bottle in accordance with SOP 1-1, rev. 9, *Surface Water Sampling*. During creek surface water sample collection, a headspace of approximately 100 milliliters (mL) was left in the bottle to facilitate ozonation/Ultraviolet (UV) treatment for Transmission Electron Microscopy (TEM) analysis.

This creek surface water sample served as a “baseline” of the background composition of Wissahickon Creek surface water prior to it being poured over Reservoir sediment in the Reservoir bench study. Before collecting the creek water sample, water quality parameters (pH, conductivity, oxidation reduction potential, temperature, and dissolved oxygen) were measured using a Horiba U-52 water quality meter. Water quality data are presented in **Table 4-1**. Table 4-1 also presents water quality data for a water pit sample (PW-SW-081114) collected at EPA’s request. EPA requested that CDM Smith collect the pit water sample for TEM analysis on the day of the Reservoir bench study to determine if asbestos was present in the standing water adjacent to the 24-inch PVC pipe which

extends from the 6-foot diameter manhole located directly northeast of the Reservoir. Refer to Section 5 for additional information on the pit water location and data.

Creek surface water collected from Wissahickon Creek was transported to the on-site trailer and the Reservoir bench study was conducted immediately in the on-site trailer.

4.2.3 Bench Study Procedures

Sediment for the Reservoir bench study was placed into the two 18-gallon plastic bins using disposable plastic scoops. One bin was designated as the “low asbestos zone” and contained sediment from location RVSU-02. The second bin was designated as the “high asbestos zone” and contained sediment composited from locations RVSU-03, RVSU-04, and RVSU-05. Approximately 12 inches of sediment were placed in each bin and leveled out to establish an even surface. Subsequently, five gallons of creek surface water were poured directly onto the sediment directly from the height of the bin lid. Pouring was conducted in a manner to induce significant agitation of sediment. The Reservoir bench study was conducted inside the on-site trailer to minimize disturbance from Site-related activities.

After filling each bin with creek surface water, bin water samples were collected from both the low asbestos zone bin and the high asbestos zone bin. The first sample was collected 5 minutes following the disturbance of sediment in the low and high asbestos zone bins. Following the 5-minute time interval, subsequent bin water samples were collected at the 1-hour, 3-hour, 6-hour, and 10-hour time intervals. A duplicate sample was collected for the low asbestos zone bin at the 1-hour time interval.

The bin water samples were collected directly into one, 500-mL polyethylene bottle by submerging the bottle below the surface of the bin water line. Extra precaution was taken not to disturb underlying sediments during sample collection. A head space of approximately 100 mL was left to conduct the TEM analysis.

4.3 Results

Table 4-2 shows analytical results for composite sediment samples collected from the Reservoir and used in the Reservoir bench study. Asbestos (chrysotile) was detected at a concentration of 0.2 percent for the low asbestos zone bin sample (BL-SD-080514). Asbestos (chrysotile) was detected at concentrations of 0.5 and 1.1 percent for the high asbestos zone bin and its duplicate sample, respectively (BH-SD-080514 and BH-SD-080514A). **Table 4-3** shows analytical results for bin water samples, the Wissahickon Creek surface water sample, and the pit water sample.

Figure 4-1 presents the results of the Reservoir bench study. The EPA’s National Recommended Water Quality Criteria (NRWQC) includes the 7 MFL drinking water MCL as a surface water quality criteria for asbestos for the protection of human health (EPA 2015). Although the Reservoir does not serve as a drinking water source, the NRWQC was used as a screening level for the Reservoir surface water. The Reservoir bench study results demonstrate that, even when asbestos concentrations in sediment are less than 1 percent, a disturbance of sediment results in surface water concentrations that exceed the 7 MFL MCL for an extended period of time. The Reservoir bench study results suggest that larger sediment and asbestos particles settle out fairly quickly (within 1 to 2 hours), but the smaller asbestos particles take longer to settle. Overall, the Reservoir bench study demonstrated that surface water asbestos concentrations exceeded the 7 MFL MCL immediately following the disturbance activity and

decreased overtime but asbestos concentrations remained above the MCL at the conclusion of the Reservoir bench study.

Section 5

Reservoir Investigations

5.1 Reservoir Hydraulics and Berm Stability Investigation

The USACE conducted a Reservoir Hydraulics and Berm Stability Investigation for EPA in 2013 (USACE 2013). Concern had been noted by EPA about Reservoir berm stability and the possibility of contaminant migration via seepage through the berm or from a catastrophic failure of the berm. In addition, the hydraulics of the Reservoir were not clearly understood. In order to clarify these issues, USACE performed a geotechnical investigation and a water level investigation for EPA. Results and conclusions drawn from these investigations are presented in USACE's *Reservoir Hydraulics and Berm Stability Investigation* report (USACE 2013),

The purpose of the USACE geotechnical investigation was to collect subsurface information for use in a berm slope stability and seepage analysis. The purpose of the berm slope stability and seepage analysis was to evaluate the Reservoir's stability in its existing condition (USACE 2013). The purpose of the water level investigation was to study the response of water levels to storm events and to determine if there was any interaction between the Reservoir and the shallow groundwater (USACE 2013).

USACE review of their geotechnical investigation results indicated that materials originally used for construction of the Reservoir berm in the southwestern corner likely contain excessive ACM and are not suitable for long term berm stability. A surface geophysics survey was performed as part of the investigation to help determine the soil consistency of the Reservoir berm and locate any subsurface anomalies such as pipes, culverts, or buried debris (USACE 2013). The geophysics did not find any additional pipes that could be filling or draining the Reservoir, although a cut in the bedrock was identified on the eastern edge of the berm that could be a conduit for groundwater flow (USACE 2013).

USACE analysis of water level data did not indicate a direct connection between the Reservoir and the shallow groundwater, and anomalies in the groundwater levels were not noted in the Reservoir water level data. With the exception of a few anomalies, all significant water level increases seemed to be directly correlated to rainfall. This correlation indicates that the only significant inflow to the Reservoir is likely to be rainfall (USACE 2013). The USACE also notes that small outfalls into the Reservoir may also act as a source of inflow to the Reservoir, but volumes are not significant enough to be separated or distinguished from noisy data (USACE 2013). In addition, USACE noted that the Reservoir experiences a slow loss of water between rain events, possibly due to a combination of evaporation and seepage to groundwater (USACE 2013).

USACE analysis of the geophysical, geotechnical, and hydraulic conditions of the Reservoir showed that the only area with a slope stability concern is in the southwest corner. According to the USACE report, the berm in this area is not in immediate danger of a major failure from normal water levels in the Reservoir, but measures to improve stability should be performed in the near future. The recommended solution of widening the interior slope of the berm by 30 ft would adequately address any slope stability problems (USACE 2013). The USACE report noted that this option is also consistent with removal action measures that were being considered (and currently being implemented) by the EPA Region 3 Removal Program.

5.2 2014 Reservoir Sediment Investigation

Under the Eastern Area START contract, the EPA's START contractor was tasked to assist the USACE with the collection of sediment samples from the dewatered Reservoir in 2014.

5.2.1 Rationale

The EPA START contractor's *Draft Field Sampling Plan for Sediment Sampling, BoRit Asbestos NPL Site* outlines the objectives, sampling methods, and QA/QC procedures for performance of the 2014 Reservoir sediment investigation (Weston 2014). The objective of the 2014 Reservoir sediment investigation was to determine the extent of contamination present in the Reservoir sediments in response to community claims of chemical dumping and drum burial in the study area (Weston 2014). EPA plans to use these sample results to determine the extent of remediation activities for the Reservoir. CDM Smith was tasked by EPA to present these sediment data results in this RI Addendum Report.

5.2.2 Procedure

The 2014 Reservoir sediment investigation was completed in two rounds. The first round of sampling was performed on March 31, 2014, after the first half of the Reservoir (eastern portion) had been dewatered. The second round of Reservoir sediment sampling was conducted on August 5, 2014, to sample the remaining half (western portion) of the Reservoir after it had been completely drained. (The EPA Removal Program completed draining the Reservoir on July 31, 2014.) Reservoir sediment sample locations were determined in the field by the EPA On-Scene Coordinator (OSC) and were distributed to characterize the sediment throughout the Reservoir. Sediment samples were collected by the EPA START contractor using a hand auger to depths up to 4.8 ft. Two composite samples (shallow and deep) were collected at each of the eleven sample locations, except for sample location RSVB-29. Only one composite sample was collected at RSVB-29, because the overlying muck layer was approximately 2.2 ft in thickness. The composite sample for RSVB-29 was collected between 2.2 ft and 3.2 ft and consisted of the gray soft clay encountered below the muck layer.

Each sample was composited by depth. The shallow sediment sample at each location was collected between 0 ft below ground surface (bgs) and 4 ft bgs (or between the surface and one-half of the total auger depth for that location, if 4 ft bgs was not achievable). The deep sediment sample at each location was collected between 4 ft bgs and 8 ft bgs (or between one-half of the total auger depth and refusal, if 8 ft bgs was not achievable). Each sample interval was collected into a stainless steel bowl to be homogenized. The volatile organic compound (VOC) portion of the sample was collected from the stainless steel bowl using an EnCore sampling devices (or equivalent) prior to homogenization. Once the VOC portion was collected, the remaining sediment core was homogenized using a decontaminated stainless steel trowel and placed into appropriate sample jars by the EPA START contractor.

The following sample identification was used for each sample:

BRT-RS-MMDDYY-XX-YY-ZZ

Where

BRT – BoRit Asbestos NPL Site

RS – Reservoir Sediment Samples

MMDDYY - two digit month, day, and year of sample collection

XX – Sample location number

YY – Depth interval (i.e. 04 = 0 ft to 4 ft, 48 = 4 ft to 8 ft, etc.)

ZZ – Sample type (i.e. 00 – field sample, 01 – field duplicate, RB – Rinsate Blank, TB – Trip Blank)

5.2.3 Results

Figure 5-1 shows the 2014 Reservoir sediment investigation sample locations. Samples locations vary by color to signify the date of sample collection. Hand auger boring logs are presented in **Appendix C**. Hand auger sample depths ranged from 2.3 ft to 4.8 ft in depth. Clay was detected in all hand auger samples collected during the March 31, 2014 sampling round for the eastern, northeastern portion of the Reservoir. Clay classification included brown stiff clay, white clayey silt, red clay with rock fragments, gray stiff clay with rock fragments, gray brown stiff clay with rock fragments, and gray soft clay. The western, southwestern portion of the Reservoir was sampled on August 5, 2014, and only one hand auger detected very soft clayey silt and stiff dry clay at hand auger location RVS-34. Sediment classification for the remaining hand auger samples in the western, southwestern portion included stiff gray silt, dark gray soft organic silt, red silty fine sand with trace gravel, very soft gray brown organic silt, stiff gray silt, and gravelly sand. **Figure 5-2** shows the approximate extent of the clay encountered during the 2014 Reservoir sediment investigation.

Tables 5-1, 5-2, and 5-3 present analytical detections for organic compounds, asbestos, and inorganic compounds, respectively, for the 2014 Reservoir sediment investigation sampling. The complete set of analytical results is presented in Appendix C.

- Four VOCs were detected in Reservoir sediment, but at concentrations substantially below their respective Regional Screening Levels (RSLs): VOCs included 2-butanone (MEK), 4-methyl-2-pentanone (MIBK), acetone, and carbon disulfide. MEK was detected in ten of the sampling locations for both shallow and deep composite samples. MIBK and acetone were detected in all 11 sample locations. Carbon disulfide was detected in five sample locations.
- Semi-volatile organic compounds (SVOCs) detected in Reservoir sediments were diethyl phthalate and dimethyl phthalate. Diethyl phthalate was not detected at concentrations exceeding its RSL. No RSL exists for dimethyl phthalate.
- Asbestos (chrysotile) was detected only in Reservoir sediment samples collected on August 5, 2014 in the western, southwestern portion of the Reservoir; however, none of the detections exceeded the asbestos screening level of 1 percent. Asbestos was detected in both shallow and deep composite samples at locations RVS-33 and RSV-35. Asbestos was only detected in shallow composite samples for locations RVS-32 and RVS-34. Concentrations of asbestos ranged from 0.25 to 0.75 percent.
- Twenty-three metals were detected in Reservoir sediment. **Figure 5-3** shows locations where metals exceeded the sediment RSLs. Arsenic detections exceeded the RSL of 6.7 milligrams per kilogram (mg/kg) at RVS-31 (deep composite sample) and RVS-35 (shallow composite sample) at concentrations of 6.9 mg/kg and 6.7 mg/kg, respectively. Chromium detections exceeded the RSL of 0.30 mg/kg in all 21 samples. Chromium concentrations in shallow composite samples ranged from 22.2 mg/kg to 52.6 mg/kg. Chromium concentrations in deeper composite samples ranged from 19.7 mg/kg to 34.2 mg/kg. It should be noted that the

RSL for chromium is based on toxicity of the hexavalent form of chromium (i.e. Cr⁺⁶). The Reservoir sediment samples were analyzed for total chromium content; the reported value therefore includes all forms of chromium. Analysis of the various species of chromium was not performed.

- No pesticides or polychlorinated biphenyls (PCBs) were detected in Reservoir sediment samples.

It should be noted that locations sampled by the EPA START contractor for the 2014 Reservoir sediment investigation completed on March 31, 2014 and August 5, 2014 differed from Reservoir sediment locations sampled by CDM Smith in November 2009 during the RI. Reservoir sediment locations sampled by CDM Smith during the RI are presented in Figure 3-2 of the *Final RI Report* (CDM Smith 2013b). During the RI, sediment samples were collected and composited from a 0-inch to 6-inch depth interval. While the 2014 Reservoir sediment investigation and the RI sediment sampling events consisted of different Reservoir sediment sampling locations, and the RI sediment samples were collected while the Reservoir was filled with water, a general comparison and consideration of the sampling results follows.

- Three of the VOCs detected in the 2014 Reservoir sediment investigation were also detected in the November 2009 RI sediment sampling. These VOCs include 2-butanone, carbon disulfide, and acetone (Table 5-9b, *Final RI Report* (CDM Smith 2013b)). None of these compounds were found at concentrations exceeding their respective RSLs in the RI sediment samples. 1,1-dichloroethene (1,1- DCE) was the only other organic compound detected in the RI sediment sampling , but 1,1-DCE was not found at a concentration exceeding its RSL.
- Fifteen SVOCs were detected in sediment samples during the RI (Table 5-9c, *Final RI Report* (CDM Smith 2013b)). Benzo(a)pyrene was the only compound that exceeded its RSL. Unlike the 2014 Reservoir sediment investigation, diethyl phthalate and dimethyl phthalate were not detected in the RI Reservoir sediment sampling.
- Asbestos was detected in all sediment samples collected during the RI (Table 5-9a, *Final RI Report* (CDM Smith 2013b)) at concentrations similar to the 2014 Reservoir sediment investigation, with no detections exceeding the screening level of 1 percent.
- Eighteen metals were detected in Reservoir sediment samples collected during the RI (Table 5-9e, *Final RI Report* (CDM Smith 2013b)). Similar to the 2014 Reservoir Investigation, arsenic and chromium were the only metals that exceeded soil RSLs in the RI sediment samples. Concentrations of arsenic ranged from 0.55J mg/kg (where J qualifies the result as an estimated quantity) to a maximum of 7.6 mg/kg. Concentrations of chromium ranged from 2.6 mg/kg to a maximum of 65.5 mg/kg.
- Fourteen pesticides were detected in Reservoir sediment during the RI (Table 5-9d, *Final RI Report* (CDM Smith 2013b)); however, none of these pesticides were detected at concentrations exceeding their RSLs. In addition, similar to the 2014 Reservoir Investigation, no PCBs were detected in Reservoir sediment samples collected during the RI.

5.3 August 2014 Reservoir Site Visit and Observations

The August 13, 2014, Site visit/on-site meeting was conducted at the request of the EPA to investigate the potential of the EPA Removal Program's new stormwater management system (installed adjacent to / in the Reservoir in July 2014) to impact hydraulic conditions in the Reservoir(USACE 2014). Observations, areas inspected at the Site, and discussion that occurred during this meeting are

summarized in the *BoRit Superfund Site, Ambler, PA – Trip Report of Flow Paths to the Reservoir* (USACE 2014). Figure 5-2 highlights Site features and potential sources of inflow to the Reservoir that were discussed during this meeting. The inspection team included personnel from EPA, USACE, the Whitpain Township Public Works Department, and the BoRit EPA Removal contractor. The EPA specifically wanted to discuss whether the new stormwater management system could change the future water level of the Reservoir (USACE 2014). While inspecting the BoRit Reservoir area, the existence and extent of the clay layer on the bottom of the Reservoir was discussed, and it was noted that, during the excavation of the new pipe outlet pit in the northeast corner of the Reservoir, stiff clay typically was encountered from approximately 0.5 ft bgs to about 3 ft bgs. However, during the 2014 Reservoir sediment investigation in August, the clay layer was not encountered in the deeper half of the Reservoir at the western, southwestern end. Two of three auger borings completed in the deeper portion of the Reservoir by USACE were completed to a red silty fine sand overlain by a soft organic silt layer (RVSB-33) and a gravelly sand that was overlain by a stiff silt layer (RVSB-35). The third auger boring was completed to a stiff silt layer (RVSB-32). Boring logs from MW-03 and BOB-2 (located on the Reservoir berm in the southwestern corner of the Reservoir) do not show the presence of a clay layer; rather, there is a granular soil layer over bedrock in these areas.

The USACE Trip Report concludes that, if clay is not continuous under the Reservoir, as the USACE auger borings suggest, it is difficult to explain how the Reservoir maintains a surface water level above the measured groundwater level at locations immediately adjacent to the Reservoir (USACE 2014). The only known inflow besides rainfall is the pipeline along West Maple Street, which was noted to be nearly full of debris and dirt during the trace dye test that was performed by Whitpain Township on April 14, 2014 (USACE 2014). During the trace dye test, dye was injected into the existing American Legion manhole, and it eventually discharged from the existing North vitrified clay pipe (VCP) in the Reservoir two hours later, after flushing approximately 4,000 gallons of water into the American Legion manhole (USACE 2014).

On January 15, 2015, personnel from the EPA START contractor observed water flowing and accumulating on top of clean cover material and fabric that has been placed on the west side of the Reservoir by the EPA Removal Program. Several explanations provided by the EPA START contractor for this source of inflowing water include the seep located on the west side of the Reservoir (shown in Figure 3-2 of the *Final RI Report* (CDM Smith 2013b), the 24-inch North VCP under West Maple Street, or snow and ice melt (Weston 2015). However, the EPA START contractor did not indicate the direction of the flowing water.

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Section 6

Updated Conceptual Site Model

A CSM essentially tells the story of when and where a site was contaminated, what media were affected, where the contamination migrated (pathways), and who and what is or can be potentially harmed from the contamination (receptors). In addition, a CSM provides a framework for assessing risks from contaminants, developing remedial strategies, determining source control requirements, and identifying methods to address unacceptable risks. Development of the CSM is an evolving process; as more is learned about the site, the CSM is modified to reflect that knowledge. A CSM has been developed for the BoRit Site based on the Site's history (e.g., past uses), physical characteristics (e.g., topography and hydrogeology), and results of various investigations. **Figure 6-1** presents a flow diagram of the CSM that illustrates potential migration of contaminants from source material to receptors for consideration in the development of remedial alternatives.

6.1 Asbestos

6.1.1 Primary Source

Asbestos is the dominant environmental concern at the BoRit Site. The primary source of contamination, most significantly the chrysotile asbestos-containing waste, comprises the waste layer and contaminated soil found in the Park parcel, the berm of the Reservoir parcel, and the pile area of the Asbestos Pile parcel. The asbestos contamination is the result of historical disposal practices at these three Site parcels.

6.1.2 Primary Release/Transport Mechanisms

The primary release/transport mechanisms for the ACM and soil contamination include dust-re-suspension and surface runoff. Although many areas of landfilled waste were at one time covered by fill/soil, that cover has eroded in some areas. In summary, several asbestos-containing areas across the Site are not covered, and therefore re-suspension and runoff mechanisms exist.

6.1.3 Exposure Media

Air is the primary exposure medium of asbestos released via dust re-suspension. Results of the ABS raking scenarios performed at the Park and the Asbestos Pile parcels indicate that, even when the soil concentration of asbestos is less than 1 percent, the ABS activity can release sufficient asbestos to air to exceed the Site-specific ABS preliminary remediation goal (PRG) for air. Once disturbed and airborne, asbestos fibers will be transported through advection of air currents until they settle.

The primary exposure media for asbestos transported via surface runoff include soil, surface water, and sediment.

Asbestos was found in the surface water and sediment of Wissahickon Creek, indicating that asbestos fibers were directly eroded by normal or flood stream flow or adsorbed to fine particles that were eroded from upland areas and washed into the creeks via precipitation surface run-off.

As in air, the asbestos fibers in water will travel downstream with the currents until they can settle out. During flooding events, sediment with entrained asbestos fibers can be re-distributed and washed into floodplain soils. Concentrations of asbestos were found to be higher in deep floodplain soils than in shallow floodplain soils, indicating that, over time, less asbestos has been deposited during flooding events. Asbestos fibers deposited in the floodplain during flooding events could become airborne if disturbed after the floodplain soil has dried.

A related transport mechanism/pathway that can occur at the BoRit Site is the release of asbestos fibers from the sediment at the Reservoir bottom to Reservoir surface water after the sediment has been disturbed. Examples of sediment-disturbing activities include re-filling the Reservoir after it has been drained or has otherwise dried out, impact of the natural freeze-thaw cycle, and aquatic animal activities.

The Reservoir bench study results demonstrate that, even when asbestos concentrations in sediment are less than 1 percent screening level (EPA 2008), a disturbance of the sediment results in surface water concentrations that exceed the MCL for an extended period of time. Overall, the Reservoir bench study demonstrates that surface water asbestos concentrations exceed the MCL immediately following the sediment disturbance activity.

In addition to transport to soil, surface water, and sediment via surface runoff, asbestos can be transported to groundwater. Low levels of asbestos in five Site shallow bedrock aquifer monitoring wells indicate that asbestos fibers can flow with groundwater through the bedrock fractures. The detections of asbestos in Site groundwater were below the MCL. Because the Site groundwater velocities are very low, the transport of asbestos fibers in the Site groundwater is minimal. At the Site, much of the bedrock is overlain by silty and clayey sands, silts, and clays that are likely inhibiting the migration of asbestos to groundwater in the bedrock aquifer.

The possibility of hydraulic communication between groundwater and Reservoir surface water could potentially suggest a pathway to pass asbestos contamination between Site groundwater and surface water. However, the limited extent of that communication, coupled with the low concentrations of asbestos detected in Site groundwater, indicates that this is not a significant transport mechanism/pathway for asbestos at the Site.

6.1.4 Exposure Receptors

Future use plans for the Park parcel include a public park and open space (RR&M 2014). The WWP plans to maintain ownership of the Reservoir parcel and continue to use the property as a waterfowl preserve. Based on the current and potential future land use (recreational, nonresidential), people who are most likely to be exposed to asbestos via air inhalation include:

- On-site maintenance workers maintaining each of the BoRit Site parcels;
- On-site commercial workers carrying out activities associated with developing/maintaining recreational use of the BoRit Site parcels; and
- On-site recreational users.

Potential ecological receptors include both terrestrial and aquatic receptors.

6.2 Non-Asbestos Contaminants

6.2.1 Primary Source

Other contaminants detected in the ACM waste include VOCs, SVOCs, pesticides, and metals. In addition, three specific potential sources of contamination were investigated. These consisted of the fire training area on the Asbestos Pile parcel, the former transformers on the Reservoir and Asbestos Pile parcels, and the slag area on the Asbestos Pile parcel. The presence of dioxins was observed at the fire training area, and PCBs were noted at the location of the transformers.

6.2.2 Primary Release/Transport Mechanisms and Exposure Media

The primary release/transport mechanism for the non-asbestos contamination present in ACM and soil is surface runoff. Primary exposure media include soil, groundwater, surface water, and sediment.

VOCs

Because VOCs are present below the land surface, surface water runoff is not an issue. However, VOCs are highly mobile and would be expected to dissolve in precipitation that infiltrates the waste and travel with the infiltrating water to the native soils and groundwater below. VOCs were found consistently in one onsite shallow bedrock monitoring well, MW-02. The source of the nine VOCs found in one or more sample from this well may be the waste in the Park parcel, as this well is located on the downgradient edge of the parcel. However, samples from MW-07, an upgradient off-site well that was installed and sampled twice during the RI, had detections of five of those same VOCs: carbon tetrachloride, cis-1,2-dichloroethylene (cis-1,2-DCE), methyl tert-butyl ether (MTBE), tetrachloroethene (PCE), and trichloroethene (TCE). These VOCs detected in MW-07 were found at low concentrations in on-site soil/waste; however, due to the elevated concentrations found in groundwater, on-site soil/waste are not believed to be a large contributor to contamination in the shallow bedrock aquifer.

The groundwater discharges to the creeks, and seven VOCs were detected in the surface water of Wissahickon Creek and one VOC was detected in the surface water of Rose Valley Creek and Tannery Run. The presence of VOCs in creek water may also be from upstream sources. One VOC, TCE, was detected in the most upstream surface water sample collected from Wissahickon Creek approximately 500 feet north of the Site boundary. VOCs dissolved in the surface water can be expected to volatilize and travel downstream with the surface water; they do not easily partition to the fine-grained mineral or organic sediments.

SVOCs

SVOCs generally adsorb to soil and organic material and therefore do not easily desorb with infiltrating precipitation. SVOCs in surface soil and waste can erode from the upland areas and enter streams adsorbed to fine-grained soil and organic matter. Because SVOCs have high partition coefficients, the contaminants will likely adsorb onto particles and remain on the particles before settling out at dispositional areas downstream. SVOCs were found in all the creek sediment samples. However, the source of SVOCs in Site creek sediments could be upstream sources on the creeks, including road and parking area runoff. Benzo(a)pyrene was the only SVOC in sediments that exceeded the RSL, and it was found in the upstream sample at a concentration of 540

milligram/kilogram (mg/kg). This concentration is higher than some of the samples collected adjacent to the Site.

Similarly, more polynuclear aromatic hydrocarbons (PAHs) were found above RSLs in the surface soils at the Park and Asbestos Pile parcels than in the wastes in those parcels. Additionally, concentrations of SVOCs were higher in the surface soil than in the waste at the Asbestos Pile parcel. It is likely that some of the PAHs in the surface soils on all parcels are due to deposition of airborne products of off-site combustion, as PAHs were also found in background surface soil samples. This airborne off-site source would explain the higher PAH concentrations in the surface soils than in the wastes and native soils

Pesticides/PCBs/Dioxins

Pesticides do not dissolve easily, and they adhere to fine-grained and organic material. Pesticides were found at low levels in native soils, surface water from all surface water bodies, and turbid overburden groundwater; however, pesticides were not detected in groundwater samples from bedrock monitoring wells. Pesticides present in waste material and cover soil of upland areas will adsorb to fine-grained particulate matter and migrate on the particle via runoff and overland flow to the Reservoir and creeks. However, pesticides were found in similar numbers and concentrations in upstream sediment samples. The ubiquitous presence of pesticides suggests their presence may not be attributable to the waste material disposed on the Site.

Surface soil samples collected near the former electrical transformers indicated that PCB contamination at those locations is limited, because only one RSL exceedance was observed. Although deeper samples were not collected in the area where the PCB concentration exceeded the RSL, the tendency for PCBs to adsorb to fine-grained material and the generally low PCB concentrations detected in surface soils do not suggest the likelihood of extensive vertical migration of PCBs.

Dioxin was detected in soil samples collected from the fire training areas and the slag area on the Asbestos Pile parcel. Concentrations detected in the deepest soil investigated at these locations (6" to 24") exceeded RSLs. However, dioxins are not considered to be highly mobile in soil because they can adsorb to organic material and fine-grained material (silts and clays). Therefore, extensive vertical migration of dioxins in these areas would not be expected.

Metals

As noted above, metals were detected in the ACM waste. However, metals also occur as constituents of minerals and can be present in non-impacted soils at concentrations greater than the RSLs. Six metals were found in soil on the Site as well as background surface soil samples at concentrations exceeding RSLs: aluminum, arsenic, chromium, cobalt, iron, and manganese. A non-statistical comparison was performed of the suite of metals and the ranges of concentrations of metals in the different soil strata at the Site to evaluate whether the waste layer was a potential source of metals to the environment. The following observations were made:

- The highest aluminum concentration on each parcel (other than from the slag area on the Asbestos Pile parcel, discussed, below) was detected in a waste sample from that parcel. Concentrations of aluminum in the waste samples at the Asbestos Pile and Reservoir parcels were only modestly higher than those from other strata;

- The maximum chromium concentration on each parcel was detected in a waste sample;
- In general, chromium concentrations across all strata were highest at the Asbestos Pile parcel;
- Some metals were found at concentrations exceeding the RSLs in waste samples: nickel and zinc (Park parcel), antimony and copper (Reservoir parcel), and copper (Asbestos Pile parcel);
- On the Asbestos Pile parcel, nickel exceeded the RSL in surface soil, waste, and native soil; and
- Mercury was only detected above the RSL in surface soil samples (from the Park and Reservoir parcels).

Based on these observations, the disposed waste may be a source for aluminum, antimony, chromium, copper, nickel, and zinc.

Metals will generally adsorb to fine-grained and organic materials, although their solubility and potential to precipitate are commonly a function of redox and pH conditions. To some extent the presence of metals in the groundwater samples appears to correlate to the turbidity (presence of particulates such as clay). For example, in MW-04, concentrations of aluminum exceeding the RSL are likely due to naturally-occurring aluminum present in clay particles present in the unfiltered, turbid sample. Similar patterns can be seen in the concentration of other metals in MW-04 (arsenic, and vanadium) where arsenic and vanadium were only detected in the most turbid samples. MW-02 also shows some correlation between higher concentrations of metals and turbidity.

6.2.3 Exposure Receptors

Based on the current and potential future land use (recreational, nonresidential) at the Site, the people who are most likely to be exposed to Site-related chemical contaminants via ingestion or dermal contact with soil, sediment, or surface water include:

- On-site maintenance workers maintaining each of the BoRit Site parcels;
- On-site commercial workers carrying out activities associated with developing/maintaining recreational use of parcels comprising the BoRit Site; and
- On-site recreational users.

While groundwater is included as a potential exposure media in the CSM, the PDOH concluded that Site groundwater does not currently influence public drinking water sources. In addition the potential future land use of the Site is considered recreational and non-residential. Therefore, groundwater exposure routes and potential receptors were not included in the CSM diagram (Figure 6-1).

Potential ecological receptors include both terrestrial and aquatic receptors.

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Section 7

References

- Center for Sustainable Communities, Temple University (CSC). 2014. Flooding and Stormwater Management Plan for Ambler Area Watersheds (Final Copy). December.
- CDM Federal Programs Corporation. (CDM Smith). 2014a. Addendum 2 to the Final Site Management Plan for RI Phase 2 Field Investigation, BoRit Superfund Site, OU-1. August 1.
- CDM Federal Programs Corporation. (CDM Smith). 2014b. CDM Smith-BoRit-6, Revision 0. *Site Specific Standard Operating Procedure, Bench Study – Asbestos Release from Reservoir Sediment*. August 1.
- CDM Federal Programs Corporation. (CDM Smith). 2013a. Final Phase 2 Data Evaluation Report, BoRit Asbestos Superfund Site, Operable Unit 1, Ambler, Pennsylvania. August 20.
- CDM Federal Programs Corporation. (CDM Smith). 2013b. Final Remedial Investigation Report, BoRit Asbestos Superfund Site, Operable Unit 1, Ambler, Pennsylvania. November 27.
- CDM Federal Programs Corporation. (CDM Smith). 2011. Preliminary Phase 2 Groundwater Report for BoRit Asbestos Superfund Site, Operable Unit 1. February 25.
- CDM Federal Programs Corporation. (CDM Smith). 2010a. Phase 1 Data Evaluations Report for BoRit Asbestos Superfund Site, Operable Unit 1, Ambler, Pennsylvania. June 18.
- CDM Federal Programs Corporation. (CDM Smith). 1988. Final Remedial Investigation/Feasibility Study Report for Ambler Asbestos Piles (Volume I), Ambler, Pennsylvania. August.
- EPA. 2015. National Recommended Water Quality Criteria, Human Health Criteria Table. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm#hhtable>. March 11.
- EPA. 2013 Region III Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites May 2013.
- EPA. 2012. Email from Dawn Ioven (EPA Region 3). “Residential ABS Data - BoRit.” May 15.
- EPA. 2011. Email from Dawn Ioven (EPA Region 3). “Fw: BoRit HHRA Scoping Call.” October 27.
- EPA. 2010. Phase I After Action Report, BoRit Asbestos Site, Ambler, Pennsylvania. March 1.
- EPA. 2008. Framework for Investigating Asbestos-Contaminated Sites. Report prepared by the Asbestos Committee of the Technical Review Workgroup of the Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency. OSWER Directive #9200.0-68. http://epa.gov/superfund/health/contaminants/asbestos/pdfs/framework_asbestos_guidance.pdf
- National Oceanic and Atmospheric Administration (NOAA). 2015. Blue Bell and Fort Washington Weather Stations. <http://www.ncdc.noaa.gov/cdo-web/search>. March 3.

Removal, Remediation and Monitoring (RR&M). 2014. Meeting Minutes. BoRit Community Action Group (CAG). February 12.

Shacklett, H.T. and Boerngen, J.G., 1984. Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States. USGS Professional Paper 1270.

United States Army Corps of Engineers, Philadelphia District (USACE). 2014. BoRit Superfund Site, Ambler Pa – Trip Report of Flow Paths to the Reservoir. August 15.

United States Army Corps of Engineers, Philadelphia District (USACE). 2013. Reservoir Hydraulics and Berm Stability Investigation: BoRit Asbestos Superfund Site, Ambler, PA. September.

Weather Underground. (2015). Philadelphia Wings Airport Weather Station.
<http://www.wunderground.com/cgi-bin/findweather/getForecast?query=KLOM>. February 24.

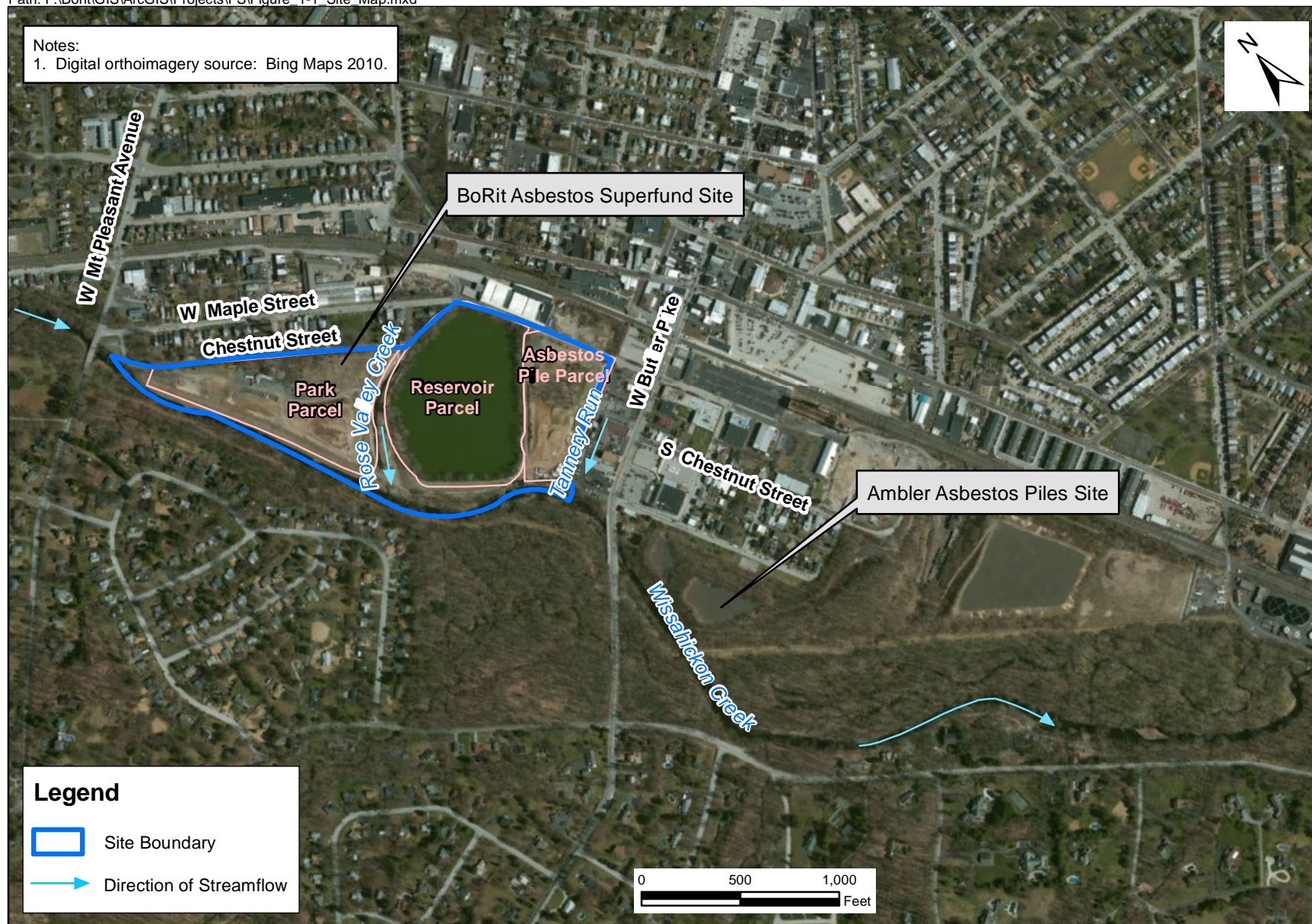
Weston Solutions, Inc. (Weston). 2015. Email from Jessica Duffy. “Reservoir water accumulation.” January 15.

Weston. 2014. Draft Field Sampling Plan for Sediment Sampling, BoRit Asbestos NPL Site. March 27.

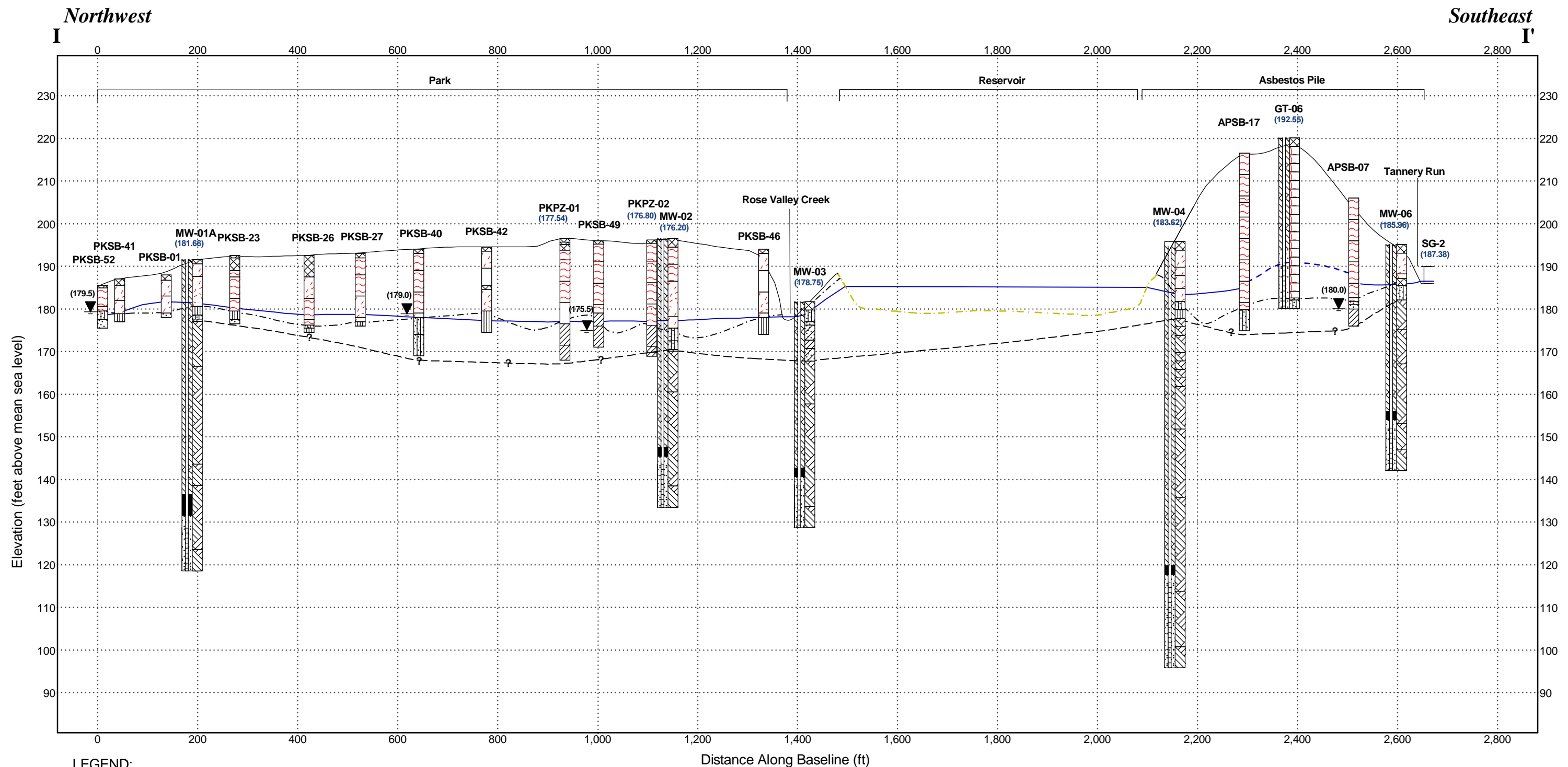
Whitpain Township. 2012. *Request for Proposals, Professional Community Planning and Engineering Services Associated with Development of a Plan of Action and Milestones for the West Ambler Neighborhood*. January 20.

Figures

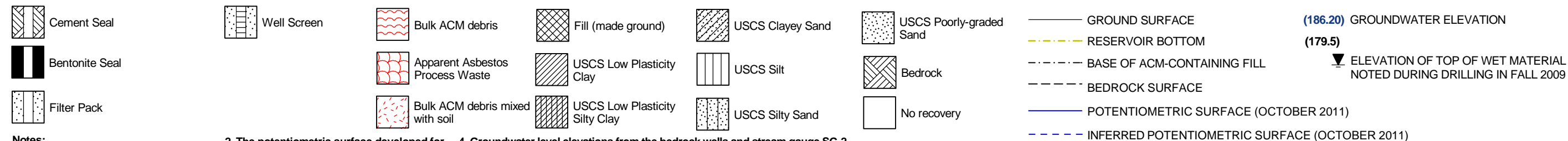








LEGEND:



Notes:

1. Topography is based on EPA START survey dated June 2, 2008. Subsequent elevation changes (e.g. remedial excavation within asbestos pile) are not reflected in the cross section.

2. The potentiometric surface developed for the October 2011 monitoring event is represented in profile along the cross-section baseline.

3. The elevations of the base of fill and bedrock surface were modeled to generate a surface for each unit across the Site. These surfaces are also represented in profile along the baseline of the cross section.

4. Groundwater level elevations from the bedrock wells and stream gauge SG-2 are contoured to illustrate the potentiometric surface in the shallow bedrock. The water level elevation in overburden well GT-06 is included in the contouring scheme to recognize that groundwater is mounded in this area and potentially increases the elevation head in the underlying shallow bedrock groundwater. Groundwater elevations from the overburden are posted for comparison to the other water levels.

5. If no (▼) symbol is next to a boring, saturated conditions were not noted in the boring during drilling.

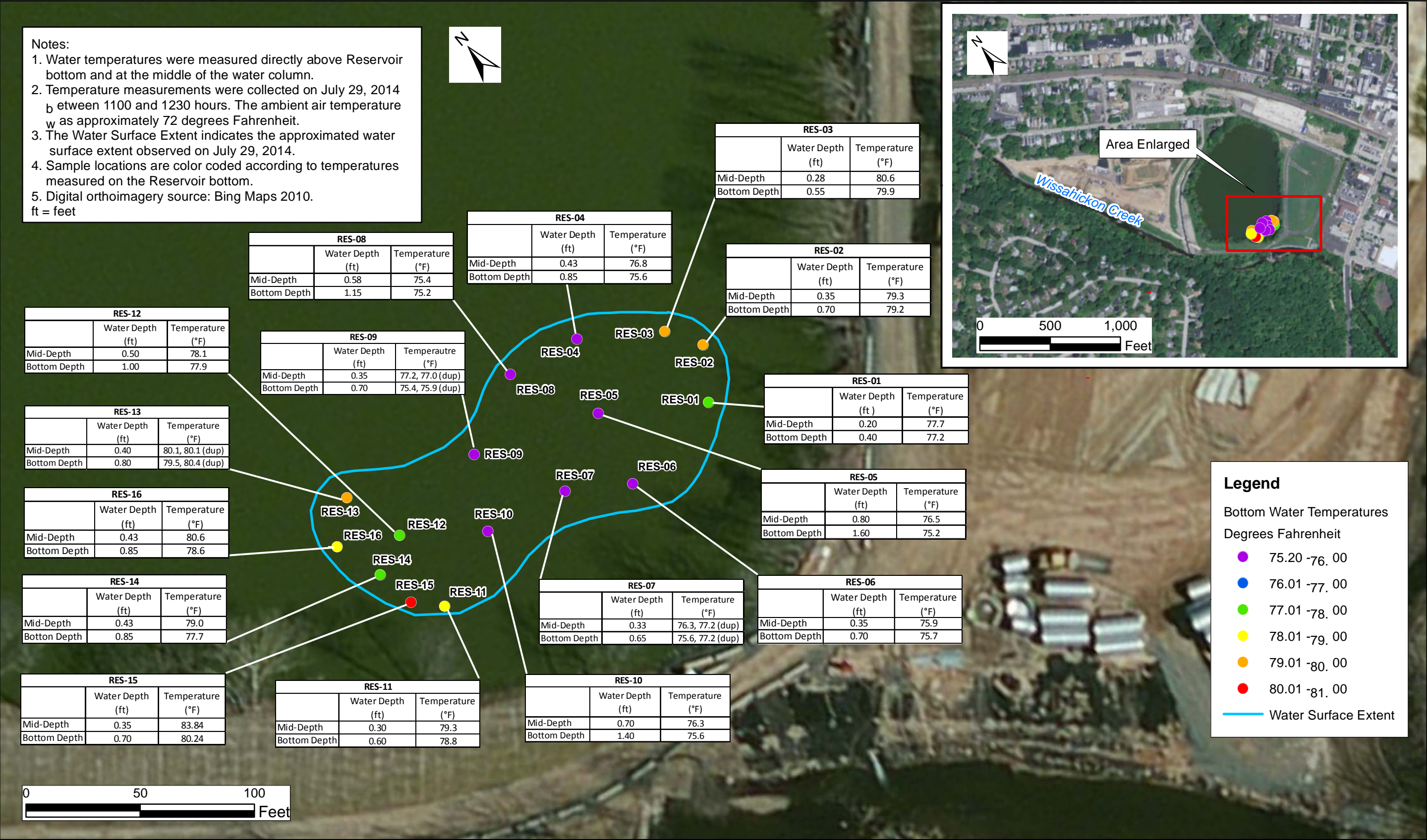
6. Vertical datum is North American Vertical Datum of 1988 (NAVD88).

(186.20) GROUNDWATER ELEVATION
(179.5)
▼ ELEVATION OF TOP OF WET MATERIAL NOTED DURING DRILLING IN FALL 2009

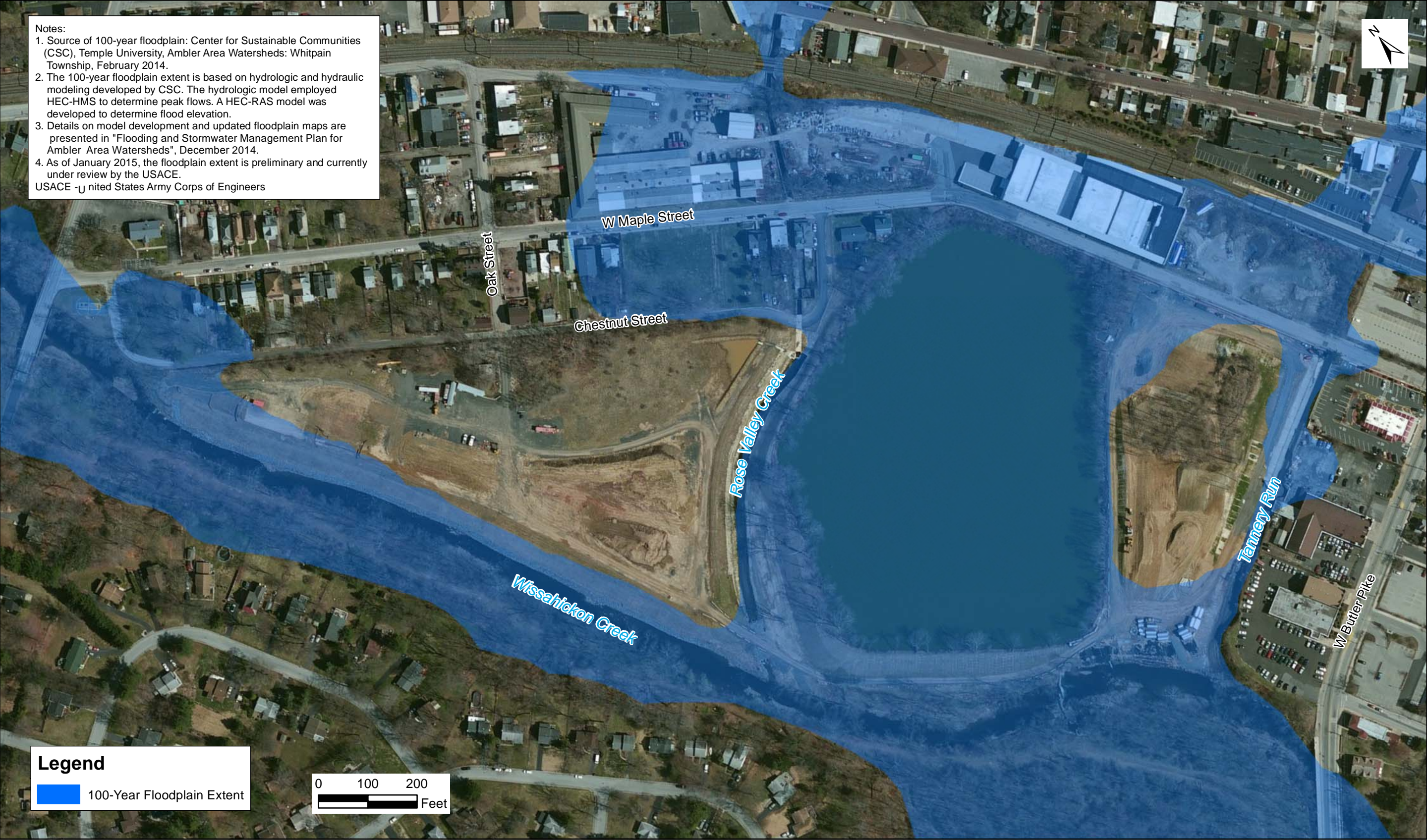


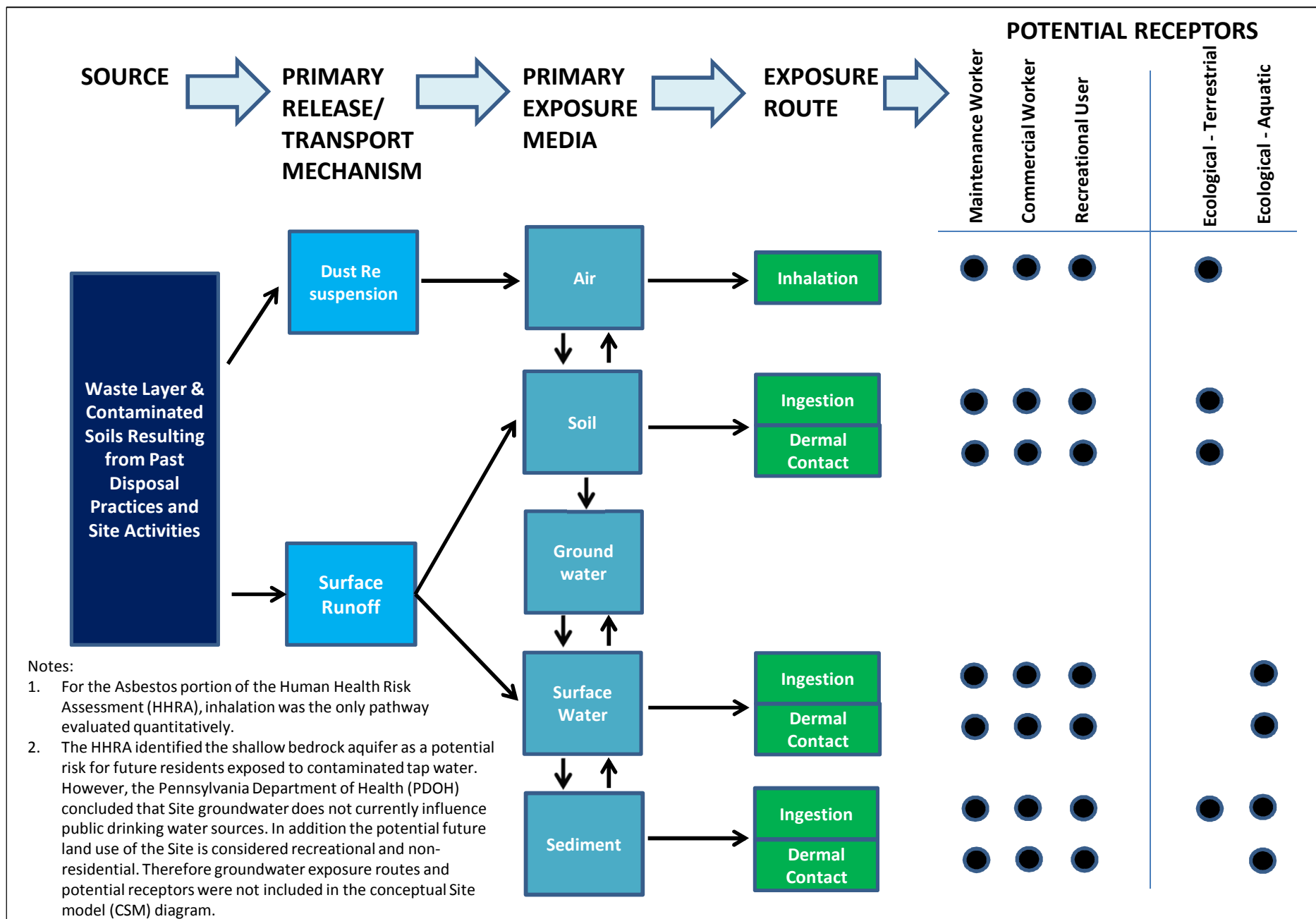


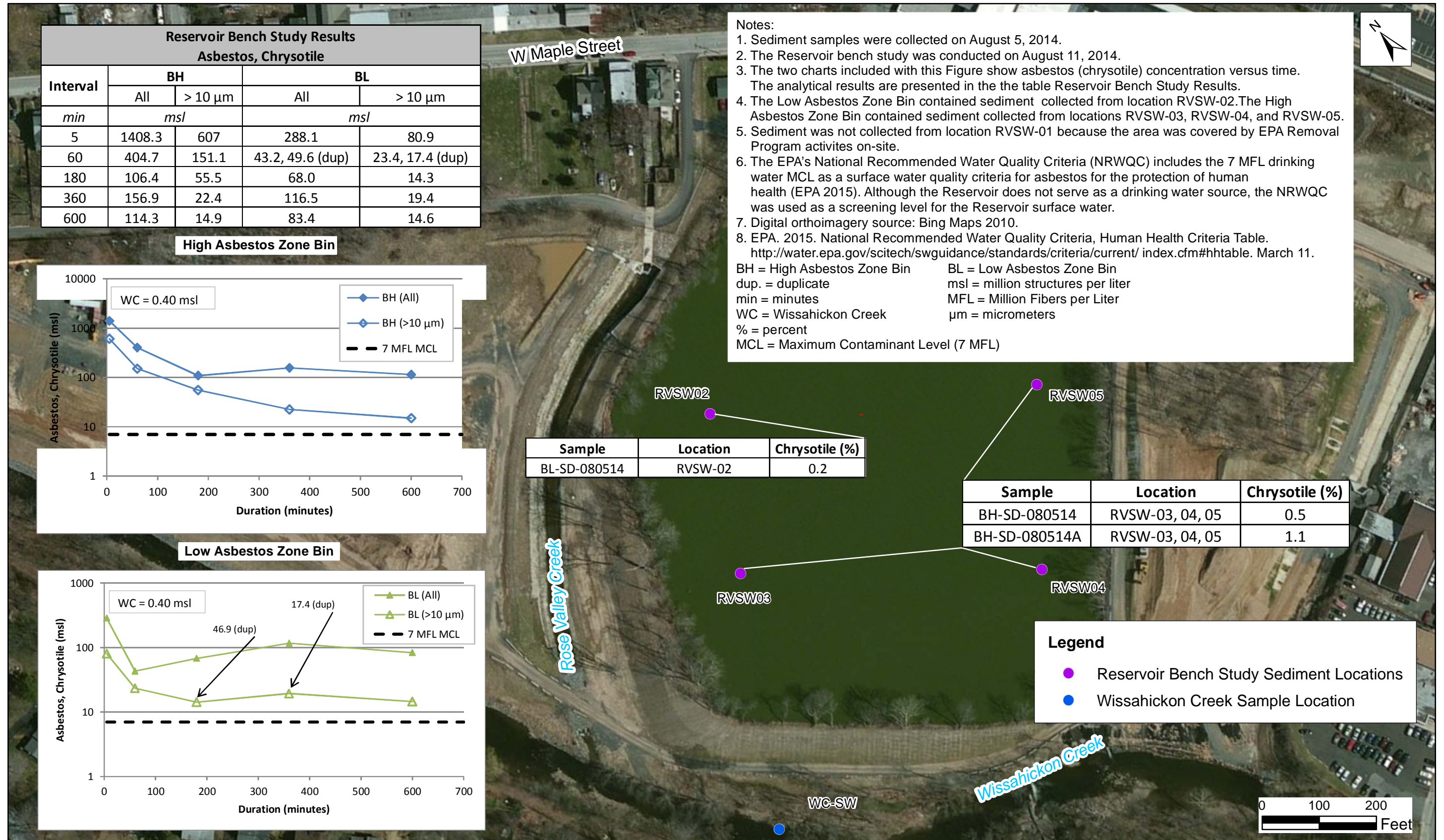


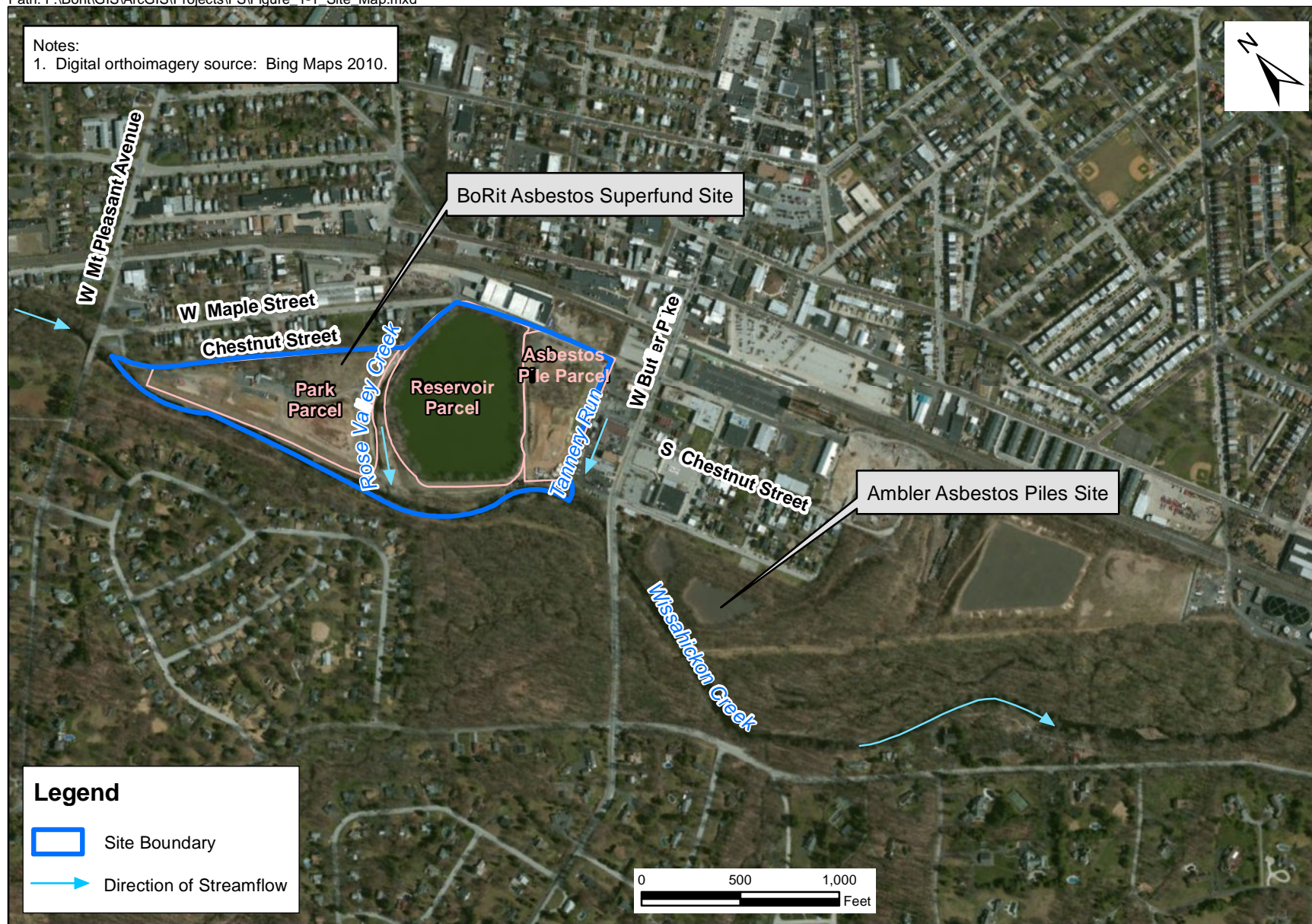






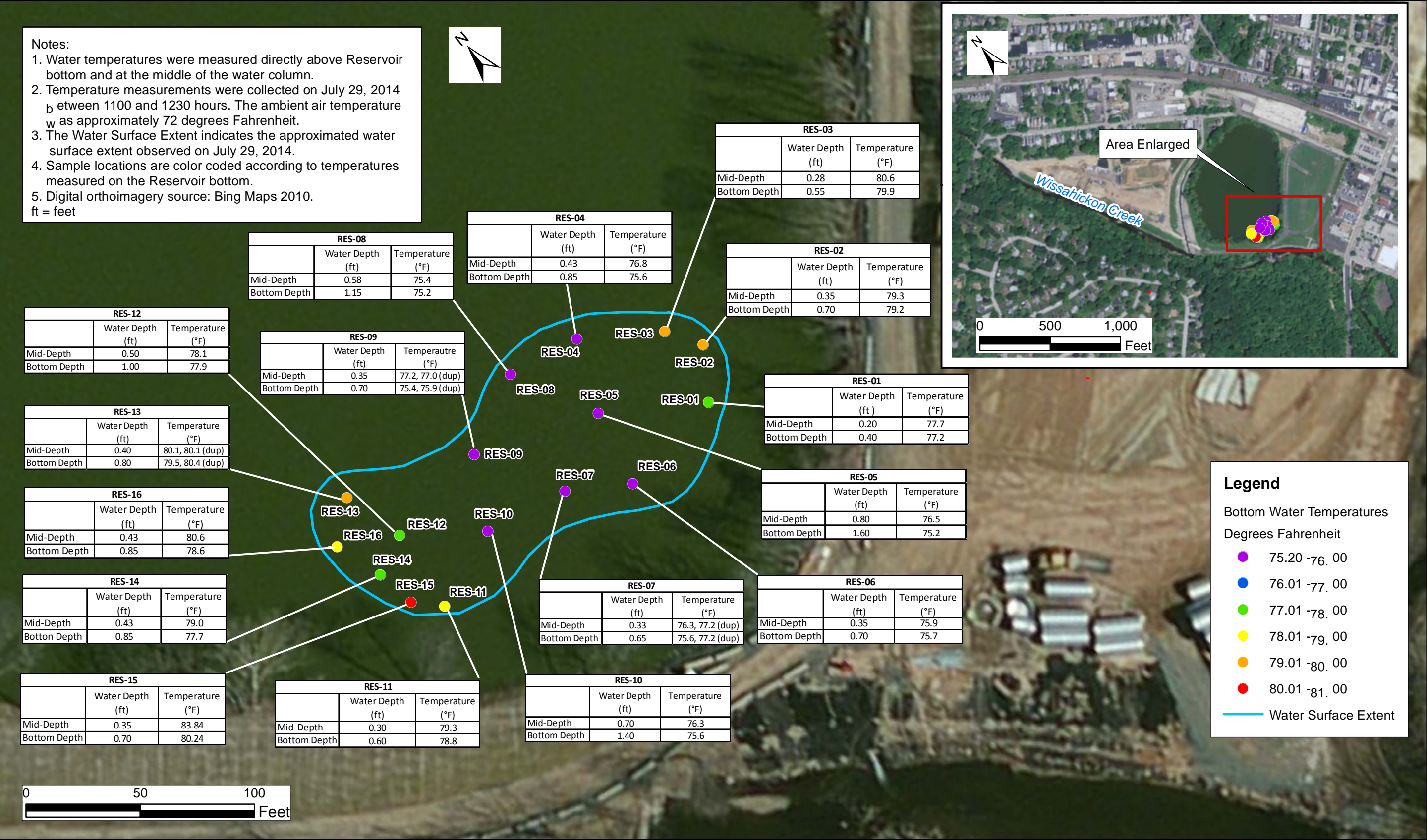






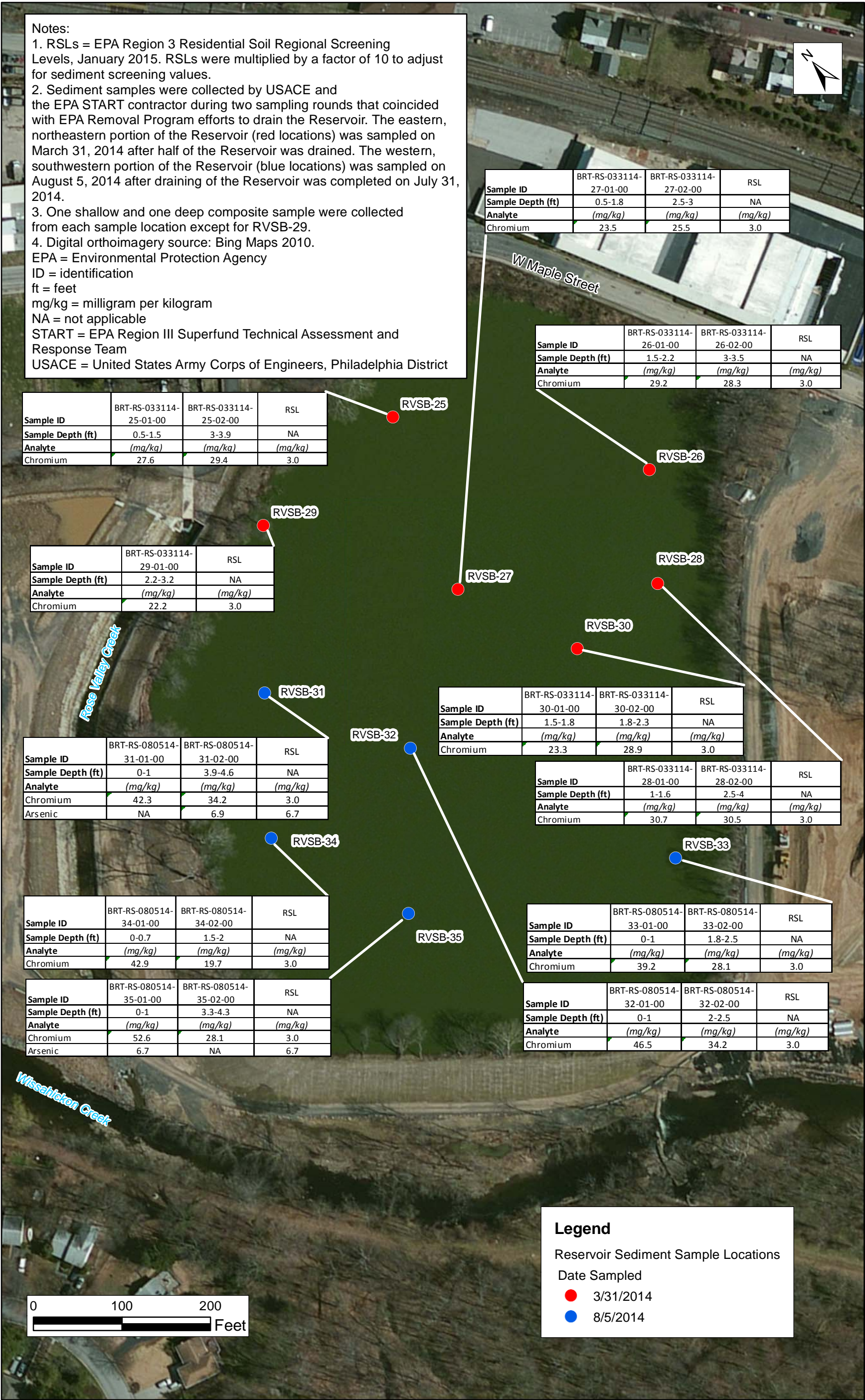


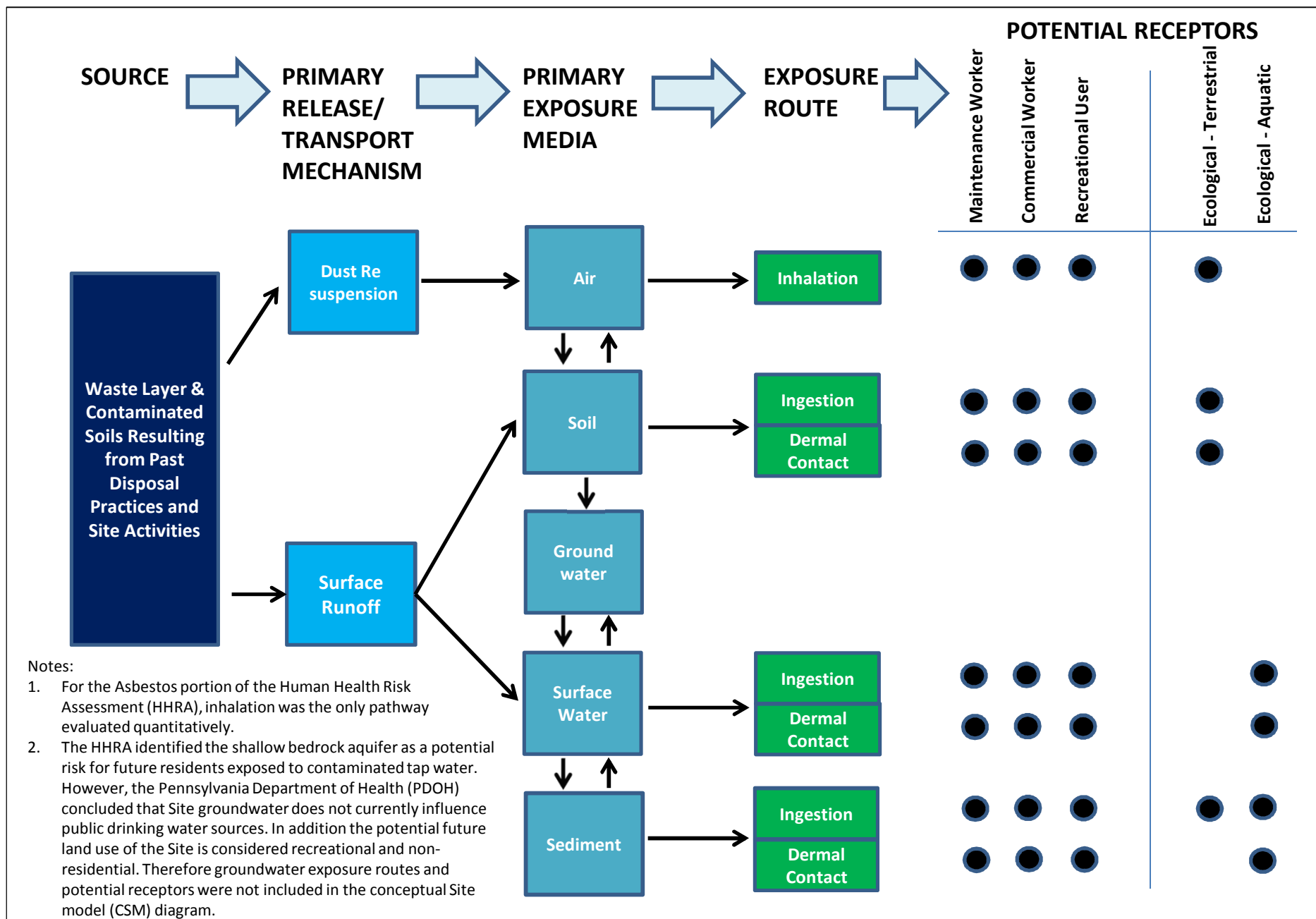












Tables

Table ES-1
Detections and Human Health Screening Level Exceedances Summary
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

	Asbestos		VOCs		SVOCs				Pesticides		PCBs		Dioxin/Furans		Inorganics		
	Detected	Detected Above SLs	Detected	Detected Above SLs	PAHs	Detected Above SLs	Non-PAHs	Detected Above SLs	Detected	Detected Above SLs	Detected	Detected Above SLs	Detected	Detected Above SLs	Nutrients	Detected	Detected Above SLs
Park Parcel																	
Surface Soil	Y	Y	Y	N	Y	Y	Y	N	Y	N	Y	N	NA	NA	Y	Y	Y
Cover/Waste Interface Soil	Y	Y	Y	N	Y	Y	Y	N	Y	N	Y	N	NA	NA	Y	Y	Y
Waste	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	NA	NA	Y	Y	Y
Native Soil	Y	N	Y	N	Y	Y	Y	N	Y	N	Y	N	NA	NA	Y	Y	Y
Groundwater (piezometer grab)	Y	NC	Y	NC	Y	NC	N	NC	Y	NC	N	NC	NA	NA	Y	Y	NC
ABS - Surface Soil	N	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABS - Personal Air	Y	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABS - Perimeter Air	Y	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Personal and Perimeter Air	Y	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Reservoir Parcel																	
Surface Soil	Y	Y	Y	N	Y	Y	Y	N	Y	N	Y	Y	NA	NA	Y	Y	Y
Cover/Waste Interface Soil	Y	Y	Y	N	Y	Y	Y	N	Y	N	Y	N	NA	NA	Y	Y	Y
Waste	Y	Y	Y	N	Y	Y	Y	N	Y	N	Y	N	NA	NA	Y	Y	Y
Native Soil	Y	Y	Y	N	N	N	Y	N	Y	N	N	N	NA	NA	Y	Y	Y
Surface Water	Y	Y	N	N	N	N	Y	N	Y	N	N	N	NA	NA	Y	Y	Y
Sediment	Y	N	Y	N	Y	Y	Y	N	Y	N	N	N	NA	NA	Y	Y	Y
ABS - Surface Soil	N	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABS - Personal Air	N	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABS - Perimeter Air	N	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Personal and Perimeter Air	N	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Seep Surface Water	Y	N	Y	N	N	N	N	N	N	N	N	N	NA	NA	Y	Y	Y
Asbestos Pile Parcel																	
Surface Soil																	
Characterization	Y	Y	Y	N	Y	Y	Y	N	Y	N	Y	N	NA	NA	Y	Y	Y
Transformers	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Y	Y	NA	NA	NA	NA	NA
Former Fire Training Area	NA	NA	NA	NA	Y	Y	Y	Y	Y	N	Y	N	Y	Y	NA	NA	NA
Slag Area	Y	N	NA	NA	Y	Y	N	N	N	N	N	N	Y	Y	Y	Y	Y
Cover/Waste Interface Soil	Y	Y	Y	N	Y	Y	Y	N	Y	N	Y	N	NA	NA	Y	Y	Y
Waste	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	N	NA	NA	Y	Y	Y
Native Soil	Y	Y	Y	N	Y	Y	Y	N	Y	N	N	N	NA	NA	Y	Y	Y
Groundwater (piezometer grab)	Y	NC	Y	NC	Y	NC	Y	NC	Y	NC	N	NC	NA	NA	Y	Y	NC
ABS - Surface Soil	Y	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABS - Personal Air	Y	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABS - Perimeter Air	Y	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Personal and Perimeter Air	Y	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table ES-1
Detections and Human Health Screening Level Exceedances Summary
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

	Asbestos		VOCs		SVOCs				Pesticides		PCBs		Dioxin/Furans		Inorganics		
	Detected	Detected Above SLs	Detected	Detected Above SLs	PAHs	Detected Above SLs	Non-PAHs	Detected Above SLs	Detected	Detected Above SLs	Detected	Detected Above SLs	Detected	Detected Above SLs	Nutrients	Detected	Detected Above SLs
Site-Wide Groundwater																	
Shallow Bedrock Groundwater	Y	N	Y	Y	N	N	Y	Y	N	N	N	N	NA	NA	Y	Y	Y
Creeks																	
Wissahickon Creek																	
Sediment	Y	N	Y	N	Y	Y	Y	N	Y	N	Y	N	NA	NA	Y	Y	Y
Surface Water	Y	Y	Y	N	Y	Y	N	N	Y	N	N	N	NA	NA	Y	Y	Y
Rose Valley Creek																	
Sediment	N	N	N	N	Y	Y	Y	N	Y	N	Y	N	NA	NA	Y	Y	Y
Surface Water	N	N	Y	N	N	N	N	N	Y	N	N	N	NA	NA	Y	Y	N
Tannery Run																	
Sediment	N	N	N	N	Y	Y	Y	N	Y	N	N	N	NA	NA	Y	Y	Y
Surface Water	N	N	Y	N	N	N	N	N	Y	N	N	N	NA	NA	Y	Y	Y
Background Soil	NA	NA	NA	NA	Y	Y	Y	N	N	N	N	N	NA	NA	Y	Y	Y
Floodplain and Streambank Soil	Y	Y	Y	N	Y	Y	Y	N	Y	N	Y	N	NA	NA	Y	Y	Y
Residential																	
ABS - Surface Soil	Y	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABS - Personal Air	Y	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABS - Perimeter Air	Y	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Walking Trails																	
ABS - Surface Soil	Y	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABS - Personal Air	Y	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABS - Perimeter Air	Y	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Outdoor Ambient Air	Y	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Kid's Park	N	N	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

1. RSLs are not available for nutrients.

2. Asbestos in soil data screened against EPA OSWER’s Framework for Investigating Asbestos-Contaminated Superfund Sites (Sept 2008).

3. The EPA’s National Recommended Water Quality Criteria (NRWQC) includes the 7 MFL drinking water MCL as a surface water quality criteria for asbestos for the protection of human health (EPA 2015). Although the Reservoir does not serve as a drinking water source, the NRWQC was used as a screening level for the Reservoir surface water.

4. EPA. 2015. National Recommended Water Quality Criteria, Human Health Criteria Table. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm#htable>. March 11.

5. Personal and perimeter air monitoring data screened against OSHA Permissible Limit or OSHA Short Term Exposure Limit.

6. ABS air data screened against site-specific preliminary remediation goal calculated by EPA Region 3 Toxicologist, in an email dated October 27, 2011.

7. Ambient air data screened against value provided by EPA Region 3 in an email dated October 8, 2011.

8. Analytes detected in media and analytes detected above SLs are shaded in gray.

Y = Yes

N = No

ABS = activity-based sampling

EPA = Environmental Protection Agency

MCL = Maximum Contaminant Level

MFL = million fibers per liter

NA = Not analyzed

NC = Not Compared to RSLs; data are screening-level quality only and of insufficient quality for use in the Human Health Risk Assessment

OSHA - Occupational Safety and Health Administration

OSWER - Office of Solid Waste and Emergency Response

PAH = Polynuclear aromatic hydrocarbon

PCBs = Polychlorinated Biphenyls

RSL = Regional Screening Level (EPA Region 3 Risk Based Concentration Values for Residential Soil (May 2013))

SL = Screening Level

SVOC = Semi-volatile organic compound

VOC = Volatile organic compound

Table ES-2
Potential Human Health Risk Receptors
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

Receptors	Potential* Risk Cancer - Asbestos	Potential* Risk Cancer - Chemical	Potential* Risk Non-Cancer - Chemical
CURRENT/FUTURE			
Park Parcel Maintenance Worker	Yes	No	No
Reservoir Parcel Maintenance Worker	No	No	No
Asbestos Pile Maintenance Worker	Yes	No	No
Recreational User - Walking Trail	No	No	No
Recreational User - Tannery Run	NA	No	No
Recreational User - Rose Valley Creek	NA	No	No
Recreational User - Wissahickon Creek	No	Yes	No
Fisher - Wissahickon Creek	NA	Yes	Yes
Offsite Residences - Resident	No	NA	NA
FUTURE			
Recreational User - Park Parcel	No	No	No
Recreational User- Reservoir Parcel	No	No	No
Recreational User - Asbestos Pile Parcel	No	No	No
Commercial Worker - Park Parcel	No	No	No
Commercial Worker - Asbestos Pile Parcel	No	No	No
Resident - Site-wide Groundwater	NA	Yes	Yes

NA = Risk Not Evaluated

* There are a number of uncertainties that arise during the process of estimating human exposure and risk to asbestos and chemicals which limit the confidence in the risk conclusions. These uncertainties should be considered when making risk management decisions for the Site.

Table 2-1**Water Level Elevation Data - Wet and Dry Synoptic Events****BoRit Asbestos Superfund Site, OU-1****Ambler, Pennsylvania**

Name	Type	Elevation of TOC (ft msl)	Elevation of TIC (ft msl)	July 29, 2014 (Wet Event)		August 11, 2014 (Dry Event)	
				DTW (ft btic)	Water Level Elevation	DTW (ft btic)	Water Level Elevation (ft msl)
MW-01A	Monitoring Well	193.89	193.55	14.44	179.11	13.82	179.73
MW-02	Monitoring Well	198.36	198.06	23.01	175.05	23.36	174.70
MW-03	Monitoring Well	183.72	183.27	6.22	177.05	7.02	176.25
MW-04	Monitoring Well	195.79	195.44	13.61	181.83	15.35	180.09
MW-05	Monitoring Well	193.16	192.81	21.49	171.32	21.72	171.09
MW-06	Monitoring Well	197.31	196.95	12.38	184.57	15.94	181.01
MW-07	Monitoring Well	186.27	186.27	4.81	181.46	7.01	179.26
PKPZ-01	Piezometer	199.14	198.50	NM	NM	NM	NM
PKPZ-02	Piezometer	199.67	199.45	23.62	175.83	Dry	Dry
PKPZ-03	Piezometer	199.26	199.12	Dry	Dry	Dry	Dry
APPZ-03	Piezometer	191.88	191.79	Removed	Removed	Removed	Removed
APPZ-02	Piezometer	189.89	189.70	Removed	Removed	Removed	Removed
APPZ-01	Piezometer	189.68	189.48	Removed	Removed	Removed	Removed
GT-8	Piezometer	215.34	215.20	Removed	Removed	Removed	Removed
GT-6	Piezometer	222.00	221.86	Dry	Dry	Dry	Dry
GT-7	Piezometer	210.97	210.58	21.90	188.68	22.09	188.49
SG-5	Staff Gauge	178.54	n/a	-0.92	177.62	-0.97	177.57
SG-4	Staff Gauge	177.89	n/a	1.26	179.15	1.16	179.05
SG-3	Staff Gauge	185.68	n/a	NM	NM	NM	NM
SG-2	Staff Gauge	186.62	n/a	1.12	187.74	1.08	187.70
SG-1	Staff Gauge	167.98	n/a	0.12	168.10	0.00	167.98

Notes:

1. The Reservoir was being pumped dry by the EPA Removal Program during the time of wet and dry synoptic events. As a result, SG-3 could not be measured due to the low water levels in the Reservoir.
2. Rainfall information was gathered from Philadelphia Wings Airport weather station from Weather Underground. Rainfall two days prior to the July 29, 2014 event totaled 0.70 inches (Weather Underground 2015). Rainfall two days prior to the August 11, 2014 event was 0.0 inches (Weather Underground 2015). Section 2 of the RI Addendum Report provides additional weather information data.

ft btic = feet below top of inner casing

ft msl = ft above mean sea level, in North American Vertical Datum 1988 (NAVD88)

TOC = top of outer casing. For staff gauges, elevation refers to gauge bottom.

TIC = Top of inner casing

n/a = not applicable

NM = not measured

Removed = Well has been abandoned

Table 4-1
Reservoir Bench Study Water Quality Parameters
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

Parcel	Sample	Date	Temperature (°C)	pH	Specific Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Turbidity (NTU)
Wissahickon Creek	WC-SW-081114	8/11/2014	22.69	8.07	0.726	8.36	190	2.9
Reservoir	PW-SW-081114	8/11/2014	29.88	7.94	0.458	7.09	109	55.8

Notes:

1. Data was collected immediately prior to sample collection.
2. The Reservoir pit water was collected from the area of standing water adjacent to the 24" PVC pipe extending from the Reservoir manhole as shown in Figure 5-2.

Acronyms:

SW = surface water
 WC = Wissahickon Creek
 PW = pit water
 PVC = polyvinyl chloride
 mg/L = milligram per liter
 mS/cm = millisiemen per centimeter
 mV = millivolt
 NTU = nephelometric turbidity unit
 °C = degrees Celsius

Table 4-2

Asbestos Results - Reservoir Bench Study Sediment

BoRit Asbestos Superfund Site, OU-1

Ambler, Pennsylvania

Sample ID			BH-SD-080514	BH-SD-080514A	BL-SD-080514
Sample Type				Dup. of BH-SD-080514	
Analyte	Result Unit	Screening Levels (%)			
Chrysotile	%	1	0.5	1.1	0.2
Non-Asbestos (Fibrous)	%	NA	ND	ND	ND
Non-Asbestos (Non-Fibrous)	%	NA	99.5	98.9	99.8

Notes:

Screening Levels (asbestos) - USEPA asbestos screening level, 2008.

Bolded cells indicate results exceed SL for compound.

% - percent

Dup. - duplicate

BH - High Asbestos Zone Bin

BL - Low Asbestos Zone Bin

ID - identification

NA - not applicable

ND - non-detect

SD - sediment

Table 4-3
Asbestos Results - Reservoir Bench Study Bin Water
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

Analyte	Result Unit	Screening Level (MFL)	BH-SW01-081114	BH-SW03-081114	BH-SW05-081114	BH-SW06-081114	BH-SW10-081114	BL-SW01-081114	BL-SW01-081114A	BL-SW03-081114
Chrysotile	msl	7	404.7	106.4	1408.3	156.9	114.3	43.2	46.9	68
Chrysotile (>10 µm)	msl	7	151.1	55.5	607	22.4	14.9	23.4	17.4	14.3
Libby Amphibole	msl	7	ND	2.3	ND	ND	ND	ND	ND	ND
Libby Amphibole (>10 µm)	msl	7	ND	2.3	ND	ND	ND	ND	ND	ND
Other Amphibole	msl	7	ND	ND	ND	ND	ND	ND	ND	ND
Other Amphibole (>10 µm)	msl	7	ND	ND	ND	ND	ND	ND	ND	ND
Total Asbestos	msl	7	404.7	108.7	1408.3	156.9	114.3	43.2	46.9	68
Total Asbestos (>10 µm)	msl	7	151.1	57.8	607	22.4	14.9	23.4	17.4	14.3

Notes:

1. Bolded cells indicate results exceed the MCL.

2. Results presented in msl were originally reported in structures per liter (s/L). The result was converted to msl by dividing the value by 1,000,000. The result was converted so that it could be compared to the MCL which is presented in MFL.

3. Screening level - Maximum Contaminant Level (MCL), USEPA National Primary Drinking Water Regulations, May 2009.

4. The EPA’s National Recommended Water Quality Criteria (NRWQC) includes the 7 MFL drinking water MCL as a surface water quality criteria for asbestos for the protection of human health (EPA 2015). Although the Reservoir does not serve as a drinking water source, the NRWQC was used as a screening level for the Reservoir surface water.

5. EPA. 2015. National Recommended Water Quality Criteria, Human Health Criteria Table. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm#hhtable>. March 11.

EPA - Environmental Protection Agency

MFL - million fibers per liter

msl - million structures per liter

MCL - maximum contaminant level

BH - High Asbestos Zone Bin

BL - Low Asbestos Zone Bin

L - liter

ND - non-detect

PW - pit water

SW- surface water

WC - Wissahickon Creek

U - The analyte was analyzed for but was not detected above the level of the reported sample quantitation limit.

J - The associated analyte may be inaccurate or imprecise.

UJ - The non-detect result may be inaccurate or imprecise due to the quality of the data generated because certain QC criteria were not met.

QC - quality control

µm - micrometer

> - greater than

Table 4-3
Asbestos Results - Reservoir Bench Study Bin Water
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

Analyte	Result Unit	Screening Level (MFL)	BL-SW05-081114	BL-SW06-081114	BL-SW10-081114	PW-SW-081114	WC-SW-081114
Chrysotile	msl	7	288.1	116.5	83.4	ND	0.4
Chrysotile (>10 µm)	msl	7	80.9	19.4	14.6	ND	ND
Libby Amphibole	msl	7	ND	ND	ND	ND	ND
Libby Amphibole (>10 µm)	msl	7	ND	ND	ND	ND	ND
Other Amphibole	msl	7	ND	ND	ND	ND	ND
Other Amphibole (>10 µm)	msl	7	ND	ND	ND	ND	ND
Total Asbestos	msl	7	288.1	116.5	83.4	ND	0.4
Total Asbestos (>10 µm)	msl	7	80.9	19.4	14.6	ND	ND

Notes:

1. Bolded cells indicate results exceed the MCL.

2. Results presented in msl were originally reported in structures per liter (s/L). The result was converted to msl by dividing the value by 1,000,000. The result was converted so that it could be compared to the MCL which is presented in MFL.

3. Screening level - Maximum Contaminant Level (MCL), USEPA National Primary Drinking Water Regulations, May 2009.

4. The EPA’s National Recommended Water Quality Criteria (NRWQC) includes the 7 MFL drinking water MCL as a surface water quality criteria for asbestos for the protection of human health (EPA 2015). Although the Reservoir does not serve as a drinking water source, the NRWQC was used as a screening level for the Reservoir surface water.

5. EPA. 2015. National Recommended Water Quality Criteria, Human Health Criteria Table. <http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm#hhtable>. March 11.

EPA - Environmental Protection Agency

MFL - million fibers per liter

msl - million structures per liter

MCL - maximum contaminant level

BH - High Asbestos Zone Bin

BL - Low Asbestos Zone Bin

L - liter

ND - non-detect

PW - pit water

SW- surface water

WC - Wissahickon Creek

U - The analyte was analyzed for but was not detected above the level of the reported sample quantitation limit.

J - The associated analyte may be inaccurate or imprecise.

UJ - The non-detect result may be inaccurate or imprecise due to the quality of the data generated because certain QC criteria were not met.

QC - quality control

µm - micrometer

> - greater than

Table 5-1
Organic Analytes Detected in Reservoir during the 2014 Reservoir Sediment Investigation
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

Sample Location		RVSB-25		RVSB-26		RVSB-27		RVSB-28		RVSB-29	RVSB-30		RVSB-31	
Sample Number		BRT-RS-033114-25-01-00	BRT-RS-033114-25-02-00	BRT-RS-033114-26-01-00	BRT-RS-033114-26-02-00	BRT-RS-033114-27-01-00	BRT-RS-033114-27-02-00	BRT-RS-033114-28-01-00	BRT-RS-033114-28-02-00	BRT-RS-033114-29-01-00	BRT-RS-033114-30-01-00	BRT-RS-033114-30-02-00	BRT-RS-080514-31-01-00	BRT-RS-080514-31-02-00
Sample Type		N	N	N	N	N	N	N	N	N	N	N	N	N
Sample Depth (ft)		0.5-1.5	3-3.9	1.5-2.2	3-3.5	0.5-1.8	2.5-3	1-1.6	2.5-4	2.2-3.2	1.5-1.8	1.8-2.3	0-1	3.9-4.6
Volatile Organic Compounds (VOCs) (µg/kg)		RSL (µg/kg)												
2-Butanone (MEK)	27,000,000	12	10 J	39	14	24	16	20	7.8 J	11 J	11 J	11 J	26 UJ	11 U
4-Methyl-2-Pentanone (MIBK)	5,300,000	12 U	13 U	12 U	13 U	14 U	12 U	13 U	13 U	14 U	14 U	13 U	14 J	3.9 J
Acetone	61,000,000	24	17	43	14	69	49	94	37	17	20	42	55 J	40
Carbon Disulfide	770,000	6 U	6.6 U	14	6.4	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U
Semi-Volatile Organic Compounds (SVOCs) (µg/kg)		RSL (µg/kg)												
Diethyl Phthalate	49,000,000	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U
Dimethyl Phthalate	NSL	590	520	580	490	470	520	590	440	510	640	500	2600 J	1100

Sample Location		RVSB-32	RVSB-33		RVSB-34		RVSB-35		QC			
Sample Number		BRT-RS-080514-32-02-00	BRT-RS-080514-33-01-00	BRT-RS-080514-33-02-00	BRT-RS-080514-34-01-00	BRT-RS-080514-34-02-00	BRT-RS-080514-35-01-00	BRT-RS-080514-35-02-00	BRT-RS-033114-00-01-03	BRT-RS-080514-00-01-03	BRT-RS-033114-00-01-04	BRT-RS-080514-00-01-04
Sample Type		N	N	N	N	N	N	N	RB*	RB*	TB*	TB*
Sample Depth (ft)		2-2.5	0-1	1.8-2.5	0-0.7	1.5-2	0-1	3.3-4.3	NA	NA	NA	NA
Volatile Organic Compounds (VOCs) (µg/kg)		RSL (µg/kg)										
2-Butanone (MEK)	27,000,000	6.4 U	21 UJ	6.2 U	26 UJ	7.3 U	31 UJ	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-Pentanone (MIBK)	5,300,000	2.4 J	21 UJ	2.6 J	13 J	3.5 J	18 J	3.2 J	10 U	10 U	10 U	10 U
Acetone	61,000,000	22	81 J	18	67 J	34	140 J	50	10 U	10 U	10 U	10 U
Carbon Disulfide	770,000	3.2 U	10 UJ	3.1 U	13 UJ	3.6 U	7 J	5 U	5 U	5 U	5 U	5 U
Semi-Volatile Organic Compounds (SVOCs) (µg/kg)		RSL (µg/kg)										
Diethyl Phthalate	49,000,000	220 UJ	710 UJ	210 U	890 UJ	250 U	1100 UJ	340 U	5.1 U	1.8 J	NS	NS
Dimethyl Phthalate	NSL	720 J	2400 J	690	2400 J	920	4100 J	1500	5.1 U	5.2 U	NS	NS

Notes:

1. Only analytes with at least one detection are shown.
2. Pesticide and PCB analysis was performed; however, no positive results were detected in any of the sediment samples.
- * - The rinsate blank and trip blank results are reported in micrograms per liter (µg/L).

µg/kg - microgram per kilogram

ft - feet

N - normal field sample

RB - rinsate blank

TB - trip blank

NS - not sampled; trip blanks were not analyzed for semi-volatile organic analysis.

RSL - Regional Screening Level, USEPA Region 3 Residential Soil Regional Screening Levels, January 2015.

N- normal field sample

NSL - no screening level

NA - not applicable

PCB - polychlorinated biphenyl

U - The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted

Contract Required Quantitation Limit (CRQL) for sample and method.

UJ - The analyte was not detected at a level greater than or equal to the adjusted CRQL. However, the reported adjusted CRQL is approximate and may be inaccurate or imprecise.

J - The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the CRQL).

For non-detects (U qualified results), the number preceding the qualifier is the reporting detection limit.

QC - Quality Control

Table 5-2
Asbestos Detected in Reservoir during the 2014 Reservoir Sediment Investigation
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

Analyte	Screening Level (%)	Sample Location	RVSB-25		RVSB-26		RVSB-27		RVSB-28			RVSB-29	RVSB-30	
		Sample Number	BRT-RS-033114-25-01-00	BRT-RS-033114-25-02-00	BRT-RS-033114-26-01-00	BRT-RS-033114-26-02-00	BRT-RS-033114-27-01-00	BRT-RS-033114-27-02-00	BRT-RS-033114-28-01-00	BRT-RS-033114-28-02-00	BRT-RS-033114-28-02-01	BRT-RS-033114-29-01-00	BRT-RS-033114-30-01-00	BRT-RS-033114-30-02-00
		Sample Type	N	N	N	N	N	N	N	N	FD	N	N	N
		Sample Depth (ft)	0.5-1.5	3-3.9	1.5-2.2	3-3.5	0.5-1.8	2.5-3	1-1.6	2.5-4	2.5-4	2.2-3.2	1.5-1.8	1.8-2.3
Asbestos (%)														
Chrysotile	1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Non-Asbestos (Fibrous)	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Non-Asbestos (Non-Fibrous)	NA		100	100	100	100	100	100	100	100	100	100	100	100

Analyte	Screening Level (%)	Sample Location	RVSB-31		RVSB-32			RVSB-33		RVSB-34		RVSB-35		QC
		Sample Number	BRT-RS-080514-31-01-00	BRT-RS-080514-31-02-00	BRT-RS-080514-32-01-00	BRT-RS-080514-32-01-01	BRT-RS-080514-32-02-00	BRT-RS-080514-33-01-00	BRT-RS-080514-33-02-00	BRT-RS-080514-34-01-00	BRT-RS-080514-34-02-00	BRT-RS-080514-35-01-00	BRT-RS-080514-35-02-00	BRT-RS-080514-00-01-03
		Sample Type	N	N	N	FD	N	N	N	N	N	N	N	RB*
		Sample Depth (ft)	0-1	3.9-4.6	0-1	0-1	2-2.5	0-1	1.8-2.5	0-0.7	1.5-2	0-1	3.3-4.3	NA
Asbestos (%)														
Chrysotile	1		0.25 U	0.50	0.25	0.25	ND	0.75	0.25	0.25	ND	0.25 U	0.50	3
Non-Asbestos (Fibrous)	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
Non-Asbestos (Non-Fibrous)	NA		100	99.5	99.75	99.75	100	99.25	99.75	99.75	100	100	99.5	NA

Notes:

Screening Levels (asbestos) - USEPA screening level, 2008.

For non-detects (U qualified results), the number preceding the qualifier is the reporting detection limit.

* - Rinsate blank results are reported in MFL (million fibers per liter).

% - percent

ft - feet

U - The analyte was analyzed for, but was not detected at a level greater than or equal to the reporting detection limit for sample and method.

N - normal field sample

NA - not applicable

ND - non-detect

FD - field duplicate sample

RB - rinsate blank

QC - Quality Control

Table 5-3
Inorganic Analytes Detected in Reservoir during the 2014 Reservoir Sediment Investigation
BoRit Asbestos Supefund Site, OU-1
Ambler, Pennsylvania

Sample Location		RVSB-25		RVSB-26		RVSB-27		RVSB-28		RVSB-29	RVSB-30		RVSB-31	
Sample Number		BRT-RS-033114-25-01-00	BRT-RS-033114-25-02-00	BRT-RS-033114-26-01-00	BRT-RS-033114-26-02-00	BRT-RS-033114-27-01-00	BRT-RS-033114-27-02-00	BRT-RS-033114-28-01-00	BRT-RS-033114-28-02-00	BRT-RS-033114-29-01-00	BRT-RS-033114-30-01-00	BRT-RS-033114-30-02-00	BRT-RS-080514-31-01-00	BRT-RS-080514-31-02-00
Sample Type		N	N	N	N	N	N	N	N	N	N	N	N	N
Sample Depth (ft)		0.5-1.5	3-3.9	1.5-2.2	3-3.5	0.5-1.8	2.5-3	1-1.6	2.5-4	2.2-3.2	1.5-1.8	1.8-2.3	0-1	3.9-4.6
Inorganic Compounds (mg/kg)	RSL (mg/kg)													
Aluminum	77000	15800	12800	15800	11700	14200	11800	17900	16900	13800	11500	12800	8050	15300
Antimony	31	0.63 J	0.38 J	1.3 J	0.77 J	0.54 J	0.32 J	0.88 J	0.92 J	0.43 J	0.61 J	0.8 J	1.2 J	0.9 J
Arsenic	6.7	4.1	2.3	3.4	2.7	3.5	2.9	5.1	4	3	5.5	4.3	5	6.9
Barium	15000	103	122	135	156	87.6	156	72.5	119	146	116	170	94.7	252
Beryllium	160	1.3	0.96	1.6	1.3	0.46 J	1.3	0.88	1.1	1.1	0.77	1.1	0.79	1.5
Cadmium	70	0.19 J	0.06 J	0.26 J	0.19 J	0.05 J	0.26 J	0.11 J	0.18 J	0.11 J	0.14 J	0.2 J	1.4 J	0.78 J
Calcium	NSL	919 J	984 J	662 J	811 J	1050 J	1480 J	1090 J	1200 J	1330 J	918 J	813 J	8700	2710
Chromium	3	27.6	29.4	29.2	28.3	23.5	25.5	30.7	30.5	22.2	23.3	28.9	42.3	34.2
Cobalt	23	16.7	6.8	11.2	13.2	2.6 J	14.7	7.8	12.6	7.5	5.1	14.2	7.7	11.6
Copper	3100	22.6	10.5	7	2.9	8	23.9	18.5	18.2	9.2	12.8	14.7	57.5 J	30.9 J
Cyanide	21	0.6 U	0.66 U	0.6 U	0.62 U	0.67 U	0.61 U	0.64 U	0.64 U	0.69 U	0.69 U	0.67 U	0.07 J	1.1 U
Iron	55000	29800 J	14100 J	34600 J	29600 J	21300 J	20700 J	31900 J	31600 J	16000 J	26200 J	32100 J	17900 J	26400 J
Lead	4000	10.9	5.5	24	20.4	10.9	10.3	11.4	12.4	10.6	11.9	13.1	66	60.2
Magnesium	NSL	4940 J	3460 J	4780 J	3470 J	1460 J	3510 J	3770 J	4890 J	2190 J	2220 J	3620 J	2710	3960
Manganese	1800	667 J+	226 J+	282 J+	437 J+	110 J+	209 J+	183 J+	325 J+	210 J+	116 J+	168 J+	267	386
Mercury	9.4	0.11 U	0.12 U	0.12 U	0.11 U	0.13 U	0.11 U	0.11 U	0.11 U	0.13 U	0.13 U	0.12 U	0.26	0.17 J
Nickel	1500	19.8	13.4	19.8	17	6.2	30	15.3	20.3	13.5	9.8	15.6	24.8	28.4
Potassium	NSL	2080	1390	2610	1620	614	1170	1580	2800	717	622	1420	582 J-	752 J-
Selenium	390	3 U	0.32 J	0.17 J	0.26 J	0.18 J	3 U	0.27 J	0.34 J	0.45 J	0.75 J	0.41 J	1.1 J	1.5 J
Silver	390	0.86 U	0.95 U	0.88 U	0.93 U	0.93 U	0.86 U	0.92 U	0.95 U	1 U	0.98 U	0.97 U	0.83 U	1.6 U
Sodium	NSL	181 J+	149 J+	262 J+	243 J+	128 J+	143 J+	162 J+	196 J+	105 J+	134 J+	183 J+	179 J	149 J
Thallium	0.78	2.1 U	2.4 U	2.2 U	2.3 U	2.3 U	2.1 U	2.3 U	2.4 U	2.5 U	2.5 U	2.4 U	2.1 U	4.1 U
Vanadium	390	44.1	31.1	29.6	21.4	36.6	38	46.5	41.9	26	37	40.5	28.1	37.5
Zinc	2300	37.6	29.1	49.5	35.7	20.9	39.5	36.9	38.3	32	31.4	37.7	227	126

Notes:

1. Values in bold indicate the detected analyte exceeds its respective RSL.

* - The rinsate blank results are reported in micrograms per liter (µg/L).

mg/kg - millogram per kilogram

ft - feet

QC - Quality Control

RSL - Regional Screening Level, USEPA Region 3 Residential Soil Regional Screening Levels, January 2015.

NSL - no screening level

N - normal field sample

RB - rinsate blank

U - The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted Contract Required Quantitation Limit (CRQL) for sample and method.

UJ - The analyte was not detected at a level greater than or equal to the adjusted CRQL. However, the reported adjusted CRQL is approximate and may be inaccurate or imprecise.

J - The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the CRQL).

J- - The result is an estimated quantity, but the result may be biased low.

J+ - The result is an estimated quantity, but the result may be biased high.

For non-detects (U qualified results), the number preceding the qualifier is the reporting detection limit.

Table 5-3
Inorganic Analytes Detected in Reservoir during the 2014 Reservoir Sediment Investigation
BoRit Asbestos Supefund Site, OU-1
Ambler, Pennsylvania

Sample Location		RVSB-32		RVSB-33		RVSB-34		RVSB-35		QC	
Sample Number		BRT-RS-080514-32-01-00	BRT-RS-080514-32-02-00	BRT-RS-080514-33-01-00	BRT-RS-080514-33-02-00	BRT-RS-080514-34-01-00	BRT-RS-080514-34-02-00	BRT-RS-080514-35-01-00	BRT-RS-080514-35-02-00	BRT-RS-033114-00-01-03	BRT-RS-080514-00-01-03
Sample Type		N	N	N	N	N	N	N	N	RB*	RB*
Sample Depth (ft)		0-1	2-2.5	0-1	1.8-2.5	0-0.7	1.5-2	0-1	3.3-4.3		
Inorganic Compounds (mg/kg)	RSL (mg/kg)										
Aluminum	77000	9860	13600	7040	11200	7780	10200	10400	13200	200 U	200 U
Antimony	31	0.97 J	0.8 J	0.84 J	0.66 J	0.95 J	0.37 J	1.5 J	0.52 J	60 U	60 U
Arsenic	6.7	6.5	5.2	5.9	3	5.8	3.8	6.7	5	10 U	10 U
Barium	1500	133	95.8	117	107	119	141	132	190	200 U	200 U
Beryllium	160	0.97	0.76	0.66	1	0.77	1	0.88	1.1	5 U	5 U
Cadmium	70	1 J	0.41 J	0.97 J	0.57 J	1.4 J	0.31 J	1.5 J	0.51 J	5 U	5 U
Calcium	NSL	5470	1290	12100	1420	8270	1270	9700	2640	305 J	5000 U
Chromium	3	46.5	34.2	39.2	28.1	42.9	19.7	52.6	28.1	10 U	10 UJ
Cobalt	23	7.8 J	5.4	6.7	16.1	6.9	8	7.8	9.3	50 U	50 U
Copper	3100	40.7 J	18.3 J	40.7 J	28.5 J	52 J	10.9 J	57 J	21.4 J	25 U	25 U
Cyanide	21	0.11 J	0.64 U	0.07 J	0.61 U	0.06 J	0.73 U	0.11 J	0.94 U	10 U	10 U
Iron	55000	18200 J	28600 J	13200 J	31100 J	16500 J	15900 J	19100 J	19800 J	100 UJ	18.6 J
Lead	4000	66.1	15	63	14.6	66.8	17.7	73.5	39	10 U	10 U
Magnesium	NSL	2470	2490	3670	3960	2550	1830	3000	3070	176 J	5000 U
Manganese	1800	257	124	283	611	266	186	301	263	15 U	1.2 J
Mercury	9.4	0.15 J	0.019 J	0.23	0.0037 J-	0.27	0.044 J	0.26	0.074 J	0.2 UJ	0.2 UJ
Nickel	1500	20.1	11.3	25.6	20	23	12.1	26.6	21.6	40 U	1.7 J
Potassium	NSL	344 J-	872 J	404 J-	1850 J-	555 J-	338 J-	838 J	570 J-	5000 UJ	5000 UJ
Selenium	390	1.1 J	0.83 J	0.16 J	0.5 J	0.78 J	0.27 J	0.47 J	1.2 J	35 U	35 U
Silver	390	1.6 U	0.89 U	0.81 U	0.9 U	0.07 J	1 U	0.07 J	1.4 U	10 U	10 U
Sodium	NSL	144 J	112 J	109 J	141 J	160 J	104 J	180 J	144 J	5000 U	5000 U
Thallium	0.78	4.1 U	2.2 U	2 U	2.3 U	1.9 U	2.6 U	2.3 U	3.5 U	2.1 J	25 U
Vanadium	390	29.5	48.4	24.3	37.9	27.5	26.9	33.7	32	50 U	50 U
Zinc	2300	184	36.3	160	48.9	211	36.5	236	94.6	7.2 J	5.2 J

Notes:

1. Values in bold indicate the detected analyte exceeds its respective RSL.

* - The rinsate blank results are reported in micrograms per liter (µg/L).

mg/kg - millogram per kilogram

ft - feet

QC - Quality Control

RSL - Regional Screening Level, USEPA Region 3 Residential Soil Regional Screening Levels, January 2015.

NSL - no screening level

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UJ - The analyte was not detected at a level greater than or equal to the adjusted CRQL. However, the reported adjusted CRQL is approximate and may be inaccurate or imprecise.

J - The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the CRQL).

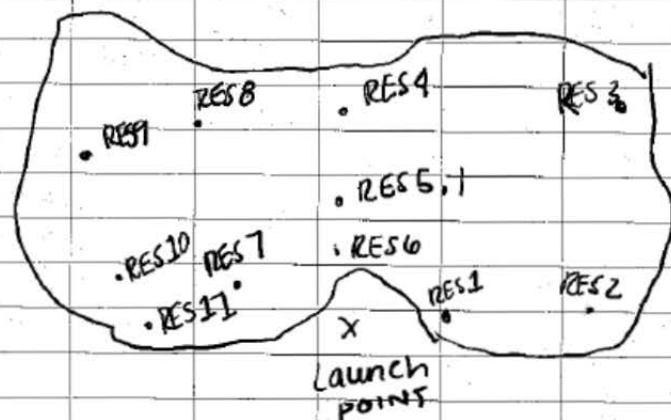
J- - The result is an estimated quantity, but the result may be biased low.

J+ - The result is an estimated quantity, but the result may be biased high.

For non-detects (U qualified results), the number preceding the qualifier is the reporting detection limit.

Appendix A

Logbook Entries and Field Sample Data Sheets (FSDS)

Location AMBLER, PA Date 07/29/14Project / Client BORIT ASBESTOS SITEEPA REGION IIIA. DONAGHUEWEATHER: SUNNY 72°FACTIVITIES: RESERVOIR TEMPERATURE STUDY.
AND WET SYNOPTIC EVENT.PPE: LEVEL DPERSONNEL: ADRIENNE DONAGHUE (AD)
MIKE NIGRO (MN)0950 AD ARRIVES ON SITE AND PARK BY
TRAILERS.1020 Edward DRIVES AD TO RESERVOIR
PARCEL1035 MN ARRIVES ON SITE1058 MN PREPARES TO CONDUCT TEMP STUDY.1105 MN + ADLocation AMBLER, PA Date 07/29/14Project / Client BORIT ASBESTOS SITEEPA REGION IIIA. DONAGHUE

LOCATION	COORDINATE	DEPTH - (ft)	TEMP. (°C)	
RES1	40.706414	B=0.4ft	25.1	AD 7/29
	-75.22126	M=0.2ft	25.4	
RES2	N 40.15377	B=0.7ft	26.2	
	W 075.22837	M=0.35ft	26.3	
RES3	N 40.15383	B=0.55	26.6	
	W 075.22835	M=0.28	27.0	
RES4	N 40.15389	B=0.85	24.4	
	W 075.22846	M=0.43	24.9	
RES5	N 40.15379	B=1.6	24.0	
	W 075.22850	M=0.80	24.7	
RES6	N 40.15364	B=0.7	24.3	
	W 075.22857	M=0.35	24.3	AD 7/29
RES7	AD 7/29	B=0.65	24.2	QC=24.6
		M	24.2	QC=24.6
		M	25.1	QC=25.1
RES8		AD 7/29		
RES7	40.153739	B=0.65	24.2	QC=25.1
	-75.22865	M=0.33	24.6	QC=25.1
RES8	40.153888	B=1.15	24.0	
	-75.22859	M=0.58	24.1	
RES9	40.153845	B=0.7	24.1	QC=24.4
	-75.228722	M=0.35	25.1	QC=25.0

Location AMBLER PADate 7/29/2014Project / Client BORIT ASBESTOS SITE

EPA REGION III

A. DONAGHUE

	CORD	DEPTH	TEMP (°C)
RES 10	40.153705	B=1.4	24.2
	- 75.22878	M=0.70	24.6
RES 11	40.153732	B=0.6	26.0
	- 75.22891	M=0.30	26.3
RES 12	40.153832	B=1.0	26.5
	- 75.22889	M=0.50	25.6
RES 13	40.153907	B=0.8	26.4 AC=26.9
	- 75.22891	M=0.40	26.7 AC=26.7
RES 14	40.153811	B=0.85	25.4
	- 75.228957	M=0.43	26.1
RES 15	40.153762	B=0.7	26.8
	- 75.22895	M=0.35	28.8 AD 7/29
RES 16	40.153871	B=0.85	25.9 AC
	- 75.228979	M=0.43	27.0 AC

1221 AD & MN COMPLETE TEMP STUDY.

1230 AD & MN TRAVEL TO PIT TO MEASURE
TEMP. EPA & URS & ACOE ARE PRESENT.

1235 MN TAKE TEMP READINGS FROM PIT.

25.1 °C

25.5 °C

1236 MN TAKES TEMP READING IN MANHOLE
MH INSIDE FLOOR = 16.27Location AMBLER PADate 7/29/2014⁵⁷Project / Client BORIT ASBESTOS SITE

EPA REGION III

A. DONAGHUE

TEMP = 21.4 °C		WATER LEVEL = 9.3 ft	
1300 AD GETS WELL KEYS FROM EDUARDO			
AD + MN BEGIN WET DA AD 7/29 SYNOPTIC EVENT.			
WELL ID	TIME	DIW (ft)	NOTES
MW01A	1307	14.44	NO LOCK
SG-5	1316	-0.92	TEMP = 23.4 °C
MW-02	1357	23.01	NO LOCK
RKPZ-02	1349	23.42	MN CUT LOCK
PKPZ-01			COULD NOT BE FOUND
MW-03	1355	6.22	NO LOCK
SG-4	1400	1.26	TEMP = 21.4
STREAM GAUGE IS BENT & DAMAGED			
RKPZ03	1427	21.85 DTB	PIEZ WAS DRY
			MN CUT LOCK
MW-05	1430	21.49	EIF MARKING ON ROCK 193.09
MW-04	1433	13.61	NO WELL CAP, STANDING WATER IN WELL COLLAR
MW-06	1436	12.38	NO LOCK ON STEEL CAP
SG-2	1439	1.12	TEMP = 19.2 °C
GT-06	1447	35.35	PIEZ WAS DRY
GT-07	1446	21.9	NO LOCK ON CAP
MW-07	1515	4.81	

Location AMBLER, PADate 7/29/2014Project / Client BORIT ASBESTOS SITE

EPA REGION III

A. DONAGHUE

WELL ID	TIME	DTW (H)	NOTES
SG-1	1525	0.12	TEMP = 23.2°C

NOTE: YSI 60 PH/TEMPERATURE METER DID NOT HAVE SPECIFICATIONS FOR TEMPERATURE CALIBRATION. AS A RESULT THE YSI 60 WAS NOT CALIBRATED FOR TEMPERATURE READINGS. IN ADDITION TO MW-05, PKPZ-03 HAD THE ELEVATION MARK 199.06 ON CAP. IT APPEARED AS IF WELL CAPS WERE CUT IN THESE LOCATIONS OR THE GRADIN G CHANGED. IT WAS UNCLEAR WHAT THE REFERENCE MARK WAS.

LATE ENTRY: 1125 PERSONNEL ON SITE TOOK ELEVATION OF RESERVOIR WATER LEVEL AT LOCATION OF BOAT LAUNCH POINT. ELEVATION OF RESERVOIR = 170.17'. BOAT LAUNCH POINT WAS FROM SOUTHERN CORNER OF BASIN.

1200 PERSONNEL TOOK WATER ELEVATION OF PIT LOCATED AT NE CORNER OF BASIN. RESERVOIR ELEVATION = 179.72'.

LATE ENTRY: 1320 AD + MN RETURN TO TRAILER TO ASK EDUARDO FOR KEYS TO PIEZOMETERS. EDUARDO CONSENTED TO CUTTING LOCKS IF KEYS DID NOT WORK.

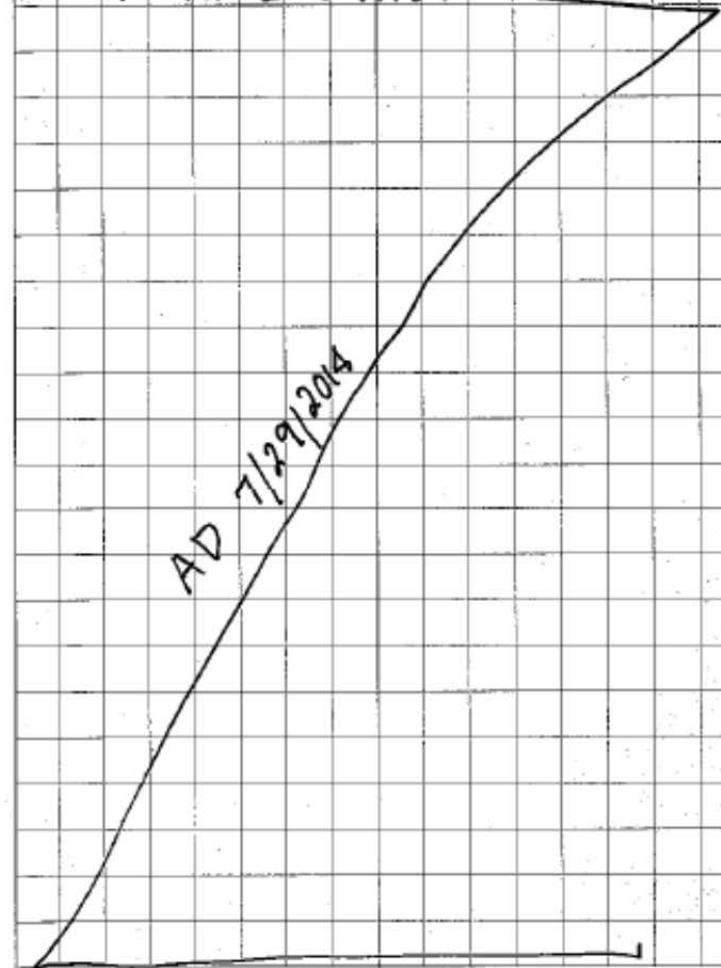
Location AMBLER, PADate 7/29/2014 59Project / Client BORIT ASBESTOS SITE

EPA REGION III

A. DONAGHUE

1545 AD + MN RETURN TO SITE TRAILER. AD RETURNS KEYS TO EDUARDO 7/29 EDUARDO.

1550 AD + MN LEAVE SITE



Location AMBLER PA Date 8/11/2014Project / Client A BORIT ASBESTOS SITEEPA REGION 3PERSONNEL: ADRIENNE DONAGHUE (AD)WEATHER: SUNNY, HIGH 85°FPPE: MODIFIED LEVEL DPURPOSE: RESERVOIR BENCH STUDY AND DRY
WEATHER SYNOPTIC EVENT.0840 AD ARRIVES ON SITE.0845 AD FILL BINS BL = LOW ASBESTOS ZONEBIN AND BH = HIGH ASBESTOS ZONE BIN.LATE ENTRY 0726 AD CALIBRATES HORIBA
U-52 IN OFFICE (COM SMITH WAYNE)SERIAL NUMBER / LOT: 3UG1X4ABINSTRUMENT ID: 21056AUTO CAL SOLUTION: 4.0 pH, 4.49 ms/cm,
0 NTU.Exp: 06/30/2015 LOT #: C971579CALIBRATED VALUESpH(SU) : 4.02COND(ms/cm): 4.49DU (mg/L): 8.40NTU: 0.00900 JEFF BROWN FROM WESTIN ASSISTS AD IN
COLLECTING SURFACE WATER FROM WISSAHICKON
CREEK. AD AND JEFF TRAVEL TO
LOCATION JUST SOUTH OF THE ROSE VALLEY
CONFLUENCE.Location AMBLER PA Date 8/11/2014Project / Client BORIT ASBESTOS SITEEPA REGION IIIA. DONAGHUE0910 AD MEASURES WATER QUALITY PARAMETERS
OF WISSAHICKON CREEK.

TIME	pH(SU)	ORP (mV)	COND (ms/cm)	NTU	DO (mg/L)	TEMP (°C)
0910	8.07	190	0.726	2.90	8.36	22.69

0912 AD COLLECTS [SAMPLE WC-SW-081114]FOR EPA METHOD 100.2 ANALYSIS. SAMPLE WAS
COLLECTED IN A 500 ML W/ AD 8/11 POLY W/
APPROXIMATELY 200 ML HEAD SPACE FOR
OZONE/UV DISINFECTION.0915 AD AND J.B. COLLECT 4 5 GALLON
BUCKETS OF SURFACE WATER FOR BENCH STUDY.0917 AD & J. TRAVEL BACK TO TRAILER.0926 AD FILLS BH WITH 5 GALLONS OF
WISSAHICKON SURFACE WATER.0927 AD FILLS BL WITH 5 GALLONS ^{AD 8/11} OF
SURFACE WATER FROM WISSAHICKON CREEK.0931 AD COLLECTS SAMPLE [BH-SW05-081114]
IN 1 500 ML POLY FOR EPA METHOD 101.2
ANALYSIS. 200ML OF HEAD SPACE WAS LEFT FOR
OZONE AD 8/11 TEM ANALYSIS.0932 AD COLLECTS SAMPLE [BL-SW05-081114]
FOR TEM ANALYSIS. 100-200 ML OF HEAD SPACE
WAS LEFT.AD 8/11/2014

Location AMBLER PADate 08/11/2014Project / Client BORIT ASBESTOS SITE

EPA REGION III

A. DONAGHUE

1026 AD COLLECTS SAMPLE BH-SW01-081114 IN
 1 500 ML POLY W/ 100 ML HEADSPACE FOR TEM
 (EPA METHOD 100.2) ANALYSIS.

110:27 AD COLLECT SAMPLES BL-SW01-081114
 AND BL-SW01-081114A BOTH SAMPLES WERE
 COLLECTED SIMULTANEOUSLY IN A 1L POLY. THEN
 SAMPLE WAS POURED ALTERNATING FILLING
 2 500 ML POLYS. 100 ML HEAD SPACE WAS
 LEFT TO FACILITATE TEM (EPA 100.2) ANALYSIS.

1226 AD COLLECTS SAMPLE BH-SW03-081114
 IN 1 500 ML POLY FOR TEM ANALYSIS.
 100 ML OF HEAD SPACE WAS LEFT

1227 AD COLLECTS SAMPLE BL-SW03-081114 IN
 1 500 ML POLY FOR TEM ANALYSIS. 100 ML
 OF HEAD SPACE WAS LEFT.

1327 MIKE NIGRO ARRIVES ON SITE. MIKE NIGRO (MN)
 ADMIN PREPARE TO CONDUCT SYNOPSIS
 EVENT.

AD 8/11/2014

Location AMBLER PADate 08/11/2014Project / Client BORIT ASBESTOS SITE

EPA REGION III

A. DONAGHUE

TIME	WELL ID	DTW (ft)	NOTES
1347	MW-01A	13.82	NO CAP LOCK
1355	SG-5	-0.97	
1403	MW-02	23.36	NO LOCK
1405	RKPZ-02	23.85 ^{AD 8/11}	NO LOCK, DRY 23.85'
1409	PKPZ-03	—	DRY 21.65', NO LOCK
1410	MW-03	7.02	NO LOCK. TRAFFIC CONE ON WELL
1413	SG-4	1.16	NO WATER RUNNING OUT OF CULVERTS. PUMP IS ACTIVE BY SG 4
1424	MW-05	21.72	NO LOCK
1428	MW-04	15.35	NO WELL CAP
1435	MW-06	15.94	NO LOCK
1437	SG-2	1.08	
1439	GT-7	22.09	NO LOCK
1440	GT-6	35.51 ^{AD 8/11}	DRY 35.51
1450	SG-1	0.0	AD 8/11
1452	ADMIN RETURN TO SITE TRAILER.		
1457	MW-7	7.01	STANDING WATER IN CASING

AD 8/11/2014

Location AMBLER PADate 08/11/2014Project / Client BORIT ASBESTOS SITE

EPA REGION III

A. DONAGHUE

1459 ADMIN TRAVEL BACK TO SITE TRAILER.

1526 AD COLLECTS SAMPLE BH-SW06-081114IN 1 500 ML POLY W/ 100 ML HEAD SPACE FOR
TEM ANALYSIS.1527 AD COLLECTS SAMPLE BL-SW06-081114IN 1 500 ML POLY W/ 100 ML HEAD SPACE FOR
TEM ANALYSIS.1530 MN & AD TRAVEL TO EXCAVATION PIT TO
COLLECT PIT SAMPLE.

TIME	TEMP (°C)	PH (SU)	COND (mS/cm)	NTU	ORP (mV)	DO (mg/L)
------	--------------	------------	-----------------	-----	-------------	--------------

1536	29.88	7.94	0.458	55.8	109	7.09
------	-------	------	-------	------	-----	------

1537 MN TAKES DEPTH TO BOTTOM OF SAMPLE
LOCATION - 0.8 ft.1540 MN COLLECTS SAMPLE PW-SW-081114

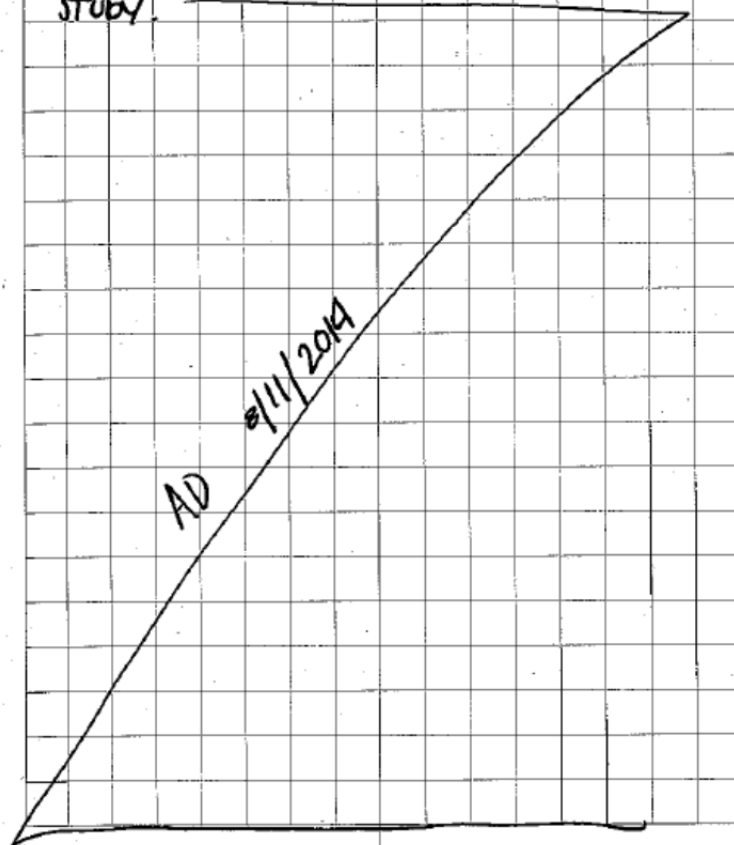
IN 1 L POLY - w/ AD 8/11. FOR TEM ANALYSIS.

1542 AD & MN RETURN TO TRAILER ON SITE.

AD & MN PREPARE SAMPLES & PERFORM
SAMPLE MANAGEMENT.1926 AD COLLECTS SAMPLE BH-SW06-081114 AD 8/11/2014IN 1 500 ML POLY
WITH 100 ML HEAD SPACE FOR TEM ANALYSIS.1927 AD COLLECTS SAMPLE BL-SW10-081114 IN
1 500 ML POLY FOR TEM ANALYSIS W/
100 ML HEAD SPACE.Location AMBLER PADate 08/11/2014Project / Client BORIT ASBESTOS SITE

EPA REGION III

A. DONAGHUE

1929 ADMIN FINISH PACKING COOLER AND
SEAL.1930 AD LEAVES SITE. MN LOCKS TRAILER AND
ENTRANCE GATE PRIOR TO LEAVING SITE.
AD WILL RETURN 8/12 TO DEMOB BENCH
STUDY.

Location AMBLER PADate 8/12/2014Project / Client BORIT ASBESTOS SITEEPA REGION IIIA. DONAGHUEPERSONNEL ADRIENNE DONAGHUE (AD)WEATHER: 80°F, RAINY, CLOUDYPPE: MODIFIED LEVEL DPURPOSE: DEMOB FROM BENCH STUDY ON 8/11/2014

0735 AD ARRIVES ON SITE.

0740 AD + Jeff Broudy (Nestor) dump BIN
WASTE IN RESERVOIR.0750 AD FILL TRAILER FREEZER w/ ICE TO
REPLACE ICE USED 8/11/14.

0800 AD CLEANS BENCH STUDY AREA.

0833 AD LEAVES SITE FOR DAY.

AD
8/12/2014

Location _____

Date _____

Project / Client _____

Charge No.: 62625-3330-029-BAS-RBZ-RESER
(write in or place label here)

Sheet No.: AA-00000

BORIT FIELD SAMPLE DATA SHEET (FSDS) FOR CREEK SURFACE WATER AND SEDIMENT SAMPLE COLLECTION

Address: Maple Street Reservoir

Sampling Date: 8/5/2014

Field Logbook No: _____

Page No: _____

Sampling Team: CDM Smith

Names: Lucinda Pyper

Data Item	CREEK SURFACE WATER	RESERVOIR SEDIMENT	RESERVOIR SEDIMENT
Sample Location:	X	<u>RVSND2</u>	<u>RVSND30405</u>
Sample Collection Date and Time		Date: <u>8/5/2014</u> Time: <u>1040</u>	Date: <u>8/5/2014</u> Time: <u>1430</u>
Number of Samples Collected		<u>1</u>	<u>1</u>
Sample Bottle ware		<u>80Z GLASS JAR</u>	<u>80Z GLASS JAR</u>
Volume of Sample Collected		<u>70Z</u>	<u>70Z</u>
Sample ID		<u>BL-SD-080514</u>	<u>BH-SD-080514</u>
Sample Matrix Type		<u>SEDIMENT</u>	<u>SEDIMENT</u>
Duplicate		Yes: _____ No: _____ Sample ID: _____ Time: _____	Yes: _____ No: <u>X</u> Sample ID: _____ Time: _____
Field Comments			

Lucinda Pyper
08/08/2014

v 100709

For Field Team Completion (Initials)	Completed by: _____ QC by: _____	For Data Entry	Entered by: _____ QC by: _____
For eFSDS validation	Validated _____	Validated _____	Validated _____

**CDM
Smith**

Charge No.: 62625-3330-029-BAS-RRZ-RESER
(write in or place label here)

Sheet No.: AA-00000

BORIT FIELD SAMPLE DATA SHEET (FSDS) FOR CREEK SURFACE WATER AND SEDIMENT SAMPLE COLLECTION

Address: Maple Street south of Reservoir

Sampling Date: 08/11/2014

Field Logbook No: P2-2010-06

Page No: 61

Sampling Team: CDM Smith

Names: ADRIENNE DONAGHUE

Data Item	CREEK SURFACE WATER	RESERVOIR SEDIMENT	RESERVOIR SEDIMENT
Sample Location:	WISSAHICKON CR. South of Rose Valley Confluence		
Sample Collection Date and Time	Date: <u>08/11/2014</u> Time: <u>0912</u>	Date: Time:	Date: Time:
Number of Samples Collected	<u>1</u>		
Sample Bottle ware	<u>500mL HDPE</u>		
Volume of Sample Collected	<u>400mL</u>		
Sample ID	<u>WL-SW-081114</u>		
Sample Matrix Type	<u>SURFACE WATER</u>		
Duplicate	Yes: <input type="checkbox"/> No: <input checked="" type="checkbox"/> Sample ID: Time:	Yes: <input type="checkbox"/> No: <input type="checkbox"/> Sample ID: Time:	Yes: <input type="checkbox"/> No: <input type="checkbox"/> Sample ID: Time:
Field Comments			

Adrienne Donaghue
08/11/2014

v 100709

For Field Team Completion (Initials)	Completed by: _____ QC by: _____	For Data Entry	Entered by: _____ QC by: _____
For eFSDS validation	Validated _____	Validated _____	Validated _____

**CDM
Smith**

Charge No.: 02625-3330-029-BAS-RRZ-RESEN
(write in or place label here)

Sheet No.: AA-00000

BORIT FIELD SAMPLE DATA SHEET (FSDS) FOR SEDIMENT BENCH STUDY

Address: BORIT EPA Trailer

Sampling Date: 08/11/2014

Field Logbook No: P2-2010-05

Page No: 60-64

Sampling Team: CDM Smith

Names: ADRIENNE DONAGHUE

Data Item	Low Asbestos Zone Bin	High Asbestos Zone Bin
Reservoir Sediment Collection Locations (circle)	RVS-01 <u>RVS-02</u>	<u>RVS-03</u> <u>RVS-04</u> <u>RVS-05</u>
Reservoir Sediment Collection Date and Time	Date: <u>08/08/2014</u> Time:	Date: <u>08/05/2014</u> Time:
Surface Water Collection Time:	<u>08/11/2014</u> <u>0915</u>	<u>08/11/2014</u> <u>0915</u>
Volume of Surface Water Used in Bench Study:	<u>5 GALLONS</u>	<u>5 GALLONS</u>
Volume of Sediment Used in Bench Study:	Vol: <u>5</u> (gal) Depth: <u>12.5</u> (in)	Vol: <u>5</u> (gal) Depth: <u>11.5</u> (in)
Sample Matrix Type:	<u>SURFACE WATER</u>	<u>SURFACE WATER</u>
Bench Study Start Time	<u>0927</u>	<u>0926</u>
Interval 5 Minutes Sample Time	Sample ID: <u>BL-SW05-081114</u> Time: <u>0932</u>	Sample ID: <u>BH-SW05-081114</u> Time: <u>0931</u>
Interval 1 Hour Sample Time	Sample ID: <u>BL-SW01-081114</u> Time: <u>1027</u>	Sample ID: <u>BH-SW01-081114</u> Time: <u>1026</u>
Interval 3 Hours Sample Time	Sample ID: <u>BL-SW03-081114</u> Time: <u>1227</u>	Sample ID: <u>BH-SW03-081114</u> Time: <u>1226</u>
Interval 6 Hour Sample Time	Sample ID: <u>BL-SW06-081114</u> Time: <u>1537 1527</u>	Sample ID: <u>BH-SW06-081114</u> Time: <u>1536 1526</u>
Interval 10 hour Sample Time	Sample ID: <u>BL-SW10-081114</u> Time: <u>1927</u>	Sample ID: <u>BH-SW10-081114</u> Time: <u>1926</u>
Duplicate	Yes: <input checked="" type="checkbox"/> No: <input type="checkbox"/> Sample ID: <u>BL-SW01-081114</u> Time: <u>1027</u>	Yes: <input type="checkbox"/> No: <input checked="" type="checkbox"/> Sample ID: _____ Time: _____
Field Comments	<u>Dup was collected w/ 1L HDPE. 500 mL HDPE bottles were filled alternating between 2 500 mL bottles</u>	

Adrienne Donaghue
8/11/2014

v 100709

For Field Team Completion (Initials)	Completed by: _____ QC by: _____	For Data Entry	Entered by: _____ QC by: _____
For eFSDS validation	Validated _____	Validated _____	Validated _____

CDM Smith

Appendix B

Reservoir Photograph Log



Date: 07/17/2014

Time: 1149

Description: Southern corner of the Reservoir during pumping. Photograph was taken facing southwest from the top of the Asbestos Pile.

Photographer: EPA



Date: 07/29/2014

Time: 1428

Description: Center portion of Reservoir during pumping. Photograph was taken facing northwest from the construction access road between the Asbestos Pile and the Reservoir.

Photographer: A. Donaghue (CDM Smith)



Date: 07/29/2014

Time: 1429

Description: Southern corner of the Reservoir during pumping. Photograph was taken facing southwest from the construction access road been the Asbestos Pile and the Reservoir.

Photographer: A. Donaghue (CDM Smith)



Date: 07/29/2014

Time: 1449

Description: Western, southwest end of the Reservoir taken from the top of the Asbestos Pile. Photograph was taken facing southwest.

Photographer: A. Donaghue (CDM Smith)



Date: 07/29/2014

Time: 1449

Description: Center portion of the Reservoir taken from the top of the Asbestos Pile. Photograph was taken facing west.

Photographer: A. Donaghue (CDM Smith)



Date: 07/29/2014

Time: 1449

Description: Northern end of the Reservoir taken from the top of the Asbestos Pile. Photograph was taken facing north.

Photographer: A. Donaghue (CDM Smith)



Date: 08/11/2014

Time: 1429

Description: Western, southwest end of the Reservoir after continuous pumping terminated on July 31, 2014.

Photograph was taken facing southwest.

Photographer: A. Donaghue (CDM Smith)



Date: 08/11/2014

Time: 1429

Description: Center portion of Reservoir after continuous pumping terminated on July 31, 2014. Photograph was taken facing west.

Photographer: A. Donaghue (CDM Smith)



Date: 08/20/2014

Time: 0917

Description: Southwestern end of the Reservoir after continuous pumping terminated on July 31, 2014.

Photograph was taken facing northwest.

Photographer: J. Lowe (EPA)



Date: 08/20/2014

Time: 0918

Description: Southwestern end of the Reservoir after continuous pumping terminated in July 31, 2014. Photograph was taken facing northwest.

Photographer: J. Lowe (EPA)



Date: 01/15/2015

Time: 1049

Description: Photograph of the Reservoir taken facing north towards West Maple Street. Water is shown accumulating over clean fill material and geotextile fabric placed on the Reservoir bottom by the EPA Removal Program.

Photographer: J. Duffy (EPA START Contractor)

Appendix C

2014 Reservoir Sediment Investigation Hand Auger Boring Logs and Analytical Data

DRILLING LOG		DIVISION --		INSTALLATION --		SHEET 1 OF 1 SHEETS	
1. PROJECT BoRit Reservoir Investigation				9. COORDINATE SYSTEM : HORIZONTAL State Plane - Pennsylvania SouthNAD83		VERTICAL	
2. HOLE NUMBER RVSB-25				10. SIZE AND TYPE OF BIT 3 1/4" Soil Auger		11. MANUFACTURER'S DESIGNATION OF DRILL AMS Enironmental Soil Sampler (Hand Auger)	
3. DRILLING AGENCY USACE Philadelphia District				12. TOTAL SAMPLES : DISTURBED : UNDISTURBED 2 : 2 : 0			
4. NAME OF DRILLER Fatzinger/Martowska				13. TOTAL NUMBER CORE BOXES 0			
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED				DEG FROM VERTICAL : BEARING --- : --		14. DEPTH GROUND WATER See Remarks	
6. THICKNESS OF OVERBURDEN				15. DATE BORING : STARTED : COMPLETED 3/31/14 : 3/31/14			
7. DEPTH DRILLED INTO ROCK				16. ELEVATION TOP OF BORING			
8. TOTAL DEPTH OF BORING 3.92'				17. TOTAL CORE RECOVERY FOR BORING N/A			
				18. SIGNATURE AND TITLE OF INSPECTOR Fatzinger			

ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	REMARKS
	0.5		Bottom Deposits			S-1 Compositied between 6" to 18"
	1.5		Brown Stiff CLAY	100	S-1	
	3.9		White Clayey SILT	100	S-2	
BOTTOM OF BOREHOLE AT 3.9 ft						

DRILLING LOG		DIVISION --		INSTALLATION --		SHEET 1 OF 1 SHEETS	
1. PROJECT BoRit Reservoir Investigation				9. COORDINATE SYSTEM : HORIZONTAL State Plane - Pennsylvania SouthNAD83		VERTICAL	
2. HOLE NUMBER RVSB-26				LOCATION COORDINATES N 309344 E 2673571		10. SIZE AND TYPE OF BIT 3 1/4" Soil Auger	
3. DRILLING AGENCY USACE Philadelphia District				11. MANUFACTURER'S DESIGNATION OF DRILL AMS Enironmental Soil Sampler (Hand Auger)		12. TOTAL SAMPLES : DISTURBED : UNDISTURBED 2 : 2 : 0	
4. NAME OF DRILLER Fatzinger/Martowska				13. TOTAL NUMBER CORE BOXES 0		14. DEPTH GROUND WATER See Remarks	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED				DEG FROM VERTICAL ---		BEARING --	
6. THICKNESS OF OVERBURDEN				15. DATE BORING : STARTED : COMPLETED 3/31/14 : 3/31/14		16. ELEVATION TOP OF BORING	
7. DEPTH DRILLED INTO ROCK				17. TOTAL CORE RECOVERY FOR BORING N/A		18. SIGNATURE AND TITLE OF INSPECTOR Fatzinger	
8. TOTAL DEPTH OF BORING 3.6'							
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	REMARKS	
	0.5		Very Soft Brown Bottom Sediment/ Muck			S-1 Compositied between 18" to 26"	
			Red CLAY with Rock fragments				
				100	S-1		
	3.6			100	S-2	S-2 Compositied between 36" to 42"	

BOTTOM OF BOREHOLE AT 3.6 ft

RVSB-27

DRILLING LOG				DIVISION --		INSTALLATION --		SHEET 1 OF 1 SHEETS	
1. PROJECT BoRit Reservoir Investigation				9. COORDINATE SYSTEM State Plane - Pennsylvania SouthNAD83		HORIZONTAL VERTICAL			
2. HOLE NUMBER RVSB-27				LOCATION COORDINATES N 309379 E 2673318		10. SIZE AND TYPE OF BIT 3 1/4" Soil Auger			
3. DRILLING AGENCY USACE Philadelphia District				11. MANUFACTURER'S DESIGNATION OF DRILL AMS Enironmental Soil Sampler (Hand Auger)		12. TOTAL SAMPLES 2		DISTURBED 2 UNDISTURBED 0	
4. NAME OF DRILLER Fatzinger/Martowska				13. TOTAL NUMBER CORE BOXES 0		14. DEPTH GROUND WATER See Remarks			
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED				DEG FROM VERTICAL ---		BEARING --		15. DATE BORING 3/31/14	
6. THICKNESS OF OVERBURDEN				16. ELEVATION TOP OF BORING		STARTED 3/31/14		COMPLETED 3/31/14	
7. DEPTH DRILLED INTO ROCK				17. TOTAL CORE RECOVERY FOR BORING N/A		18. SIGNATURE AND TITLE OF INSPECTOR Fatzinger			
8. TOTAL DEPTH OF BORING 3'									
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	REMARKS			
	0.5		Very Soft Brown Bottom Sediment/ Muck			S-1 Compositied between 6" to 22"			
			Gray Stiff CLAY with Rock fragments	100	S-1				
	3.0			100	S-2	S-2 Compositied between 30" to 36"			

BOTTOM OF BOREHOLE AT 3.0 ft

DRILLING LOG		DIVISION --		INSTALLATION --		SHEET 1 OF 1 SHEETS	
1. PROJECT BoRit Reservoir Investigation				9. COORDINATE SYSTEM : HORIZONTAL State Plane - Pennsylvania SouthNAD83		VERTICAL	
2. HOLE NUMBER RVSB-28				10. SIZE AND TYPE OF BIT 3 1/4" Soil Auger		11. MANUFACTURER'S DESIGNATION OF DRILL AMS Enironmental Soil Sampler (Hand Auger)	
3. DRILLING AGENCY USACE Philadelphia District				12. TOTAL SAMPLES 2		DISTURBED : 2 UNDISTURBED : 0	
4. NAME OF DRILLER Fatzinger/Martowska				13. TOTAL NUMBER CORE BOXES 0		14. DEPTH GROUND WATER See Remarks	
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG FROM VERTICAL ---		BEARING --		15. DATE BORING 3/31/14	
6. THICKNESS OF OVERBURDEN				16. ELEVATION TOP OF BORING		COMPLETED 3/31/14	
7. DEPTH DRILLED INTO ROCK				17. TOTAL CORE RECOVERY FOR BORING N/A		18. SIGNATURE AND TITLE OF INSPECTOR Fatzinger	
8. TOTAL DEPTH OF BORING 4'							
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	REMARKS	
	0.5		Very Soft Brown Bottom Sediment/ Muck			S-1 Compositied between 12" to 19"	
			Gray Brown Stiff CLAY with Rock fragments	100	S-1		
				100	S-2		
	4.0					S-2 Compositied between 30" to 48", Duplicate Sample taken	

BOTTOM OF BOREHOLE AT 4.0 ft

DRILLING LOG		DIVISION --		INSTALLATION --		SHEET 1 OF 1 SHEETS	
1. PROJECT BoRit Reservoir Investigation				9. COORDINATE SYSTEM : HORIZONTAL : VERTICAL State Plane - Pennsylvania SouthNAD83			
2. HOLE NUMBER RSVB-29		LOCATION COORDINATES N 309576 E 2673196		10. SIZE AND TYPE OF BIT : 3 1/4" Soil Auger			
3. DRILLING AGENCY USACE Philadelphia District				11. MANUFACTURER'S DESIGNATION OF DRILL AMS Enironmental Soil Sampler (Hand Auger)			
4. NAME OF DRILLER Fatzinger/Martowska				12. TOTAL SAMPLES : DISTURBED : UNDISTURBED 1 : 1 : 0			
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG FROM VERTICAL : BEARING --- : --		13. TOTAL NUMBER CORE BOXES : 0			
6. THICKNESS OF OVERBURDEN				14. DEPTH GROUND WATER : See Remarks			
7. DEPTH DRILLED INTO ROCK				15. DATE BORING : STARTED : COMPLETED 3/31/14 : 3/31/14			
8. TOTAL DEPTH OF BORING : 3.17'				16. ELEVATION TOP OF BORING			
				17. TOTAL CORE RECOVERY FOR BORING : N/A			
				18. SIGNATURE AND TITLE OF INSPECTOR Fatzinger			

ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	REMARKS
	2.2		Very Soft Brown Bottom Sediment/ Muck			
	3.2		Gray Soft CLAY with Rock fragments	100	S-1	S-1 Compositied between 26" to 38", sampled through overlaying muck layer
BOTTOM OF BOREHOLE AT 3.2 ft						

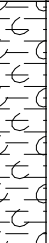

DRILLING LOG		DIVISION --		INSTALLATION --		SHEET 1 OF 1 SHEETS	
1. PROJECT BoRit Reservoir Investigation				9. COORDINATE SYSTEM : HORIZONTAL : VERTICAL State Plane - Pennsylvania SouthNAD83			
2. HOLE NUMBER RVSB-30		LOCATION COORDINATES N 309241 E 2673378		10. SIZE AND TYPE OF BIT : 3 1/4" Soil Auger			
3. DRILLING AGENCY USACE Philadelphia District				11. MANUFACTURER'S DESIGNATION OF DRILL AMS Enironmental Soil Sampler (Hand Auger)			
4. NAME OF DRILLER Fatzinger/Martowska				12. TOTAL SAMPLES : DISTURBED : UNDISTURBED 2 : 2 : 0			
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG FROM VERTICAL : BEARING --- : --		13. TOTAL NUMBER CORE BOXES : 0			
6. THICKNESS OF OVERBURDEN				14. DEPTH GROUND WATER : See Remarks			
7. DEPTH DRILLED INTO ROCK				15. DATE BORING : STARTED : COMPLETED 3/31/14 : 3/31/14			
8. TOTAL DEPTH OF BORING : 2.33'				16. ELEVATION TOP OF BORING			
				17. TOTAL CORE RECOVERY FOR BORING : N/A			
				18. SIGNATURE AND TITLE OF INSPECTOR Fatzinger			
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	REMARKS	
	0.5		Very Soft Brown Bottom Sediment/ Muck				
			Gray Stiff CLAY with Rock fragments				
				100	S-1	S-1 Compositied between 18" to 22"	
	2.3			100	S-2	S-2 Compositied between 22" to 28"	
BOTTOM OF BOREHOLE AT 2.3 ft							

DRILLING LOG		DIVISION --		INSTALLATION --		SHEET 1 OF 1 SHEETS	
1. PROJECT BoRit Reservoir Investigation				9. COORDINATE SYSTEM : HORIZONTAL : VERTICAL State Plane - Pennsylvania SouthNAD83			
				10. SIZE AND TYPE OF BIT : 3 1/4" Soil Auger			
2. HOLE NUMBER RVSB-31		LOCATION COORDINATES N 309430 E 2673075		11. MANUFACTURER'S DESIGNATION OF DRILL AMS Enironmental Soil Sampler (Hand Auger)			
3. DRILLING AGENCY USACE Philadelphia District				12. TOTAL SAMPLES : DISTURBED : UNDISTURBED 2 : 2 : 0			
4. NAME OF DRILLER Fatzinger/Martowska				13. TOTAL NUMBER CORE BOXES : 0			
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG FROM VERTICAL : BEARING --- : ---		14. DEPTH GROUND WATER : See Remarks			
6. THICKNESS OF OVERBURDEN				15. DATE BORING : STARTED : COMPLETED 8/5/14 : 8/5/14			
				16. ELEVATION TOP OF BORING			
7. DEPTH DRILLED INTO ROCK				17. TOTAL CORE RECOVERY FOR BORING : N/A			
8. TOTAL DEPTH OF BORING : 4.75'				18. SIGNATURE AND TITLE OF INSPECTOR Fatzinger			
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	REMARKS	
	1.0		Very Soft Brown Organic Bottom Sediment	100	S-1	S-1 Compositied between 0" to 12"	
	4.6		Clayey SILT with organics				
	4.8		Gravel	100	S-2	S-2 Compositied between 47" to 55"	
BOTTOM OF BOREHOLE AT 4.8 ft							

DRILLING LOG		DIVISION --		INSTALLATION --		SHEET 1 OF 1 SHEETS	
1. PROJECT BoRit Reservoir Investigation				9. COORDINATE SYSTEM : HORIZONTAL : VERTICAL		State Plane - Pennsylvania SouthNAD83	
				10. SIZE AND TYPE OF BIT 3 1/4" Soil Auger			
2. HOLE NUMBER RVSB-32		LOCATION COORDINATES N 309276 E 2673161		11. MANUFACTURER'S DESIGNATION OF DRILL AMS Enironmental Soil Sampler (Hand Auger)			
3. DRILLING AGENCY USACE Philadelphia District				12. TOTAL SAMPLES : DISTURBED : UNDISTURBED		2 : 2 : 0	
4. NAME OF DRILLER Fatzinger/Martowska				13. TOTAL NUMBER CORE BOXES 0			
5. DIRECTION OF BORING		DEG FROM VERTICAL		14. DEPTH GROUND WATER See Remarks			
<input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		---		15. DATE BORING : STARTED : COMPLETED		8/5/14 : 8/5/14	
6. THICKNESS OF OVERBURDEN				16. ELEVATION TOP OF BORING			
7. DEPTH DRILLED INTO ROCK				17. TOTAL CORE RECOVERY FOR BORING N/A			
8. TOTAL DEPTH OF BORING 2.5'				18. SIGNATURE AND TITLE OF INSPECTOR Fatzinger			

ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	REMARKS
			Stiff Gray SILT	100	S-1	S-1 Compositied between 0" to 12"
	2.5			100	S-2	S-2 Compositied between 24" to 30"
BOTTOM OF BOREHOLE AT 2.5 ft						

DRILLING LOG		DIVISION --		INSTALLATION --		SHEET 1 OF 1 SHEETS	
1. PROJECT BoRit Reservoir Investigation				9. COORDINATE SYSTEM : HORIZONTAL : VERTICAL State Plane - Pennsylvania SouthNAD83			
2. HOLE NUMBER RVSB-33		LOCATION COORDINATES N 308988 E 2673311		10. SIZE AND TYPE OF BIT 3 1/4" Soil Auger			
3. DRILLING AGENCY USACE Philadelphia District				11. MANUFACTURER'S DESIGNATION OF DRILL AMS Enironmental Soil Sampler (Hand Auger)			
4. NAME OF DRILLER Fatzinger/Martowska				12. TOTAL SAMPLES : DISTURBED : UNDISTURBED 2 : 2 : 0			
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG FROM VERTICAL : BEARING --- : ---		13. TOTAL NUMBER CORE BOXES 0			
6. THICKNESS OF OVERBURDEN				14. DEPTH GROUND WATER See Remarks			
7. DEPTH DRILLED INTO ROCK				15. DATE BORING : STARTED : COMPLETED 8/5/14 : 8/5/14			
8. TOTAL DEPTH OF BORING 2.5'				16. ELEVATION TOP OF BORING			
				17. TOTAL CORE RECOVERY FOR BORING N/A			
				18. SIGNATURE AND TITLE OF INSPECTOR Fatzinger			

ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	REMARKS
	1.8		Dark Gray Soft Organic SILT	100	S-1	S-1 Compositied between 0" to 12"
	2.5		Red Silty Fine SAND, Trace Gravel	100	S-2	S-2 Compositied between 22" to 30"
BOTTOM OF BOREHOLE AT 2.5 ft						

RVSB-34

DRILLING LOG				DIVISION --		INSTALLATION --		SHEET 1 OF 1 SHEETS	
1. PROJECT BoRit Reservoir Investigation				9. COORDINATE SYSTEM State Plane - Pennsylvania SouthNAD83		HORIZONTAL VERTICAL			
2. HOLE NUMBER RVSB-34				LOCATION COORDINATES N 309299 E 2672975		10. SIZE AND TYPE OF BIT 3 1/4" Soil Auger			
3. DRILLING AGENCY USACE Philadelphia District				11. MANUFACTURER'S DESIGNATION OF DRILL AMS Enironmental Soil Sampler (Hand Auger)		12. TOTAL SAMPLES 2		DISTURBED 2 UNDISTURBED 0	
4. NAME OF DRILLER Fatzinger/Martowska				13. TOTAL NUMBER CORE BOXES 0		14. DEPTH GROUND WATER See Remarks			
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED				DEG FROM VERTICAL ---		BEARING --		15. DATE BORING 8/5/14	
6. THICKNESS OF OVERBURDEN				16. ELEVATION TOP OF BORING		17. TOTAL CORE RECOVERY FOR BORING N/A		18. SIGNATURE AND TITLE OF INSPECTOR Fatzinger	
7. DEPTH DRILLED INTO ROCK				8. TOTAL DEPTH OF BORING 2.5'					
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	REMARKS			
	1.5		Very Soft Clayey SILT with organics	100	S-1	S-1 Compositied between 0" to 8"			
	2.5		Stiff Dry CLAY	100	S-2	S-2 Compositied between 18" to 24"			

BOTTOM OF BOREHOLE AT 2.5 ft

RVSB-35

DRILLING LOG				DIVISION --		INSTALLATION --		SHEET 1 OF 1 SHEETS	
1. PROJECT BoRit Reservoir Investigation				9. COORDINATE SYSTEM State Plane - Pennsylvania SouthNAD83		: HORIZONTAL VERTICAL			
2. HOLE NUMBER RVSB-35				LOCATION COORDINATES N 309134 E 2673039		10. SIZE AND TYPE OF BIT 3 1/4" Soil Auger			
3. DRILLING AGENCY USACE Philadelphia District				12. TOTAL SAMPLES 2		DISTURBED 2		UNDISTURBED 0	
4. NAME OF DRILLER Fatzinger/Martowska				13. TOTAL NUMBER CORE BOXES 0		14. DEPTH GROUND WATER See Remarks			
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED				DEG FROM VERTICAL ---		BEARING		15. DATE BORING 8/5/14	
6. THICKNESS OF OVERBURDEN				16. ELEVATION TOP OF BORING		STARTED 8/5/14		COMPLETED 8/5/14	
7. DEPTH DRILLED INTO ROCK				17. TOTAL CORE RECOVERY FOR BORING N/A		18. SIGNATURE AND TITLE OF INSPECTOR Fatzinger			
8. TOTAL DEPTH OF BORING 4.33'									
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	REMARKS			
	3.3		Very Soft Gray Brown Organic SILT	100	S-1	S-1 Compositied between 0" to 12"			
	3.8		Stiff Gray SILT	100	S-2	S-2 Compositied between 40" to 52"			
	4.3		Gravelly SAND						

BOTTOM OF BOREHOLE AT 4.3 ft

Appendix C-1
Organic Analytes in Reservoir Sediment - 2014 Reservoir Sediment Investigation
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

Sample Number	BRT-RS-033114-25-01-00	BRT-RS-033114-25-02-00	BRT-RS-033114-26-01-00	BRT-RS-033114-26-02-00	BRT-RS-033114-27-01-00	BRT-RS-033114-27-02-00	BRT-RS-033114-28-01-00	BRT-RS-033114-28-02-00	BRT-RS-033114-29-01-00	BRT-RS-033114-30-01-00	BRT-RS-033114-30-02-00	BRT-RS-080514-31-01-00	BRT-RS-080514-31-02-00	BRT-RS-080514-32-01-00	BRT-RS-080514-32-02-00	BRT-RS-080514-33-01-00	BRT-RS-080514-33-02-00	BRT-RS-080514-34-01-00
Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Sample Depth (ft)	0.5-1.5	3-3.9	1.5-2.2	3-3.5	0.5-1.8	2.5-3	1-1.6	2.5-4	2.2-3.2	1.5-1.8	1.8-2.3	0-1	3.9-4.6	0-1	2-2.5	0-1	1.8-2.5	0-0.7
Volatile Organic Compounds (µg/kg)																		
1,1,1-Trichloroethane	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
1,1,2-Trichloro-1,2,2-Trifluoroethane	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
1,1,2-Trichloroethane	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 UJ	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
1,1-Dichloroethane	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
1,1-Dichloroethene	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
1,2,3-Trichlorobenzene	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 R	6.4 U	6.9 U	7.2 U	6.5 U	13 R	5.3 U	5.7 U	3.2 U	10 R	3.1 U	13 R
1,2,4-Trichlorobenzene	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 R	6.4 U	6.9 U	7.2 U	6.5 U	13 R	5.3 U	5.7 U	3.2 U	10 R	3.1 U	13 R
1,2-Dibromo-3-Chloropropane	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 R	6.4 U	6.9 U	7.2 U	6.5 U	13 R	5.3 U	5.7 U	3.2 U	10 R	3.1 U	13 R
1,2-Dibromoethane	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
1,2-Dichlorobenzene	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 R	6.4 U	6.9 U	7.2 U	6.5 U	13 R	5.3 U	5.7 U	3.2 U	10 R	3.1 U	13 R
1,2-Dichloroethane	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
1,2-Dichloropropane	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
1,3-Dichlorobenzene	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 R	6.4 U	6.9 U	7.2 U	6.5 U	13 R	5.3 U	5.7 U	3.2 U	10 R	3.1 U	13 R
1,4-Dichlorobenzene	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 R	6.4 U	6.9 U	7.2 U	6.5 U	13 R	5.3 U	5.7 U	3.2 U	10 R	3.1 U	13 R
1,4-Dioxane	120 R	130 R	120 R	130 R	140 R	120 R	130 R	130 R	140 R	140 R	130 R	260 R	110 R	110 R	64 R	210 R	62 R	260 R
2-Butanone (MEK)	12	10 J	39	14	24	16	20	7.8 J	11 J	11 J	11 J	26 UJ	11 U	11 U	6.4 U	21 UJ	6.2 U	26 UJ
2-Hexanone	12 U	13 U	12 U	13 U	14 U	12 U	13 U	13 U	14 U	14 U	13 U	26 UJ	11 U	11 U	6.4 U	21 UJ	6.2 U	26 UJ
4-Methyl-2-Pentanone (MIBK)	12 U	13 U	12 U	13 U	14 U	12 U	13 U	13 U	14 U	14 U	13 U	14 J	3.9 J	5.1 J	2.4 J	21 UJ	2.6 J	13 J
Acetone	24	17	43	14	69	49	94	37	17	20	42	55 J	40	21	22	81 J	18	67 J
Benzene	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Bromochloromethane	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Bromodichloromethane	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Bromoform	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 R	6.4 U	6.9 U	7.2 U	6.5 U	13 R	5.3 U	5.7 U	3.2 U	10 R	3.1 U	13 R
Bromomethane	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Carbon Disulfide	6 U	6.6 U	14	6.4	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Carbon Tetrachloride	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Chlorobenzene	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Chloroethane	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Chloroform	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Chloromethane	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Cis-1,2-Dichloroethene	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Cis-1,3-Dichloropropene	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 UJ	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Cyclohexane	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Dibromochloromethane	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Dichlorodifluoromethane	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Ethylbenzene	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Isopropylbenzene	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
M,P-Xylene (Sum Of Isomers)	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Methyl Acetate	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Methyl Tert-Butyl Ether	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Methylcylohexane	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Methylene Chloride	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
O-Xylene	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Styrene	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Tetrachloroethene	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Toluene	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Trans-1,2-Dichloroethene	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Trans-1,3-Dichloropropene	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 UJ	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Trichloroethene	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Trichlorofluoromethane	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ
Vinyl Chloride	6 U	6.6 U	5.9 U	6.4 U	6.9 U	6.2 U	6.4 U	6.4 U	6.9 U	7.2 U	6.5 U	13 UJ	5.3 U	5.7 U	3.2 U	10 UJ	3.1 U	13 UJ

Notes:
* - The rinsate blank and trip blank results are reported in micrograms per liter.
ug/kg - micrograms per kilogram
ft - feet
N - normal field sample
RB - rinsate blank
TB - trip blank
NS - Not sampled, a trip blank is not collected for semi-volatile organic analysis.

U - The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted Contract Required Quantitation Limit (CRQL) for sample and method.
J - The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the CRQL).
R - The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.

UJ - The analyte was not detected at a level greater than or equal to the adjusted CRQL. However, the reported adjusted CRQL is approximate and maybe inaccurate or imprecise.
For non-detects (U and R qualified results), the number preceding the qualifier is the reporting detection limit.
PCB - Polychlorinated biphenyl

Appendix C-1
Organic Analytes in Reservoir Sediment - 2014 Reservoir Sediment Investigation
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

Sample Number	BRT-RS-080514-34-02-00	BRT-RS-080514-35-01-00	BRT-RS-080514-35-02-00	BRT-RS-033114-00-01-03	BRT-RS-080514-00-01-03	BRT-RS-033114-00-01-04	BRT-RS-080514-00-01-04
Sample Type	N	N	N	RB*	RB*	TB*	TB*
Sample Depth (ft)	1.5-2	0-1	3.3-4.3				
Volatile Organic Compounds (ug/kg)							
1,1,1-Trichloroethane	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
1,2,3-Trichlorobenzene	3.6 U	16 R	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	3.6 U	16 R	5 U	5 U	5 U	5 U	5 U
1,2-Dibromo-3-Chloropropane	3.6 U	16 R	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	3.6 U	16 R	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
1,2-Dichloropropane	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	3.6 U	16 R	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	3.6 U	16 R	5 U	5 U	5 U	5 U	5 U
1,4-Dioxane	73 R	310 R	100 R	100 R	100 R	100 R	100 R
2-Butanone (MEK)	7.3 U	31 UJ	10 U	10 U	10 U	10 U	10 U
2-Hexanone	7.3 U	31 UJ	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-Pentanone (MIBK)	3.5 J	18 J	3.2 J	10 U	10 U	10 U	10 U
Acetone	34	140 J	50	10 U	10 U	10 U	10 U
Benzene	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Bromochloromethane	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Bromodichloromethane	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Bromoform	3.6 U	16 R	5 U	5 U	5 U	5 U	5 U
Bromomethane	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Carbon Disulfide	3.6 U	7 J	5 U	5 U	5 U	5 U	5 U
Carbon Tetrachloride	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Chloroethane	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Chloroform	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Chloromethane	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Cis-1,2-Dichloroethene	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Cis-1,3-Dichloropropene	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Cyclohexane	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Dichlorodifluoromethane	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Isopropylbenzene	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
M,P-Xylene (Sum Of Isomers)	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Methyl Acetate	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Methyl Tert-Butyl Ether	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Methylcyclohexane	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Methylene Chloride	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
O-Xylene	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Styrene	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Toluene	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Trans-1,2-Dichloroethene	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Trans-1,3-Dichloropropene	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Trichloroethene	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Trichlorofluoromethane	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	3.6 U	16 UJ	5 U	5 U	5 U	5 U	5 U

Notes:
* - The rinsate blank and trip blank results are reported in micrograms per liter.
ug/kg - micrograms per kilogram
ft - feet
N - normal field sample
RB - rinsate blank
TB - trip blank
NS - Not sampled, a trip blank is not collected for semi-volatile organic analysis.

U - The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted Contract Required Quantitation Limit (CRQL) for sample and method.
J - The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the CRQL).
R - The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.

UJ - The analyte was not detected at a level greater than or equal to the adjusted CRQL. However, the reported adjusted CRQL is approximate and maybe inaccurate or imprecise.
For non-detects (U and R qualified results), the number preceding the qualifier is the reporting detection limit.
PCB - Polychlorinated biphenyl

Appendix C-1
Organic Analytes in Reservoir Sediment - 2014 Reservoir Sediment Investigation
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

Sample Number	BRT-RS-033114-25-01-00	BRT-RS-033114-25-02-00	BRT-RS-033114-26-01-00	BRT-RS-033114-26-02-00	BRT-RS-033114-27-01-00	BRT-RS-033114-27-02-00	BRT-RS-033114-28-01-00	BRT-RS-033114-28-02-00	BRT-RS-033114-29-01-00	BRT-RS-033114-30-01-00	BRT-RS-033114-30-02-00	BRT-RS-080514-31-01-00	BRT-RS-080514-31-02-00	BRT-RS-080514-32-01-00	BRT-RS-080514-32-02-00	BRT-RS-080514-33-01-00	BRT-RS-080514-33-02-00	BRT-RS-080514-34-01-00
Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Sample Depth (ft)	0.5-1.5	3-3.9	1.5-2.2	3-3.5	0.5-1.8	2.5-3	1-1.6	2.5-4	2.2-3.2	1.5-1.8	1.8-2.3	0-1	3.9-4.6	0-1	2-2.5	0-1	1.8-2.5	0-0.7
Semi-Volatile Organic Compounds (ug/kg)																		
1,1'-Biphenyl	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 UJ	220 UJ	710 UJ	210 U	890 UJ
1,2,4,5-Tetrachlorobenzene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
1,2-Benzphenanthracene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 UJ	390 UJ	220 UJ	710 UJ	210 UJ	890 UJ
2,3,4,6-Tetrachlorophenol	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
2,4,5-Trichlorophenol	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
2,4,6-Trichlorophenol	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
2,4-Dichlorophenol	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
2,4-Dimethylphenol	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
2,4-Dinitrophenol	400 U	430 U	390 U	420 U	460 U	410 U	420 U	420 U	460 U	480 U	430 U	1700 UJ	700 U	750 U	420 U	1400 UJ	410 U	1700 UJ
2,4-Dinitrotoluene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
2,6-Dinitrotoluene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
2-Chloronaphthalene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
2-Chlorophenol	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
2-Methylnaphthalene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
2-Methylphenol	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
2-Nitroaniline	400 U	430 U	390 U	420 U	460 U	410 U	420 U	420 U	460 U	480 U	430 U	1700 UJ	700 U	750 U	420 U	1400 UJ	410 U	1700 UJ
2-Nitrophenol	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
3,3'-Dichlorobenzidine	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
3,5,5-Trimethyl-2-Cyclohexene-1-One	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
3-Nitroaniline	400 U	430 U	390 U	420 U	460 U	410 U	420 U	420 U	460 U	480 U	430 U	1700 UJ	700 U	750 U	420 U	1400 UJ	410 U	1700 UJ
4,6-Dinitro-2-Methylphenol	400 U	430 U	390 U	420 U	460 U	410 U	420 U	420 U	460 U	480 U	430 U	1700 UJ	700 U	750 U	420 U	1400 UJ	410 U	1700 UJ
4-Bromophenyl Phenyl Ether	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 UJ	390 UJ	220 U	710 UJ	210 U	890 UJ
4-Chloro-3-Methylphenol	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
4-Chlorophenyl Phenyl Ether	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 UJ	390 UJ	220 U	710 UJ	210 U	890 UJ
4-Methylphenol	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
4-Nitrophenol	400 U	430 U	390 U	420 U	460 U	410 U	420 U	420 U	460 U	480 U	430 U	1700 UJ	700 U	750 U	420 U	1400 UJ	410 U	1700 UJ
Acenaphthene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
Acenaphthylene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
Acetophenone	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
Anthracene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
Atrazine	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
Benzaldehyde	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
Benzo(a)Anthracene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 UJ	390 UJ	220 UJ	710 UJ	210 UJ	890 UJ
Benzo(a)Pyrene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 UJ	390 UJ	220 UJ	710 UJ	210 UJ	890 UJ
Benzo(b)Fluoranthene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 UJ	390 UJ	220 UJ	710 UJ	210 UJ	890 UJ
Benzo(g,h,i)Perylene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 UJ	390 UJ	220 UJ	710 UJ	210 UJ	890 UJ
Benzo(k)Fluoranthene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 UJ	390 UJ	220 UJ	710 UJ	210 UJ	890 UJ
Benzyl Butyl Phthalate	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 UJ	220 UJ	710 UJ	210 U	890 UJ
Bis(2-Chloroethoxy)Methane	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
Bis(2-Chloroethyl) Ether	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
Bis(2-Ethylhexyl)Phthalate	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 UJ	220 UJ	710 UJ	210 U	890 UJ
Bis-Chloroisopropyl Ether	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
Caprolactam	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 UJ	220 UJ	710 UJ	210 U	890 UJ
Carbazole	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 UJ	390 UJ	220 U	710 UJ	210 U	890 UJ
Dibenzo(a,h)Anthracene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 UJ	390 UJ	220 UJ	710 UJ	210 UJ	890 UJ
Dibenzofuran	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 UJ	390 UJ	220 U	710 UJ	210 U	890 UJ
Diethyl Phthalate	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 UJ	220 UJ	710 UJ	210 U	890 UJ
Dimethyl Phthalate	590	520	580	490	470	520	590	440	510	640	500	2600 J	1100	1500 J	720 J	2400 J	690	2400 J
Di-N-Butylphthalate	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 UJ	220 UJ	710 UJ	210 U	890 UJ
Di-N-Octylphthalate	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 UJ	220 UJ	710 UJ	210 U	890 UJ
Fluoranthene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 UJ	390 UJ	220 UJ	710 UJ	210 UJ	890 UJ
Fluorene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 UJ	390 UJ	220 U	710 UJ	210 U	890 UJ
Hexachloro-1,3-Butadiene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
Hexachlorobenzene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
Hexachlorocyclopentadiene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
Hexachloroethane	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ

Notes:
* - The rinsate blank and trip blank results are reported in micrograms per liter.
ug/kg - micrograms per kilogram
ft - feet
N - normal field sample
RB - rinsate blank
TB - trip blank
NS - Not sampled, a trip blank is not collected for semi-volatile organic analysis.

U - The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted Contract Required Quantitation Limit (CRQL) for sample and method.
J - The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the CRQL).
R - The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.

UJ - The analyte was not detected at a level greater than or equal to the adjusted CRQL. However, the reported adjusted CRQL is approximate and maybe inaccurate or imprecise.
For non-detects (U and R qualified results), the number preceding the qualifier is the reporting detection limit.
PCB - Polychlorinated biphenyl

Appendix C-1
Organic Analytes in Reservoir Sediment - 2014 Reservoir Sediment Investigation
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

Sample Number	BRT-RS-080514-34-02-00	BRT-RS-080514-35-01-00	BRT-RS-080514-35-02-00	BRT-RS-033114-00-01-03	BRT-RS-080514-00-01-03	BRT-RS-033114-00-01-04	BRT-RS-080514-00-01-04
Sample Type	N	N	N	RB*	RB*	TB*	TB*
Sample Depth (ft)	1.5-2	0-1	3.3-4.3				
Semi-Volatile Organic Compounds (ug/kg)							
1,1'-Biphenyl	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
1,2,4,5-Tetrachlorobenzene	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
1,2-Benzphenanthracene	250 UJ	1100 UJ	340 UJ	5.1 U	5.2 U	NS	NS
2,3,4,6-Tetrachlorophenol	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
2,4,5-Trichlorophenol	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
2,4,6-Trichlorophenol	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
2,4-Dichlorophenol	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
2,4-Dimethylphenol	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
2,4-Dinitrophenol	480 U	2100 UJ	660 U	10 UJ	10 UJ	NS	NS
2,4-Dinitrotoluene	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
2,6-Dinitrotoluene	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
2-Chloronaphthalene	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
2-Chlorophenol	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
2-Methylnaphthalene	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
2-Methylphenol	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
2-Nitroaniline	480 U	2100 UJ	660 U	10 UJ	10 UJ	NS	NS
2-Nitrophenol	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
3,3'-Dichlorobenzidine	250 U	1100 UJ	340 U	5.1 U	5.2 R	NS	NS
3,5,5-Trimethyl-2-Cyclohexene-1-One	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
3-Nitroaniline	480 U	2100 UJ	660 U	10 UJ	10 UJ	NS	NS
4,6-Dinitro-2-Methylphenol	480 U	2100 UJ	660 U	10 U	10 U	NS	NS
4-Bromophenyl Phenyl Ether	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
4-Chloro-3-Methylphenol	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
4-Chlorophenyl Phenyl Ether	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
4-Methylphenol	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
4-Nitrophenol	480 U	2100 UJ	660 U	10 UJ	10 UJ	NS	NS
Acenaphthene	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Acenaphthylene	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Acetophenone	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Anthracene	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Atrazine	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Benzaldehyde	250 U	1100 UJ	340 U	5.1 UJ	5.2 UJ	NS	NS
Benzo(a)Anthracene	250 UJ	1100 UJ	340 UJ	5.1 U	5.2 U	NS	NS
Benzo(a)Pyrene	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Benzo(b)Fluoranthene	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Benzo(g,h,i)Perylene	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Benzo(k)Fluoranthene	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Benzyl Butyl Phthalate	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Bis(2-Chloroethoxy)Methane	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Bis(2-Chloroethyl) Ether	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Bis(2-Ethylhexyl)Phthalate	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Bis-Chloroisopropyl Ether	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Caprolactam	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Carbazole	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Dibenzo(a,h)Anthracene	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Dibenzofuran	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Diethyl Phthalate	250 U	1100 UJ	340 U	5.1 U	1.8 J	NS	NS
Dimethyl Phthalate	920	4100 J	1500	5.1 U	5.2 U	NS	NS
Di-N-Butylphthalate	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Di-N-Octylphthalate	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Fluoranthene	250 UJ	1100 UJ	340 UJ	5.1 U	5.2 U	NS	NS
Fluorene	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Hexachloro-1,3-Butadiene	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Hexachlorobenzene	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Hexachlorocyclopentadiene	250 U	1100 UJ	340 U	5.1 U	5.2 R	NS	NS
Hexachloroethane	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS

Notes:

* - The rinsate blank and trip blank results are reported in micrograms per liter.
ug/kg - micrograms per kilogram
ft - feet
N - normal field sample
RB - rinsate blank
TB - trip blank
NS - Not sampled, a trip blank is not collected for semi-volatile organic analysis.

U - The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted Contract Required Quantitation Limit (CRQL) for sample and method.
J - The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the CRQL).
R - The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.

UJ - The analyte was not detected at a level greater than or equal to the adjusted CRQL. However, the reported adjusted CRQL is approximate and maybe inaccurate or imprecise.
For non-detects (U and R qualified results), the number preceding the qualifier is the reporting detection limit.
PCB - Polychlorinated biphenyl

Appendix C-1
Organic Analytes in Reservoir Sediment - 2014 Reservoir Sediment Investigation
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

Sample Number	BRT-RS-033114-25-01-00	BRT-RS-033114-25-02-00	BRT-RS-033114-26-01-00	BRT-RS-033114-26-02-00	BRT-RS-033114-27-01-00	BRT-RS-033114-27-02-00	BRT-RS-033114-28-01-00	BRT-RS-033114-28-02-00	BRT-RS-033114-29-01-00	BRT-RS-033114-30-01-00	BRT-RS-033114-30-02-00	BRT-RS-080514-31-01-00	BRT-RS-080514-31-02-00	BRT-RS-080514-32-01-00	BRT-RS-080514-32-02-00	BRT-RS-080514-33-01-00	BRT-RS-080514-33-02-00	BRT-RS-080514-34-01-00
Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Sample Depth (ft)	0.5-1.5	3-3.9	1.5-2.2	3-3.5	0.5-1.8	2.5-3	1-1.6	2.5-4	2.2-3.2	1.5-1.8	1.8-2.3	0-1	3.9-4.6	0-1	2-2.5	0-1	1.8-2.5	0-0.7
Semi-Volatile Organic Compounds Cont. (ug/kg)																		
Indeno(1,2,3-cd)Pyrene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 UJ	390 UJ	220 UJ	710 UJ	210 UJ	890 UJ
M-Cresol & P-Cresol	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
Naphthalene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
Nitrobenzene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
N-Nitroso-Di-N-Propylamine	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
N-Nitrosodiphenylamine	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
P-Chloroaniline	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
Pentachlorophenol	400 U	430 U	390 U	420 U	460 U	410 U	420 U	420 U	460 U	480 U	430 U	1700 UJ	700 U	750 U	420 U	1400 UJ	410 U	1700 UJ
Phenanthrene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
Phenol	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 U	390 U	220 U	710 UJ	210 U	890 UJ
P-Nitroaniline	400 U	430 U	390 U	420 U	460 U	410 U	420 U	420 U	460 U	480 U	430 U	1700 UJ	700 U	750 U	420 U	1400 UJ	410 U	1700 UJ
Pyrene	200 U	220 U	200 U	210 U	240 U	210 U	210 U	220 U	240 U	250 U	220 U	890 UJ	360 UJ	390 UJ	220 UJ	710 UJ	210 UJ	890 UJ
Pesticide/PCBs (ug/kg)																		
4,4'-DDD	4 U	4.4 U	3.9 U	4.2 U	4.6 U	4.1 U	4.2 U	4.2 U	4.6 U	4.7 U	4.3 U	17 UJ	7 U	7.6 U	4.2 U	14 UJ	4.1 U	17 UJ
4,4'-DDE	4 U	4.4 U	3.9 U	4.2 U	4.6 U	4.1 U	4.2 U	4.2 U	4.6 U	4.7 U	4.3 U	17 UJ	7 U	7.6 U	4.2 U	14 UJ	4.1 U	17 UJ
4,4'-DDT	4 U	4.4 U	3.9 U	4.2 U	4.6 U	4.1 U	4.2 U	4.2 U	4.6 U	4.7 U	4.3 U	17 UJ	7 U	7.6 U	4.2 U	14 UJ	4.1 U	17 UJ
Aldrin	2 U	2.2 U	2 U	2.1 U	2.4 U	2.1 U	2.2 U	2.2 U	2.4 U	2.4 U	2.2 U	8.7 UJ	3.6 U	3.9 U	2.2 U	7.1 UJ	2.1 U	9 UJ
Alpha-BHC	2 U	2.2 U	2 U	2.1 U	2.4 U	2.1 U	2.2 U	2.2 U	2.4 U	2.4 U	2.2 U	8.7 UJ	3.6 U	3.9 U	2.2 U	7.1 UJ	2.1 U	9 UJ
Alpha-Chlordane	2 U	2.2 U	2 U	2.1 U	2.4 U	2.1 U	2.2 U	2.2 U	2.4 U	2.4 U	2.2 U	8.7 UJ	3.6 U	3.9 U	2.2 U	7.1 UJ	2.1 U	9 UJ
Beta-BHC	2 U	2.2 U	2 U	2.1 U	2.4 U	2.1 U	2.2 U	2.2 U	2.4 U	2.4 U	2.2 U	8.7 UJ	3.6 U	3.9 U	2.2 U	7.1 UJ	2.1 U	9 UJ
Delta-BHC	2 U	2.2 U	2 U	2.1 U	2.4 U	2.1 U	2.2 U	2.2 U	2.4 U	2.4 U	2.2 U	8.7 UJ	3.6 U	3.9 U	2.2 U	7.1 UJ	2.1 U	9 UJ
Dieldrin	4 U	4.4 U	3.9 U	4.2 U	4.6 U	4.1 U	4.2 U	4.2 U	4.6 U	4.7 U	4.3 U	17 UJ	7 U	7.6 U	4.2 U	14 UJ	4.1 U	17 UJ
Endosulfan I	2 U	2.2 U	2 U	2.1 U	2.4 U	2.1 U	2.2 U	2.2 U	2.4 U	2.4 U	2.2 U	8.7 UJ	3.6 U	3.9 U	2.2 U	7.1 UJ	2.1 U	9 UJ
Endosulfan II	4 U	4.4 U	3.9 U	4.2 U	4.6 U	4.1 U	4.2 U	4.2 U	4.6 U	4.7 U	4.3 U	17 UJ	7 U	7.6 U	4.2 U	14 UJ	4.1 U	17 UJ
Endosulfan Sulfate	4 U	4.4 U	3.9 U	4.2 U	4.6 U	4.1 U	4.2 U	4.2 U	4.6 U	4.7 U	4.3 U	17 UJ	7 U	7.6 U	4.2 U	14 UJ	4.1 U	17 UJ
Endrin	4 U	4.4 U	3.9 U	4.2 U	4.6 U	4.1 U	4.2 U	4.2 U	4.6 U	4.7 U	4.3 U	17 UJ	7 U	7.6 U	4.2 U	14 UJ	4.1 U	17 UJ
Endrin Aldehyde	4 U	4.4 U	3.9 U	4.2 U	4.6 U	4.1 U	4.2 U	4.2 U	4.6 U	4.7 U	4.3 U	17 UJ	7 U	7.6 U	4.2 U	14 UJ	4.1 U	17 UJ
Endrin Ketone	4 U	4.4 U	3.9 U	4.2 U	4.6 U	4.1 U	4.2 U	4.2 U	4.6 U	4.7 U	4.3 U	17 UJ	7 U	7.6 U	4.2 U	14 UJ	4.1 U	17 UJ
Gamma-BHC (Lindane)	2 U	2.2 U	2 U	2.1 U	2.4 U	2.1 U	2.2 U	2.2 U	2.4 U	2.4 U	2.2 U	8.7 UJ	3.6 U	3.9 U	2.2 U	7.1 UJ	2.1 U	9 UJ
Gamma-Chlordane	2 U	2.2 U	2 U	2.1 U	2.4 U	2.1 U	2.2 U	2.2 U	2.4 U	2.4 U	2.2 U	8.7 UJ	3.6 U	3.9 U	2.2 U	7.1 UJ	2.1 U	9 UJ
Heptachlor	2 U	2.2 U	2 U	2.1 U	2.4 U	2.1 U	2.2 U	2.2 U	2.4 U	2.4 U	2.2 U	8.7 UJ	3.6 U	3.9 U	2.2 U	7.1 UJ	2.1 U	9 UJ
Heptachlor Epoxide	2 U	2.2 U	2 U	2.1 U	2.4 U	2.1 U	2.2 U	2.2 U	2.4 U	2.4 U	2.2 U	8.7 UJ	3.6 U	3.9 U	2.2 U	7.1 UJ	2.1 U	9 UJ
Methoxychlor	20 U	22 U	20 U	21 U	24 U	21 U	22 U	22 U	24 U	24 U	22 U	87 UJ	36 U	39 U	22 U	71 UJ	21 U	90 UJ
Toxaphene	200 U	220 U	200 U	210 U	240 U	210 U	220 U	220 U	240 U	240 U	220 U	870 UJ	360 U	390 U	220 U	710 UJ	210 U	900 UJ
Aroclor 1016	40 U	44 U	39 U	42 U	46 U	41 U	42 U	42 U	46 U	47 U	43 U	170 UJ	70 U	76 U	42 U	140 UJ	41 U	170 UJ
Aroclor 1221	40 U	44 U	39 U	42 U	46 U	41 U	42 U	42 U	46 U	47 U	43 U	170 UJ	70 U	76 U	42 U	140 UJ	41 U	170 UJ
Aroclor 1232	40 U	44 U	39 U	42 U	46 U	41 U	42 U	42 U	46 U	47 U	43 U	170 UJ	70 U	76 U	42 U	140 UJ	41 U	170 UJ
Aroclor 1242	40 U	44 U	39 U	42 U	46 U	41 U	42 U	42 U	46 U	47 U	43 U	170 UJ	70 U	76 U	42 U	140 UJ	41 U	170 UJ
Aroclor 1248	40 U	44 U	39 U	42 U	46 U	41 U	42 U	42 U	46 U	47 U	43 U	170 UJ	70 U	76 U	42 U	140 UJ	41 U	170 UJ
Aroclor 1254	40 U	44 U	39 U	42 U	46 U	41 U	42 U	42 U	46 U	47 U	43 U	170 UJ	70 U	76 U	42 U	140 UJ	41 U	170 UJ
Aroclor 1260	40 U	44 U	39 U	42 U	46 U	41 U	42 U	42 U	46 U	47 U	43 U	170 UJ	70 U	76 U	42 U	140 UJ	41 U	170 UJ
Aroclor 1262	40 U	44 U	39 U	42 U	46 U	41 U	42 U	42 U	46 U	47 U	43 U	170 UJ	70 U	76 U	42 U	140 UJ	41 U	170 UJ
Aroclor 1268	40 U	44 U	39 U	42 U	46 U	41 U	42 U	42 U	46 U	47 U	43 U	170 UJ	70 U	76 U	42 U	140 UJ	41 U	170 UJ

Notes:
* - The rinsate blank and trip blank results are reported in micrograms per liter.
ug/kg - micrograms per kilogram
ft - feet
N - normal field sample
RB - rinsate blank
TB - trip blank
NS - Not sampled, a trip blank is not collected for semi-volatile organic analysis.

U - The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted Contract Required Quantitation Limit (CRQL) for sample and method.
J - The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the CRQL).
R - The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.

UJ - The analyte was not detected at a level greater than or equal to the adjusted CRQL. However, the reported adjusted CRQL is approximate and maybe inaccurate or imprecise.
For non-detects (U and R qualified results), the number preceding the qualifier is the reporting detection limit.
PCB - Polychlorinated biphenyl

Appendix C-1
Organic Analytes in Reservoir Sediment - 2014 Reservoir Sediment Investigation
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

Sample Number	BRT-RS-080514-34-02-00	BRT-RS-080514-35-01-00	BRT-RS-080514-35-02-00	BRT-RS-033114-00-01-03	BRT-RS-080514-00-01-03	BRT-RS-033114-00-01-04	BRT-RS-080514-00-01-04
Sample Type	N	N	N	RB*	RB*	TB*	TB*
Sample Depth (ft)	1.5-2	0-1	3.3-4.3				
Semi-Volatile Organic Compounds Cont. (ug/kg)							
Indeno(1,2,3-cd)Pyrene	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
M-Cresol & P-Cresol	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Naphthalene	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Nitrobenzene	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
N-Nitroso-Di-N-Propylamine	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
N-Nitrosodiphenylamine	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
P-Chloroaniline	250 U	1100 UJ	340 U	5.1 U	5.2 R	NS	NS
Pentachlorophenol	480 U	2100 UJ	660 U	10 U	10 U	NS	NS
Phenanthrene	250 U	1100 UJ	340 U	5.1 U	5.2 U	NS	NS
Phenol	250 U	1100 UJ	340 U	5.1 UJ	5.2 UJ	NS	NS
P-Nitroaniline	480 U	2100 UJ	660 U	10 UJ	10 UJ	NS	NS
Pyrene	250 UJ	1100 UJ	340 UJ	5.1 U	5.2 U	NS	NS
Pesticide/PCBs (ug/kg)							
4,4'-DDD	4.8 U	21 UJ	6.6 U	0.1 U	0.1 U	NS	NS
4,4'-DDE	4.8 U	21 UJ	6.6 U	0.1 U	0.1 U	NS	NS
4,4'-DDT	4.8 U	21 UJ	6.6 U	0.1 U	0.1 U	NS	NS
Aldrin	2.5 U	11 UJ	3.4 U	0.05 U	0.051 U	NS	NS
Alpha-BHC	2.5 U	11 UJ	3.4 U	0.05 U	0.051 U	NS	NS
Alpha-Chlordane	2.5 U	11 UJ	3.4 U	0.05 U	0.051 U	NS	NS
Beta-BHC	2.5 U	11 UJ	3.4 U	0.05 U	0.051 U	NS	NS
Delta-BHC	2.5 U	11 UJ	3.4 U	0.05 U	0.051 U	NS	NS
Dieldrin	4.8 U	21 UJ	6.6 U	0.1 U	0.1 U	NS	NS
Endosulfan I	2.5 U	11 UJ	3.4 U	0.05 U	0.051 U	NS	NS
Endosulfan II	4.8 U	21 UJ	6.6 U	0.1 U	0.1 U	NS	NS
Endosulfan Sulfate	4.8 U	21 UJ	6.6 U	0.1 U	0.1 U	NS	NS
Endrin	4.8 U	21 UJ	6.6 U	0.1 U	0.1 U	NS	NS
Endrin Aldehyde	4.8 U	21 UJ	6.6 U	0.1 U	0.1 U	NS	NS
Endrin Ketone	4.8 U	21 UJ	6.6 U	0.1 U	0.1 U	NS	NS
Gamma-BHC (Lindane)	2.5 U	11 UJ	3.4 U	0.05 U	0.051 U	NS	NS
Gamma-Chlordane	2.5 U	11 UJ	3.4 U	0.05 U	0.051 U	NS	NS
Heptachlor	2.5 U	11 UJ	3.4 U	0.05 U	0.051 U	NS	NS
Heptachlor Epoxide	2.5 U	11 UJ	3.4 U	0.05 U	0.051 U	NS	NS
Methoxychlor	25 U	110 UJ	34 U	0.5 U	0.51 U	NS	NS
Toxaphene	250 U	1100 UJ	340 U	5 U	5.1 U	NS	NS
Aroclor 1016	48 U	210 UJ	66 U	1 U	1 U	NS	NS
Aroclor 1221	48 U	210 UJ	66 U	1 U	1 U	NS	NS
Aroclor 1232	48 U	210 UJ	66 U	1 U	1 U	NS	NS
Aroclor 1242	48 U	210 UJ	66 U	1 U	1 U	NS	NS
Aroclor 1248	48 U	210 UJ	66 U	1 U	1 U	NS	NS
Aroclor 1254	48 U	210 UJ	66 U	1 U	1 U	NS	NS
Aroclor 1260	48 U	210 UJ	66 U	1 U	1 U	NS	NS
Aroclor 1262	48 U	210 UJ	66 U	1 U	1 U	NS	NS
Aroclor 1268	48 U	210 UJ	66 U	1 U	1 U	NS	NS

Notes:

* - The rinsate blank and trip blank results are reported in micrograms per liter.

ug/kg - micrograms per kilogram

ft - feet

N - normal field sample

RB - rinsate blank

TB - trip blank

NS - Not sampled, a trip blank is not collected for semi-volatile organic analysis.

U - The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted

Contract Required Quantitation Limit (CRQL) for sample and method.

J - The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the CRQL).

R - The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.

UJ - The analyte was not detected at a level greater than or equal to the adjusted CRQL. However, the reported adjusted CRQL

is approximate and maybe inaccurate or imprecise.

For non-detects (U and R qualified results), the number preceding the qualifier is the reporting detection limit.

PCB - Polychlorinated biphenyl

Appendix C-2
Asbestos in Reservoir Sediment - 2014 Reservoir Sediment Investigation
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

Sample Number	BRT-RS-033114-25-01-00	BRT-RS-033114-25-02-00	BRT-RS-033114-26-01-00	BRT-RS-033114-26-02-00	BRT-RS-033114-27-01-00	BRT-RS-033114-27-02-00	BRT-RS-033114-28-01-00	BRT-RS-033114-28-02-00	BRT-RS-033114-28-02-01	BRT-RS-033114-29-01-00	BRT-RS-033114-30-01-00	BRT-RS-033114-30-02-00
Sample Type	N	N	N	N	N	N	N	N	FD	N	N	N
Sample Depth (ft)	0.5-1.5	3-3.9	1.5-2.2	3-3.5	0.5-1.8	2.5-3	1-1.6	2.5-4	2.5-4	2.2-3.2	1.5-1.8	1.8-2.3
Asbestos (%)												
Chrysotile	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Non-Asbestos (Fibrous)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Non-Asbestos (Non-Fibrous)	100	100	100	100	100	100	100	100	100	100	100	100

Sample Number	BRT-RS-080514-31-01-00	BRT-RS-080514-31-02-00	BRT-RS-080514-32-01-00	BRT-RS-080514-32-01-01	BRT-RS-080514-32-02-00	BRT-RS-080514-33-01-00	BRT-RS-080514-33-02-00	BRT-RS-080514-34-01-00	BRT-RS-080514-34-02-00	BRT-RS-080514-35-01-00	BRT-RS-080514-35-02-00	BRT-RS-080514-00-01-03
Sample Type	N	N	N	FD	N	N	N	N	N	N	N	RB*
Sample Depth (ft)	0-1	3.9-4.6	0-1	0-1	2-2.5	0-1	1.8-2.5	0-0.7	1.5-2	0-1	3.3-4.3	NA
Asbestos (%)												
Chrysotile	0.25 U	0.5	0.25	0.25	ND	0.75	0.25	0.25	ND	0.25 U	0.5	3
Non-Asbestos (Fibrous)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
Non-Asbestos (Non-Fibrous)	100	99.5	99.75	99.75	100	99.25	99.75	99.75	100	100	99.5	NA

Notes:

* - Rinsate blank results are reported in million fibers per liter (MFL).

For non-detects (U qualified results), the number preceding the qualifier is the reporting detection limit.

% - percent

ft - feet

U - The analyte was analyzed for, but was not detected at a level greater than or equal to the reporting detection limit for sample and method.

N - normal field sample

NA - not applicable

ND - non-detect

FD - field duplicate sample

Appendix C-3
Inorganic Analytes in Reservoir Sediment - 2014 Reservoir Sediment Investigation
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

Sample Number	BRT-RS-033114-25-01-00	BRT-RS-033114-25-02-00	BRT-RS-033114-26-01-00	BRT-RS-033114-26-02-00	BRT-RS-033114-27-01-00	BRT-RS-033114-27-02-00	BRT-RS-033114-28-01-00	BRT-RS-033114-28-02-00	BRT-RS-033114-29-01-00	BRT-RS-033114-30-01-00	BRT-RS-033114-30-02-00	BRT-RS-080514-31-01-00	BRT-RS-080514-31-02-00
Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N
Sample Depth (ft)	0.5-1.5	3-3.9	1.5-2.2	3-3.5	0.5-1.8	2.5-3	1-1.6	2.5-4	2.2-3.2	1.5-1.8	1.8-2.3	0-1	3.9-4.6
Inorganic Compounds (mg/kg)													
Aluminum	15800	12800	15800	11700	14200	11800	17900	16900	13800	11500	12800	8050	15300
Antimony	0.63 J	0.38 J	1.3 J	0.77 J	0.54 J	0.32 J	0.88 J	0.92 J	0.43 J	0.61 J	0.8 J	1.2 J	0.9 J
Arsenic	4.1	2.3	3.4	2.7	3.5	2.9	5.1	4	3	5.5	4.3	5	6.9
Barium	103	122	135	156	87.6	156	72.5	119	146	116	170	94.7	252
Beryllium	1.3	0.96	1.6	1.3	0.46 J	1.3	0.88	1.1	1.1	0.77	1.1	0.79	1.5
Cadmium	0.19 J	0.06 J	0.26 J	0.19 J	0.05 J	0.26 J	0.11 J	0.18 J	0.11 J	0.14 J	0.2 J	1.4 J	0.78 J
Calcium	919 J	984 J	662 J	811 J	1050 J	1480 J	1090 J	1200 J	1330 J	918 J	813 J	8700	2710
Chromium	27.6	29.4	29.2	28.3	23.5	25.5	30.7	30.5	22.2	23.3	28.9	42.3	34.2
Cobalt	16.7	6.8	11.2	13.2	2.6 J	14.7	7.8	12.6	7.5	5.1	14.2	7.7	11.6
Copper	22.6	10.5	7	2.9	8	23.9	18.5	18.2	9.2	12.8	14.7	57.5 J	30.9 J
Cyanide	0.6 U	0.66 U	0.6 U	0.62 U	0.67 U	0.61 U	0.64 U	0.64 U	0.69 U	0.69 U	0.67 U	0.07 J	1.1 U
Iron	29800 J	14100 J	34600 J	29600 J	21300 J	20700 J	31900 J	31600 J	16000 J	26200 J	32100 J	17900 J	26400 J
Lead	10.9	5.5	24	20.4	10.9	10.3	11.4	12.4	10.6	11.9	13.1	66	60.2
Magnesium	4940 J	3460 J	4780 J	3470 J	1460 J	3510 J	3770 J	4890 J	2190 J	2220 J	3620 J	2710	3960
Manganese	667 J+	226 J+	282 J+	437 J+	110 J+	209 J+	183 J+	325 J+	210 J+	116 J+	168 J+	267	386
Mercury	0.11 U	0.12 U	0.12 U	0.11 U	0.13 U	0.11 U	0.11 U	0.11 U	0.13 U	0.13 U	0.12 U	0.26	0.17 J
Nickel	19.8	13.4	19.8	17	6.2	30	15.3	20.3	13.5	9.8	15.6	24.8	28.4
Potassium	2080	1390	2610	1620	614	1170	1580	2800	717	622	1420	582 J-	752 J-
Selenium	3 U	0.32 J	0.17 J	0.26 J	0.18 J	3 U	0.27 J	0.34 J	0.45 J	0.75 J	0.41 J	1.1 J	1.5 J
Silver	0.86 U	0.95 U	0.88 U	0.93 U	0.93 U	0.86 U	0.92 U	0.95 U	1 U	0.98 U	0.97 U	0.83 U	1.6 U
Sodium	181 J+	149 J+	262 J+	243 J+	128 J+	143 J+	162 J+	196 J+	105 J+	134 J+	183 J+	179 J	149 J
Thallium	2.1 U	2.4 U	2.2 U	2.3 U	2.3 U	2.1 U	2.3 U	2.4 U	2.5 U	2.5 U	2.4 U	2.1 U	4.1 U
Vanadium	44.1	31.1	29.6	21.4	36.6	38	46.5	41.9	26	37	40.5	28.1	37.5
Zinc	37.6	29.1	49.5	35.7	20.9	39.5	36.9	38.3	32	31.4	37.7	227	126

Notes:

* - The rinsate blank results are reported in micrograms per liter.

mg/kg - milligrams per kilogram

ft - feet

N - normal field sample

RB - rinsate blank

NA - not applicable

U - The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted Contract Required Quantitation Limit (CRQL) for sample and method.

UJ - The analyte was not detected at a level greater than or equal to the adjusted CRQL. However, the reported adjusted CRQL is approximate and may be inaccurate or imprecise.

J - The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the CRQL).

J- - The result is an estimated quantity, but the result may be biased low.

J+ - The result is an estimated quantity, but the result may be biased high.

For non-detects (U qualified results), the number preceding the qualifier is the reporting detection limit.

Appendix C-3
Inorganic Analytes in Reservoir Sediment - 2014 Reservoir Sediment Investigation
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

Sample Number	BRT-RS-080514-32-01-00	BRT-RS-080514-32-02-00	BRT-RS-080514-33-01-00	BRT-RS-080514-33-02-00	BRT-RS-080514-34-01-00	BRT-RS-080514-34-02-00	BRT-RS-080514-35-01-00	BRT-RS-080514-35-02-00	BRT-RS-033114-00-01-03	BRT-RS-080514-00-01-03
Sample Type	N	N	N	N	N	N	N	N	RB*	RB*
Sample Depth (ft)	0-1	2-2.5	0-1	1.8-2.5	0-0.7	1.5-2	0-1	3.3-4.3	NA	NA
Inorganic Compounds (mg/kg)										
Aluminum	9860	13600	7040	11200	7780	10200	10400	13200	200 U	200 U
Antimony	0.97 J	0.8 J	0.84 J	0.66 J	0.95 J	0.37 J	1.5 J	0.52 J	60 U	60 U
Arsenic	6.5	5.2	5.9	3	5.8	3.8	6.7	5	10 U	10 U
Barium	133	95.8	117	107	119	141	132	190	200 U	200 U
Beryllium	0.97	0.76	0.66	1	0.77	1	0.88	1.1	5 U	5 U
Cadmium	1 J	0.41 J	0.97 J	0.57 J	1.4 J	0.31 J	1.5 J	0.51 J	5 U	5 U
Calcium	5470	1290	12100	1420	8270	1270	9700	2640	305 J	5000 U
Chromium	46.5	34.2	39.2	28.1	42.9	19.7	52.6	28.1	10 U	10 UJ
Cobalt	7.8 J	5.4	6.7	16.1	6.9	8	7.8	9.3	50 U	50 U
Copper	40.7 J	18.3 J	40.7 J	28.5 J	52 J	10.9 J	57 J	21.4 J	25 U	25 U
Cyanide	0.11 J	0.64 U	0.07 J	0.61 U	0.06 J	0.73 U	0.11 J	0.94 U	10 U	10 U
Iron	18200 J	28600 J	13200 J	31100 J	16500 J	15900 J	19100 J	19800 J	100 UJ	18.6 J
Lead	66.1	15	63	14.6	66.8	17.7	73.5	39	10 U	10 U
Magnesium	2470	2490	3670	3960	2550	1830	3000	3070	176 J	5000 U
Manganese	257	124	283	611	266	186	301	263	15 U	1.2 J
Mercury	0.15 J	0.019 J	0.23	0.0037 J-	0.27	0.044 J	0.26	0.074 J	0.2 UJ	0.2 UJ
Nickel	20.1	11.3	25.6	20	23	12.1	26.6	21.6	40 U	1.7 J
Potassium	344 J-	872 J	404 J-	1850 J-	555 J-	338 J-	838 J	570 J-	5000 UJ	5000 UJ
Selenium	1.1 J	0.83 J	0.16 J	0.5 J	0.78 J	0.27 J	0.47 J	1.2 J	35 U	35 U
Silver	1.6 U	0.89 U	0.81 U	0.9 U	0.07 J	1 U	0.07 J	1.4 U	10 U	10 U
Sodium	144 J	112 J	109 J	141 J	160 J	104 J	180 J	144 J	5000 U	5000 U
Thallium	4.1 U	2.2 U	2 U	2.3 U	1.9 U	2.6 U	2.3 U	3.5 U	2.1 J	25 U
Vanadium	29.5	48.4	24.3	37.9	27.5	26.9	33.7	32	50 U	50 U
Zinc	184	36.3	160	48.9	211	36.5	236	94.6	7.2 J	5.2 J

Notes:

* - The rinsate blank results are reported in micrograms per liter.

mg/kg - milligrams per kilogram

ft - feet

N - normal field sample

RB - rinsate blank

NA - not applicable

U - The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted Contract Required Quantitation Limit (CRQL) for sample and method.

UJ - The analyte was not detected at a level greater than or equal to the adjusted CRQL. However, the reported adjusted CRQL is approximate and may be inaccurate or imprecise.

J - The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the CRQL).

J- - The result is an estimated quantity, but the result may be biased low.

J+ - The result is an estimated quantity, but the result may be biased high.

For non-detects (U qualified results), the number preceding the qualifier is the reporting detection limit.

Appendix D

Quality Assurance (QA) Summary

Appendix D

Quality Assurance Summary

D.1 Controlling Documents

The primary objectives of instituting quality control procedures are to ensure that staff collect and record data in a uniform manner and to ensure that data are of consistently high quality and/or sufficient for their intended use. Data are therefore more likely to be accurate and can be interpreted with a high degree of confidence. In order to collect and record data in a uniform manner, controlling documents that describe and specify quality assurance/quality control (QA/QC) procedures for the field investigation were prepared and/or used. The documents used to guide and direct procedures throughout the BoRit Post-RI field investigation activities included:

- Final Site Management Plan (SMP) for the Remedial Investigation (RI) Phase 2 Field Investigation for the BoRit Superfund Site, CDM Smith Federal Programs Corporation, September 24, 2010. (CDM Smith 2010).
- Addendum 2 to the Final Site Management Plan for RI Phase 2 Field Investigation, BoRit Asbestos Superfund Site, OU-1, CDM Smith Federal Programs Corporation, August 1, 2014. (CDM Smith 2014a).
- Site Specific Standard Operating Procedure (SOP), CDM Smith-BoRit-6, Bench Study – Asbestos Release from Reservoir Sediment, Revision 0, August 1, 2014. (CDM Smith 2014b).
- Draft Field Sampling Plan for Sediment Sampling, BoRit Asbestos National Priorities List (NPL) Site, Weston Solutions, Inc. (Weston), March 27, 2014. (Weston 2014).
- Guidance on Systematic Planning using the Data Quality Objectives Process (EPA QA/G-4), EPA/240/B-06/001, February 2006. (Environmental Protection Agency (EPA) 2006).
- EPA Requirements for Quality Assurance Project Plans, QA/R-5, Final, March, 2001. (EPA 2001).

The Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP), which are included and or referenced in the in the BoRit Site Management Plan (SMP) and SMP Addendum above, specify and describe all QA, QC, analytical, data management, auditing, and reporting procedures for the field investigations outlined in the BoRit RI Addendum Report and conducted by CDM Smith. The *Draft Field Sampling Plan for Sediment Sampling* prepared by the EPA Superfund Technical Assessment and Response Team (START) contractor specifies all QA, QC, sample handling procedures, analytical requirements, data management, and reporting procedures followed by the EPA START contractor during the collection of Reservoir sediment samples (Weston 2014). The EPA START contractor was tasked by the EPA Removal Program to assist the United States Army Corps of Engineers (USACE) for the 2014 Reservoir sediment investigation (Weston 2014). By providing a framework for sample collection, decontamination, field quality control, sample identification, chain-of-custody, and sample handling procedures, the controlling documents helped ensure the collection of high quality data and enhanced data comparability.

Post-RI activities conducted by CDM Smith included wet and dry synoptic events, a Reservoir temperature study, and a Reservoir bench study. In addition to field activities performed by CDM Smith, this RI Addendum Report also includes analytical results from the 2014 Reservoir sediment investigation conducted by the USACE and EPA START contractor on March 31, 2014 and August 5, 2014.

D.2 Field Investigation

CDM Smith conducted post-RI field investigation activities from July 29, 2014 through August 11, 2014. Procedures and rationale for these post-RI field activities are described in *Addendum 2 to the Final SMP for Phase 2 Field Investigation* (post-RI SMP) (CDM Smith 2014a). The objectives of the post-RI field activities were to gather additional data to enhance the understanding of the Reservoir and groundwater communication and to determine the impact of refilling the Reservoir on the potential release of asbestos from sediment. Field activities conducted during the post-RI field investigation include the following:

- Wet and dry synoptic events;
- A Reservoir temperature study;
- A Reservoir Bench Study;
- 2014 Reservoir sediment investigation

D.2.1 Wet and Dry Synoptic Events

CDM Smith measured synoptic water levels for monitoring wells (MW) MW-1A, MW-02, MW-03, MW-04-, MW-05, MW-06, and MW-07 and piezometers (PK) PKPZ-02 and PK-PZ03. In addition, CDM Smith measured water levels on staff gauges (SG) located in Wissahickon Creek (SG-1 and SG-5), Rose Valley Creek (SG-4), and Tannery Run (SG-2).

During measurement of synoptic water levels, the following changes were implemented to the Post-RI SMP:

- The Post-RI SMP specified that water levels be collected from PK-01, PK-02, and PK-03. However once in the field, it was recognized that PK-01 was buried during EPA Removal Program activities on the Site. As a result, PK-01 was not measured.
- A water level was not collected from SG-03, which is located on the northwest berm of the Reservoir. Because the Reservoir was being pumped by the EPA Removal Program during the time of the wet and dry synoptic events, the Reservoir water level was significantly below the base of SG-03 at this time.

D.2.2 Reservoir Temperature Study

CDM Smith conducted the Reservoir temperature study concurrently during EPA Removal Program efforts to drain the Reservoir surface water. When the Reservoir temperature study was conducted on July 29, 2014, a substantial amount of surface water had been pumped, treated, and discharged to Wissahickon Creek. The EPA Removal Program completed draining the Reservoir on July 31, 2014. Due to the small ponded area of water remaining on July 29, 2014, CDM Smith collected temperature readings for the Reservoir in accordance with Scenario 2 Method 2 as outlined in the Post-RI SMP (CDM Smith 2014a).

During performance of the Reservoir temperature study, CDM Smith implemented the following changes to the Post-RI SMP:

- Scenario 2 Method 2 of the Post-RI SMP specified that temperature readings be measured on a grid with approximate 25-foot spacing. However during performance of the Reservoir temperature study, the locations of temperature readings did not follow an exact grid spacing as a result of the boat drifting. This deviation did not impact the overall objectives of the Reservoir temperature study.

D.2.3 Reservoir Bench Study

The Reservoir bench study was conducted in accordance with the Site-specific SOP *CDM Smith-Bo-Rit-6, Bench Study - Asbestos Release from Reservoir Sediment* (CDM Smith 2014b). CDM Smith collected three sediment samples in accordance with CDM Smith SOP 1-3, *Surface Soil Sampling* (CDM Smith 2012a). Sediment samples were analyzed for asbestos by polarized light microscopy (PLM) point counting method described in California Air Research Board (CARB) 435. CDM Smith collected two surface water samples in accordance with CDM Smith SOP 1-1, *Surface Water Sampling* (CDM Smith 2012b), and CDM Smith collected eleven bin water samples in accordance with SOP *CDM Smith-BoRit-6, Bench Study - Asbestos Release from Reservoir Sediment* (CDM Smith 2014b). Surface water and bin water samples were analyzed for asbestos by transmission electron microscopy (TEM) EPA Method 100.2. Field sample data sheets (FSDS) for the bench study are included in **Appendix A** of this RI Addendum Report.

During the performance of the Reservoir bench study, CDM Smith made deviations from protocols, plans, and procedures in the approved Post-RI SMP for several reasons. The following changes to Post-RI SMP were implemented:

- The Site-specific SOP, *CDM Smith-Bo-Rit-6, Bench Study - Asbestos Release from Reservoir Sediment*, specified that a composite sediment sample be collected for the low asbestos zone bin from surface water locations RVSU-01 and RVSU-02 presented in Figure 5-9 of the *Final RI Report* (CDM Smith 2013). However during Reservoir sediment collection on August 5, 2014, surface water sample location RVSU-01 was covered due to EPA Removal Program efforts. As a result, sediment for the low asbestos zone bin only contained sediment collected from surface water location RVSU-02.
- The Site-specific SOP, *CDM Smith-Bo-Rit-6, Bench Study - Asbestos Release from Reservoir Sediment*, specified that sediment placed in the low asbestos zone bins and the high asbestos zone bins should be approximately 13 inches in depth. However the depth of sediment used in the bench study was 12.5 inches and 11.5 inches, for the low asbestos zone bins and the high asbestos zone bins, respectively. Because sediment thickness in the Reservoir ranges between 0.5 ft and 3 ft, the actual depth of sediment used in the Reservoir bench study is still representative of conditions in the Reservoir.
- A surface water sample was collected from standing water that accumulated in the pit located on the Reservoir bottom adjacent to the 24-inch polyvinyl chloride (PVC) pipe that originates from the 6-foot diameter concrete manhole installed on July 8, 2014 (location is shown in Figure 5-2 of the RI Addendum Report). Collection of this sample was not specified in the Post-RI SMP. EPA requested the collection of this sample at a later time. The pit surface water sample was analyzed for asbestos by TEM EPA Method 100.2. Analytical results for the pit water sample (PW-SW-081114) are presented in **Table 5-2** of the RI Addendum Report and **Table C-2** in **Appendix C**.

D.2.4 2014 Reservoir Sediment Investigation

Two rounds of sediment sampling and hand auger borings were conducted by USACE and the EPA START contractor on March 31, 2014 and August 5, 2014. The first round of sediment sampling, conducted on March 31, 2014, was limited to the eastern, northeastern half of the Reservoir made accessible by the EPA Removal Program effort to drain the Reservoir. The second round of sediment sampling, conducted on August 5, 2014, was for the western, southwestern half of the Reservoir, after the EPA Removal Program completed draining the Reservoir on July 31, 2014. The details and sampling procedures for Reservoir sediment sampling are defined in the *Draft Field Sampling Plan for Sediment Sampling, BoRit Asbestos NPL Site* (Weston 2014). The purpose of the Reservoir sediment investigation was to determine the extent of contamination present in Reservoir sediment in response

to community claims of chemical dumping and drum burial in the study area (Weston 2014). Activities conducted during the 2014 Reservoir sediment investigation included the collection of 21 sediment samples from 11 locations. One shallow composite sample and one deep composite sample were collected from each of the eleven locations except for location RSVB-29. Additional details on the sediment sample collected at RSVB-29 are provided below.

Analyses for sediment samples included Target Analyte List (TAL) metals, cyanide, and mercury; asbestos (greater than 10 micrometers (μm)); Target Compound List (TCL) polychlorinated biphenyls (PCBs); volatile organic compounds (VOCs); semi-volatile organic compounds (SVOCs); and pesticides. All analytical data was generated in accordance with the documentation and quality requirements described in the *EPA Region III Superfund Technical Assessment and Response Team 4 (START-4) Contract Program-Wide Uniform Federal Policy QAPP* (Weston 2010).

The following deviations from the *Draft Field Sampling Plan for Sediment Sampling, BoRit Asbestos NPL Site* (Weston 2014) were noted during the sediment investigation:

- Only one composite sample was collected from boring location RSVB-29. The depth of the hand auger extended a total depth of 3.2 ft. The upper 2.2 ft of the auger consisted of very soft brown sediment and muck. As a result, only one composite sample was collected for the gray soft clay layer encountered within the 2.2-foot to 3.2-foot sample depth.

D.3 Field Quality Control Procedures

D.3.1 Reservoir Temperature Study

The Post-RI SMP directed that duplicate temperature readings be measured for ten percent of the temperature reading locations (CDM Smith 2014a). During the Reservoir temperature study, 16 locations in the Reservoir were measured for both mid-depth and bottom-depth temperatures. Three duplicate temperature readings were taken for sample locations RES-07, RES-09, and RES-13. The results of these QC samples are discussed in Section D.5.

D.3.2 Bench Study

During the Reservoir bench study, two field duplicates were collected. All sample collection, chain-of-custody, and sample shipping procedures were carried out as specified in the Post-RI SMP (CDM Smith 2014a).

The analytical results of these QC samples are discussed in Section D.5.

D.3.3 2014 Reservoir Sediment Investigation

Specific QA/QC samples for 2014 Reservoir sediment investigation sampling included two field duplicate pairs (analyzed for asbestos only), two matrix spike/matrix spike duplicate (MS/MSD) samples for organic analyses (pesticides and PCBs only), spike/duplicate (S/D) samples for TAL metals, mercury, and cyanide, and a laboratory duplicate for asbestos. Two aqueous rinsate blanks were collected for all parameters. Rinsate blanks were collected from non-dedicated sampling equipment (e.g., hand augers) and the stainless steel bowls and trowels used to homogenize the samples. VOCs were collected prior to sample homogenization.

D.4 Data Verification and Validation

D.4.1 Asbestos Data

Asbestos data collected by CDM Smith were verified according to the following SOPs: SOP CDM-BoRit-03 Revision 0, TEM Verification (CDM Smith 2011a) and SOP CDM-BoRit-4, Revision 0, and PLM Point

Counting Verification (CDM Smith 2011b). Verification of water samples analyzed by TEM EPA Method 100.2 (modified to use International Organization for Standardization (ISO) 10312 counting rules) was performed. The verification effort was based on a compilation of BoRit electronic data deliverable (EDDs) and laboratory report/data packages provided by the laboratory. Recently, the laboratory adopted a direct data transfer system in which the analyst enters analytical and result information directly in the EDD at the time of analysis. As a result, hand-written bench sheets are not included in the laboratory data package and verification of the data transfer is not needed. No issues were identified with PLM point counting results. It was recommended that for future water analyses at the BoRit Site, a Site-specific EDD be developed for the ease of implementation of Site-specific requirements.

Asbestos data were validated according to the draft *National Functional Guidelines for Asbestos Data Review* (EPA 2011). Validation of asbestos samples included a review of field QC results as well as a review of instrument calibration and microscope alignment. Data Validation Reports are included in **Appendix E** of the RI Addendum Report.

Data Qualifier Code (Asbestos):

J	-	The associated analyte may be inaccurate or imprecise due to the quality of the data generated because certain QC criteria were not met.
UJ	-	The non-detect result may be inaccurate or imprecise due to the quality of data generated because certain QC criteria were not met.
R	-	The sample results are unusable due to the quality of the data generated because certain criteria were not met.
U	-	The analyte was analyzed for but not detected at a level greater than or equal to the level of the reported sample quantitation limit.

D.4.2 Organic and Inorganic Data

Organic data were validated according to *National Functional Guidelines for Superfund Organic Methods Data Review* and were assigned the Superfund Data Validation Label Stage 4 Validation Manual (S4VM) (EPA, 2008). Inorganic data were validated according to inorganic *National Functional Guidelines for Inorganic Superfund Data Review* and were assigned the Superfund Data Validation Label S4VM (EPA 2010). The validation process for organic samples included review of compliance with holding times, instrument performance checks, initial and continuing calibrations, blanks, system monitoring compounds, regional QA/QC, internal standards, target compound identification, contract required quantitation limits, tentatively identified compounds (TICs), system performance, and overall assessment of data. The validation process for inorganic samples included review of compliance with holding times, calibrations, blanks, interference checks, laboratory control samples, duplicate samples, matrix spike samples, furnace atomic absorption QC, Inductively Coupled Plasma (ICP) Serial Dilution, and sample result verification.

In addition, results of duplicate, MS/MSD, and other QC samples were used to assess precision and accuracy of the analytical data and potential matrix effects. The following qualifiers are used to qualify laboratory data (as specified by Functional Guidelines).

Data Qualifiers (Organics and Inorganics)

B	-	The result is assumed to be a blank contaminant. This qualifier is only used for drinking water samples.
U	-	The analyte was analyzed for but not detected at a level greater than or equal to the level of the adjusted Contract Required Quantitation Limit (CRQL) for sample and method.

J	-	The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
NJ	-	The analysis indicates the presence of an analyte that has been “tentatively identified” and the associated numerical value represents its approximate concentration.
UJ	-	The analyte was analyzed for but not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.
R	-	The sample results are unusable. The sample results are rejected due to serious deficiencies in meeting QC criteria. The analyte may or may not be present in the sample.
J+	-	The result is an estimated quantity, but the result may be biased high.
J-	-	The result is an estimated quantity, but the result may be biased low.
C	-	This qualifier applies to pesticides and Aroclor results when the identification has been confirmed by Gas Chromatograph/Mass Spectrometer (GC/MS).
X	-	This qualifier applies to pesticides and Aroclor results when GC/MS analysis was attempted but was unsuccessful.

Unusable data qualified with an “R” are not used in this RI Addendum Report. All other data, both qualified and unqualified are useable.

D.5 Data Evaluation

As part of the overall data review, the results of field QC samples were examined so that the effect of field procedures on data quality could be evaluated. Field QC samples included trip blanks, equipment rinsate blanks, and field duplicates. In addition, for the 2014 Reservoir sediment investigation, sampling personnel collected sufficient volume for the laboratory to analyze MS/MSD and S/D pairs.

The data quality objectives (DQOs) specified in the SMPs were met for all analyses.

D.5.1 Trip Blanks

Trip blanks (for VOCs only) accompanied the shipments of samples to the Contract Laboratory Program (CLP) laboratory for 2014 Reservoir sediment investigation sampling whenever coolers contained samples for VOC analyses. Trip blanks are used to show contamination which may occur during sample handling or storage (i.e., potentially from cross contamination with other samples). The trip blank was prepared by the field team prior to the sampling event and kept with the investigative samples throughout the sampling event. It was then packaged for shipment with the other samples and sent for analysis. No VOCs were detected in the two trip blanks (BRT-RS-030114-00-01-04 and BRT-RS-080514-00-01-04) collected for each round of Reservoir sediment sampling on March 31, 2014 and August 5, 2014. Analytical results for trip blank samples are presented in **Table C-1** included in Appendix C.

D.5.2 Equipment Rinsate Blanks

Rinsate blanks collected during the 2014 Reservoir sediment investigation were obtained by running organic-free water over sampling equipment after decontamination. Sampling equipment included hand augers, stainless steel bowls, and trowels. These samples were used to determine if decontamination procedures were adequate. Analytical results for rinsate blank samples are presented in **Tables C-1 through C-3** in Appendix C.

Diethyl phthalate was detected in rinsate blank sample BRT-RS-080514-00-01-03. However the reported value was qualified with a J and the value was below the CRQL.

Rinsate blank BRT-RS-080514-00-01-03 reported a positive result of 3 million fibers per liter (MFL) determined to be asbestos type chrysotile. No data were qualified based on this finding.

For inorganic analysis performed for sample delivery group (SDG) MC0AB0, laboratory instrumentation reported negative values for chromium and potassium greater than absolute values of the Method Detection Limits (MDLs) in blank analyses. Positive results reported for these analytes were significantly greater than the absolute values of the blank concentrations; therefore, no data were qualified based on these outliers. For SDG F3472, no contaminants were found in the analysis of the associated blanks that would qualify field sample data.

D.5.3 Duplicate Samples

Field duplicates were collected as a means of quality control from the point of sample collection through all analytical processes. Duplicates were collected during the Reservoir temperature study, Reservoir bench study, and 2014 Reservoir sediment investigation. The Relative Percent Difference (RPD) values were calculated for field samples and duplicates which showed positive results. As specified in the Final SMP for RI Phase 2 Field Investigation, the acceptable limits for RPDs were less than or equal to 35 percent ($\leq 35\%$) for soil and sediment and less than or equal to 20 percent ($\leq 20\%$) for surface water (CDM Smith 2010). Due to the heterogeneous nature of asbestos samples, RPD limits were not set for asbestos in any media (CDM Smith 2010). However these values were calculated and are presented in **Tables D-1 and D-2** attached to this QA Summary. See Section D.6.1 for further discussion on RPD values.

D.6 Precision, Accuracy, Representativeness, Comparability, and Completeness

D.6.1 Precision

Precision is the evaluation of the reproducibility of a measurement. Precision is estimated by the analysis of duplicate samples and the calculation of RPD. These Post-RI activities involved both the collection of field duplicates and the creation of laboratory duplicates. Field duplicate samples serve as an indicator of overall precision from sample collection through laboratory analysis. Laboratory duplicates focus on the precision of the analytical method. Calculations were not performed for duplicate pairs with a detection of a compound in only one of the samples. Field duplicates were analyzed for asbestos only.

Table D-1 presents RPD values calculated for the Reservoir bench study. The RPD for sediment samples collected for the Reservoir bench study were calculated for the duplicate sample pair BH-SD-080514/BH-SD-080514A. RPD values ranged from 0.6 percent to 75 percent for asbestos type chrysotile. However, chrysotile was detected at low concentration (0.5% and 1.1 %). When concentrations are low, small differences in the results will result in large RPDs. The RPDs for bin water samples were calculated for the bin water duplicate pair BL-SW01-081114/BL-SW01-081114A. RPD values ranged from 0 percent to 37.3 percent. Because of the clumping nature of asbestos fibers and the heterogeneous nature of soil and sediment, no RPD limits were established for asbestos sample-field duplicate pairs.

Table D-2 presents RPD values calculated for the 2014 Reservoir sediment investigation. Two duplicate field samples were collected for the 2014 Reservoir sediment investigation. The duplicate pairs included BRT-RS-033114-28-02-00/BRT-RS-033114-28-02-01 and BRT-RS-080514-32-01-00/BRT-RS-080514-32-01-01. Calculated RPD values were 0 percent for both duplicate sample pairs for asbestos type chrysotile.

Table D-3 presents RPD values calculated for the Reservoir temperature study. Three duplicate measurements were taken for temperature readings. The highest RPD value between samples and duplicates was 2.1%. Divergence in temperature readings could be attributed to the boat drifting from the original sample location and disturbance of the water column when collecting temperature measurements throughout the water column.

Several types of laboratory duplicate analyses are performed for asbestos. An inter-verified analysis is performed by a different analyst than the original analysis. A verified analysis is a re-evaluation performed on the same grid openings examined as the original analysis. An inter-duplicate analysis is a re-preparation (new grids prepared from the original filter) and different grid openings are examined. An inter-replicate analysis re-evaluates the same grid as the original analysis, but different grid openings are examined. For the bin water samples analyzed by EMSL Analytical Inc. (EMSL), handwritten notes on the Water Sample Prep Log indicated that one inter-verified analysis, one inter-duplicate, and one inter-replicate analysis was performed. However, documentation was not included in the data package. It is important to note that the *National Functional Guidelines* (NFGs) for Asbestos Data Review indicate that, until EPA establishes control limits, the measurement parameters and recommended acceptance criteria for laboratory QC analyses are advisory only (EPA 2011). Because of this, the lack of QC documentation is not deemed to impact data usability.

The 2014 Reservoir sediment investigation samples were also analyzed in accordance with EMSL's QC Quality Assurance Manual, and no deficiencies were identified. It does not appear that any laboratory duplicate samples were performed for the 2014 Reservoir sediment investigation samples.

D.6.2 Accuracy

Accuracy is a measure of the bias in a system. It is the degree of agreement of a measurement with an accepted reference or true value. Accuracy is quantitative and usually expressed as the percent recovery (%R) of a sample result. Accuracy for this project was estimated from the analysis of QC samples whose true values are known (surrogate or matrix spikes) and was expressed as percent recovery. No surrogates were used during the Post-RI field investigation, but they were used for laboratory QC evaluation.

For the 2014 Reservoir sediment investigation samples, MS/MSD samples were analyzed for pesticides and PCBs. Reported recoveries and RPDs for pesticide compounds in MS/MSD analyses of sample C0AB0 were within control limits. No data were qualified based on these findings. Reported recoveries and RPDs for aroclor compounds in MS/MSD analyses of sample C0AB0 were within control limits except for the percent recovery for aroclor-1016 in the MSD analysis on one column and for aroclor-1016 and aroclor-1260 RPDs on both columns. No data were qualified based on these findings. RPDs for pesticide and aroclor compounds in MS/MSD analyses of sample C0AD8 were within control limits. No data were qualified based on these findings.

S/D pairs were analyzed for TAL metals, mercury, and cyanide. For case R34356, the matrix spike recovery was low (<75% but >30%) for antimony. The post-digestion spike recovery was within control limits. Low recovery may be attributed to matrix interferences or analyte lost during the digestion process. Positive results for this analyte are estimated and have been qualified "J". The matrix spike recovery was high (>125%) for manganese. The post-digestion spike recovery was within control limits. Positive results for this analyte may be estimated high and have been qualified "J+". For Case R34356 the matrix spike recovery was low (<75% but >30%) for Sb. The post-digestion spike recovery was within control limits. Low recovery may be attributed to matrix interferences or analyte lost during the digestion process. Positive results for this analyte are estimated and have been qualified "J".

The holding times were not exceeded for any sediment or bin water samples presented in this RI Addendum.

D.6.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population at a sampling point, process condition, or environmental condition. Representativeness is a qualitative objective which was met by following standard operating procedures for sample collection and analysis. Standard operating procedures are designed to provide representative samples.

D.6.4 Comparability

Comparability expresses the confidence with which one data set can be compared to another. Comparability is a qualitative objective which was met by following standard operating procedures for sample collection and analysis. No problems with data comparability were identified for the chemical data.

D.6.5 Completeness

Completeness is the measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under current normal conditions. The Final SMP for RI Phase 2 Field Investigations had established a completeness goal of 90 percent for this project (CDM Smith 2010). This is measured by the percentage of qualified data or non-rejected results from the total analytical results. This goal was met for data obtained for the Reservoir bench study (0 results rejected out of 269 total results, for a completeness value of 100 percent) and the 2014 Reservoir sediment investigation (63 results rejected out of 4150 total results, for a completeness value of 98.5 percent). **Tables D-4 and D-5** present completeness values for the Reservoir bench study and the 2014 Reservoir sediment investigation respectively.

Most of the rejected data from the 2014 Reservoir sediment investigation was the 1,4-dioxane data. These data represented 39.7 percent the total rejected data and 100 percent of the data for 1,4-dioxane. The validator noted that in SOM01.2, 1,4-dioxane is no longer a target analyte by Trace Volatile Organic Analyte (VOA) Selected Ion Monitoring (SIM) analyses. Using SOM01.2 for the detection and reporting of 1,4-dioxane at low and medium levels has not consistently generated data of sufficiently known quality. This is due to poor purge efficiency. In addition, Relative Response Factors (RRFs) for 1,4-dioxane were outside criteria in volatile initial and continuing calibration standards associated with the samples in this sample set. No positive results were reported for this compound; quantitation limits for this compound were noted as unusable and qualified "R". This loss of data does not impact project objectives, because 1,4-dioxane is not expected at this Site.

Other rejected data from the Reservoir sediment investigation included: 4.3 percent of the p-chloroaniline data, 4.3 percent of the hexachlorocyclopentadiene data, 4.3 percent of 3,3'-dichlorobenzidine data, 20 percent of 1,4-dichlorobenzene data, 20 percent of bromoform data, 20 percent of 1,2,4-trichlorobenzene data, 20 percent of 1,2,3-trichlorobenzene data, 20 percent of 1,3-dichlorobenzene data, 20 percent of 1,2-dichlorobenzene data, and 20 percent of 1,2-dibromo-3-chloropropane data. This loss of data is not considered to significantly impact the overall completeness of the study, because these chemicals are not considered to be related to the Site.

D.7 Audits

As part of the CDM Smith QA Program, various projects are selected quarterly for auditing. Auditing can be either performance audits or system audits. Performance audits are quantitative checks on different segments of project activity; they are most appropriate for field measurements and for

laboratory analysis activities. CDM Smith's EPA Region 3 RAC 2 Quality Management Plan (QMP) requires that one field audit be performed for every five weeks of field work that involve sample collection (CDM Smith 2010). Because CDM Smith's Post-RI field activities were performed over a few days, no field audit was required or conducted for these Post-RI activities.

System audits are qualitative reviews of project activity to verify that the overall CDM Smith QA program is functioning and any project-specific QA and QC requirements are being met. During the course of Work Assignment 029-RICO-A3EN, office self-assessments have been periodically performed to evaluate the work activities to determine whether the technical requirements are being met. These self-assessments have been conducted by project personnel who are knowledgeable of the project requirements. They are intended to provide rapid feedback to the project staff to facilitate timely corrective action. Five office self-assessments have been conducted to date on this work assignment. No quality issues were identified in the self-assessments.

CDM Smith is not aware whether any audits were conducted by the EPA START contractor on the 2014 Reservoir sediment investigation which they conducted for the EPA Removal Program and USACE.

D.8 Acronyms

%R	percent recovery
µm	micrometer
1,1,1-TCA	1,1,1-trichloroethane
CARB	California Air Research Board
CLP	Contract Laboratory Program
CRQL	Contract Required Quantitation Limit
DQOs	data quality objectives
EDD	electronic data deliverable
EMSL	EMSL Analytical Inc.
FSDS	field sample data sheets
FSP	Field Sampling Plan
GC/MS	Gas Chromatograph/Mass Spectrometer
ICP	Inductively Coupled Plasma
MDLs	Method Detection Limits
MS/MSD	matrix spike/matrix spike duplicate
MW	monitoring well
NFG	National Functional Guideline
NPL	National Priorities List
PCB	polychlorinated biphenyls
PK	piezometer
PLM	polarized light microscopy
PVC	polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan

QMP	Quality Management Plan
RAC	Response Action Contract
RI	Remedial Investigation
RPD	Relative Percent Difference
RRF	Relative Response Factor
S/D	spike/duplicate
SDG	Sample Delivery Group
SG	staff gauge
SIM	Selected Ion Monitoring
SMP	Site Management Plan
SOP	standard operating procedure
START	EPA Region III Superfund Technical Assessment and Response Team
SVOCs	semi-volatile organic compounds
S4VM	Stage 4 Validation Manual
TAL	Target Analyte List
TCL	Target Compound List
TEM	transmission electron microscopy
TIC	tentatively identified compound
USACE	United State Army Corps of Engineers
VOA	Volatile Organic Analyte
VOC	volatile organic compound
Weston	Weston Solutions, Inc.

D.9 References

CDM Federal Programs Corporation. (CDM Smith). 2014a. Addendum 2 to the Final Site Management Plan for RI Phase 2 Field Investigation, BoRit Asbestos Superfund Site, Operable Unit 1. August 1.

CDM Federal Programs Corporation. (CDM Smith). 2014b. CDM Smith-BoRit-6, Revision 0. *Site Specific Standard Operating Procedure, Bench Study – Asbestos Release from Reservoir Sediment*. August 1.

CDM Federal Programs Corporation. (CDM Smith). 2013. Final Remedial Investigation Report, BoRit Asbestos Superfund Site, OU-1, Ambler, Pennsylvania. November.

CDM Federal Programs Corporation. (CDM Smith). 2012a. SOP1-11. Revision 9. *Standard Operating Procedure, Sediment and/or Sludge Sampling*. January.

CDM Federal Programs Corporation. (CDM Smith). 2012b. SOP1-1. Revision 9. *Standard Operating Procedure, Surface Water Sampling*. January.

CDM Federal Programs Corporation. (CDM Smith). 2011a. CDM-BoRit-3. Revision 0. *Site Specific Standard Operating Procedure, Transmission Electron Microscopy (TEM) Verification*. November 1.

CDM Federal Programs Corporation. (CDM Smith). 2011b. CDM-BoRit-4. Revision 0 *Site Specific Standard Operating Procedure, Polarized Light Microscopy (PLM) Point Counting Verification* November 2.

CDM Federal Programs Corporation. (CDM Smith). 2010. Final Site Management Plan for Remedial Investigation, Phase2, BoRit Asbestos Superfund Site, OU- 1, Ambler, Pennsylvania. September 24.

Environmental Protection Agency (EPA). 2011. *National Functional Guidelines for Asbestos Data Review*. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation, Analytical Services Branch. Draft – August.

Environmental Protection Agency (EPA). 2010. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review*. Office of Superfund Remediation and Technology Innovation. January.

Environmental Protection Agency (EPA). 2008. *USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review*. Office of Superfund Remediation and Technology Innovation. June.

Environmental Protection Agency (EPA). 2006. Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA QA/G-4), EPA/240/B-06/001. February.

Environmental Protection Agency (EPA). 2001. EPA Requirements for Quality Assurance Project Plans, QA/R-5, Final, March.

Weston Solutions, Inc. (Weston). 2014. *Draft Field Sampling Plan for Sediment Sampling, BoRit Asbestos NPL Site*. March 27.

Weston Solutions, Inc. (Weston). 2010. *EPA Region III Superfund Technical Assessment and Response Team 4 (START-4) Contract Program-Wide Uniform Federal Policy Quality Assurance Project Plan (QAPP)*.

Table D-1**Relative Percent Difference for the Reservoir Sediment and Bin Water Samples****BoRit Asbestos Superfund Site, OU-1****Ambler, Pennsylvania**

Sample Number		BH-SD-080514	BH-SD-080514A	RPD (%)	BL-SW01-081114	BL-SW01-081114A	RPD (%)
Sample Type		N	FD		N	FD	
Analyte	Units						
Chrysotile	%	0.5	1.1	75.0%	NS	NS	NS
Non-Asbestos (Fibrous)	%	ND	ND	NC	NS	NS	NS
Non-Asbestos (Non-Fibrous)	%	99.5	98.9	0.6%	NS	NS	NS
Chrysotile	s/L	NS	NS	NS	43164983	46886102	8.3%
Chrysotile (>10µm)	s/L	NS	NS	NS	23381033	17414838	29.2%
Libby Amphibole	s/L	NS	NS	NS	0	0	0.0%
Libby Amphibole (>10µm)	s/L	NS	NS	NS	0	0	0.0%
Other Amphibole	s/L	NS	NS	NS	0	0	0.0%
Other Amphibole (>10µm)	s/L	NS	NS	NS	0	0	0.0%
Total Asbestos	s/L	NS	NS	NS	43164983	46886102	8.3%
Total Asbestos (>10µm)	s/L	NS	NS	NS	23381033	17414838	29.2%

Notes:

N - normal field sample

FD - field duplicate sample

NS - not sampled

ND - not detected

NC - not calculated

% - percent

s/L - structures per liter

RPD - relative percent difference

BH-SD - sample of the sediment used in the Reservoir bench study

BL-SW01 - water sampled collected during the Reservoir bench study

µm - micrometer

Table D-2**Relative Percent Difference for Sediment Samples collected during 2014 Reservoir Sediment Investigation****BoRit Asbestos Superfund Site, OU-1****Ambler, Pennsylvania**

Sample Number		BRT-RS-033114- 28-02-00	BRT-RS-033114- 28-02-01	RPD (%)	BRT-RS-080514- 32-01-00	BRT-RS-080514- 32-01-01	RPD (%)
Sample Type		N	FD		N	FD	
Analyte	Units						
Chrysotile	%	ND	ND	NC	0.25	0.25	0%
Non-Asbestos (Fibrous)	%	ND	ND	NC	ND	ND	NC
Non-Asbestos (Non-Fibrous)	%	100	100	0%	99.75	99.75	0%

Notes:

N - normal field sample

FD - field duplicate sample

ND - not detected

NC - not calculated

% - percent

RPD - relative percent difference

Table D-3
Relative Percent Difference for the Reservoir Temperature Study
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

Sample Location		Res 7	Res 7 Dup.	RPD (%)	Res 9	Res 9 Dup.	RPD (%)	Res 13	Res 13 Dup.	RPD (%)
Sample Mid-point Depth (ft)		0.33	0.33	--	0.35	0.35	--	0.4	0.4	--
	Units									
Temperature	°F	76.3	77.2	1.2%	77.2	77.0	0.2%	80.1	80.1	0.0%

Sample Location		Res 7	Res 7 Dup.	RPD (%)	Res 9	Res 9 Dup.	RPD (%)	Res 13	Res 13 Dup.	RPD (%)
Sample Total Depth (ft)		0.65	0.65	--	0.7	0.7	--	0.8	0.8	--
	Units									
Temperature	°F	75.6	77.2	2.1%	75.4	75.9	0.7%	79.5	80.4	0.0

Notes:

°F - degrees Fahrenheit

Dup. - duplicate

Res - Reservoir

RPD - relative percent difference

% - percent

ft - feet

Table D-4
Data Qualifier Statistics for the Reservoir Bench Study
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

Qualifiers		No Qualifier	J	U	UJ	Total Results	Total Detected	Total Non-Detect	Total Rejected	Percent Detected	Percent Non-Detect
Analytical Method	Analyte										
EPA 600/R-93/116	Chrysotile	3				3	3	0	0	100%	0.0%
EPA 600/R-93/116	Non-Asbestos (Fibrous)			3		3	0	3	0	0.0%	100%
EPA 600/R-93/116	Non-Asbestos (Non-Fibrous)	3				3	3	0	0	100%	0.0%
TEM 100.2	Chrysotile	24			2	26	24	2	0	92.3%	7.7%
TEM 100.2	Chrysotile (>10µm)	22		2	2	26	22	4	0	84.6%	15.4%
TEM 100.2	Chrysotile - Sensitivity	12	1			13	13	0	0	100%	0.0%
TEM 100.2	Libby Amphibole	2		22	2	26	2	24	0	7.7%	92.3%
TEM 100.2	Libby Amphibole (>10µm)	2		22	2	26	2	24	0	7.7%	92.3%
TEM 100.2	Libby Amphibole - Sensitivity	12	1			13	13	0	0	100%	0.0%
TEM 100.2	Other Amphibole			24	2	26	0	26	0	0.0%	100%
TEM 100.2	Other Amphibole (>10µm)			24	2	26	0	26	0	0.0%	100%
TEM 100.2	Other Amphibole - Sensitivity	12	1			13	13	0	0	100%	0.0%
TEM 100.2	Total Asbestos	24			2	26	24	2	0	92.3%	7.7%
TEM 100.2	Total Asbestos (>10µm)	22		2	2	26	22	4	0	84.6%	15.4%
TEM 100.2	Total Asbestos - Sensitivity	12	1			13	13	0	0	100%	0.0%
Notes:					Total Results	269	154	115	0	57.2%	42.8%
					Completeness	100.0%					

Notes:

EPA - Environmental Protection Agency

TEM - transmission electron microscopy Method 100.2

J - The associated analyte may be inaccurate or imprecise due to the quality of the data generated because certain Quality Control (QC) criteria were not met.

U - The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the reporting limit for the sample and method.

UJ - The non-detect result may be inaccurate or imprecise due to the quality of data generated because certain QC criteria were not met.

% - percent

µm - micrometer

Table D-5
Data Qualifier Statistics for the 2014 Reservoir Sediment Investigation
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

	Qualifiers	No Qualifier	J	J-	J+	R	U	UJ	Total Results	Total Detected	Total Non- Detect	Total Rejected	Percent Detected	Percent Non- Detect	Percent Rejected
Analytical Method ¹	Analyte														
CPEST	Heptachlor Epoxide						19	4	23	0	23	0	0.0%	100.0%	0.0%
CPEST	Endosulfan Sulfate						19	4	23	0	23	0	0.0%	100.0%	0.0%
CPEST	Aldrin						19	4	23	0	23	0	0.0%	100.0%	0.0%
CPEST	Alpha-Bhc						19	4	23	0	23	0	0.0%	100.0%	0.0%
CPEST	Beta-Bhc						19	4	23	0	23	0	0.0%	100.0%	0.0%
CPEST	Delta-Bhc						19	4	23	0	23	0	0.0%	100.0%	0.0%
CPEST	Endosulfan li						19	4	23	0	23	0	0.0%	100.0%	0.0%
CPEST	4,4'-Ddt						19	4	23	0	23	0	0.0%	100.0%	0.0%
CPEST	Alpha-Chlordane						19	4	23	0	23	0	0.0%	100.0%	0.0%
CPEST	Gamma-Chlordane						19	4	23	0	23	0	0.0%	100.0%	0.0%
CPEST	Endrin Ketone						19	4	23	0	23	0	0.0%	100.0%	0.0%
CPEST	Gamma-Bhc (Lindane)						19	4	23	0	23	0	0.0%	100.0%	0.0%
CPEST	Dieldrin						19	4	23	0	23	0	0.0%	100.0%	0.0%
CPEST	Endrin						19	4	23	0	23	0	0.0%	100.0%	0.0%
CPEST	Methoxychlor						19	4	23	0	23	0	0.0%	100.0%	0.0%
CPEST	4,4'-Ddd						19	4	23	0	23	0	0.0%	100.0%	0.0%
CPEST	4,4'-Dde						19	4	23	0	23	0	0.0%	100.0%	0.0%
CPEST	Endrin Aldehyde						19	4	23	0	23	0	0.0%	100.0%	0.0%
CPEST	Heptachlor						19	4	23	0	23	0	0.0%	100.0%	0.0%
CPEST	Toxaphene						19	4	23	0	23	0	0.0%	100.0%	0.0%
CPEST	Endosulfan I						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	P-Nitroaniline						17	6	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	4-Nitrophenol						17	6	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Benzaldehyde						17	6	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	4-Bromophenyl Phenyl Ether						17	6	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Caprolactam						17	6	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	2,4-Dimethylphenol						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	4-Methylphenol						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	P-Chloroaniline					1	18	4	23	0	22	1	0.0%	95.7%	4.3%
CSVOL	Bis-Chloroisopropyl Ether						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Phenol						17	6	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	3-Methylphenol + 4-Methylphenol						7	4	11	0	11	0	0.0%	100.0%	0.0%
CSVOL	Bis(2-Chloroethyl) Ether						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Bis(2-Chloroethoxy)Methane						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Bis(2-Ethylhexyl)Phthalate						17	6	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Di-N-Octylphthalate						17	6	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Hexachlorobenzene						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Anthracene						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	2,4-Dichlorophenol						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	2,4-Dinitrotoluene						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Pyrene						13	10	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Dimethyl Phthalate	15	6				2		23	21	2	0	91.3%	8.7%	0.0%
CSVOL	Dibenzofuran						17	6	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Atrazine						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Benzo(G,H,I)Perylene						15	8	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Indeno(1,2,3-Cd)Pyrene						15	8	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Benzo(B)Fluoranthene						15	8	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Fluoranthene						13	10	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Benzo(K)Fluoranthene						15	8	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Acenaphthylene						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	1,2-Benzphenanthracene						13	10	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Benzo(A)Pyrene						15	8	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	2,4-Dinitrophenol						17	6	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	4,6-Dinitro-2-Methylphenol						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Dibenzo(A,H)Anthracene						15	8	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Benzo(A)Anthracene						13	10	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	2,3,4,6-Tetrachlorophenol						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	4-Chloro-3-Methylphenol						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	2,6-Dinitrotoluene						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	N-Nitroso-Di-N-Propylamine						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	M-Cresol & P-Cresol						12		12	0	12	0	0.0%	100.0%	0.0%
CSVOL	Hexachloroethane						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	4-Chlorophenyl Phenyl Ether						17	6	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Hexachlorocyclopentadiene					1	18	4	23	0	22	1	0.0%	95.7%	4.3%
CSVOL	3,5,5-Trimethyl-2-Cyclohexene-1-One						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Acenaphthene						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Diethyl Phthalate		1				16	6	23	1	22	0	4.3%	95.7%	0.0%
CSVOL	Di-N-Butylphthalate						17	6	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Phenanthrene						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Benzyl Butyl Phthalate						17	6	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	N-Nitrosodiphenylamine						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Fluorene						17	6	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Carbazole						17	6	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Hexachloro-1,3-Butadiene						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Pentachlorophenol						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	2,4,6-Trichlorophenol						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	2-Nitroaniline						17	6	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	2-Nitrophenol						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Naphthalene						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	2-Methylnaphthalene						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	2-Chloronaphthalene						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	3,3'-Dichlorobenzidine					1	18	4	23	0	22	1	0.0%	95.7%	4.3%
CSVOL	1,1'-Biphenyl						17	6	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	2-Methylphenol						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	2-Chlorophenol						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	1,2,4,5-Tetrachlorobenzene						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	2,4,5-Trichlorophenol						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	Acetophenone						19	4	23	0	23	0	0.0%	100.0%	0.0%

Table D-5
Data Qualifier Statistics for the 2014 Reservoir Sediment Investigation
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

	Qualifiers	No Qualifier	J	J-	J+	R	U	UJ	Total Results	Total Detected	Total Non- Detect	Total Rejected	Percent Detected	Percent Non- Detect	Percent Rejected
Analytical Method¹	Analyte														
CSVOL	Nitrobenzene						19	4	23	0	23	0	0.0%	100.0%	0.0%
CSVOL	3-Nitroaniline						17	6	23	0	23	0	0.0%	100.0%	0.0%
CVOL	Ethylbenzene						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Styrene						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Cis-1,3-Dichloropropene						20	5	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Trans-1,3-Dichloropropene						20	5	25	0	25	0	0.0%	100.0%	0.0%
CVOL	1,4-Dichlorobenzene					5	20		25	0	20	5	0.0%	80.0%	20.0%
CVOL	1,2-Dibromoethane						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	1,2-Dichloroethane						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	4-Methyl-2-Pentanone (Mibk)		9				15	1	25	9	16	0	36.0%	64.0%	0.0%
CVOL	Methylcyclohexane						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Toluene						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Chlorobenzene						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Cyclohexane						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	1,2,4-Trichlorobenzene					5	20		25	0	20	5	0.0%	80.0%	20.0%
CVOL	1,4-Dioxane					25			25	0	0	25	0.0%	0.0%	100.0%
CVOL	Dibromochloromethane						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Tetrachloroethene						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Cis-1,2-Dichloroethene						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Trans-1,2-Dichloroethene						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Methyl Tert-Butyl Ether						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	M,P-Xylene (Sum Of Isomers)						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	1,3-Dichlorobenzene					5	20		25	0	20	5	0.0%	80.0%	20.0%
CVOL	Carbon Tetrachloride						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	2-Hexanone						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Acetone	17	4				4		25	21	4	0	84.0%	16.0%	0.0%
CVOL	Chloroform						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Benzene						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	1,1,1-Trichloroethane						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Bromomethane						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Chloromethane						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Bromochloromethane						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Chloroethane						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Vinyl Chloride						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Methylene Chloride						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Carbon Disulfide	2	1				19	3	25	3	22	0	12.0%	88.0%	0.0%
CVOL	Bromoform					5	20		25	0	20	5	0.0%	80.0%	20.0%
CVOL	Bromodichloromethane						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	1,1-Dichloroethane						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	1,1-Dichloroethene						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Trichlorofluoromethane						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Dichlorodifluoromethane						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	1,1,2-Trichloro-1,2,2-Trifluoroethane						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	1,2-Dichloropropane						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	2-Butanone (Mek)	6	5				10	4	25	11	14	0	44.0%	56.0%	0.0%
CVOL	1,1,2-Trichloroethane						20	5	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Trichloroethene						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	Methyl Acetate						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	1,2,3-Trichlorobenzene					5	20		25	0	20	5	0.0%	80.0%	20.0%
CVOL	O-Xylene						21	4	25	0	25	0	0.0%	100.0%	0.0%
CVOL	1,2-Dichlorobenzene					5	20		25	0	20	5	0.0%	80.0%	20.0%
CVOL	1,2-Dibromo-3-Chloropropane					5	20		25	0	20	5	0.0%	80.0%	20.0%
CVOL	Isopropylbenzene						21	4	25	0	25	0	0.0%	100.0%	0.0%
EPA 600/R-93/116	Chrysotile	7					16		23	7	16	0	30.4%	69.6%	0.0%
EPA 600/R-93/116	Non-Asbestos (Fibrous)						23		23	0	23	0	0.0%	100.0%	0.0%
EPA 600/R-93/116	Non-Asbestos (Non-Fibrous)	23							23	23	0	0	100.0%	0.0%	0.0%
ISM01.3	Cyanide		5				18		23	5	18	0	21.7%	78.3%	0.0%
ISM01.3	Aluminum (Fume Or Dust)	21					2		23	21	2	0	91.3%	8.7%	0.0%
ISM01.3	Iron		22					1	23	22	1	0	95.7%	4.3%	0.0%
ISM01.3	Lead	21					2		23	21	2	0	91.3%	8.7%	0.0%
ISM01.3	Magnesium	10	12				1		23	22	1	0	95.7%	4.3%	0.0%
ISM01.3	Manganese	10	1		11		1		23	22	1	0	95.7%	4.3%	0.0%
ISM01.3	Mercury	4	5	1			11	2	23	10	13	0	43.5%	56.5%	0.0%
ISM01.3	Nickel	21	1				1		23	22	1	0	95.7%	4.3%	0.0%
ISM01.3	Potassium	11	2	8				2	23	21	2	0	91.3%	8.7%	0.0%
ISM01.3	Silver		2				21		23	2	21	0	8.7%	91.3%	0.0%
ISM01.3	Sodium		10		11		2		23	21	2	0	91.3%	8.7%	0.0%
ISM01.3	Thallium		1				22		23	1	22	0	4.3%	95.7%	0.0%
ISM01.3	Antimony		21				2		23	21	2	0	91.3%	8.7%	0.0%
ISM01.3	Arsenic	21					2		23	21	2	0	91.3%	8.7%	0.0%
ISM01.3	Barium	21					2		23	21	2	0	91.3%	8.7%	0.0%
ISM01.3	Beryllium	20	1				2		23	21	2	0	91.3%	8.7%	0.0%
ISM01.3	Cadmium		21				2		23	21	2	0	91.3%	8.7%	0.0%
ISM01.3	Chromium	21					1	1	23	21	2	0	91.3%	8.7%	0.0%
ISM01.3	Cobalt	19	2				2		23	21	2	0	91.3%	8.7%	0.0%
ISM01.3	Copper	11	10				2		23	21	2	0	91.3%	8.7%	0.0%
ISM01.3	Vanadium (Fume Or Dust)	21					2		23	21	2	0	91.3%	8.7%	0.0%
ISM01.3	Zinc	21	2						23	23	0	0	100.0%	0.0%	0.0%
ISM01.3	Calcium Metal	10	12				1		23	22	1	0	95.7%	4.3%	0.0%
ISM01.3	Selenium		19				4		23	19	4	0	82.6%	17.4%	0.0%
PCB	Aroclor 1260						19	4	23	0	23	0	0.0%	100.0%	0.0%
PCB	Aroclor 1254						19	4	23	0	23	0	0.0%	100.0%	0.0%
PCB	Aroclor 1268						19	4	23	0	23	0	0.0%	100.0%	0.0%
PCB	Aroclor 1221						19	4	23	0	23	0	0.0%	100.0%	0.0%

Table D-5
Data Qualifier Statistics for the 2014 Reservoir Sediment Investigation
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

Qualifiers		No Qualifier	J	J-	J+	R	U	UJ	Total Results	Total Detected	Total Non-Detect	Total Rejected	Percent Detected	Percent Non-Detect	Percent Rejected	
Analytical Method¹	Analyte															
PCB	Aroclor 1232						19	4	23	0	23	0	0.0%	100.0%	0.0%	
PCB	Aroclor 1248						19	4	23	0	23	0	0.0%	100.0%	0.0%	
PCB	Aroclor 1016						19	4	23	0	23	0	0.0%	100.0%	0.0%	
PCB	Aroclor 1262						19	4	23	0	23	0	0.0%	100.0%	0.0%	
PCB	Aroclor 1242						19	4	23	0	23	0	0.0%	100.0%	0.0%	
									Total Results	4150	539	3548	63	13.0%	85.5%	1.5%
									Completeness	98.5%						

Notes:
1. Contract Laboratory Program (CLP) methods SOM01.2 and ISM01.3 were performed for all analyses which included VOCs, SVOCs, PCBs, TAL Metals, mercury, and cyanide.
EPA - Environmental Protection Agency
VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds
PCBs - polychlorinated biphenyls
TAL - Target Analyte List

J - The result is an estimated quantity. The associated numerical value is the Approximate concentration of the analyte in the sample.
J- - The result is an estimated quantity, but the result may be biased low
J+ - The result is an estimated quantity, but the result may be biased high
R - The sample results are unusable. The sample results are rejected due to serious deficiencies in meeting Quality Control (QC) criteria. The analyte may or may not be present in the sample.
U - The analyte was analyzed for but not detected at a level greater than or equal to the the level of the adjusted Contract Required Quantitation Limit (CRQL) for sample and method.
UJ - The analyte was analyzed for but not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.
% - percent

Appendix E

Validation and Verification Reports (on CD)

Appendix E
File Description - Validation and Verification Reports
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

<i>Remedial Investigation (RI) Validation Packages</i>	
Subfolder	Contents
<i>PLM Validation Report</i>	Data validation conducted for soil and sediment samples analyzed for asbestos by polarized light microscopy (PLM) according to the State of California Air Resource Board (CARB) Method 435. A total of 36 samples were analyzed by EMSL Laboratories Inc. and a total of 178 samples were analyzed by Bata Laboratories. Data validation was performed by CDM Smith.
<i>TEM Validation Report</i>	Data validation for a total of 25 laboratory jobs involving 272 air analyses and six laboratory jobs involving 19 water analyses. Air samples were analyzed by transmission electron microscopy (TEM) ISO 10312 and water samples were analyzed by Environmental Protection Agency (EPA) Method 100.2. Two additional supplemental data validation reports are included for the following samples: - Data validation for two off-site air samples and one groundwater sample - Data validation for a total of three laboratory jobs encompassing 57 water analyses.

<i>Post-RI Validation Packages</i>	
Subfolder	Contents
<i>Reservoir Bench Study</i>	
	Validation and verification reports provided for 3 sediment samples including one duplicate pair analyzed for asbestos by PLM CARB Method 435 and validation and verification for 13 surface water samples analyzed for asbestos by TEM EPA Method 100.2. All sediment and surface water samples were collected by CDM Smith during the Reservoir bench study (August 5 and August 11 2014). Data validation and verification was performed by CDM Smith.
<i>2014 Reservoir Sediment Investigation</i>	
EMSL Order ID: 041408211	Case R34356: Validation and verification reports for 10 sediment samples collected March 31, 2014 by the EPA's Superfund Technical Assessment and Response Team (START) contractor. Samples were analyzed for asbestos by CARB Method 435. Data validation and verification was performed by CDM Smith.
EMSL Order ID: 041408578	Case R34356: Validation report for two sediment samples collected March 31, 2014 by the EPA's START contractor. Samples were analyzed for asbestos by CARB Method 435. Data validation was performed by CDM Smith.
EMSL Order ID: 041422600	Case R34356: Verification and validation Report for 11 sediment samples including on duplicate pair collected August 5, 2014 by the EPA's START contractor. In addition, one rinsate blank was analyzed for asbestos by EPA Method 100.2. Data Validation was performed by Region III Environmental Services Assistant Team (ESAT) contractor, ICF International. Data verification was performed by CDM Smith.

Appendix E
File Description - Validation and Verification Reports
BoRit Asbestos Superfund Site, OU-1
Ambler, Pennsylvania

<i>2014 Reservoir Sediment Investigation (Continued)</i>	
SDG: C0AB0	Case R34356: Organic data validation for 11 sediment samples, 1 aqueous trip blank, and 1 aqueous rinsate blank collected on March 31, 2014 by the EPA's START contractor. Sediment samples were analyzed for volatile, semi-volatile, pesticide, and aroclor compounds. Data validation was performed by ESAT contractor IFC International.
SDG: F3471	Case R34356: Organic Data Validation for 10 sediment samples, 1 aqueous trip blank, and 1 aqueous rinsate blank collected on August 5, 2014 by the EPA START contractor. Sediment samples were analyzed for volatile, semi-volatile, pesticide, and aroclor compounds. Data Validation was performed by ESAT contractor IFC International.
SDG: F3472	Case R34356: Inorganic data validation for 10 sediment samples and 1 aqueous rinsate blank collected on August 5, 2014 by the EPA's START contractor. Sediment samples were analyzed for metals, mercury, and cyanide. Data Validation was performed by ESAT contractor IFC International.
SDG: MCOAB0	Case R34356: Inorganic data validation for 11 sediment samples and 1 aqueous rinsate blank collected on March 31, 2014 by the EPA START contractor. Sediment samples were analyzed for metals, mercury, and cyanide. Data validation was performed by ESAT contractor IFC International.
SDG: MCOAB2	Case R34356: Inorganic data validation for 10 sediment samples collected on March 31, 2014 by the EPA's START contractor. Samples were analyzed for asbestos by CARB Method 435. Data validation was performed by ESAT contractor, IFC International.

Notes:

ID - identification

SGD - sample delivery group