RECORD OF DECISION

BORIT ASBESTOS SUPERFUND SITE

BOROUGH OF AMBLER, WHITPAIN TOWNSHIP AND UPPER DUBLIN TOWNSHIP, MONTGOMERY COUNTY, PENNSYLVANIA

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 3, PHILADELPHIA, PENNSYLVANIA

July 2017

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Acronyms and Abbreviations

%	percent
°C	degrees Celsius
μg/kg	microgram per kilogram
μg/L	microgram per liter
μm	micrometer
cy	cubic yard
days/yr	days per year
f/cc	fiber per cubic centimeter
hrs/day	hours per day
mg/kg	milligram per kilogram
$(mg/kg\text{-}day)^{-1}$	milligram per kilogram per day
ng/kg	nanogram per kilogram
s/cc	structures per cubic centimeter
s/gram	structures per gram
a	age at first exposure
ABS	activity-based sampling
ACM	asbestos-containing material
Ambler	Borough of Ambler
ARARs	applicable or relevant and appropriate requirements
ARI	ARI Global Technologies
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
BoRit Site	BoRit Asbestos Superfund Site
BSAF	biota-sediment accumulation factor
CAG	Community Advisory Group
CCM	cable concrete mat
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
C.F.R.	Code of Federal Regulations
cis-1,2-DCE	cis-1,2-dichloroethene
COCs	contaminants of concern
COPCs	contaminants of potential concern
CSC	Center for Sustainable Communities
CSM	conceptual site model
CTE	central tendency exposure
d	duration
DDT	dichloro-diphenyl-trichloroethane

Acronyms and Abbreviations (continued)

EA	environmental assessment
EC	engineering control
EF	exposure frequency
EPA	United States Environmental Protection Agency
EPC	exposure point concentration
ESL	ecological screening level
E&S	erosion and sediment
ET	exposure time
FEMA	Federal Emergency Management Agency
FIT	Field Investigation Team
FS	Feasibility Study
FYR	five-year review
GSR	green and sustainable remediation
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
H&S	health and safety
HRS	Hazard Ranking System
IARC	International Agency for Research on Cancer
IC	institutional control
IRIS	Integrated Risk Information System
ISO	International Organization for Standardization
IUR	inhalation unit risk
K&M	Keasby & Mattison
LTM	long-term monitoring
M	million
MCL	maximum contaminant level
MEK	2-butanone
MFL	million fibers per liter
MG	million gallons
MIBK	4-methyl-2-pentanone
Mt.	Mount
MTBE	methyl tert-butyl ether
MW	monitoring well
NAVD88	North American Vertical Datum 1988
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NESHAP	National Emission Standards for Hazardous Air Pollutants
NOAEL	no observed adverse effect level

Acronyms and Abbreviations (continued)

NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRWQC	National Recommended Water Quality Criteria
NTU	Nephelometric Turbidity Units
O&F	operational and functional
O&M	operation and maintenance
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
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
PFBC	Pennsylvania Fish and Boat Commission
PRAP	Proposed Remedial Action Plan
RAO	remedial action objective
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
REAC	Response Engineering and Analytical Contract
RfC	reference concentration
RfD	reference dose
RI	remedial investigation
RME	reasonable maximum exposure
ROD	Record of Decision
RSC	Retail and Service Commercial
RSL	regional screening level
SEFA	Spreadsheets for Environmental Footprint Analysis
SEPTA	Southeastern Pennsylvania Transportation Authority
SF	slope factor
Site	BoRit Asbestos Superfund Site
SLERA	screening level ecological risk assessment
SVOC	semi-volatile organic compound
T/M/V	toxicity, mobility, or volume
TCCT	Thermochemical Conversion Treatment
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin

Acronyms and Abbreviations (continued)

TCE	trichloroethene
TEM	transmission electron microscopy
TEQ	toxicity equivalent quotient
TRV	toxicity reference value
TWF	time weighting factor
UCL	upper confidence limit
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service
VOC	volatile organic compound
WHO	World Health Organization
WSS	waste, soil, and Reservoir sediment
WVWA	Wissahickon Valley Watershed Association
WWP	Wissahickon Waterfowl Preserve

I. DECLARATION

BORIT ASBESTOS SUPERFUND SITE

BOROUGH OF AMBLER, WHITPAIN TOWNSHIP AND
UPPER DUBLIN TOWNSHIP,
MONTGOMERY COUNTY, PENNSYLVANIA

RECORD OF DECISION
BORIT ASBESTOS SUPERFUND SITE

PART I: DECLARATION

Site Name and Location

The BoRit Asbestos Superfund Site (Site or BoRit Site) (EPA ID: PAD981034887) is located in the Borough of Ambler, Whitpain Township and Upper Dublin Township, Montgomery County, Pennsylvania.

Statement of Basis and Purpose

This decision document presents the Selected Remedy (Remedial Action) for the waste, soil, and Reservoir sediment contamination associated with the Site, located in the Borough of Ambler (Ambler), Whitpain Township and Upper Dublin Township, Montgomery County, Pennsylvania, (see **Figure 1**) which was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 United States Code (U.S.C.)§§ 9601 et seq., as amended, (CERCLA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 Code of Federal Regulations (C.F.R.) Part 300. This decision document is based on the Administrative Record file for this Site.

The Pennsylvania Department of Environmental Protection (PADEP) concurred with the Selected Remedy in a letter dated June 29, 2017.

Assessment of the Site

The Remedial Action selected in this Record of Decision (ROD) is necessary to protect the public health or welfare and the environment from actual or threatened releases of hazardous substances, pollutants, or contaminants from the Site that may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Remedy

The Remedial Action described herein is intended to address waste, soil, and Reservoir sediment contamination associated with the Site and will be the final action for the Site. The selected Remedial Action will encompass and enhance the Removal Action initiated by EPA's Removal Program in 2008 to address the most immediate environmental concerns at the Site. It is anticipated that the EPA Removal Program will complete the Removal Action in August 2017. The waste, soil, and Reservoir sediment contaminated with asbestos and other Contaminants of Concern (COCs) at the Site is considered a principal threat waste. The Selected Remedy will physically contain the asbestos and other COCs to prevent migration from the Site and to prevent exposure to human and ecological receptors.

The Selected Remedy includes capping of waste, contaminated soil, and Reservoir sediment with clean material along with implementation of associated health and safety (H&S) controls, erosion and sediment (E&S) controls, grubbing and clearing, and regrading to meet design grade to facilitate capping. Because the Selected Remedy is a continuation/completion of EPA's Removal Action, the majority of the construction activities and funding allocations for the Selected Remedy are complete. Major components of the Selected Remedy completed by the EPA Removal Program or to be completed by the EPA Remedial Program are described below:

EPA Removal Program

- Stream bank stabilization at Rose Valley Creek, Tannery Run, and Wissahickon Creek (completed)
- Installation of cover at Asbestos Pile (completed)
- Installation of cover at Park (completed)
- Dewatering of Reservoir with treatment of surface water prior to discharge (completed)
- Re-grading and lining of Reservoir berm interior slopes (completed)
- Installation of a cover on the Reservoir bottom (completed)
- Refilling of the Reservoir (completed)
- ABS at residences adjacent to the Site (completed)

EPA Remedial Program

- Implementation of institutional controls (ICs) (to be completed)
- Confirmation sampling (to be completed)
- Long-term monitoring (LTM) for Site-related COCs (to be completed)
- Operation and maintenance (O&M) (to be completed)
- Five-year reviews (FYRs) (to be completed)

Statutory Determinations

The Selected Remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the Remedial Action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

The Selected Remedy does not satisfy the statutory preference for treatment as a principal element. However, the treatment alternatives developed for the Site have significant implementability concerns which include increased short-term risks to off-Site residents and on-Site workers and would be substantially more expensive to complete. The Selected Remedy for waste, soil and Reservoir sediment (WSS), Alternative WSS2 Capping, is cost-effective and will physically contain hazardous substances, pollutants or contaminants on-Site, and will prevent the release and migration of hazardous substances, pollutants, or contaminants off-Site.

The Selected Remedy will result in hazardous substances, pollutants, or contaminants remaining on-Site above levels that allow for unlimited use and unrestricted exposure. Therefore, an assessment of the Site will be conducted no less often than every five years after initiation of Remedial Action in accordance with Section 121(c) of CERCLA, 42 U.S.C. § 962l(c), to ensure that the Selected Remedy continues to provide adequate protection of human health and the environment.

ROD Data Certification Checklist

The following information is included in the Decision Summary of this ROD. Additional information can be found in the Administrative Record for the Site.

ROD CERTIFICATION CHECKLIST	
Information	**Location/Page Number**
COCs and respective concentrations	Section 7.3, page 62
Baseline risk represented by COCs	Section 7.0, page 44
Cleanup levels established for COCs and the basis for these levels	Section 8.0, page 64
How source materials constituting principal threat are addressed	Section 14.5, page 93
Current and reasonably anticipated future land use assumptions	Section 6.0, page 42
Potential land use that will be available at the Site as a result of the Selected Remedy	Section 13.4, page 91
Estimated capital, annual O&M, and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected	Section 13.3, page 91
Key factors that led to selecting the remedy	Section 13.1, page 85

Karen Melvin, Director
Hazardous Site Cleanup Division
EPA Region 3

JUL 28 2017
Date

II. DECISION SUMMARY

BORIT ASBESTOS SUPERFUND SITE

BOROUGH OF AMBLER, WHITPAIN TOWNSHIP AND
UPPER DUBLIN TOWNSHIP,
MONTGOMERY COUNTY, PENNSYLVANIA

1.0 SITE NAME, LOCATION, AND DESCRIPTION

The BoRit Asbestos Superfund Site (Site or BoRit Site) (EPA ID: PAD981034887) is located in the Borough of Ambler, Whitpain Township and Upper Dublin Township, Montgomery County, Pennsylvania (PA) (**Figure 1**).

The Site includes three adjacent parcels near the intersection of West Maple Street and Butler Pike:

- The Park parcel, located in Whitpain Township, is approximately eleven acres and contains a former asbestos disposal area (now the closed Whitpain Wissahickon Park).
- The Asbestos Pile parcel, located in Ambler Borough, is approximately six acres and contains an asbestos waste pile, approximately three acres, in the middle of the property.
- The Reservoir parcel, primarily located in Upper Dublin Township, is approximately 15 acres and contains a reservoir. The Reservoir is manmade 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 connected to a 24-inch pipe that ultimately discharged into the Reservoir.

The Site also includes portions of Wissahickon Creek, Rose Valley Creek, and Tannery Run, which flow adjacent to the three Site parcels. The Site map is shown on **Figure 1**.

The U.S. Environmental Protections Agency (EPA) will be the lead agency for the Remedial Action at the Site. The Pennsylvania Department of Environmental Protection (PADEP) will perform long-term O&M of the remedy implemented by EPA.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

This section summarizes the general Site history, previous investigations, and EPA Removal Program activities. References for this document are included in Appendix A.

2.1 Site History

The contamination at the Site is a result of disposal operations by the former Keasby & Mattison (K&M) Company. 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. K&M ceased operations in 1962. A description of historical activities that occurred on each parcel follows:

<u>Park Parcel</u>

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.

<u>Asbestos Pile Parcel</u>

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. Prior to the EPA Removal Action (described below), 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. 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 (including slag disposal) and for local Fire Department training.

<u>Reservoir Parcel</u>
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.

2.2 Regulatory History

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

EPA performed a preliminary assessment of the Asbestos Pile parcel in March 1987. The Asbestos Pile was found to be fenced and vegetated, but there was evidence of trespassers. A soil sample collected from the Asbestos Pile was found to contain asbestos. These data, as well as other information, were used to evaluate the Site, ultimately resulting in a Hazard Ranking System (HRS) screening score below the threshold score of 28.5 for possible inclusion on the National Priorities List (NPL). The surface water and groundwater migration pathway were not scored because risk receptors were not identified. Therefore, the surface water and groundwater pathway contributed minimally to the Site score.

For approximately 20 years, PADEP regulated the parcel according to the applicable National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations, promulgated pursuant to Section 112 of the Clean Air Act, 42 U.S.C. § 7412, and codified at 40 C.F.R. § 61.151, which required the parcel to be fenced, have a vegetated cover, and have signs indicating the presence of asbestos, since asbestos-containing material (ACM) had not been covered with two feet of clean material.

In April 2006, EPA's Site Assessment Program conducted sampling and found asbestos in the air, soil, surface water, and sediments at the Site. EPA re-evaluated the BoRit parcels prompting proposal to the NPL on September 3, 2008. The Site was listed on the NPL on April 9, 2009.

2.3 Previous Investigations

The investigation history of the Site is summarized on **Table 1**. In 1978 and 1979, EPA collected surface water samples from Wissahickon Creek, both upstream of the Park parcel and downstream from the Site to the Belmont drinking water intake on the Schuylkill River. EPA's National Recommended Water Quality Criteria (NRWQC) includes a drinking water maximum contaminant level (MCL) of 7 million fibers per liter (MFL) (for fibers greater than 10 micrometers (µm) in length) as a surface water quality criterion for asbestos for the protection of human health. Most results were at or near method detection limits and ranged from 0.08 to 0.16 MFL; however, samples collected at the CertainTeed and Nicolet plant outfalls at what is currently the Ambler Asbestos Piles Superfund Site had values ranging from non-detect to 1,060 MFL.

In June 1983, EPA's Field Investigation Team (FIT) collected surface water samples from the Wissahickon Creek. A sample collected near the Butler Pike Bridge contained 39 MFL total asbestos (18 MFL chrysotile), and a sample collected downstream from Church Street contained 310 MFL total asbestos (260 MFL chrysotile). When surface water samples were collected from similar locations in October 1986, asbestos fibers were not detected in any of the samples.

In December 1983, EPA and PADER collected a soil sample from the Asbestos Pile parcel that contained three to four percent chrysotile asbestos. Soil samples collected from the Park parcel contained five to 35 percent chrysotile asbestos, and one sample contained crocidolite asbestos. No health or risk-based regulations or guidelines have been established for asbestos in soil. However, during the Remedial Investigation (RI), soil and sediment sample asbestos concentrations were screened against a criterion of one percent asbestos. The one percent threshold is found in Occupational Safety and Health Administration (OSHA) regulations (29 C.F.R. § 1910.1001) and in EPA's applicable NESHAP regulations to define ACM. The one percent screening value is not a risk-based value; studies have shown that soil with less than one percent asbestos can release sufficient asbestos fibers to air to present a risk to human health.

In October 1984, EPA collected surface soil samples from the Park parcel and adjacent areas, and several samples contained one percent or less chrysotile asbestos. In December 1984, EPA collected vacuum samples from the Park parcel surface, and no asbestos fibers were detected. Other vacuum samples collected from nearby yards and roads had inconclusive results because the levels could not be differentiated from background levels. Soil core and surface soil samples collected were all found to be negative for asbestos.

In March 1987, during the Remedial Investigation/Feasibility Study (RI/FS) for the Ambler Asbestos Piles Superfund Site, surface water samples were collected from Wissahickon Creek. Surface water samples collected approximately 250 feet, 1,050 feet, and 3,770 feet downstream of Butler Pike Bridge contained 52 MFL chrysotile, 450 MFL chrysotile, and 199 MFL chrysotile, respectively. Sediment samples collected at the surface water locations were negative for asbestos fibers. A surface water sample collected from Tannery Run and Rose Valley Creek contained 8,700 MFL chrysotile and 4,500 MFL chrysotile, respectively. Sediment samples collected at these two surface water locations contained five and 40 percent chrysotile, respectively.

In October 1987, EPA's FIT collected soil samples from the Asbestos Pile parcel and surface water samples from Tannery Run and Wissahickon Creek as part of a Site inspection. The soil samples contained up to 22 percent total asbestos, and the aqueous samples contained non-detectable levels up to 2.5 MFL. Observations made during the Site inspection indicated that people were gaining access to the Asbestos Pile parcel for unauthorized disposal of household wastes. In addition, although the Asbestos Pile was described as "95 to 99% covered with heavy vegetation," three small areas were devoid of vegetation and six abandoned vehicles were located on the Site. Runoff was noted entering Tannery Run from the southwest portion of the Asbestos Pile parcel, four empty 55-gallon drums were located in the Reservoir north of the Asbestos Pile, and asbestos shingles were observed on the ground throughout the Asbestos Pile parcel.

In July 1996, EPA and PADEP collected numerous subsurface soil samples (0 to 14 inches below ground surface [bgs]) as well as surface soil samples from the Park parcel. Chrysotile asbestos was detected in 86 of the 93 samples, and amosite asbestos was detected in six of the 93 samples. Percentages of asbestos ranged from trace to 15 percent, with higher percentages generally found in the deeper samples.

In the summer of 2001, the Borough of Ambler conducted a Phase I and Phase 2 environmental assessment (EA) of the Asbestos Pile parcel. Eleven test pits were excavated, with layers of ACM observed in the excavated areas. Samples from seven of the test pits contained one to 35 percent asbestos. The volume of the Asbestos Pile was estimated to be approximately 149,500 cy. An air sample analyzed by transmission electron microscopy (TEM) was included in this EA and reported as non-detect for asbestos fibers; however, the report did not provide a location of the air sample.

In June 2004, the Wissahickon Valley Watershed Association (WVWA) conducted a Phase I EA at the Reservoir parcel. Surface water and sediment samples were collected from the Reservoir as well as waste and soil samples from the banks of the Reservoir. The surface water and sediment samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals but not for asbestos. Contaminant concentrations did not exceed the applicable screening levels, as specified in Pennsylvania's Land Recycling and Environmental Remediation Standards Act (Act 2). Waste samples collected from the east side of the Reservoir (gray-white soil or soil-like material) and around the Reservoir below the vegetation were found to contain 20 to 30 percent chrysotile asbestos. The EA identified non-friable ACM along the banks of the Reservoir, which were constructed of asbestos shingles, millboard, and soil. ACM was also observed within the Reservoir. Cement-asbestos pipe sections and ACM were scattered around the Reservoir, along Rose Valley Creek, and along and in Wissahickon Creek. ACM observed near the Reservoir was described as transite, a mixture of cement and asbestos. The transite was beginning to degrade and become friable at the weathered ends of the material. Two air samples were collected downwind of the Reservoir parcel to the west. Sample results were reported as approximately 0.004 fibers per cubic centimeter (f/cc). For comparison, the Site-specific screening level for asbestos in ambient air is 0.001 f/cc.

In March 2005, O-Brien and Gere conducted a Phase II EA at the Reservoir parcel, collecting additional samples in and around the Reservoir. Soil samples collected near a transformer in the southwest corner of the Reservoir parcel tested negative for polychlorinated biphenyls (PCBs). Surface soil samples collected near a metal storage tank tested positive for several polycyclic aromatic hydrocarbons (PAHs), with all results less than the applicable Act 2 screening levels. Sediment samples collected from the bottom of the Reservoir near suspected ACM material and the Reservoir outflow all tested negative for asbestos.

In April 2006, as part of a Site assessment, EPA collected two soil samples from the Park parcel and three soil samples from the Asbestos Pile. All five samples tested positive for chrysotile asbestos with values ranging from 5.974×10^6 to 5.407×10^8. Two of the five soil samples also tested positive for amphibole asbestos, with values ranging from 2.850×10^6 to 1.460×10^8 structures per gram (s/gram). The Site assessment also included sediment sampling at one location upstream and downstream of the Site in Wissahickon Creek. The upstream sediment sample contained 2.9×10^6 chrysotile s/gram, and the downstream sediment sample contained 8.9×10^6 chrysotile s/gram. In addition, surface water samples were collected from the northeast and southwest edges of the Reservoir as well as in two locations in Wissahickon Creek immediately upstream and downstream of the Site. The sample collected from the southwest corner of the Reservoir was the only surface water sample found to contain asbestos, with a concentration of 110 MFL of chrysotile asbestos. Finally, six air samples at or adjacent to the Site were collected during the 2006 EPA Site assessment, and all samples were found to contain detectable asbestos fiber concentrations, with values ranging from 0.00061 to 0.039 f/cc. The information from the Site assessment was used in the HRS.

Throughout 2006 and 2007, EPA collected and analyzed 72 air samples (including eight field blanks) from on-Site and off-Site ambient air locations. Seven off-Site locations had detectable chrysotile asbestos concentrations, ranging from 0.0005 to 0.005 f/cc. Five on-Site locations had detectable chrysotile and actinolite (only one sample) asbestos concentrations, ranging from 0.0005 to 0.001 f/cc. In addition, EPA conducted two activity-based sampling (ABS) events at the Park. ABS is a standard sampling method for asbestos in air to measure potential exposures experienced by a person performing a particular activity. ABS scenarios involve actors performing an activity that could disturb the soil and release asbestos, if present, to the air. During an ABS event, air data are collected using personal air monitors worn by the actors. One of the two scenarios conducted in 2007 simulated brush clearing activities, and did not generate any asbestos detections; however, it should be noted that the detection limit was 0.0029 f/cc. The second ABS scenario simulated soil sampling activities and resulted in detectable chrysotile asbestos ranging from 0.003 to 0.015 f/cc. For reference, the Site-specific screening level for asbestos in ABS samples is 0.04 f/cc.

In October, November, and December 2006, sampling was performed at the Park parcel, in the floodplain, and in adjacent tributaries (Tannery Run, Rose Valley Creek, and Wissahickon Creek). Twenty-four soil samples were collected at the Park parcel, and one background sample was collected from a nearby parking lot. Five surface soil samples were collected from floodplain areas. Twenty sediment samples and eight surface water samples were collected from the three adjacent tributaries. Soil sampling results at the Park parcel showed chrysotile asbestos in six samples <0.3 percent, crocidolite asbestos in six samples <0.1 percent, and amosite asbestos in two samples <0.1 percent. Three sediment samples collected from adjacent tributaries had detectable asbestos concentrations (0.1, 0.1, and <0.1 percent). No soil samples in the floodplain areas or surface water from adjacent tributaries had detectable asbestos concentrations.

In November 2006, EPA collected and analyzed 61 air samples (including six field blanks) from on-Site and off-Site ambient air locations as well as ABS conducted at the Park and the Asbestos Pile parcels. Four on-Site ambient air samples had detectable chrysotile asbestos concentrations, ranging from 0.0005 to 0.001 f/cc. No off-Site ambient air samples had detectable asbestos concentrations. The first ABS scenario simulated potential exposure from leaf/yard raking at the Asbestos Pile parcel.

Four samples from the first ABS event were submitted for analysis, and all four samples had detectable chrysotile asbestos concentrations, ranging from 0.017 to 0.046 f/cc. The second ABS scenario simulated leaf/yard raking at the Park parcel. Four samples from the second ABS event were submitted for analysis, and two samples had detectable chrysotile asbestos concentrations, ranging from 0.0029 to 0.015 f/cc. The third ABS scenario simulated walking and raking along the bank of Wissahickon Creek. Four samples from the third ABS event were collected, and one sample had detectable chrysotile asbestos concentrations at 0.076 f/cc (bank of creek raking). It should be noted that the detection limit (i.e., the smallest quantity of asbestos that can be distinguished under any specific laboratory analysis) for all ABS sample analysis was 0.0029 f/cc.

In March 2007, EPA collected and analyzed 34 air samples (including four field blanks) from on-Site and off-Site ambient air locations. Nine on-Site locations had detectable chrysotile asbestos concentrations, ranging from 0.0005 to 0.0009 f/cc. Three off-Site locations had detectable chrysotile and crocidolite (only one sample) asbestos concentrations (all three had a concentration of 0.0005 f/cc).

In May 2007, EPA collected and analyzed 29 air samples (including four field blanks) from on-Site and off-Site ambient air locations and four surface soil samples for percent moisture. Eight on-Site locations had detectable chrysotile and actinolite (only one sample) asbestos concentrations, ranging from 0.0005 to 0.002 f/cc. Three off-Site locations had detectable chrysotile and actinolite (two samples) asbestos concentrations (0.0005 f/cc).

In June 2007, EPA collected and analyzed 35 air samples (including four field blanks) from on-Site and off-Site ambient air locations and ABS at the Park parcel. One on-Site location had a detectable actinolite asbestos concentration (0.0005 f/cc). No off-Site locations had detectable asbestos concentrations. The ABS scenario was brush clearing at the Park parcel. No asbestos was found in the ABS sample; however, the detection limit for that ABS sample was 0.01 f/cc due to limited sample volume.

In July 2007, EPA collected and analyzed 34 air samples (including four field blanks) from on-Site and off-Site ambient air locations and four surface soil samples for percent moisture.

In August 2007, collected and analyzed 34 air samples (including four field blanks) from on-Site and off-Site ambient air locations and four soil samples for percent moisture. Samples from five on-Site locations contained detectable chrysotile asbestos concentrations, ranging from 0.0005 to 0.0015 f/cc. Detectable chrysotile asbestos concentrations (0.0005 f/cc) were found in samples from four off-Site locations.

In September 2007, EPA collected and analyzed 36 air samples (including four field blanks) from on-Site and off-Site ambient air locations, four soil samples for percent moisture, and ABS at the Park parcel representing brush clearing. Six on-Site locations had detectable chrysotile and amosite (only one sample) asbestos concentrations, ranging from 0.0005 to 0.0029 f/cc. One off-Site location had a detectable chrysotile asbestos concentration (0.0005 f/cc). Three ABS samples were submitted for analysis, and no asbestos was detected in any samples; however, it should be noted that the detection limits for the ABS samples ranged from 0.0099 to 0.017 f/cc.

2.4 EPA Removal Program

In December 2008, the EPA Removal Program initiated a Removal Action to address the most immediate environmental concerns at the Site. Since 2008, all three parcels have undergone a Removal Action to cover ACM in accordance with applicable NESHAP regulations. The Park and Asbestos Pile parcels are not currently being used and are vacant. The Reservoir parcel is currently being used as a waterfowl preserve. The term “current conditions” refers to Site conditions post-Removal Action. A summary of current conditions at the Site is provided below and in more detail under the description entitled ‘Alternative WSS2 Capping’ on page 67 of this ROD.

The stabilization work conducted by EPA’s Removal Program was initially performed to address the issue of erosion of stream banks exposing ACM waste. All stream 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 stream banks performed as part of the Removal Action is designed to prevent or minimize future contamination of surface water and sediment in the Creeks surrounding the Site and the floodplain soils. The cap on the stream bank portions of the Site includes the placement of ten to 15 inches of clean fill, a layer of topsoil and vegetation, as well as the placement of cable concrete mats (CCM), geocells, and erosion control mats, where warranted. In addition, the Removal Action involved cutting back slopes on the Asbestos Pile to a stable three horizontal:one vertical gradient and covering the Asbestos Pile and the

Reservoir berm with geotextile, a minimum of two feet of clean material, and approximately six inches of topsoil to support a vegetative cover. In certain areas, the Reservoir berm includes up to ten feet of soil cover. At the Reservoir, the Removal Action included emptying the Reservoir, covering the Reservoir bottom with geotextile and a minimum of two feet of clean material, and refilling the Reservoir. 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 geotextile, a minimum two feet of clean material, and approximately six inches of topsoil to support a vegetative cover. Other areas of the Park parcel were covered with geotextile, two feet of clean material, approximately six inches of topsoil, and then hydroseeded. Additional detail of areas where two feet of clean material was not placed on stream banks/slopes is provided under the description of Alternative WSS2: Capping.

Permanent engineering controls have been implemented as part of the Removal Action to prevent Site access. Specifically, chain-link fences extend along the West Maple Street side of the Asbestos Pile parcel and the Reservoir parcel. EPA's Removal Program installed a permanent fence 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. The Wissahickon Waterfowl Preserve (WWP) would maintain ownership of the Reservoir parcel and continue to use the property as a waterfowl preserve. The WWP installed amenities along West Maple Street to promote birding and improve the aesthetic value of the area. Future use of the Asbestos Pile parcel is unknown at this time. The Asbestos Pile parcel is currently zoned as a Retail and Service Commercial District by the Borough of Ambler. The Asbestos Pile parcel is in a Redevelopment Overlay District, which permits additional uses (i.e., hotel, grocery store, fitness center); however, after a review of the Borough's zoning ordinance, it does not appear that the Asbestos Pile Parcel would meet the conditional use criteria for transportation-oriented development at this time. The Site was not assessed for residential use during the RI.

3.0 COMMUNITY PARTICIPATION

Numerous community meetings have been hosted by EPA during various stages of the Site work. The meetings took place in different locations throughout the area as well as during meetings of the BoRit Asbestos Area Community Advisory Group (CAG). The CAG was established by EPA and local community members to represent the interests of the communities surrounding the Site. The CAG is designed to serve as an ongoing vehicle for information-sharing, discussion, and, where possible, consensus-building regarding EPA decision-making efforts for the Site. CAG meetings have been occurring since 2007 and currently are held the first Wednesday of every other month.

In addition to community meetings, EPA has issued twenty-one factsheets since November 2006, which have provided updates on the Site status. In July 2016, EPA presented a Superfund Remedial Process Update Question and Answer Session to the community to help the community prepare to review and comment on the Site's Proposed Remedial Action Plan (PRAP).

On December 4, 2016, pursuant to Section 113(k)(2)(B) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. § 9613(k)(2)(b), EPA released the PRAP for a 60-day public comment period.[1] In response to a request for a time extension, the public comment period was extended an additional 30 days and closed on March 3, 2017. The PRAP was

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[1] Although a typical EPA public comment periods run for 30 days, the comment period for the PRAP was expanded to 60 days in anticipation of extensive interest from the local community.

based on documents contained in the Administrative Record for the Site and set forth EPA's preferred remedial alternative for the Site. EPA made these documents available to the public in the EPA Administrative Record Room in EPA Region 3's Philadelphia office and at the local information repository at the Wissahickon Valley Library Ambler Branch located at 209 Race Street, Ambler, PA 19002. The PRAP was also available online at the following address: https://semspub.epa.gov/src/collection/03/AR64805

A public meeting was held at the Ambler Borough Building Gymnasium on January 10, 2017. During the meeting, EPA staff presented an overview of the events that had occurred at the Site, described how the Superfund cleanup process works, described the remedial alternatives, and explained EPA's rationale for recommending the preferred alternative. Following this presentation, EPA answered questions from citizens regarding the Site and the PRAP. Questions, comments, and concerns received during the public meeting and throughout the public comment period are categorized and summarized in the Responsiveness Summary attached to this ROD. Each comment or group of similar comments is followed by EPA's response to that comment or group of similar comments.

More detailed documentation on the information contained in this ROD may be found in the Administrative Record for this Site. The Administrative Record includes, among other documents, the RI, the RI Addendum, the FS, and the PRAP. EPA encourages the public to review the Administrative Record to gain a more comprehensive understanding of the Site and Site activities that have been conducted. The Administrative Record, including hard copies of any oversized images, are available to the public in the EPA Administrative Record Room located in EPA Region 3's Philadelphia office and at the Wissahickon Valley Library, Ambler Branch. The Administrative Record can also be accessed on the web at the following address: https://semspub.epa.gov/src/collection/03/AR64805.

4.0 SCOPE AND ROLE OF REMEDIAL ACTION

The Selected Remedy addresses waste, soil, and Reservoir sediment contamination associated with the Site and will be the final action for the Site. The Selected Remedy will encompass and enhance the Removal Action conducted by the EPA Removal Program at the Site. Because the Selected Remedy is a continuation/completion of EPA's Removal Action, the majority of the remedy construction has been completed. Major components of the Selected Remedy completed by the EPA Removal Program or to be completed by the EPA Remedial Program are described below:

EPA Removal Program

- Stream bank stabilization at Rose Valley Creek, Tannery Run, and Wissahickon Creek (complete)
- Installation of cover at Asbestos Pile (completed)
- Installation of cover at Park (completed)
- Dewatering of Reservoir with treatment of surface water prior to discharge (completed)
- Re-grading and lining of Reservoir berm interior slopes (completed)
- Installation of a cover on the Reservoir bottom (completed)
- Refilling of the Reservoir (completed)
- ABS at residences adjacent to the Site (completed)

EPA Remedial Program

- Implementation of ICs (to be completed)
- Confirmation sampling (to be completed)
- LTM for Site-related COCs (to be completed)

- O&M (inspection and maintenance of covers, liners, and stabilized areas) (to be completed)
- FYRs (to be completed)

The waste, soil, and Reservoir sediment contaminated with asbestos and other COCs at the Site is considered a principal threat waste. The Selected Remedy will physically contain the asbestos and other COCs to prevent migration from the Site and to prevent exposure to human and ecological receptors.

To accomplish this Remedial Action, EPA has identified four remediation zones, highlighted in **Figure 2**, including (1) the Stream Banks, (2) the Park, (3) the Asbestos Pile, and (4) the Reservoir (which includes two sub-zones – Reservoir Bottom and Reservoir Berm). The four remediation zones have been delineated for the Site by considering the extent of Site contamination, the individual parcel boundaries, EPA Removal Program activities, and the remedial action objectives (RAOs) developed for the Site.

5.0 SITE CHARACTERISTICS

This section contains an overview of the Site in general and the conceptual site model (CSM). In addition, Section 5 provides an overview of the nature and extent of contamination at the Site and provides a description of the CSM.

5.1 Physical Characteristics of the Site

Summary descriptions of Site topography and drainage, geology and hydrogeology, and the floodplain are presented in Sections 5.1.1 through 5.1.3.

5.1.1 Topography and Drainage

Ambler, Whitpain Township, and Upper Dublin Township are situated in the Triassic Lowland section of the Piedmont physiographic province. 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 referenced to the North American Vertical Datum 1988 (NAVD88). Although significant capping work has occurred on the Site since 2009, the relative topography of the Site has not been altered significantly. The Asbestos Pile remains the highest point of elevation at the Site and the Creeks remain the lowest.

5.1.2 Site Geology and Hydrogeology

Except for 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 property at the toe of the Asbestos Pile next to Tannery Run. The waste consists of ACM mixed in some locations with sand and silt. The ACM is primarily composed of chrysotile. 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 to 36 feet bgs. Borings at the monitoring well locations detected native soil at depths ranging from two to 20 feet bgs; 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 medium sand, silt, clayey silt, and clay. Stratigraphic Cross Section I-I' was developed during the RI to depict the relationships between overburden groundwater, ACM waste material, bedrock groundwater, and surface water at the Site.

The location and cross-section maps for Cross Section I-I’ are presented in **Figure 3 and Figure 4**, 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 NAVD88) occurs northeast of the Pile within the Asbestos Pile parcel. The lowest observed bedrock elevations occur at the bed of the Wissahickon Creek (approximately 170 feet NAVD88) and its two local tributaries. Depth to bedrock was not observed beneath the Reservoir or the Asbestos Pile, which itself 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 synoptic rounds of water level measurements were conducted as part of the RI and post-RI field activities to evaluate the groundwater to surface water interface in the Reservoir. The synoptic results suggest that communication with groundwater might potentially occur in the southern half of the Reservoir if a barrier (i.e., a continuously thick and low permeability unit) between the groundwater and surface water is not present. However, the specific 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.

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.

<u>Reservoir Hydraulics</u>

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 monitoring well MW-06.

Noted below are several Site investigations conducted to better understand the hydraulics of the Reservoir:

- United States Army Corps of Engineers (USACE) hydraulic investigation
- July 2014 Reservoir temperature study
- August 13, 2014 Site visit

The USACE undertook a hydraulic investigation for EPA to study the response of water levels in the Reservoir after storm events and to determine if any interaction existed between the Reservoir and shallow groundwater. Results of the hydraulic investigation indicated that, with the exception of a few anomalies, all significant water level increases seemed to be directly correlated to rainfall. USACE concluded this correlation indicates that the only significant inflow to the Reservoir is likely to be rainfall. The 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.

In July 2014, a Reservoir temperature study was conducted in the pooled water that remained in the Reservoir after a substantial portion of the Reservoir had been drained as part of the EPA Removal Action. The purpose of the study was to determine if there are locations within the Reservoir where groundwater inflow may be occurring. Cooler temperatures, indicating a potential groundwater inflow, were recorded in the central portion of the study area; however, the cooler temperature cluster was well above the range of temperatures recorded in Site monitoring wells. It is possible that the shallow depth and relatively small volume of water in the study area could have led to a relatively quick increase in temperature of cooler influent and masked the identification of influent groundwater. Therefore, the results of the July 2014 Reservoir temperature study should be considered in conjunction with synoptic events completed in the same time frame (July and August 2014) and observations from the August 13, 2014 Site visit.

On August 13, 2014, when the Reservoir had been completely drained, a Site visit was held to evaluate whether the new stormwater management system (installed adjacent to the Reservoir in July 2014) was impacting hydraulic conditions at the Reservoir. Consideration of all the available data and Site observations made during the Site visit suggest that, while there is some hydraulic communication between groundwater and Reservoir surface water, 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.

5.1.3 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. 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. FEMA finalized the updated 100-year and 500-year floodplain on August 1, 2016. Although the CSC's study was not included as part of the RI for the Site, **Figure 5** shows the extent of the 100-year floodplain updated by CSC. This updated 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 floodplain increasing in area to surround the entire perimeter of the Reservoir and extending northwest up West Maple Street.

5.2 Nature and Extent of Contamination

This section of the ROD summarizes key findings of RI and post-RI activities. The EPA Removal Program was conducting a Removal Action at the Site before, during, and after RI and post-RI fieldwork. However, the samples collected as part of the RI and post-RI field efforts were collected prior to, or were not directly impacted by, the ongoing Removal Action. Therefore, the results summarized in this ROD represent pre-Removal Action conditions, i.e., un-remediated conditions.

EPA initiated RI activities in a series of phases beginning in 2009. The first RI phase was performed in fall 2009 and winter 2010 when EPA collected surface water, sediment, surface soil, floodplain soil, and waste samples. The second RI phase, which occurred in fall 2010 and concluded in summer 2011, included the installation of six groundwater monitoring wells, evaluation of groundwater at the Site, additional surface soil sampling, and the collection of air quality data, including ABS. Specific scenarios performed for the ABS sampling included raking, digging, hiking, and mowing. In addition, ambient air samples were collected at least monthly at seven locations outside the perimeter of the Site from November 2010 to October 2011.[2] The third RI phase, performed during February 2013 to July 2013, included three rounds of groundwater sampling, installation of a background monitoring well and background groundwater sampling, background soil sampling, and Reservoir seep sampling. Results are included in the Final RI Report.

To further characterize the Site and to better understand potential fate and transport of hazardous substances, pollutants, or contaminants at the Site, additional data were collected after initial RI activities. These post-RI activities included additional groundwater evaluations, a Reservoir temperature study, a Reservoir bench study, and Reservoir sediment sampling. The results of these activities are included in the RI Addendum Report.

Sampling results were screened against the following risk-based screening criteria:

Human Health

- Analytical data for chemical contaminants in soil, sediment, groundwater, and surface water were screened against the EPA Region 3 *Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites*. RSLs are conservative values developed using EPA Superfund risk assessment guidance and are generic, i.e., they are calculated without site-specific information. RSL exceedances do not necessarily indicate the presence of unacceptable risk; they are used to help identify areas, contaminants, and conditions that require further evaluation.
- Dioxin concentrations in the RI were expressed as dioxin total toxicity equivalent quotients (TEQ) using TEQ conversion factors based on the 2005 World Health Organization (WHO)

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[2] All ABS and ambient air samples were analyzed by 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) to ensure comparability to the toxicity data. PCME structures are defined as structures with a length greater than 5 µm, 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 of asbestos discussed within this report are reported in terms of PCME structures

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*, September 2008. Soil sample asbestos concentrations were screened against a criterion of one percent asbestos. The one percent threshold is found in OSHA regulations (29 C.F.R. § 1910.1001) and in EPA's applicable NESHAP regulations to define ACM. The one percent screening value is not a risk-based value; studies have shown that soil with less than one percent asbestos can release sufficient asbestos fibers to air to present a risk to human health.
- ABS air samples were screened against a preliminary cleanup level of 0.04 f/cc calculated by the EPA Region 3 toxicologist specifically for a raking/lawn maintenance scenario at the Site. This Site-specific ABS air preliminary cleanup level was derived based on a target cancer risk of $1x10^{-4}$ (1 in 10,000 chance) for an adult raking/lawn maintenance scenario, assuming an exposure time (ET) and exposure frequency (EF) of four hours per day and 50 days per year, respectively. The starting age of exposure is assumed to be six years, with an exposure duration of 24 years. This ABS preliminary cleanup level was used to screen all personal ABS air data and was the most protective value of all ABS scenarios evaluated.
- EPA Region 3's toxicologist also provided a screening level of 0.001 f/cc asbestos for ambient air. This screening level is derived based on a target cancer risk of $1x10^{-4}$ for a residential exposure scenario, assuming a long-term residential exposure (24 hours per day, 350 days per year for 30 years).
- EPA's NRWQC are published pursuant to Section 304(a) of the Clean Water Act and provide guidance for states in adopting water quality criteria. EPA's NRWQC includes the 7 MFL drinking water MCL as a surface water quality criterion for asbestos for the protection of human health. Although the Reservoir does not serve as a drinking water source, EPA used a conservative approach, and the NRWQC was used as a screening level for the Reservoir surface water and seep. The 7 MFL drinking water MCL for fibers greater than 10 µm was also used as a screening level for groundwater.

Ecological

- Soil screening – the primary screening values are EPA's *Ecological Soil Screening Levels*. Secondary screening values are EPA's *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants* and EPA's *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process*. Tertiary screening values are EPA Region 5's *Resource Conservation and Recovery Act (RCRA) Ecological Screening Levels*. There are no soil ecological screening levels for asbestos.
- Reservoir sediment screening – the screening levels for Reservoir sediment are EPA Region 3 Freshwater Sediment Screening Benchmarks. The asbestos sediment ecological screening level is five percent (i.e., five times higher than that used for human health).
- Reservoir surface water and seep – the screening levels for Reservoir surface water and seep are EPA Region 3 Freshwater Screening Benchmarks. The asbestos surface water ecological screening value is the lowest no observed adverse effect concentration reported for effects to growth, reproduction, and survival of aquatic invertebrates or fish and is based on all fibers (0.0001 MFL).

5.2.1 Summary of Park Parcel Sampling – 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. No native soil samples below the ACM waste contained more than the one percent asbestos soil screening level; generally, concentrations of asbestos decreased two orders of magnitude from the waste layer to the native soil.
- Surface soil samples collected for ABS sample locations targeted areas where routine activities would take place (i.e., hiking or raking). Surface soil samples collected from planned ABS locations, prior to performing ABS, contained less than the soil screening level (one percent) for asbestos; however, the air samples collected during ABS still exceeded EPA's defined Site-specific ABS preliminary cleanup level of 0.04 f/cc. As mentioned previously, the one percent screening value is not a risk-based value. The results from these surface soil/ABS locations align with studies noted in the 2004 EPA Memo *Clarifying Cleanup Goals and Identification for New Assessment Tools for Evaluating Asbestos at Superfund Sites* that have shown that soil with less than one percent asbestos can still release sufficient asbestos fibers to air to present a risk to human health.
- In addition to asbestos, the Park Parcel waste was found to contain VOCs and SVOCs (mostly PAHs and phthalates) at concentrations above the RSLs. 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 also present in all Park parcel media, but were well below the RSLs.
- Inorganics (metals) exceeding the soil RSLs 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.

5.2.2 Summary of Reservoir Parcel Sampling – Waste, Soil, Air, Surface Water, Seep Water, and Sediment

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

- The ACM waste was 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, isolated locations on the southern corner of the Reservoir, and mid-way along the south side of the Reservoir. One native soil sample contained more than one percent asbestos. The asbestos in this sample is assumed to be contamination from surrounding waste.
- Organic compounds that exceeded the screening levels included PAHs in surface soil, cover/waste interface samples, and waste samples. There were no organic compounds at concentrations above screening levels in the native soil samples.
- Metals exceeding the screening levels for 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 to 640 MFL. EPA's NRWQC includes the 7 MFL drinking water MCL for fibers greater than 10 million µm in length as a surface water quality criterion for asbestos for the protection of human health. EPA conservatively used 7 MFL as

a screening level for surface water even though the Reservoir is not used as a drinking water source. Three Reservoir surface water locations had asbestos concentrations greater than the screening level of 7 MFL. The Reservoir was subsequently drained as part of the EPA Removal Action at the Site and approximately 37.8 million gallons (MG) of Reservoir surface water were pumped, treated,[3] and discharged to Wissahickon Creek in accordance with a temporary National Pollutant Discharge Elimination System (NPDES) permit. Pumping was needed after each rain event and throughout the Removal Action.

- Asbestos detections in the seep samples were below the screening level of 7 MFL (conservatively used; seep not a drinking water source). Concentrations ranged from 1.5 to 5.1 MFL.
- Three unfiltered surface water samples from the Reservoir exceeded the respective screening levels for metals, including arsenic, chromium, and lead.
- No organic compounds exceeded the screening levels for surface water at the Reservoir.
- Asbestos was detected in 14 of 15 Reservoir sediment samples collected while the Reservoir was filled with water; however, no sediment samples exceeded the asbestos screening level of one 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 the Removal Action 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, 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.
- Metals exceeding the screening levels for sediment at the Reservoir include arsenic, chromium, and vanadium. For the 2014 Reservoir sediment investigation, chromium and arsenic were the only metals to exceed the respective screening levels.
- The surface soil collected at the ABS location prior to performing ABS did not exceed the soil screening level (one percent) for asbestos. The air samples collected during the ABS scenario did not exceed the Site-specific ABS preliminary cleanup level of 0.04 f/cc.

5.2.3 Summary of Asbestos Pile Parcel Sampling – Waste, Soil, and Air

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

- The Asbestos Pile itself is composed of a slurry of magnesium and calcium as well as ACM waste in thick layers. The ACM waste is present on the property surrounding the Asbestos Pile in thin layers. Asbestos concentrations exceeded the soil screening level of one 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, little cover material existed above the ACM prior to the Removal Action.
- PAHs exceeded the soil RSLs in soil characterization borings throughout all subareas of the Asbestos Pile parcel (fire training area).

[3] Treatment was achieved by pumping Reservior surface water into settling tanks and then running the settled water through a filtration process that progressed from sand filters to a filter size of 1 µm before discharging to Wissahickon Creek. Discharge sampling was conducted in accordance with the temporary NPDES permit requirements.

- Metals exceeding the soil RSLs include aluminum, arsenic, cobalt, iron, lead, manganese, nickel, and vanadium. There were minimal differences in the concentrations of metals found in the cover, waste, and native soils within a single boring.
- Surface soil samples collected beneath fallen electrical transformers contained one 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 contained asbestos below the screening level, five PAHs exceeded the respective RSLs, and dioxin TEQ exceeded the RSL.
- Slag area soils contained aluminum, arsenic, chromium, iron, manganese, and thallium at concentrations greater than respective RSLs.
- All surface soil samples collected from the Asbestos Pile parcel ABS scenario locations prior to performing ABS contained asbestos at levels greater than the soil screening level of one percent. Air samples collected during each ABS scenario conducted at the Asbestos Pile parcel exceeded the Site-specific ABS preliminary cleanup level of 0.04 f/cc.

5.2.4 Summary of Site Groundwater Sampling

Asbestos was detected at low levels in samples from five of the six on-Site groundwater monitoring wells located within the disposal areas and sampled during RI Phases 2 and 3; however, all concentrations were less than the MCL of 7 MFL. During the last round of groundwater sampling for Phase 3 of the RI, asbestos was detected from only two of the six on-Site groundwater monitoring wells and at the lowest levels compared to previous sampling rounds.

Organic compounds found in groundwater at concentrations exceeding the RSLs were also found in the ACM waste material. Fifteen of the 16 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 their respective RSLs in MW-02, located at the southwest corner of the Park parcel. All of the compounds exceeding RSLs are common solvents used for many industrial processes. Multiple contaminants were detected in upgradient, offsite well MW-07 at concentrations exceeding RSLs. MW-07 was installed as a background well and is not expected to be impacted by contamination from the Site. Results from MW-07 are discussed in detail in Section 5.2.9.

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 PAHs, pesticides, or PCBs were detected in shallow bedrock groundwater samples.

Total and dissolved metals and cyanide (inorganics) were analyzed in monitoring well groundwater samples. Metals that exceeded the RSLs in samples analyzed for both total and dissolved metals included arsenic, barium, cadmium, cobalt, manganese, and thallium. Metals that exceeded the RSLs in samples analyzed for total metals included aluminum, chromium, cyanide, iron, and vanadium. Total metal concentrations are typically due to the presence of particulate matter in the aqueous sample. Metals bound to the particulate matter are generally not mobile, nor are they bioavailable. Therefore, total metal concentrations are not indicative of impacts to groundwater. Only selenium exceeded its respective RSL exclusively for dissolved metals.

5.2.5 Summary of Site Creeks Sampling

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 one percent in normal depositional areas (less than six inches of sediment). No asbestos was detected in sediment from Rose Valley Creek or Tannery Run.

Two VOCs were detected in Wissahickon Creek sediment at concentrations below RSLs. Several SVOCs were detected in sediment from Wissahickon Creek, Rose Valley Creek and Tannery Run; 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 at concentrations below RSLs. Additionally, PCBs were detected in Wissahickon Creek sediments and Rose Valley Creek sediments at concentrations below RSLs.

Three metals (arsenic, chromium, and manganese) exceeded the soil RSLs in Wissahickon Creek sediment samples. Chromium concentrations exceeded the RSL in all samples. Arsenic in the upstream sample exceeded the RSL, 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 and exceeded the MCL of 7 MFL in 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 at concentrations below 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)perylene 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 at concentrations below RSLs. Endrin aldehyde, was detected in two surface water samples from Wissahickon Creek, while dieldrin was detected in one sample collected in Rose Valley Creek and one sample collected from Tannery Run.

The total chromium concentration in surface water samples from Wissahickon Creek and Tannery Run exceeded the screening level. The RSL for chromium is based on hexavalent chromium (Cr^{+6}). Samples were analyzed only for total chromium and did not include an analysis of specific forms of chromium such as trivalent or hexavalent chromium.

5.2.6 Summary of Site Floodplain Soil Sampling

Three shallow floodplain soil samples (zero to three inches) detected asbestos below the screening level of one percent asbestos; three soil samples collected from the deep floodplain soils (six to 24 inches) exceeded one percent asbestos. No asbestos was detected in the surface soil sample collected on the west side of Wissahickon Creek. Asbestos was detected below the screening level of one percent in two creek bank samples following the Removal Action 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 stream bank boring; although, the grab sample of the waste did not contain greater than one 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 the Removal Action .

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

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

5.2.7 Summary of Off-Site Air Sampling for Asbestos

ABS: Residential Areas and Walking Trails

Soil samples were collected prior to performing ABS in the residential areas and walking trails. All soil samples collected contained less than one percent asbestos (soil screening level). Personal and perimeter ABS air samples were also collected during the raking activities at eight residential areas, during mowing activities along the Green Ribbon Trail, and during hiking activities along the Green Ribbon Trail. All ABS air concentrations were below the Site-specific ABS preliminary cleanup level of 0.04 f/cc.

EPA conducted additional ABS at residences along West Maple Street and the Mercer Hill area in September 2016. All ABS air concentrations were below the Site-specific ABS preliminary cleanup level 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; 98 samples in total were collected to provide a representative data set for the area surrounding the Site. Asbestos was not detected in 95 of 98 samples (based on PCME air concentrations). In the three samples where PCME asbestos was detected, concentrations were below the Site-specific ambient air preliminary cleanup level of 0.001 f/cc at two locations (0.00075 and 0.00079 PCME s/cc) and slightly above the preliminary cleanup level at a third location (0.0012 PCME s/cc).

It should be noted that Sample CM01-AA-HD12, which reported an asbestos air concentration slightly above the preliminary cleanup level, was collected in September of 2011. This sample was collected on the west bank of Wissahickon Creek directly across from the western corner of the Reservoir. Based on EPA Removal Program Reports, the Removal Action 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 Action 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 the asbestos ambient air preliminary cleanup level in this sample is most likely associated with the Removal Action excavation activities on the Site.

5.2.8 Summary of Background Soil Sampling

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)perylene.

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. Although arsenic was detected above the RSL in background (and on-Site) soil samples, observations of this naturally occurring inorganic fall within the range that would be expected for the northeastern United States.

5.2.9 Summary of Background Groundwater

Industrial areas can pose a challenge to determining background groundwater levels. Ambient conditions may include elevated concentrations of common contaminants from sources not associated with the Site. For example, some common contaminants in background groundwater 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-Site as an upgradient 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-Site in groundwater from that aquifer.

Eight metals were detected in at least one sample from MW-07: barium, calcium, chromium, lead, magnesium, manganese, sodium, 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., Cr^{+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.

5.3 Conceptual Site Model

A CSM essentially tells the story of when and where a site was contaminated, what media were affected, how and where the contamination migrated (pathways), and who and what is or can be potentially impacted by the contamination (receptors). In addition, a CSM provides a framework for assessing risks from hazardous substances, pollutants, or 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 a site, the CSM is modified to reflect that knowledge. A CSM has been developed for the Site based on pre-removal conditions and accounts for the Site's history (e.g., past uses), physical characteristics (e.g., topography and hydrogeology), and results of various investigations. **Figure 6** presents a flow diagram of the CSM that illustrates potential migration of hazardous substances, pollutants, or contaminants from source material to receptors for consideration in the development of remedial alternatives. Note that the CSM reflects pre-Removal Action work baseline, i.e., un-remediated conditions.

5.3.1 Asbestos

This section presents the primary source, release/transport mechanisms, exposure media, and exposure receptors for asbestos at the Site.

5.3.1.1 Primary Source

Asbestos is the dominant environmental concern at the 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.

5.3.1.2 Primary Release/Transport Mechanisms

Based on pre-removal conditions, the primary release/transport mechanisms of asbestos fibers in ACM and contaminated soil is airborne dust generation and surface runoff. Once airborne, asbestos fibers will be transported through advection of air currents until they settle out. The magnitude of airborne asbestos generated depends on multiple factors, including the intensity of the soil disturbances, the asbestos content of the ACM and soil, and nature of the ACM (e.g., friability) and soil (e.g., moisture content). Although many areas of landfilled waste were at one time covered by fill/soil, that cover has eroded in some areas. In summary, prior to the Removal Action, several asbestos-containing areas across the Site were not covered; therefore, airborne dust generation (due to disturbances of ACM and contaminated soil) and surface runoff mechanisms existed under pre-removal conditions.

5.3.1.3 Exposure Media

Air is the primary exposure medium of asbestos fibers released via airborne dust generation for human receptors and some ecological receptors (e.g., burrowing mammals), based on pre-removal conditions. 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 one percent, the ABS activity can release sufficient asbestos fibers to air to exceed the Site-specific ABS preliminary cleanup level for air.

Asbestos was found in the surface water and sediment of Wissahickon Creek under pre-removal conditions, indicating that asbestos fibers were directly eroded from Site soils by normal or flood stream flow or adsorbed to fine particles that were eroded from Site soils and washed into the Creeks via surface run-off from precipitation events.

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 onto floodplain soils. Pre-Removal Action 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.

For some ecological receptors, soil, surface water, and sediment are the primary exposure media for asbestos transported via surface runoff, based on pre-removal conditions. Ecological receptors, such as terrestrial plants/invertebrates and fish, are exposed to these media via direct contact while other ecological receptors (e.g., wildlife) are exposed via ingestion. Human exposures to asbestos in surface water and sediment are likely to be minor relative to soil.

Based on pre-removal conditions, a related transport mechanism/pathway that could occur at the 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. As previously stated, the EPA's NRWQC includes the 7 MFL drinking water MCL as a surface water quality criterion for asbestos for the protection of human health. Although the Reservoir does not serve as a drinking water source, and is not anticipated to serve as a drinking water source in the future, the NRWQC was used as a screening level for the Reservoir surface water. The Reservoir bench study results demonstrated that even when asbestos concentrations in sediment are less than the one percent screening level, a disturbance of the sediment results in high surface water concentrations for an extended period of time. Overall, the Reservoir bench study demonstrated that surface water asbestos concentrations exceeded the MCL immediately following the sediment disturbance activity and decreased over time, but asbestos concentrations remained above the MCL at the conclusion of the Reservoir bench study.

Groundwater has a limited potential to be an exposure medium of asbestos via groundwater flow transport. Low levels of asbestos in five Site shallow bedrock aquifer monitoring wells (detected in different wells during the four rounds of groundwater sampling and generally not repeated at any one well) indicate that asbestos fibers can flow with groundwater through the bedrock fractures. However, although detected in groundwater, the concentrations of asbestos in Site groundwater were below the drinking water MCL of 7 MFL. At the Site, much of the bedrock is overlain by silty and clayey sands, silts, and clays, which inhibits 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.

5.3.1.4 Exposure Receptors

People who most likely would be exposed to asbestos via air inhalation under potential future land uses (residential, non-residential) include:

- On-Site maintenance workers maintaining each of the Site parcels
- On-Site commercial workers carrying out activities associated with developing/maintaining recreational use of the Site parcels
- On-Site and off-Site recreational visitors, including adults and children

- Off-Site residents

The most conservative on-Site exposure receptor at all three parcels is the maintenance worker. Potential ecological receptors include both terrestrial receptors, such as plants, soil invertebrates, insectivorous birds, and insectivorous mammals, and aquatic receptors such as fish, aquatic invertebrates, piscivorous birds, and piscivorous mammals.

Based on the data gathered prior to the Removal Action, the potential human and ecological risks from asbestos exposures were evaluated and are discussed further in Section 7.

5.3.2 Non-Asbestos Hazardous Substances, Pollutants, or Contaminants

This section presents the primary source, release/transport mechanisms, exposure media, and exposure receptors for non-asbestos hazardous substances, pollutants, or contaminants at the Site.

5.3.2.1 Primary Source

Other hazardous substances, pollutants, or contaminants detected in the ACM waste based on pre-removal conditions 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 locations of the transformers.

5.3.2.2 Primary Release/Transport Mechanisms and Exposure Media

The primary release/transport mechanism based on pre-removal conditions for the non-asbestos contamination present in ACM and soil is from surface runoff due to precipitation events. Although not the primary contributor to the shallow bedrock aquifer VOC contamination, there may be dissolution of VOCs from infiltrating precipitation and eventual migration to groundwater. Primary exposure media include soil, groundwater, surface water, and sediment.

VOCs

Because VOCs are present below the ground 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. Based on pre-removal conditions, nine VOCs were found consistently in one on-Site shallow bedrock monitoring well, MW-02, which is located on the downgradient edge of the Park parcel. 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. The data demonstrate that the VOC contamination detected in the Park parcel soils was not significant enough to be considered a contributor to the groundwater contamination, and that the upgradient groundwater contamination detected in MW-07 is believed to be the main contributor to VOC contamination in the shallow bedrock aquifer.

Shallow bedrock groundwater discharges to the creeks. 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 based on pre-removal conditions. The presence of VOCs in creek water appears to 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 likely will adsorb onto particles and remain on the particles before settling out at depositional areas downstream. Pre-removal conditions for creek sediment samples detected SVOCs in all samples. However, the source of SVOCs in Site creek sediments is likely from 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 micrograms/kilogram (µg/kg) while detections at downstream locations ranged from 84J to 1,000 µg/kg in heavy deposition areas and 150J to 990 µg/kg in normal deposition areas.[4]

Bis(2-ethylhexyl)phthalate was the only SVOC in groundwater that was detected at concentrations above the RSL. Detections of bis(2-ethylhexyl)phthalate above the RSL were limited to samples collected from MW-02, MW-05, and MW-06 collected in the first round of sampling in 2010. There were no detections of bis(2-ethylhexyl)phthalate from any wells in the three later rounds of sampling completed in 2013. For this reason, bis(2-ethylhexyl)phthalate in groundwater is not considered a Site-related contaminant.

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, but they were not detected in the upper bedrock aquifer. 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 is likely the cause of 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. Samples collected during pre-removal conditions detected pesticides 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 during pre-removal conditions 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.

[4] The letter "J" is used next to an analytical result to indicate that the result is an estimated value. This flag is used when the analytical results indicate the presence of an analyte at a concentration that is less than the Contract Required Quantitation Limit (CRQL), but greater than zero.

Dioxins were detected in soil samples collected during pre-removal conditions from the fire training areas and the slag area on the Asbestos Pile parcel. Concentrations detected in the deepest soil investigated at these locations (six inches to 24 inches) 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
Metals were detected in the ACM waste during pre-removal conditions. 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-Site as well as background surface soil samples at concentrations exceeding RSLs: aluminum, arsenic, chromium, cobalt, iron, and manganese. A 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 higher than those from other strata.
- Manganese was detected frequently at levels above the RSL of 430 micrograms per liter (µg/L), however, manganese only exceeded the RSL in filtered samples in MW-03 and MW-06. Manganese does not appear to be related to historical site activities.
- 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.
- 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. The concentrations of metals in the groundwater samples appear to correlate to the turbidity associated with the presence of particulates such as clay. For example, in MW-04, concentrations of aluminum exceeding the RSL are likely due to naturally occurring aluminum in clay particles present in the unfiltered, turbid sample. Similar patterns can be seen in concentrations of other metals in MW-04 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.

5.3.2.3 Exposure Receptors
Based on the pre-removal conditions and potential future land use (recreational, non-residential) 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 Site parcels
- On-Site commercial workers carrying out activities associated with developing/maintaining recreational use of parcels comprising the Site
- On-Site recreational users, including adults and children

Groundwater was evaluated in the CSM and considered in the Human Health Risk Assessment (HHRA) as a hypothetical source of exposure to future residents living on-Site and in the vicinity of the Site using water from a private well. However, no action is anticipated for groundwater because the data collected from the Site demonstrate that the groundwater contaminants of potential concern (COPCs) occurred at concentrations lower than those found in the upgradient well, that the hazardous substances, pollutants, or contaminants detected in the groundwater above MCLs/RSLs are not Site-related, and/or included isolated or one-time detections that do not suggest the presence of a contaminant plume. The groundwater data evaluated were based on pre-removal conditions and were identified in the HHRA (provided in **Table 2**).

Potential ecological receptors include both terrestrial receptors, such as plants, soil invertebrates, insectivorous birds, and insectivorous mammals, and aquatic receptors such as fish, aquatic invertebrates, piscivorous birds, and piscivorous mammals.

Based on the data gathered prior to the Removal Action, the potential human and ecological risks from exposure to non-asbestos hazardous substances, pollutants, or contaminants were evaluated and are discussed further in Section 7.

6.0 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

This section discusses current and future potential land use for the Site, including groundwater and surface water.

<u>Land Use</u>

The Site is zoned as limited industrial (part of Reservoir parcel), park and recreation (Park parcel), retail and service commercial (Asbestos Pile parcel and part of Reservoir parcel), and residential (part of Reservoir parcel).

The zoning directly adjacent to the Site includes residential, commercial, and industrial. The majority of housing in Ambler is single family residential. The nearest residences are directly adjacent to the Park parcel, and there are several residential areas within one-quarter mile of the Site, including West Ambler and Mercer Hill Village.

The commercial properties adjacent to the Site include Classic Coachworks and Sons of Italy to the south of the Site. Ambler Warehouse, Ambler Manor (an adult apartment complex), and a shopping plaza are located east of the Site. The Kid's Park and basketball courts are located to the northeast and north of the Site, respectively.

Two major roads, Butler Pike and Bethlehem Pike, are within one-half mile of the Site. West Mt. Pleasant Avenue and Main Street, which carry local automotive traffic, are within 500 feet of the Site. Southeastern Pennsylvania Transportation Authority (SEPTA) railroad tracks run parallel to West Maple Street, east of the Site.

The Central Business District of Ambler is located approximately one-half mile northeast of the Site. Since 1992, the non-profit organization Ambler Main Street has been operational, with the purpose of downtown revitalization and preservation. In 2003, a Redevelopment Area Plan was developed for the Ambler Rail Corridor, which encompasses the properties within approximately two blocks of the SEPTA rail line within Ambler Borough. As a result of these actions, there has been substantial redevelopment of downtown Ambler, including new restaurants and retail stores, construction of luxury townhomes, renovation of the community movie theater, and redevelopment of the former K&M factory (Ambler Boiler House) into energy-efficient office space.

All three parcels that comprise the Site have undergone Removal Actions to cover ACM in accordance with applicable NESHAP regulations. The Park and Asbestos Pile parcels are currently unused and vacant, and the Reservoir parcel is currently used as a waterfowl preserve. The Reservoir is owned by the WWP, a local conservation organization whose offices are located approximately one mile downstream of the Site on the west bank of the Wissahickon Creek. WWP purchased the Reservoir for land preservation and waterfowl observation.

Permanent engineering controls have been implemented by the EPA Removal Program to prevent Site access. Specifically, chain-link fences extend along the West Maple Street side of the Asbestos Pile parcel and the Reservoir parcel. EPA installed a permanent fence 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. The WWP will maintain ownership of the Reservoir parcel and continue to use the property as a waterfowl preserve. The WWP installed amenities along West Maple Street to promote birding and improve the aesthetic value of the area. Future use of the Asbestos Pile parcel is unknown at this time. The Asbestos Pile parcel is currently zoned, by the Borough of Ambler, as a Retail and Service Commercial (RSC) District. The parcel is in a Redevelopment Overlay District, which permits additional uses; however, it does not appear that the Asbestos Pile parcel would meet the conditional use criteria for transit-oriented development at this time.

Groundwater

In 2015 the Ambler Water Department supplied water to approximately 5,670 customers in Ambler Borough and portions of Lower Gwynedd Township, Upper Dublin Township, Whitemarsh Township and Whitpain Township. The source water includes groundwater from nine supply wells (six in Upper Dublin Township, one in Lower Gwynedd Township, and two in Ambler Borough) and surface water from a quarry (spring) well located in Whitemarsh Township. The spring well was not in operation for several years prior to 2009. In 2015, these sources provided an average of 1.478 million gallons (MG) of water per day. The municipal well nearest to the Site is Well No. 4, which is approximately 0.2 miles east of the former asbestos disposal area, however, groundwater flows west-southwest across the Site toward Wissahickon Creek and away from the public water supply wells. Groundwater is not currently used at the Site and is not anticipated to be used in the future.

Surface Water

The major surface water body in the vicinity of the Site is Wissahickon Creek, which flows southeast at a gradient of roughly 22 feet per mile. The creek and its floodplain form the southern and western borders of the Site. Tannery Run, a perennial stream, and Rose Valley Creek flow to the southwest into Wissahickon Creek. Prophecy Creek and several unnamed easterly flowing tributaries empty into Wissahickon Creek west (and upstream) of the Site. A concrete structure, assumed to be the remnants of an old dam, is located on the banks of Wissahickon Creek approximately 350 feet upstream of Tannery Run's confluence with Wissahickon Creek.

Potential current/future beneficial use of surface water includes recreational use of Wissahickon Creek (fishing, swimming), Tannery Run (wading), and Rose Valley Creek (wading).

7.0 SUMMARY OF SITE RISKS

As part of the RI/FS, a baseline HHRA and Screening Level Ecological Risk Assessment (SLERA) were conducted to evaluate the potential risks to human health and the environment from chronic exposure to COPCs associated with the Site. The HHRA and SLERA were conducted to estimate the probability and magnitude of potential adverse effects to human and ecological receptors, respectively, associated with Site-related hazardous substances, pollutants, or contaminants in the absence of any Remedial Action.

Figures 7 through 11 show sample locations for samples collected as part of the RI and post-RI field efforts. As mentioned previously, RI and post-RI samples were primarily collected prior to or were not directly impacted by ongoing Removal Action work. Therefore, the risk assessments completed for the RI evaluated risks for the baseline, un-remediated conditions at the Site.

7.1 Summary of Human Health Risk Assessment

The HHRA estimates what risks the Site poses to potential receptors if no action were taken. It provides the basis for taking action and identifies the hazardous substances, pollutants, or contaminants and exposure pathways that need to be addressed by the Remedial Action. This section of the ROD summarizes the results of the HHRA for this Site. The HHRA is included in its entirety in Appendix A of the RI Report.

The COPCs at the Site include asbestos as well as a variety of organic and inorganic chemicals. Because the risk assessment methodology for asbestos differs from methodologies used for non-asbestos chemicals, the HHRA is presented in two sections – asbestos and chemical.

7.1.1 Asbestos Human Health Risk Assessment

Asbestos is the primary COC at the Site. The Asbestos HHRA estimates the health risks to people who may breathe asbestos in air due to Site-related releases, either now or in the future, in the absence of any Remedial Action. The Asbestos HHRA also includes a qualitative evaluation of potential risks from the ingestion of asbestos in groundwater. The Asbestos HHRA methodology followed was in accordance with the EPA guidance document identified below:

- *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, September 2008.

7.1.1.1 Data Summary

As stated in Section 5.2, the assessment of risks to humans from exposure to asbestos is most reliably achieved by the evaluation of asbestos concentrations released to the air in the breathing zone. Because predicting asbestos levels in air based on measured asbestos levels in the source material is extremely difficult, ABS was performed to measure asbestos concentrations in air at the location of a source disturbance. Several ABS investigations were conducted at the Site to evaluate potential asbestos exposures under various hypothetical and anticipated future human use scenarios. In addition to the ABS investigations, ambient air samples were collected at seven monitoring locations surrounding the Site.

Four groundwater sampling events were conducted at the Site. During each sampling event, one sample was collected from each of six monitoring wells, with the exception of MW-01. Numerous soil and sediment samples were also collected and analyzed for asbestos; however, these data could not be utilized quantitatively in the asbestos risk assessment because it is not possible to directly interpret these data with respect to exposure and risk.

Each of the data sets used in the asbestos risk assessment were evaluated with regard to data useability. The Asbestos HHRA includes Data Useability Worksheets for asbestos in air and groundwater. For the ambient air data set, the data useability assessment concluded that the ambient air data were adequate for use in the risk assessment. For groundwater, because the intended use of these data was to provide a qualitative assessment of groundwater conditions with respect to asbestos, although the data were noted to be quite limited, the data useability assessment concluded the groundwater data were adequate for this purpose.

7.1.1.2 Exposure Assessment

The exposure assessment identifies categories of potential human exposure based upon a characterization of the Site setting, selects potential receptors consistent with current and possible future land use patterns, and identifies possible exposure routes for each medium and the estimated concentrations of COPCs to which the receptor may be exposed.

Potential human health effects associated with exposure to CSM media (see **Figure 6**) were estimated quantitatively through the evaluation of potential current and future exposure pathways. These pathways were developed to reflect the potential for exposure to hazardous substances, pollutants, or contaminants at the Site. A complete exposure pathway has four components: a source, a route of transport, an exposure point, and a receptor (e.g., a resident). Hazardous substance, pollutant, or contaminant sources for asbestos are discussed in Section 5.3.2.1. The determination of exposure routes is made by careful examination of the current extent of affected media, the CSM, and predicting hazardous substance, pollutant, or contaminant migration pathways and estimating exposure point concentrations.

Three distinct on-Site exposure areas were evaluated for the Site in the Asbestos HHRA – the Park parcel, the Reservoir parcel, and the Asbestos Pile parcel. For these on-Site exposure areas, the receptor populations of interest included maintenance workers, commercial workers (Park parcel and Asbestos Pile parcel only), and recreational visitors. In addition to these on-Site areas, the risk assessment also evaluated potential exposures in off-Site exposure areas, including nearby residential properties and recreational areas (e.g., a walking trail) as well as nearby creeks (e.g., Wissahickon Creek). In all cases, the principal exposure route was inhalation of outdoor air in the breathing zone of the exposed individual, either under ambient conditions or during active disturbances of potential source materials (e.g., asbestos-contaminated soil).

Table 3 summarizes the exposure pathways that were considered for evaluation in the Asbestos HHRA. **Figure 6** summarizes the exposure scenarios that were evaluated quantitatively in the Asbestos HHRA (these exposure scenarios are also shaded in grey in **Table 3**). In brief, the following exposure pathways were evaluated quantitatively:

Park Parcel

- Current/Future Maintenance Worker – inhalation of outdoor ambient air and outdoor air during soil/debris disturbance activities
- Future Recreational Visitor – inhalation of outdoor ambient air and outdoor air during soil/debris disturbance activities
- Future Commercial Worker – inhalation of outdoor ambient air and outdoor air during soil/debris disturbance activities

Reservoir Parcel

- Current/Future Maintenance Worker – inhalation of outdoor ambient air and outdoor air during soil/debris disturbance activities
- Future Recreational Visitor – inhalation of outdoor ambient air

Asbestos Pile Parcel

- Current/Future Maintenance Worker – inhalation of outdoor ambient air and outdoor air during soil/debris disturbance activities
- Future Recreational Visitor – inhalation of outdoor ambient air and outdoor air during soil/debris disturbance activities
- Future Commercial Worker – inhalation of outdoor ambient air and outdoor air during soil/debris disturbance activities

Off-Site Residential Properties

- Current/Future Resident – inhalation of outdoor ambient air and outdoor air during yard soil disturbance activities

Off-Site Recreational Areas

- Current/Future Recreational Visitor – inhalation of outdoor ambient air and outdoor air during soil disturbance activities at parks and along creek banks

Although the exposure pathway of primary concern for humans is inhalation, some studies in animals suggest that ingestion of asbestos fibers can result in the growth of benign intestinal polyps. EPA regulates the amount of asbestos in drinking water, and the MCL for asbestos in drinking water is 7 MFL. Groundwater in the vicinity of the Site is not used for drinking water, therefore ingestion of groundwater was qualitatively evaluated as a hypothetical future residential exposure pathway.

Exposure Parameters

Not all individuals within a population will have equal exposures to asbestos. This is because different individuals will have differing values for average exposure time (ET), average exposure frequency (EF), age at first exposure (a), and exposure duration (d). To account for this variability in exposure between different individuals, EPA focuses on individuals who have central tendency exposures (CTE) and on those who have reasonable maximum exposures (RME). For the purposes of risk management decision-making, focus is placed on ensuring protection based on RME. The RME exposure parameters for active disturbances and ambient conditions used to quantitatively evaluate each exposure scenario in the asbestos risk assessment are presented in Appendix A of the RI Report.

Exposure Point Concentration

The exposure point concentration (EPC) used in the Asbestos HHRA is based on measured asbestos concentration levels in air expressed as PCME s/cc. To minimize the chances of underestimating the true amount of exposure and risk, EPA generally recommends that risk calculations be based on the 95 percent upper confidence limit (95% UCL) of the sample mean. However, because it is not possible to derive UCL for asbestos data sets, in accordance with EPA guidance, the EPC is equal to the average PCME air concentration for the exposure area and the exposure scenario of concern. When computing the mean, non-detects (samples with a structure count of zero) are evaluated as having a concentration of zero per EPA guidance. **Table 4** presents the detection frequency, range of concentrations, and average PCME air concentrations for each exposure area for each receptor population.

For ingestion of groundwater, the EPC is equal to the average water concentration, expressed as MFL for structures longer than 10 µm, across the six monitoring wells. Per EPA guidance, samples with non-detectable amounts of asbestos were evaluated at a concentration of zero.

7.1.1.3 Toxicity Assessment

The adverse effects of asbestos exposure in humans have been the subject of a number of studies and publications. Exposure to asbestos via inhalation may induce several types of both non-cancer and cancer effects, described below.

Non-cancer effects from asbestos exposure include asbestosis (formation of scar tissue in the lung parenchyma) and several types of abnormality in the pleura (the membrane surrounding the lungs) such as pleural effusions (excess fluid accumulation in the pleural space), pleural plaques (collagen deposits and calcification), and pleural thickening. However, there is no inhalation reference concentration (RfC) available in EPA's Integrated Risk Information System (IRIS) for the assessment of non-cancer risks for the type of asbestos primarily present at the Site (chrysotile).[5] Therefore, no quantitative evaluation of non-cancer risk was included in the Asbestos HHRA.

Many epidemiological studies have reported increased mortality from cancer in workers exposed to asbestos, especially from lung cancer and mesothelioma (tumor of the thin membrane that covers and protects the internal organs of the body). In addition, a number of studies suggest asbestos exposure may increase risk of gastrointestinal cancers. Based on these findings, and supported by extensive carcinogenicity data from animal studies, EPA has classified asbestos as a known human carcinogen.

The inhalation unit risk (IUR) for asbestos reported in IRIS is 0.23 (PCM s/cc)$^{-1}$. However, the IUR value reported in IRIS is suitable only for application to a continuous lifetime exposure scenario (i.e., exposure that begins at birth and continues until death). For "less-than-lifetime" exposure scenarios, the IUR term varies as a function of time since first exposure and the exposure duration. The IUR values for each exposure population evaluated in the asbestos risk assessment are presented in Appendix A of the RI Report (see HHRA Tables 3-2 and 3-3).

At present, there is no oral reference dose (RfD) or slope factor (SF) for asbestos reported in IRIS. However, EPA does regulate the amount of asbestos in drinking water. The MCL for asbestos in drinking water is 7 MFL and is based on structures longer than 10 µm.

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[3] Nearly all reported asbestos structures (more than 99 percent) in air samples collected from the Site are chrysotile. IRIS does provide an inhalation RfC for Libby amphibole asbestos, but this is not the type of asbestos present at the Site and cannot be used to quantify non-cancer exposures for the Site.

7.1.1.4 Risk Characterization

<u>Non-cancer</u>

As noted above, there is no inhalation RfC for asbestos. Therefore, no quantitative evaluation of non-cancer hazards could be performed in the asbestos risk assessment.

<u>Cancer</u>

Excess lifetime risk of cancer (lung cancer plus mesothelioma) from exposure to asbestos in air is related to the amount of asbestos inhaled and the age when exposure occurs. The basic equation is:

$$Risk = EPC \cdot TWF \cdot IUR_{a,d}$$

Where:

Risk = Lifetime excess risk of developing cancer (lung cancer or mesothelioma) as a consequence of the Site-related asbestos exposure.
EPC = Exposure point concentration of asbestos in air (PCME s/cc). The EPC is an estimate of the long-term average concentration of asbestos in inhaled air for the specific activity being assessed.
TWF = Time weighting factor. The value of the TWF term ranges from zero to one, and describes the average fraction of full time that exposure occurs in the time interval being evaluated.
IURa,d = Inhalation unit risk (PCM s/cc)$^{-1}$ for an exposure that begins at age "a" and lasts for duration "d" years

To determine the TWF, the general equation is:

$$TWF = ET/24 \cdot EF/365$$

Where:

ET = Average exposure time (hours per day [hrs/day]) on days when exposure is occurring
EF = Average exposure frequency (days per year [days/yr]) in years when exposure is occurring

HHRAs provide a basis for EPA to determine whether Remedial Action is needed to protect human health. For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

$$Risk = CDI \times SF$$

Where:

Risk = a unitless probability (e.g., $2x10^{-5}$) of an individual developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor (mg/kg-day)$^{-1}$

These risks are probabilities that usually are expressed in scientific notation (e.g., $1x10^{-6}$). An excess lifetime cancer risk of $1x10^{-6}$ indicates that an individual experiencing the RME estimate has a one in 1,000,000 chance of developing cancer as a result of Site-related exposure. This risk is referred to as an "excess lifetime cancer risk" because it would be in addition to the cancer risks associated with other causes such as smoking or exposure to too much sun. The chance of an individual developing cancer from all other causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for Site-related exposures is $1x10^{-4}$ to $1x10^{-6}$.

Current/Future Scenarios

The estimated RME cancer risks for each exposure area and each exposure receptor from exposures to asbestos in ABS air during soil disturbance activities are presented in Appendix A of the RI Report (see HHRA Tables 3-5 and 3-8). With the exception of current/future maintenance workers at the Asbestos Pile parcel and the Park parcel, risks are below $1x10^{-4}$ for all exposure areas and within EPA's acceptable risk range, including all of the off-Site exposure areas, and all current/future receptors. These results suggest that exposures to asbestos during soil disturbance activities are not likely to result in unacceptable risks at most exposure areas.

Table 5 presents the estimated risks for the current/future maintenance worker for the Asbestos Pile parcel and the Park parcel. As shown, risks are at or above $1x10^{-4}$ for both of these parcels. These results suggest that, if no cleanup actions were taken, unacceptable cancer risks from airborne asbestos exposures could occur for current/future maintenance workers that frequently engage in active soil disturbance activities within these two Site parcels. However, if maintenance workers were to engage in soil disturbance activities less frequently (e.g., 25 days/yr rather than 50 days/yr), estimated CTE cancer risks would be below $1x10^{-4}$.

In the HHRA, estimated cancer risks were also calculated for exposures to asbestos in air under ambient conditions. The estimated risks from ambient air exposures are presented in Appendix A of the RI Report (see HHRA Table 3-7). Risks were below $1x10^{-6}$ for all exposure areas and all current/future receptors, indicating that inhalation exposure to asbestos in outdoor ambient air is not of significant concern for exposed populations at/near the Site.

Potential risks from ingestion of asbestos in drinking water were evaluated qualitatively by comparing the mean groundwater concentration to the asbestos MCL. None of the groundwater samples collected at the Site exceeded the asbestos MCL of 7 MFL

7.1.1.5 Uncertainty Assessment

There are a number of uncertainties associated with the process of estimating human exposure and risk to asbestos. These uncertainties limit the confidence in the reported risks and must be taken into consideration when making risk management decisions for the Site. The principal sources of this uncertainty include:

Sampling variability and analytical measurement error

Concentrations of asbestos in air are inherently variable. Because only a limited number of measured values are available for each exposure area, values may not be representative of the true long-term average exposure concentration at the Site. Consequently, the observed sample mean concentration may be either higher or lower than the true mean.

Additionally, for each air sample collected, the uncertainty around a TEM estimate of asbestos concentration in a sample is a function of the number of structures observed during the analysis, and relative uncertainty is large when the number of structures observed is less than ten. For most personal ABS air samples included in the risk assessment, the number of PCME structures observed was less than ten; thus, risks calculated based on the mean may be either higher or lower than the true risk. In order to provide some information on the magnitude of the potential error due to analytical uncertainty, risk calculations were performed using two alternate calculation strategies. The outcome of these calculations suggested that analytical measurement error must be considered in risk management decision-making, but that uncertainties in PCME air concentrations (due to both sampling variability and analytical measurement error) are unlikely to alter risk conclusions about ambient air exposures.

Use of an indirect preparation technique

During TEM analysis of the air samples, the analytical laboratories noted that about 25 percent of the ABS air filters were significantly overloaded with particulates. As a result, these samples were analyzed using an indirect preparation method. Samples prepared indirectly have the potential to have a higher total structure count than those prepared directly. However, these samples may also have a lower PCME structure count than those prepared directly. Without Site-specific "paired" information (e.g., a filter that has been split and prepared using both techniques), it is not possible to determine the magnitude of the difference in structure counts as a consequence of the preparation method.

Lack of an approved non-cancer inhalation RfC

EPA has not yet developed national guidance for evaluating the risk of non-cancer effects from inhalation exposure of chrysotile asbestos. Studies of amphibole asbestos toxicity show that non-cancer effects are the more sensitive metric of asbestos exposure. The existence of similar effects for chrysotile exposures is unknown. Thus, it should not be presumed that cancer risk is the primary concern with regard to risk.

Human exposure patterns

Risk from asbestos is strongly dependent not only on the level of exposure but also on the time and frequency of exposure and on the age when exposure begins and ends. Exposure parameters for human receptor populations are based on EPA default values or professional judgment. However, there is uncertainty associated with these exposure parameters, so actual exposures might be either higher or lower than estimated.

Cancer exposure-response relationship

Although the IRIS method is currently the only approach approved by EPA for estimating cancer risks from inhalation of chrysotile asbestos, there are some uncertainties and potential limitations to the use of this method, as follows:

- Potency factors – The potency factors derived by EPA are based on measures of exposure expressed as PCM fibers without any distinction of mineral type (chrysotile, amphibole). To the extent that chrysotile is less potent than amphibole, use of the IRIS potency factors may tend to overestimate risks at the Site where the mineral form of concern is chrysotile. Additionally, the IRIS values represent the central tendency estimates of the potency factors, not an upperbound on the values. Thus, the true potency factors might be either higher or lower than the values selected.

- Particle size distribution – To the extent that the ratio is not constant between the concentration of PCM fibers and the concentrations of other size ranges with differing potencies between workplaces, the IRIS approach cannot account for these differences and may either underestimate or overestimate risk.
- Population types – The IRIS values are based on observations in workers, and may not address differences in susceptibility between different types of populations (e.g., children, women, infirm). In addition, the unit risks derived by EPA are based on mortality statistics from the 1970s. Thus, they may not be applicable to populations that are exposed to asbestos today. In particular, as life expectancy has increased, risks from asbestos exposure also tend to increase. Thus, risk estimates based on the IRIS method may be low.

Fiber size
While all types of asbestos have been shown to induce asbestos-related disease in humans and in animals, a number of researchers have proposed that not all fiber sizes (length and width) of asbestos are equally toxic. Recent research has focused on mathematical modeling of human exposure response data to a range of different asbestos types and has concluded that fibers less than 10 μm in length have very low carcinogenic potency compared to fibers longer than 10 μm. Most chrysotile structures observed in air samples for the Site were shorter than 10 μm.

Cumulative exposures
People who live near and/or work at the Site may be exposed to asbestos by a number of different pathways (e.g., a Site maintenance worker might also be a local resident and/or participate in recreational activities near the Site; local residents could have non-Site-related occupational exposures). Because this risk assessment evaluates only individual pathways associated with the Site, the risk estimates are likely to underestimate the total risks to people that have multiple pathways of exposure.

7.1.1.6 Asbestos Risk Assessment Conclusion
The Asbestos HHRA showed that, if no cleanup actions were taken, unacceptable cancer risks from airborne asbestos exposures could occur for maintenance workers that frequently engage in active soil disturbance activities within the Asbestos Pile parcel and the Park parcel. For all other exposure scenarios, including all commercial worker, recreational, and residential exposure scenarios and all off-Site exposure areas, it is unlikely that unacceptable cancer risks would occur due to soil disturbance activities.

Inhalation exposure to asbestos in outdoor ambient air most likely is not of concern for any exposed receptor at/near the Site. In addition, ingestion of asbestos in groundwater is also not of concern, and it is unlikely to be an important exposure pathway for the Site.

7.1.2 Chemical Human Health Risk Assessment
The Chemical HHRA focused on assessing risks from exposure to surface soil, surface water and sediment in off-Site creeks and in the Reservoir parcel, and groundwater. A summary of the Chemical HHRA is presented below.

7.1.2.1 Identification of Chemicals of Concern
Numerous types of hazardous substances, pollutants, or contaminants (including VOCs, SVOCs, PAHs, PCBs, pesticides, dioxins and furans, and inorganics) were identified in samples from various media collected on-Site. Screening of analytical data was conducted to identify COPCs to be further evaluated in the risk assessment in accordance with EPA's Region 3 Selection of Exposure Routes

and Contaminants of Concern by Risk-Based Screening. Since fish were not collected during the RI in the Wissahickon Creek, estimated fish tissue concentrations were modeled using biota-sediment accumulation factors (BSAFs) and used for screening and in the determination of EPCs. COPCs were selected using the risk-based screening levels discussed in Section 5.2. Chemicals were considered COPCs if the maximum detected concentration exceeded the respective screening level and carried through the risk assessment.

Not every COPC was detected or selected in every exposure area or in every environmental medium sampled at the Site. Consequently, potential health risks and hazards were characterized based on the selected COPCs for each relevant medium at each identified exposure area. Results of the screening process for each medium are presented in **Tables 6 through 10**. **Table 11** presents a summary of the chemical constituents compared to EPA's screening levels to determine COPCs for each medium. **Table 2** provides a summary of the Chemical HHRA, which identified several chemicals as COPCs detected in sediment and surface water from Wissahickon Creek, and groundwater that were at levels that may have adverse effects to human receptors. Although COPCs were identified in sediment and surface water from Rose Valley Creek and Tannery Run and in surface soil, subsequent risk analysis results were within or below EPA acceptable criteria; thus, no COCs were identified for these media. The focus of this ROD is on the COPCs that contribute to elevated risks found in surface water and sediment in Wissahickon Creek and Site groundwater.

These COPCs include:

- Surface Water: dibenzo(a,h)anthracene and indeno(1,2,3-cd)perylene
- Sediment: benzo(a)pyrene, aldrin, Aroclors 1254 and 1260, dieldrin, dichloro-diphenyl-trichloroethane (DDT), arsenic, and chromium
- Groundwater: carbon tetrachloride, chloroform, PCE, TCE, bis(2-ethylhexyl) phthalate, aluminum, arsenic, chromium, manganese, thallium, and vanadium

Data useability worksheets for all media evaluated in the risk assessment were completed to record and identify the impact of data quality issues as they relate to data useability. Data useability worksheets for these media are located in Appendix A of the RI Report (see HHRA Appendix A). Through these efforts, the worksheets concluded that the data were of sufficient quality to use in the Chemical HHRA.

For each data set (representing a single chemical in soil, groundwater, surface water, and sediment) with greater than five samples with four detected values, a 95% (or higher) UCL on the arithmetic mean concentration was calculated and compared to the maximum detected concentration for that chemical. The lower value of the UCL and the maximum detected value was selected as the EPC. UCLs were not calculated for data sets with fewer than five detected concentrations. In such cases, maximum concentrations were used as the EPCs. **Tables 12 through 15** are the EPC summary tables that provide the EPCs for each data set and the corresponding statistical basis for the media associated with the COPCs (surface water, sediment, fish tissue, and groundwater) for the various locations on the Site. The EPC summary tables used for all media evaluated in the risk assessment are presented Appendix A of the RI Report (see HHRA Appendix C, Tables 3.1 through 3.5).

7.1.2.2 Exposure Assessment

Potentially exposed populations were identified based on their locations relative to the Site, their activity patterns, and the presence of potential sensitive subpopulations. Potentially exposed populations include:

Current Scenarios

- On-Site maintenance workers maintaining each of the Site parcels
- Off-Site fishers, including adults and children
- Off-Site recreational users, including adults and children

Future Scenarios

- On-Site maintenance workers maintaining each of the Site parcels
- On-Site commercial workers carrying out activities associated with developing/maintaining recreational use of parcels comprising the Site
- On-Site and off-Site recreational users, including adults and children
- Off-Site fishers, including adults and children
- On-Site and off-Site residents, including adults and children

Exposure points are locations where humans could come in contact with contamination. Exposure points identified for the Site include:

- Surface soil from the Park, Reservoir, and Asbestos Pile parcels
- Surface soil located on the other side of Wissahickon Creek along the walking trail
- Surface water and sediment from the Wissahickon Creek, Tannery Run, and Rose Valley Creek
- Surface water and sediment from the basin located in the Reservoir parcel
- Tap water usage from potential wells drilled into the shallow bedrock aquifer

Potential exposure routes evaluated for current and potential future Site use include incidental ingestion of, dermal contact with, and inhalation of contaminated surface soil; incidental ingestion of and dermal contact with contaminated surface water and sediment; ingestion of fish tissue modeled from contaminated sediment in the Wissahickon Creek; and ingestion, dermal contact, and inhalation of contaminated groundwater.

The exposure scenarios identified under current and potential future conditions and complete pathways of exposure evaluated in the risk assessment are presented on **Table 16**. These exposure pathways, by exposure medium, are presented below.

Surface Soil Pathway

- Current/future maintenance workers via incidental ingestion, dermal contact, and inhalation (Park, Asbestos Pile and Reservoir parcels)
- Future adult and child recreational users via incidental ingestion and dermal contact (Park, Asbestos Pile, and Reservoir parcels; western bank of Wissahickon Creek)
- Future commercial workers via incidental ingestion and dermal contact (Park and Asbestos Pile parcels)

Surface Water Pathway

- Current/future maintenance workers via incidental ingestion and dermal contact (Reservoir parcel)
- Future adult and child recreational users via incidental ingestion and dermal contact (Reservoir parcel; Wissahickon Creek, Rose Valley Creek, and Tannery Run)

Sediment Pathway

- Current/future maintenance workers via incidental ingestion and dermal contact (Reservoir parcel)
- Future adult and child recreational users via incidental ingestion and dermal contact (Reservoir parcel; Wissahickon Creek, Rose Valley Creek, and Tannery Run)

Fish Tissue Pathway

- Current/future adult and child fishers via ingestion of fish tissue (modeled from sediment contaminant concentrations from Wissahickon Creek)

Groundwater Pathway

- Future adult and child residents via ingestion, dermal contact, and inhalation while showering

The evaluation of a future hypothetical on-Site construction worker is not warranted because the H&S plan for the construction of structures on the Park parcel will address digging in the Park and the disposal of soil during construction.

Chemical intakes were estimated for each individual pathway following EPA guidance. The intake equation requires specific exposure parameters for each exposure pathway. Exposure parameters are often assumed values, and their magnitude influences the estimates of potential exposure (and risk). Many of the exposure parameters have default values that were used in the risk assessment. These assumptions, based on estimates of body weights, media intake levels, and exposure frequencies and durations, are provided in EPA guidance. Other assumptions required consideration of location-specific information. The assumptions about exposure frequency, duration, and other exposure parameters included in the exposure assessment for RME and CTE are presented in Appendix A of the RI Report (See HHRA Appendix C, Tables 4.1 through 4.7) for appropriate media and receptors.

7.1.2.3 Toxicity Assessment

The purpose of the toxicity assessment is to identify the types of adverse health effects that each COPC potentially may cause to exposed individuals and to define the relationship between the dose of a COPC and the likelihood and magnitude of an adverse effect. The toxic effects of a chemical generally depend on its inherent toxicity, the pathway of exposure, e.g., ingestion, inhalation, skin contact, exposure frequency, and duration and the level of exposure. There is generally a positive relationship between the dose (chemical intake through an exposure pathway) and an adverse effect. Typically, as the dose increases, the type and severity of adverse response also increases. These dose-response relationships and the potential for exposure must be evaluated before the risks to receptors can be determined. Adverse effects are characterized by the EPA as cancer and non-cancer. Dose-response values (non-cancer reference doses and cancer slope factors) have been developed by EPA and other sources for many organics and inorganics.

Toxicity criteria for carcinogens are provided as cancer SFs in units of risk per milligram of chemical per kilogram of body weight per day $(mg/kg\text{-}day)^{-1}$. Cancer SFs are based on the assumption that no threshold exists for carcinogenic effects and that any dose is associated with some finite cancer risk. The chemical-specific cancer SF is multiplied by the estimated daily chemical intake to provide an upperbound estimate of the increased likelihood of cancer resulting from exposure to the chemical. This risk would be in addition to any "background" risk of developing cancer over a lifetime due to other causes. Consequently, the risk estimates in this risk assessment are referred to as incremental or excess lifetime cancer risks.

The toxicity criteria used to evaluate the potential for non-cancer health effects are generally referred to as an RfD and represents the daily exposure to a chemical that would be without adverse effects, e.g., organ damage, biochemical alterations, and/or birth defects, even if the exposure occurred continuously over a lifetime. The RfD is provided in units of milligrams per kilogram per day for comparison with chemical intake into the body. Chemical intakes that are less than the RfD are not likely to be of concern even to sensitive individuals. Chemical intakes that are greater than the RfD indicate a possibility for adverse effects.

Toxicity values used in the risk assessment calculations were obtained from a variety of toxicological sources according to a hierarchy established by EPA. **Tables 17 through 20** summarize the toxicity values used to estimate non-carcinogenic effects and cancer risks for the COPCs and their sources. Chronic RfCs were used in the risk assessment to estimate non-cancer risks in accordance with the inhalation guidance. Oral toxicity values (RfDs and SFs) were adjusted from administered dose to absorbed dose for evaluating dermal toxicity.

Detected chemicals that did not have published toxicity criteria were compared to surrogate RBC criteria that were adopted from available RBCs for substances having similar chemical structure as follows:

- Acenaphthene for acenaphthylene
- Alpha-BHC for delta-BHC
- chlordane for alpha-chlordane and gamma-chlordane
- Endosulfan for endosulfan, I, II and sulfate
- Endrin for endrin aldehyde and ketone
- Pyrene for benzo(g,h,i)perylene and phenanthrene

There are no RBCs or surrogate chemicals for carbazole and dimethyl phthalate. These chemicals were qualitatively assessed (See Section 7.1.2.4).

7.1.2.4 Risk Characterization

Risk characterization integrates the results of the exposure and toxicity assessments to derive quantitative estimates and qualitative summaries of the potential cancer risk and non-cancer hazards that may occur due to exposure to COPCs at the Site.

For carcinogens, as described in Section 7.1.1.4, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. These risks are probabilities that usually are expressed in scientific notation (e.g., $1x10^{-6}$). EPA's generally acceptable risk range for Site-related exposures is $1x10^{-4}$ to $1x10^{-6}$.

The potential for non-cancer effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with an RfD derived for a similar exposure period. An RfD represents a level that is not expected to cause any deleterious effect to an individual exposed. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ < 1.0 indicates that a receptor's dose of a single contaminant is less than the RfD and that toxic non-carcinogenic effects from that chemical are unlikely. The hazard index (HI) is generated by adding the HQs for all COPCs that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HI ≤ 1.0 indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic non-cancer effects from all contaminants are unlikely. An HI > 1.0 indicates that site-related exposures may present a risk to human health.

The HQ is calculated as follows:

Non-cancer HQ = CDI/RfD

Where: CDI = Chronic daily intake
RfD = reference dose

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term).

In accordance with EPA guidance, risk-based screening was performed to identify COPCs in surface soil, surface water, sediment, fish tissue, and groundwater, which required further evaluation during the human health risk assessment to determine which COPCs are COCs. This section presents the unacceptable potential increased risks for the COPCs that were identified in each type of media sampled.

COCs were selected from the larger list of COPCs if they met any of these criteria:

- Individual contaminant HQ > 0.1 and the total HI > 1.0 for target organ, e.g., liver
- Individual contaminant predicted increased cancer risk greater than $1.0x10^{-6}$ and total receptor risk greater than $1.0x10^{-4}$

Two types of exposure scenarios were considered in the Chemical HHRA: RME and CTE. RME incorporates input parameters into the exposure scenarios that are expected to represent a high end, but not worst case, exposure in a given medium of concern. CTE is the exposure that is expected to represent an average exposure in a given medium of concern. CTE is only evaluated when the total cancer risk exceeds $1x10^{-4}$ (considered the upper bound of EPA's acceptable risk range) or when the non-cancer HI is greater than 1.0. In general, RME risk evaluation includes 95^{th} percentile exposure input parameter estimates while CTE includes central tendency or average exposure input parameters estimates for each exposure pathway, e.g., amount of soil or water ingested, exposure frequency, and exposure duration. For both RME and CTE risk analysis, it was assumed that a person who frequents the Site may be exposed to environmental chemical concentrations that are equal to the 95% UCL.

Table 21 summarizes the total potential RME and CTE risks by Site media, the COCs, and potential current and future receptors that exceeded EPA's acceptable risk criteria. Total estimated cancer risks and non-cancer health hazards are within or below EPA target thresholds for all receptor scenarios except the following:

- Current and hypothetical future adults and children recreational users swimming in contaminated surface water and sediment from Wissahickon Creek
- Current and hypothetical future adult and child fishers consuming their catch from Wissahickon Creek
- Hypothetical future residents exposed to contaminated tap water from the shallow bedrock aquifer

<u>*Current/Future Scenarios*</u>

<u>Recreational User (Swimmer) within Wissahickon Creek</u> – The current/future RME cancer risks for adults, children (zero to six years old), and lifetime recreational users coming into contact with contaminated surface water and sediment via dermal contact and incidental ingestion ($4x10^{-4}$, $5x10^{-4}$, and $1x10^{-3}$, respectively) exceed EPA's target risk range of $1x10^{-4}$ to $1x10^{-6}$. The COPCs are dibenzo(a,h)anthracene and indeno(1,2,3-cd)perylene in surface water and benzo(a)pyrene in sediment. For the CTE scenario, cancer risks ($2x10^{-4}$, $5x10^{-4}$, and $6x10^{-4}$, respectively) show a reduction for all recreational users. The same three contaminants identified under the RME exposure also drive the CTE cancer risk. The current/future RME non-cancer HIs for adults and children are below EPA's accepted threshold of 1.0. Risk results associated with the individual COPCs for the

recreational user receptor swimming in Wissahickon Creek are presented on **Tables 22 through 24** for RME and **Tables 25 through 27** for CTE.

Fisher ingesting potentially contaminated fish caught from Wissahickon Creek – The current/future RME cancer risks for adults and children ingesting potentially contaminated fish from Wissahickon Creek ($2x10^{-3}$ and $1x10^{-3}$, respectively) exceed EPA's target risk range of $1x10^{-4}$ to $1x10^{-6}$. The COPCs are dieldrin, benzo(a)pyrene, DDT, aldrin, Aroclor 1254 and 1260, arsenic, and chromium. For the CTE scenario, cancer risks ($3x10^{-4}$ and $2x10^{-4}$, respectively) are reduced for adults and children to slightly above EPA's acceptable risk range. Dieldrin, Aroclor 1254, arsenic, and chromium drive the CTE cancer risk. The current/future RME non-cancer HIs for adults and children (8 and 30, respectively) exceed EPA's accepted threshold of 1.0. Dieldrin is the sole COPC for the adult receptor. For the child receptor, the effects to the liver (HI = 20) are attributed to dieldrin and DDT and effects to the eyes (HI = 3) are attributed to Aroclor 1254. CTE calculations show a reduction in non-cancer HIs to 3 and 4 for adults and children, respectively. Dieldrin is the sole COPC for both the adult and child residential receptor for CTE. Risk results associated with the individual COPCs for the fisher receptor are presented on **Tables 28 and 29** for RME and **Tables 30 and 31** for CTE.

Future Scenario

Residents Using Tap Water – The future RME cancer risk for adults, children, and lifetime residents coming into contact with contaminated groundwater via dermal contact, ingestion, and inhalation ($2x10^{-4}$, $1x10^{-4}$, and $3x10^{-4}$, respectively) are at the upper range or exceed EPA's target risk range of 10^{-4} to 10^{-6}. COPCs include carbon tetrachloride, chloroform, PCE, TCE, bis(2-ethylhexyl)phthalate, arsenic, and chromium. CTE calculations for adults, children, and lifetime residents ($3x10^{-5}$, $5x10^{-5}$, and $9x10^{-5}$, respectively) show a reduction in the cancer risks to within EPA's acceptable risk range. The current/future RME non-cancer HIs for adults and children (40 and 100, respectively) exceed EPA's accepted threshold of 1.0. The COPCs are PCE, aluminum, arsenic, manganese, thallium, and vanadium. For the adult receptor, effects to the central nervous system (HI = 10) are attributed to manganese and PCE and effects to hair (HI = 20) are attributed to thallium. For the child receptor, effects to the central nervous system (HI = 30) are attributed to manganese, PCE, and aluminum, effects to the kidney (HI = 2) are attributed to arsenic, and effects to hair (HI = 70) are attributed to thallium and vanadium. CTE calculations show a reduction in non-cancer HIs to 20 and 40 for adults and children, respectively. PCE, manganese, and thallium continue to drive the risk for CTE. For the adult receptor, effects to the central nervous system (HI = 5) are attributed to manganese and effects to hair (HI = 10) are attributed to thallium. For the child receptor, effects to the central nervous system (HI = 10) are attributed to manganese and PCE and effects to hair (HI = 30) are attributed to thallium. Risk results associated with the individual COPCs for the residential receptor are shown on **Tables 32 through 34** for RME and **Tables 35 and 36** for CTE.

Three out of the five organics that were identified as COPCs in the shallow aquifer were detected in an upgradient off-Site monitoring well (MW-07): carbon tetrachloride, Cis-1,2-DCE, PCE, and TCE. These three compounds have been detected in samples from this well during both sampling events in Phase 3 of the RI. In addition, while the other two organic compounds had maximum detections that were within their respective upgradient off-Site levels, the maximum detection of carbon tetrachloride (6.6 µg/L at MW-02) exceeded its upgradient off-Site range of 0.31 J to 0.48 J µg/L. Concentrations of PCE and TCE in the MW-07 were an order of magnitude higher than those found on-Site in MW-02. However, PCE was detected at relatively lower levels in overburden groundwater at the Park parcel (0.075 J to 1.4 µg/L). Carbon tetrachloride was detected in one soil sample from the Asbestos Pile parcel, and TCE was detected in several waste or soil samples from the Park parcel.

Two metals, chromium and manganese, out of the six metals that were identified as COPCs in the shallow aquifer were each detected in one of the two upgradient off-Site monitoring well samples from MW-07. These metals were both detected in groundwater at the Site at concentrations above the upgradient off-Site concentrations.

There are a number of uncertainties associated with the process of estimating human exposure and risk to chemicals identified at the Site. These uncertainties limit the confidence in the reported risks and must be taken into consideration when making risk management decisions for the Site. The principal sources of this uncertainty include:

Uncertainties Associated with Environmental Sampling and Data Analysis
The sampling conducted at the Site focused on areas of known or suspected contamination. Therefore, the uncertainty in sampling and possibility of missing a contaminated location is expected to be minimal at this Site. The uncertainty associated with the data analysis is minimal as the data have been fully validated prior to use in the risk assessment. The general assumptions used in the COPCs selection process were conservative to ensure that the COPCs were not eliminated from the quantitative risk assessment.

There is uncertainty with the EPC developed for several of the metals in groundwater since a portion of the samples used to develop the EPC may be affected by high turbidity. The elevated concentration of aluminum in MW-04 from the February 2013 sampling event (8,760 µg/L and duplicate result 9,540 µg/L) may be due to high turbidity (519 Nephelometric Turbidity Units [NTU]) in the sample as indicated by the fact that aluminum was not detected in the filtered samples collected in February. Aluminum was found at much lower concentrations in subsequent events (68.2 J µg/L in May 2013 and 33.4 µg/L in July 2013) when the turbidity was much lower (May 2013, 9.1 NTU and July 2013, 6.4 NTU). The elevated concentration of aluminum is 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 groundwater from MW-04, including the COPCs (arsenic, manganese, and vanadium). Arsenic and vanadium were only detected in the most turbid samples from MW-04 (February 2013, 519 NTU). As at MW-04, there is some correlation with higher concentrations of metals and turbidity at MW-02. The only sample from MW-02 that had a concentration of vanadium that exceeded the RSL was a sample that had the highest turbidity (November 2010, 24.2 NTU). Thus, high turbidity may contribute to an over-estimation of metal concentrations for comparing with the EPA RBCs in selecting these metals as COPCs.

Uncertainties Associated with Exposure Assessment
Some of the complete exposure pathways are assumed, and exposure factors used for quantitation of exposure are conservative and reflect worst-case or upper-bound assumptions on the exposure.
The EPCs used in the exposure assessment (i.e., 95% UCLs or the maximum detected concentrations), without consideration of environmental migration, transformation, degradation, or loss, may result in an over-estimate of long-term exposure.

The percent of a chemical absorbed through the skin is likely to be affected by many parameters.
The availability of a chemical depends on site-specific fate and transport properties of the chemical

species available for eventual absorption through skin. Chemical concentrations, specific properties of the chemical, and soil release kinetics all impact the amount of a chemical that is absorbed. These factors contribute to the uncertainty associated with these estimates and make the quantitation of certain chemicals absorbed from water difficult.

Upon further review of the surface water and sediment data, the concentrations of chemicals in the surface water are unremarkable, and the concentrations of chemicals in the creek sediment (with the exception of benzo(a)pyrene and manganese) appear to be in the expected range. This implies a great deal of uncertainty associated with the risk estimates for this receptor, which are based on highly subjective input parameters.

Fish tissue was not collected in support of the Chemical HHRA. Instead, BSAFs are used to derive hypothetical tissue burden concentrations. Use of these values in the absence of Site-specific data is not representative of Site conditions and may artificially inflate the concentrations of contaminants in fish species when compared to those found in the Wissahickon Creek adjacent to the Site. Use of these values in calculating intake doses may over-estimate risk.

Uncertainties Associated with Toxicity Assessment

Cancer SFs developed by EPA represent upper bound estimates. Any cancer risks generated in this assessment should be regarded as an upper bound estimate on the potential cancer risks rather than an accurate representation of cancer risk. The true cancer risk is likely to be less than the predicted value. Additional uncertainty is in the prediction of relative sensitivities of different species of animals and the applicability of animal data to humans.

A large degree of uncertainty is associated with the oral to dermal adjustment factors (based on chemical-specific gastrointestinal absorption) used to transform the oral RfDs and SFs based on administered doses to dermal RfDs and SFs based on absorbed doses. It is not known if the adjustment factors result in an under-estimate or over-estimate of the actual toxicity associated with dermal exposure.

Carbazole and dimethyl phthalate were detected at the Site, but they were not quantitatively evaluated in the risk assessment due to the lack of toxicity values. This lack of toxicity information may result in an under-estimate of risk. Carbazole was detected in surface soil samples from the Reservoir parcel, Asbestos Pile parcel, and the walking trail on the western bank of the Wissahickon Creek (8 out of 25 samples) at a maximum concentration of 380 µg/kg at surface soil sample APFT-SS01-A collected in the fire training area of the Asbestos Pile parcel. The compounds were also detected in sediment from all four water bodies (10 out of 26 samples) at a maximum concentration of 230 µg/kg from the one sample collected in Tannery Run. Carbazole was not detected in background soils. Carbazole was not detected in either of the two sediment background samples. Dimethyl phthalate was detected in one groundwater sample from MW-06 at a concentration of 7.8 µg/L. Dimethyl phthalate was not detected in the upgradient off-Site groundwater samples from MW-07. Dimethyl phthalate was not detected in any other media.

Manganese is a COPC in groundwater. Using a modified chronic reference dose for manganese (lower than the EPA IRIS reference dose), i.e., adjusting the EPA reference dose by subtracting the dietary contribution from the normal U.S diet and using a modifying factor of 3, in the risk calculations may over-estimate risk. Using the IRIS value would still produce non-cancer hazards above one for future residents exposed to manganese in groundwater.

Uncertainties Associated with Risk Characterization
The uncertainties identified in each component of the risk assessment ultimately contribute to uncertainty in risk characterization. The addition of risks and HIs across pathways and chemicals contributes to uncertainty based on the interaction of chemicals such as additivity, synergism, potentiation, and susceptibility of exposed receptors. The simple assumption of additivity used for this assessment may or may not be accurate and may or may not over- or under-estimate risk; however, a better alternative is not available at this time.

7.1.2.5 Chemical Risk Assessment Conclusion
The chemical risk assessment showed that for COPCs other than asbestos, if no cleanup actions were taken, unacceptable cancer risks from COPC exposure could occur for recreational users swimming in contaminated surface water and sediment from Wissahickon Creek, fishers consuming their catch from Wissahickon Creek, and residents exposed to contaminated tap water from the shallow bedrock aquifer. For all other exposure scenarios, including maintenance worker, recreational worker, recreational users walking along the trail located on the western bank of Wissahickon Creek, recreational users wading in Tannery Run or Rose Valley Creek, and recreational users visiting the Park, Reservoir, and Asbestos Pile parcels scenario, it is unlikely that unacceptable cancer risks would occur due to soil or surface water disturbance activities.

7.2 Summary of Ecological Risk Assessment
A SLERA was conducted 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.

7.2.1 Habitat Evaluation
A qualitative habitat evaluation was conducted at the Site on October 13, 2010 while some viable vegetative communities were still present. Due to the presence and noise of heavy equipment used by EPA's Removal Program on the Site at the time of the survey, most wildlife had vacated any remaining suitable habitat. As of March 2012, most vegetation had been removed and considerable re-grading had been conducted by the EPA Removal Action.

Prior to performing the assessment, the United States Fish and Wildlife Service (USFWS) and Commonwealth of Pennsylvania agencies were contacted to identify threatened and endangered species that may exist at or near the Site. If threatened and endangered species were present, then risks to individuals of those species would be evaluated, whereas risk to communities (not individuals) would be evaluated for non-threatened and non-endangered species. 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.

7.2.2 Assessment and Measurement Endpoints
The SLERA identified nine assessment endpoints that were used to evaluate risk to ecological receptors. **Table 37** presents these nine assessment endpoints and summarizes the selected ecological receptors, exposure media, exposure routes, and measurement endpoints for each assessment endpoint. Risk from exposure to Site media (on-Site soils, surface water and sediment in

off-Site creeks and the on-Site Reservoir parcel, and an on-Site seep) were evaluated via two exposure scenarios: direct contact and/or dietary exposure. In addition, inhalation exposures to asbestos in soil were also evaluated for burrowing mammals. All exposure scenarios utilized the maximum concentration of hazardous substances, pollutants, or contaminants detected in each medium.

7.2.3 Screening Level Exposure Assessment

The screening level exposure assessment divided the Site into four exposure units: Site surface soils, the creeks (Wissahickon Creek, Tannery Run, and Rose Valley Creek), the Reservoir, and one on-Site seep. Surface soil samples collected throughout the Site were evaluated as a single unit. The SLERA as a screening assessment is conservative and uses the maximum detected concentrations of hazardous substances, pollutants, or contaminants in Site media as exposure point concentrations.

7.2.4 Screening Level Effects Assessment

The screening level effects assessment used available media-specific ecological screening levels (ESLs) to screen for potential risks. Wildlife toxicity reference values (TRVs) for ingestion and inhalation were also used to compare to modeled exposures.

7.2.5 Screening Level Risk Characterization

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. **Table 38** presents the estimated risks from direct contact exposures with Site soil (Panel A), off-Site creek sediment (Panel B), Reservoir sediment (Panel C), off-Site creek surface water (Panel D), Reservoir surface water (Panel E), and Site seep water (Panel F). In this table, only those chemicals with HQs greater than 1.0 are shown. **Table 39** presents the estimated risks for wildlife from dietary exposures to chemicals in Site soil (Panel A), off-Site creek sediment (Panel B), and Reservoir sediment (Panel C). In this table, only those chemicals with no-effect HQs greater than 1.0 are shown; low-effect HQs are also presented. No-effect HQs that are below 1.0 suggest a lack of risk, while low-effect HQs that are greater than 1.0 suggest risk. When no-effect HQs are greater than 1.0 but low-effect HQs are not, there is a potential for risk. This potential increases as the dose approaches the low-effect HQ. Comparisons of the no-effect and low-effect HQs provide a better understanding of the potential range of risk. The majority of risks noted were related to direct exposure to hazardous substances, pollutants, or contaminants in Site media; risks from dietary exposure were limited.

- For those terrestrial receptors in direct contact with soil, COPCs primarily include several metals, PAHs, dioxins/furans, and to a lesser extent, pesticides.
- For those aquatic receptors in direct contact with creek and Reservoir sediment, PAHs were the most common ecological COPC. Pesticides and metals also potentially pose a risk to receptors in both of these water bodies. Aroclor-1254 potentially poses a risk to receptors in creek sediments only; carbon disulfide potentially poses a risk to receptors in Reservoir sediment.
- Asbestos and metals were the primary COPCs in surface water for both the creek and the Reservoir; however, metal concentrations in creek surface water were generally lower than the Reservoir.
- Potential risks were identified for aquatic receptors for a limited set of metals and asbestos in seep water from the Reservoir parcel.
- For wildlife exposures to Site soil, COPCs included lead, zinc, fluoranthene, DDT, dioxins/furans, and asbestos; the highest low-effect HQs for insectivorous birds and mammals were from dietary exposure to zinc and asbestos, respectively.

- For wildlife exposures to sediment, no risks were noted for piscivorous birds or mammals from dietary exposures to chemicals in Reservoir sediment, but potential risks were identified for asbestos in off-Site creek sediment.

7.3 Identification of Contaminants of Concern and Media to Address in the Remedy

As mentioned previously, waste, soil, air, sediment, surface water, and groundwater samples were collected and analyzed as part of the RI. The results of the analyses were screened against benchmark levels for these media as part of the HHRA and SLERA, and COPCs were identified in the RI. The initial list of COPCs resulting from the completion of the HHRA and SLERA, based on pre-removal conditions, are presented, respectively, in **Table 2** and **Table 40**. During the preparation of the FS, the COPCs identified in Site media were further evaluated using Site history, the range of detections, background concentrations, regulatory criteria, and the results of the baseline risk assessment to develop a list of proposed Site-related COCs and Site media to address. **Table 41** summarizes the proposed Site-related COCs, Site media to address, and cleanup levels. An evaluation of those COPCs and media eliminated from further consideration during development of remedial alternatives is presented below under the Basis for Action section of this ROD.

Media and COCs to be addressed as part of the remedy described in this ROD are:

<u>Site-related COCs in Waste/Soil</u>

- Human Health Protection: Asbestos
- Ecological Protection: Asbestos, bis(2-ethylhexyl)phthalate, dioxins and furans, chromium, nickel, and zinc

<u>Site-related COCs in Reservoir Sediment</u>

- Ecological Protection: Asbestos[6] and carbon disulfide[7]

7.4 Basis for Action

All risks for the Site were determined based on pre-removal conditions. Generally, where the baseline risk assessment indicates that a cumulative human health site risk to an individual using RME assumptions for either current or future land use exceeds the $1x10^{-4}$ (one in 10,000) individual excess lifetime cancer risk end of the risk range, action under CERCLA is warranted. Where the non-cancer risk to humans exceeds an HI of 1.0, action under CERCLA may also be warranted. In addition, action at the Site is also generally warranted when Site-related hazardous substances, pollutants, or contaminants cause adverse environmental impacts.

The outcome of the Asbestos and Chemical HHRAs (**Table 2**) indicate that for the Asbestos Pile parcel and the Park parcel, the presence of asbestos results in cancer risks that are at or above $1x10^{-4}$ (one in 10,000) for the maintenance worker. In addition, the SLERA indicated HQs above 1.0 for waste/soil Site-related COCs, bis(2-ethylhexyl)phthalate (HQ =303), dioxins/furans (HQ=249), chromium (HQ=4.8), nickel (HQ=9.1), zinc (HQ=53), and carbon disulfide (HQ=11) in Reservoir sediment (Refer to **Table 41**).

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[4] Even though asbestos was not detected at levels that potentially posed a risk in the SLERA, the Reservoir bench study (previously discussed under the CSM section and discussed in detail in the RI Addendum) demonstrated that Reservoir surface water is directly affected by Reservoir sediment. Therefore, EPA used a conservative approach and assumed that asbestos is also a potential ecological risk in Reservoir sediment.

[5] Insufficient information is available at this time to eliminate carbon disulfide as a COC.

Based on the outcome of the Asbestos and Chemical HHRAs and SLERA, EPA has determined that the Selected Remedy identified in this ROD is necessary to protect the public health, welfare, or the environment from actual or threatened releases of hazardous substances, pollutants or contaminants from this Site which may present an imminent and substantial endangerment to public health or welfare.

Remedial Actions are not proposed for the following Site media:

Reservoir Surface Water
COPCs proposed for Reservoir surface water are asbestos, aluminum, iron, and lead; however, the Reservoir was drained and refilled as part of the previously described Removal Action at the Site. Because the Reservoir surface water was sampled prior to the Reservoir being drained, the COPCs listed above are no longer present, and FS remedial alternatives were not developed for Reservoir surface water. However, the development of the remedial alternatives for waste/soil/sediment assumes that the Reservoir will need to be drained to address Reservoir sediment and subsequently refilled. Surface water will be sampled to confirm the effectiveness of the alternatives after their construction.

Seep Water
COPCs proposed for seep water are asbestos, aluminum, and iron, all of which exceeded ecological screening levels at the seep water sampling location. However, similar to the Reservoir surface water, because the seep is no longer present (Reservoir berm was reinforced during EPA Removal Action), seep water and its associated hazardous substances, pollutants, or contaminants were not included in the FS development of remedial alternatives.

Creek Surface Water/Sediment
Portions of Wissahickon Creek, Rose Valley Creek, and Tannery Run stream banks were stabilized as part of the Removal Action in order to prevent future potential contamination of creek surface water and sediment by minimizing erosion of the waste and soil. That work, as well as the Remedial Action considered in this ROD, are all assumed to satisfactorily address creek surface water and sediment. However, the development of the remedial alternatives for waste/soil/sediment assumes post-construction sampling of creek surface water and sediment to confirm the effectiveness of the alternatives.

Groundwater
The Asbestos and Chemical HHRAs evaluated the hypothetical use of Site-wide groundwater as a risk to potential future residents exposed to contaminated groundwater and identified several chemicals as COPCs. Those COPCs occurred at concentrations lower than those found in upgradient well MW-07, included isolated or one-time detections that do not suggest the presence of a contaminant plume, and/or do not appear to emanate from waste material or contaminated soil at the Site. More specifically, manganese, which occurred at high concentrations in two wells that are not hydraulically connected to each other and which do not constitute a plume, is not a Site-related COPC in contaminated soil or waste and does not appear to be related to historical Site activities. Finally, asbestos, the primary hazardous substance, pollutant, or contaminant at the Site present in the source material (waste, soil, and Reservoir sediment), was not found above its MCL in groundwater. This is consistent with what literature suggests, i.e., that asbestos does not easily move through soil into groundwater.

8.0 REMEDIAL ACTION OBJECTIVES

8.1 Remedial Action Objectives

Several RAOs have been developed to mitigate the potential current and/or future risks associated with exposure to contamination at the Site. RAOs for the Site were developed based on the following primary assumption: RAOs and proposed remedial alternatives address Site-related COCs. Stream surface water and sediment, Reservoir surface water, seep water, and groundwater are not directly addressed because either the medium has been addressed through the removal action, on-Site COPC concentrations in the medium are similar to upgradient groundwater/upstream concentrations, a groundwater plume is not present, or the medium can be sufficiently addressed through Remedial Action of the source material coupled with monitoring and ICs.

For each medium, RAOs address both human health and environmental protection. It should be noted that the RAOs listed below are based on pre-Removal Action conditions at the Site, so remedial alternatives developed during the FS were evaluated to address the unremediated condition of the Site.

8.1.1 RAOs for Waste/Soil

Protection of Human Health

- Minimize the inhalation of asbestos associated with waste/soil disturbances such that related cancer risks from airborne asbestos fibers are within or below EPA's acceptable risk range of one in 10,000 ($1x10^{-4}$) to one in 1,000,000 ($1x10^{-6}$).

Environmental Protection

- Prevent direct contact (i.e., inhalation, incidental ingestion, and dermal absorption) by ecological receptors to contaminated waste and soil containing ecological COC [asbestos, bis(2-ethyhexyl)phthalate, dioxins and furans, chromium, nickel, and zinc] concentrations exceeding the respective cleanup levels.

8.1.2 RAOs for Reservoir Sediment

Protection of Human Health

- None.

Environmental Protection

- Prevent direct exposure of ecological receptors to contaminated sediment containing concentrations of carbon disulfide exceeding the ecological screening level of 4.1 µg/kg.
- Minimize migration of asbestos from sediment to surface water to prevent surface water concentrations of asbestos exceeding the surface water screening level of 0.0001 MFL.

8.2 Cleanup Levels

In conjunction with narrative RAOs such as those established above, the NCP also calls for the ROD to establish final cleanup levels, which are acceptable exposure levels that are protective of human health and the environment. The cleanup levels are derived from applicable and/or relevant and appropriate requirements (ARARs), risk-based levels (human health and ecological), and from comparison to the background concentrations. Consideration is also given to analytical detection limits, guidance values, and other pertinent information. Where possible, cleanup levels are expressed as contaminant-specific cleanup levels. The cleanup levels established for the Site are risk-based values that fall within EPA's acceptable risk range. Cleanup levels, referred to as preliminary remediation goals in the PRAP, were developed to protect human health and the environment and are listed in **Table 42**.

8.2.1 Cleanup Levels for Waste/Soil

Soil contaminated with asbestos poses risks to human health and ecological receptors. Cleanup levels to remediate the contaminated soil to protect human health and the environment are listed in **Table 42**. The surrogate human health cleanup level for asbestos in soil is a Site-specific value calculated by the EPA Region 3 Toxicologist for asbestos in air during ABS. This Site-specific cleanup level is based on human health risks. For asbestos, successful remediation of source waste material and soil will be assessed by achievement of the Site-specific air cleanup level. Ecological screening levels for asbestos are not available. Successful remediation of source waste material and soil will be assessed by achievement of the Site-specific air cleanup levels for asbestos. The surrogate ecological cleanup level for asbestos in air is based on the no observed adverse effect level (NOAEL) TRV for inhalation.

Soil contaminated with bis(2-ethylhexyl)phthalate, dioxins and furans, chromium, nickel, and zinc poses risks to ecological receptors. Ecological cleanup levels for contaminated soil are listed in **Table 42**. Ecological cleanup levels are based on either ecological screening levels or the maximum background concentrations.

8.2.2 Cleanup Levels for Reservoir Sediment

Sediment contaminated with carbon disulfide in the Reservoir poses risks to ecological receptors. A cleanup level based on the ecological screening level for carbon disulfide is listed in **Table 42** for the remediation of contaminated sediments in the Reservoir to protect ecological receptors.

Even though asbestos was not detected in Reservoir sediment at levels that potentially posed a risk in the SLERA, the Reservoir bench study (previously discussed under the CSM section and discussed in detail in the RI Addendum) demonstrated that Reservoir surface water is directly affected by Reservoir sediment. Therefore, EPA used a conservative approach and assumed that asbestos is also a potential ecological risk in Reservoir surface water. **Table 42** provides a target medium cleanup levels for asbestos in surface water.

9.0 SUMMARY OF REMEDIAL ALTERNATIVES

This section of the ROD presents the cleanup alternatives that were considered to address known sources of contamination at the Site. Section 121(d) of CERCLA, 42 U.S.C. § 9621(d), and the NCP, 40 C.F.R. Part 300, identify several criteria that must be considered when developing and evaluating remedial alternatives. The alternative must protect human health and the environment and meet the applicable, or relevant and appropriate requirements of Federal and State environmental laws, known as ARARs. Remedial Actions that involve treatment that permanently and significantly reduces toxicity, mobility, and volume (T/M/V) of the hazardous substances, pollutants and contaminants are preferred over Remedial Actions not involving such treatment. Emphasis is also placed on treating the wastes at a site, whenever possible, and on assessing innovative technologies to clean up site-related hazardous substances, pollutants, or contaminants.

Remedial technologies and process options were identified and evaluated during the FS to develop remedial alternatives for cleanup. The potentially applicable remedial technologies and process options were combined into seven remedial alternatives, which were screened during the FS. The seven screened remedial alternatives include the following:

Alternative WSS1	No Action
Alternative WSS2	Capping

Alternative WSS3	Excavation and Off-Site Disposal
Alternative WSS4	In Situ Joule Heating
Alternative WSS5	Excavation, On-Site Ex Situ Plasma Arc Furnace, and On-Site Disposal
Alternative WSS6	Excavation, On-Site Ex Situ Thermo-Chemical Conversion Treatment (TCCT), and On-Site Disposal
Alternative WSS7	Excavation, Off-Site Ex Situ TCCT, and Off-Site Disposal

The Remedial Action alternatives were screened with respect to the criteria for effectiveness, implementability, and cost as set forth in § 300.430(e)(7) of the NCP and OSWER Directive 9355.3-01, "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA." Descriptions of the three criteria are presented in the FS. Alternatives deemed to have implementability challenges and substantially high costs were not retained for further evaluation. Alternative WSS5 was eliminated because it would require significant time to complete, due to very limited availability of the treatment unit, lack of commercial use, and limited treatment capacity. Alternative WSS7 was eliminated due to substantially high costs as a result of the significant travel distance from the Site to the only available off-Site TCCT treatment facility. Long travel distances resulted in substantially higher costs compared to all the other alternatives. Additional information on screening determination can be found in the FS.

The five remedial alternatives retained for detailed analysis include the following:

Alternative WSS1	No Action
Alternative WSS2	Capping
Alternative WSS3	Excavation and Off-Site Disposal
Alternative WSS4	In Situ Joule Heating
Alternative WSS5[8]	Excavation, On-Site Ex Situ TCCT, and On-Site Disposal

EPA's Selected Remedy is Alternative WSS2 Capping. Common elements and detailed descriptions of the five retained remedial alternatives follow.

9.1 Common Elements of Remedial Alternatives

FYRs are included as common elements across all the alternatives. FYRs would be conducted to evaluate the implementation and performance of the remedy in order to determine if the remedy is protective of human health and the environment. The specific requirements for FYRs for each alternative are included in the following descriptions of alternatives. The number of FYRs estimated for each alternative is based on anticipated confirmation sampling and ongoing O&M requirements for the alternative.

With the exception of Alternative WSS1 No Action, confirmation sampling is included across all the alternatives. Confirmation sampling would be used to assess the effectiveness of the completed Remedial Action in achieving RAOs and cleanup levels for the Site-related COCs. Confirmation sampling activities may include conducting ABS, surface soil sampling, ambient air monitoring, sediment sampling, and surface water sampling, when applicable.

[6] Alternative WSS5 was formerly WSS6 (in Section 3 of the FS) but was renumbered after alternative screening.

9.2 Remedial Alternatives

This section describes the remedial alternatives EPA considered. The remedial alternatives and their components as described below (e.g., grading, materials, depth of cover soils) are conceptual in nature, with the exception of WSS2. The estimated present worth cost for the remedial alternatives was calculated using a seven percent discount rate and an O&M period of 30 years (unless noted otherwise). **Table 43** provides estimated quantities of waste, soil, and Reservoir sediment for each of the five remedial alternatives discussed below.

Alternative WSS1: No Action

Estimated Capital Cost: $0
Estimated Annual O&M Cost: $0
Estimated Present Value Cost: $165,000 (30-year duration; includes Six FYRs)
Estimated Construction Timeframe: None

Evaluation of the No Action Alternative is required by law to provide a baseline against which impacts of the various cleanup alternatives can be compared. Its inclusion is meant to help assure that the consequences of no action are fully evaluated so that unnecessary Remedial Action is not taken where no action is appropriate. Under Alternative WSS1, no action would be implemented. To allow for comparison with the other alternatives, the baseline conditions assumed for the No Action Alternative are the conditions that were present at the Site prior to initiation of the Removal Action on the Site (i.e., RI Site conditions). The only actions that would be implemented for Alternative WSS1 include completion of FYRs, as required by the NCP, and monitoring (specifically non-intrusive visual inspections) required to support conclusions made in the FYRs. Non-intrusive visual inspections (i.e., surface inspections) performed in support of FYRs would be made on all parcels at the Site.

The estimated present value cost for Alternative WSS1 is estimated at $165,000. This estimate is for FYRs that would be required since contamination remains on-Site at levels that do not allow for an unlimited use and unrestricted exposure scenario.

Alternative WSS2: Capping

Estimated Capital Cost: $26.2 million (M)
Estimated Annual Present Value O&M Cost: $545,000 (30-year duration; includes LTM, annual cap maintenance)
Estimated Present Value Periodic Costs: $165,000 (30-year duration; includes Six FYRs)
Estimated Present Value Cost: $27.1M
Actual Costs incurred by EPA Removal Program for Completed Capping Work: $25.5M.
Estimated Present Value Cost to be incurred by the EPA Remedial Program: $900,000
Estimated Construction Timeframe: Nine years (from the start of Removal Action work initiated in 2008)
Estimated Time to Reach RAOs: One to Two years (from the start of the EPA Remedial Program's work)

Alternative WSS2 would encompass and enhance the Removal Action conducted at the Site. Alternative WSS2 would include capping of waste, contaminated soil, and Reservoir sediment with clean material along with implementation of associated H&S controls, E&S controls, grubbing and clearing, and re-grading to meet design grade to facilitate capping. Because Alternative WSS2 would be a continuation/completion of the Removal Action, the majority of the construction of

Alternative WSS2 is already completed. Components that have been completed by the EPA Removal Program or that would be completed by the EPA Remedial Program are noted below.

Alternative WSS2 includes the following major components:

EPA Removal Program
- Stream bank stabilization at Rose Valley Creek, Tannery Run, and Wissahickon Creek (complete)
- Installation of cover at Park (complete)
- Installation of cover at Asbestos Pile (complete)
- Dewatering of Reservoir with treatment of surface water prior to discharge (complete)
- Re-grading and lining of Reservoir berm interior slopes (complete)
- Installation of a cover on the Reservoir bottom (complete)
- Refilling of the Reservoir (complete)
- ABS at residences adjacent to the Site (complete)

EPA Remedial Program
- Implementation of ICs (not complete)
- Confirmation Sampling (not complete)
- LTM for Site-related COCs (not complete)
- O&M (not complete)
- FYRs (not complete)

Major components of Alterative WSS2 completed by the EPA Removal Program include:

Stream Bank Stabilization at Rose Valley Creek, Tannery Run, and Wissahickon Creek
Stream bank stabilization was completed as follows:
- Phase 1 – (December 2008 to June 2009): Addressed approximately 1,350 linear feet of Wissahickon Creek from the north end of the Park to the confluence of Rose Valley Creek and Wissahickon Creek. After 475 tons of ACM waste were removed and properly disposed in an off-Site landfill, the east bank of Wissahickon Creek was cleared and stabilized from the water's edge to the 100-year floodplain elevation using ten to 15 inches of clean fill, geotextile fabric, geo-cells, and rip-rap followed by hydroseeding.
- Phase 2 – (July 2009 to May 2010): Addressed banks of Rose Valley Creek as well as the adjacent Reservoir berm exterior and floodplain. A 104-foot stone wall was constructed on the left side of the headwall, and a six-foot reinforced concrete retaining wall was constructed on the right side of the headwall. The Park-side slope was cleared of large ACM material and covered with ten to twelve inches of clean fill followed by a two to three-inch layer of topsoil and then hydroseeded. The slope was further covered with an erosion control mat. The Reservoir-side slope was cleared of ACM material, covered with ten to twelve inches of clean fill and a layer of topsoil, and hydroseeded for erosion control. Rose Valley Creek from Chestnut Avenue to the confluence of Wissahickon Creek was cleared of ACM and re-graded at a constant slope. CCMs were installed and infilled with concrete at the four stream bend locations. Approximately 1,073 tons of ACM material were collected and properly disposed in an off-Site landfill during Phase 2.
- Phase 3 – (March 2010 to June 2010): Addressed a 600-foot section along the Reservoir berm parallel to Wissahickon Creek. Uncontaminated material excavated during Phase 2 activities was placed on the berm slope and covered with twelve to 15 inches of clean fill and six inches of topsoil. No ACM material was collected or disposed of during this phase.

- Phase 4 – (March 2010 to June 2011): Addressed a 720-foot section of Tannery Run. Approximately 290 linear feet of stream bed downstream of Maple Street was re-graded at a constant slope and stabilized with CCM along the stream bed and banks. The remaining section of Tannery Run, approximately 380 linear feet, was enclosed in an eight-foot diameter pipe that terminates at the confluence of Wissahickon Creek. During the preparation stages of the Tannery Run stream bank, the bulk (big pieces) of ACM debris and stumps was removed and collected into roll-off containers and sent to an off-Site landfill for proper disposal.
- Phase 5 – (June 2011 to September 2011): Addressed 297 linear feet of Wissahickon Creek between the old dam and the Tannery Run confluence. The first 65 linear feet of slope along the Wissahickon Creek banks was re-graded with stone and then topsoil was added, hydroseeded, and covered with an erosion control mat. The remaining Wissahickon Creek slope area was covered with geotextile fabric and overlaid with geocells, which were in-filled with stone and/or soil, and four inches of topsoil were placed on top, hydroseeded, and covered with straw mats for erosion control. Numerous pieces of ACM (e.g., pipes, shingles, and tiles) were found along the Phase 5 area. During the preparation stages of the Wissahickon Creek slope, the bulk (big pieces) of the ACM debris and stumps were removed and collected into roll-off containers and sent to an off-Site landfill for proper disposal.

<u>Installation of Cover at Park</u>
The major components of Park parcel work completed by the EPA Removal Program are:

- Clearing Activities – The storage structure north of the Oak Street entrance was demolished, the far northern portion of the Park area along Wissahickon Creek was cleared and grubbed, and asphalt from the tennis courts was disposed of off-Site.
- Excavation Activities – Excavation was undertaken to prepare for curb installation. Excavated areas were lined with geotextile fabric and pinned in place. ACM waste was relocated within the Park parcel.

  Cover Installation – Backfill was installed in the slope and curb areas. Geotextile fabric and clean fill were placed in areas at the north end of the Site. Cover elements followed the same design as the Asbestos Pile, i.e., with geotextile fabric, a minimum of two feet of clean material, and approximately six inches of topsoil to support a vegetative cover.

<u>Installation of Cover at Asbestos Pile</u>
The design for the Asbestos Pile involved cutting the slopes back to a stable three horizontal: one vertical gradient, placing a geotextile fabric, covering the area with a minimum of two feet of clean material, and approximately six inches of topsoil to support a vegetative cover. The major components of Asbestos Pile work completed by the EPA Removal Program are:

- Clearing Activities – The area was cleared of trees and ACM material, and access roads were constructed.
- Excavation activities – ACM waste was re-located to different areas on the Asbestos Pile to create the desired subgrade prior to the placement of geotextile, clean fill, and topsoil. All areas with exposed ACM were covered at the end of each day with clean material, straw mats, or geotextile fabric (if the desired subgrade had been achieved).
- Cover Installation – Waste cells were graded, covered with geotextile fabric, and then covered with lifts of compacted clean fill to a depth of two feet to match the grade of the rest of the Asbestos Pile. The cover installation was completed with an application of the topsoil layer across the Asbestos Pile, which was then hydroseeded and covered with straw mats for erosion control.

Dewatering, Re-grading, Capping, and Refilling the Reservoir

Work at the Reservoir parcel conducted by the EPA Removal Program addressed the Reservoir interior berms, bottom, and surface water and included the following major components:

- Clearing and Initial Earthwork Activities – Activities included tree removal, placement of clean fill to widen the West Maple Street side of the Reservoir to stabilize and widen the area for brush clearing operations. A platform was constructed (using clean fill) for placement of a pump and treat system needed to dewater the Reservoir.
- Dewatering – In order to allow sufficient access to the Reservoir bottom and interior of the berms, it was necessary to completely dewater the Reservoir. Approximately 31 MG of water were pumped out of the Reservoir, treated, and discharged to Wissahickon Creek, with dewatering operations completed at the beginning of August 2014. Thereafter, until the Reservoir was refilled, water was pumped intermittently to remove collected stormwater runoff. Throughout EPA's Removal Action, more than 37 MG of water was treated.
- Cover Installation – The Reservoir berms were covered with a geotextile fabric, a minimum of two feet of clean material, and a layer of topsoil to support a vegetative cover (on the berms). Certain areas of the Reservoir berm include up to ten feet of clean material. Cover installation on the Reservoir bottom was completed in October 2015 and included a geotextile fabric and a minimum of two feet of clean material.
- Refilling of Reservoir – After construction activities were completed at the Reservoir in October 2015, the Reservoir was filled by pumping water from Wissahickon Creek into the reservoir.

ABS at Residences Adjacent to the Site

ABS was conducted by the EPA Removal Program in September 2016 at ten residential yards located adjacent to the Site. The purpose of the ABS sampling was to confirm that no ACM migrated off-Site as a result of the Removal Action. The ABS simulated a raking scenario that was conducted for approximately two hours per yard. Both adult-height and child-height sampling cassette pumps were worn by sampling personnel, with high-flow and low-flow samples collected for each height. Each yard also had three perimeter samples for asbestos placed at the edge of the raking area, plus one background sample.

As with previous ABS events, all samples were analyzed in accordance with International Organization for Standardization (ISO) Method 10312. None of the samples revealed asbestos concentrations in excess of the risk-based triggers for ABS (0.04 f/cc) or ambient perimeter air (0.001 f/cc). The maximum observed concentrations for ABS and ambient perimeter air were zero (non-detect) and 0.0006 f/cc, respectively. Based on these results, no threats associated with airborne asbestos are expected under a residential exposure scenario.

Major components of Alternate WSS2 that would be completed by the EPA Remedial Program include:

Implementation of ICs

Alternative WSS2 includes the implementation of ICs to restrict future use of the Site parcels and protect the engineered remedy. Specifically, the ICs would prohibit activities at the Site that would adversely impact the remedy and compromise the protection of human health and the environment. ICs that would be implemented as part of Alternative WSS2 are listed below and shown in **Figure 12**. ICs may be implemented and enforced via a number of different mechanisms, including, but not limited to, consent decrees, deed restrictions, environmental covenants and/or administrative orders.

Site-Wide Institutional Controls:

- Activities or modifications that could disturb or otherwise adversely impact the two-foot soil cover on the capped areas would be prohibited unless prior written approval from EPA, in consultation with PADEP, is obtained authorizing the specific activity. Any proposed future use of the Site would be reviewed by EPA, in consultation with PADEP, to ensure that such activity would not adversely impact the remedy or compromise the protection of human health and the environment.
- Construction activities would be prohibited unless prior written approval from EPA, in consultation with PADEP, is obtained authorizing the specific activity. Prohibited construction activities may include, but would not be limited to, piling installation, dredging, drilling, digging, excavation, or use of heavy equipment in the capped areas.
- Any modifications to the drainage pattern on-Site would be prohibited unless EPA, in consultation with PADEP, determines that such activity would not adversely impact the remedy.
- Public access would be restricted after significant weather events until the property has been inspected for any signs of damage or erosion, especially in the 100-year floodplain.
- Alternative WSS2 would be protective for maintenance workers, recreational visitors, and commercial workers. Any other use of the parcels would require further investigations and plans, which would be reviewed and approved by EPA, in consultation with PADEP.
- Maintain vegetation at stabilized stream banks.

Parcel Specific Institutional Controls:

Asbestos Pile Parcel:

- Construction of structures that could undermine the slope stability of the Asbestos Pile parcel would be prohibited unless prior written approval from EPA, in consultation with PADEP, is obtained authorizing the specific activity.
- Trees would be prohibited on the Asbestos Pile parcel slopes.
- Trees would be prohibited on the stream banks adjacent to Tannery Run where CCM is present to stabilize the slope.

Reservoir Parcel:

- Maintain Suitable vegetation and/or water levels on the capped areas of the Reservoir parcel (berms and Reservoir floor) to ensure protection from erosion.
- Trees would be prohibited along the berm of the Reservoir adjacent to the Wissahickon Creek.

Park Parcel:

- Trees would be prohibited along the stream banks of Wissahickon Creek where geocells were utilized to stabilize the slope, and on the stream banks of Rose Valley Creek where CCM is present to stabilize the slope.

Confirmation Sampling

At the completion of the construction phase of Alternative WSS2, at least one round of confirmation sampling would be conducted in locations where asbestos was detected prior to capping to demonstrate that the cover is operating as designed. The components of confirmation sampling would include:

- ABS in previous locations of asbestos detections in the Park and Asbestos Pile parcels
- Ambient air sampling
- Surface water sampling

ABS sampling would be limited to one activity (e.g., hiking or raking) and would include collection of both soil samples and air samples in locations where asbestos was previously detected. Ambient air monitoring would be conducted in the same locations sampled during the RI.

LTM for Site-related COCs

LTM is included as a component of Alternative WSS2. LTM would be conducted annually for the first four years leading up to the first FYR, and then at least once during every FYR cycle thereafter. LTM would include ABS, ambient air, soil, sediment, and surface water sampling to confirm cleanup levels continue to be achieved and to demonstrate that the capping remedy continues to perform as designed. The specific LTM protocols would be designed based on confirmation sampling conducted after remedy completion, and may be modified based on results indicating the remedy is protective of human health and the environment. It is anticipated that the number of sample locations and analyses likely would decrease as the O&M period progresses if sample results demonstrate that the cap continues to perform as designed.

O&M

O&M would be performed throughout the life of Alternative WSS2 to ensure capping and stream bank stabilization work remains protective of human health and the environment. EPA would develop an O&M Plan for the Site which details activities for inspecting and maintaining all components of the remedy. The O&M plan would be a living document that would be updated at a minimum of every five years, coinciding with FYRs, or as needed.

Major activities associated with O&M would include:

- ***Site Inspections:*** Non-intrusive visual Site inspections would be conducted to ensure integrity of the cap, vegetation, and stabilized stream bank areas. Site inspections would be performed at least quarterly as well as concurrently with the FYR.
- ***Post-Significant Weather Event Inspection:*** Following a significant weather event, a non-intrusive visual Site inspection would be conducted to ensure the integrity of the cap, vegetation, and stabilized stream bank areas were not impacted by the weather event.
- ***Cap and Physical Remedy Maintenance:*** Damage to the cap, vegetation, and stabilized stream bank areas observed during quarterly and post-significant weather event Site inspections would be repaired to eliminate exposure of underlying contaminated waste, soil, and Reservoir sediment. Maintenance would include the repair of minor and major breaches or other damage as a result of construction or significant weather events.
- ***IC Evaluation and Updates:*** ICs would be evaluated on an annual basis at a minimum and updated as necessary (e.g., post-significant weather events) to ensure protectiveness.
- ***Reporting:*** Routine reports summarizing O&M activities would be prepared on an annual basis, at minimum, and would be submitted to EPA and PADEP for review. Routine reporting would also involve regular review and updates as necessary to the O&M plan, H&S plan, and as-built drawings when necessary.

Five-Year Reviews

Section 121(c) of CERCLA, 42 U.S.C. § 9621(c), requires FYRs for any remedy that will result in hazardous substances, pollutants, or contaminants remaining on-Site above levels that allow for unlimited use and unrestricted exposure. FYRs would be included as a component of Alternative WSS2 because contaminated waste, soil, and Reservoir sediment would remain on-Site above levels that allow for unlimited use and unrestricted exposure.

FYRs of the Site would be required to evaluate the implementation and performance of the remedy and to determine whether the remedy remains protective of human health and the environment. EPA would be responsible for performing and funding the FYRs as long as they are required. The FYR process consists of six components: (1) community involvement and notification, (2) document review, (3) data review and analysis, (4) Site inspection, (5) interviews, and (6) protectiveness determination.

The Agency for Toxic Substances and Disease Registry (ATSDR) and the Pennsylvania Department of Health have evaluated and summarized asbestos-related cancer statistics in the Ambler area, and plan to continue to review updated data in the future on a periodic basis. The University of Pennsylvania was funded under the Superfund Research Program to study asbestos exposure pathways that lead to asbestos-related diseases in Ambler. In the FYR process, EPA would consider any new relevant health information related to asbestos-related disease in the community generated by the public health agencies and/or academic partners.

Cost Estimate

The estimated total present value cost to implement the Selected Remedy is $27.1 Million. This cost estimate includes $25.5M that was incurred by the EPA Removal Program for completed capping work, $900,000 to be incurred by the EPA Remedial Program to demonstrate that the Selected Remedy is Operational and Functional (O&F), $545,000 for thirty years of O&M, and $165,000 for FYRs. The estimated total present value cost of $900,000 to be incurred by the EPA Remedial Program includes implementation of ICs, confirmation sampling, preparation of the Remedial Action Report, and performance of O&M activities until the Selected Remedy is O&F. The estimated total present value cost of $545,000 for O&M includes LTM, inspections, physical maintenance, IC evaluations, and reporting.

Alternative WSS3: Excavation and Off-Site Disposal

Estimated Capital Cost: $268.7M
Estimated Annual O&M Cost: None
Estimated Present Value Periodic Costs: $58,000 (includes periodic costs for one FYR)
Estimated Present Value Cost: $269M
Estimated Construction Timeframe: 13 years (from initial removal and stockpiling activities through confirmation sampling)
Estimated Time to Reach RAOs: 13 to 14 years

Alternative WSS3 includes the following major components:

- Removal and stockpiling of soil covers and other contaminated materials installed as part of EPA's Removal Action for reuse
- Dewatering of the Reservoir
- Excavation of contaminated material for off-Site disposal from
  - Stream Banks
  - Asbestos Pile
  - Park
  - Reservoir
- Backfilling of excavated areas with imported fill and stockpiled material and Site restoration
- Refilling of the Reservoir
- Monitoring
- Confirmation sampling
- FYR (one)

Alternative WSS3 would include excavation of waste, contaminated soil, and Reservoir sediment from the Site with off-Site disposal. Excavation would be performed primarily via mechanical methods, which include dredging of Reservoir sediment; however, hydraulic and/or pneumatic removal may also be used. Stabilization of excavated sediment may be required to improve handling characteristics of sediment for transportation off-Site. Off-Site treatment of non-asbestos hazardous substances, pollutants, or contaminants prior to disposal may be necessary to meet handling requirements for hazardous waste or meet specified levels for hazardous constituents before disposing of the waste on the land. However, it is anticipated that waste would be characterized and disposed as non-hazardous waste, and treatment would not be necessary. Additional testing would be required to verify the classification of waste prior to disposal. ACM waste and contaminated soil and Reservoir sediment must be disposed in a facility permitted to handle asbestos waste. Physical separation of large ACM debris from soil or sediment may be required in some areas. Transport of asbestos would need to follow storage and containment requirements, which may include double bagging ACM or containing ACM in leak proof containers while wet. Alternative WSS3 would require H&S controls, E&S controls, grubbing and clearing, and the staged removal and stockpiling of the clean fill/cap material for reuse.

Prior to excavating waste, clean fill from the Removal Action stabilization work at all four remediation zones would be removed and stockpiled on the Site for reuse.

Waste excavation would be completed in stages, including one foot of native soil below the greatest depth of identified historical fill or waste. At the Stream Banks, temporary dewatering during excavation and/or pumping to divert stream water in work areas may be required. Once excavation is complete, the excavated area would be backfilled to design grade and stabilized following the design implemented for stream bank stabilization work.

At the Park parcel, the Asbestos Pile parcel, and the Reservoir Berm, excavation of historical fill and waste would be completed to one foot of native soil below the greatest depth of identified historical fill or waste, or to bedrock, to ensure hazardous substances, pollutants, or contaminants have been removed. The excavated areas would be backfilled with clean fill to design grade, followed by six inches of topsoil and hydroseeding.

At the Asbestos Pile parcel and the Reservoir berm, this alternative would require temporary dewatering during excavation below the water table with on-Site water treatment (e.g., filtration and carbon) and discharge of treated water to Wissahickon Creek.

In the Reservoir bottom, sediment would be excavated in stages down to bedrock, using hydraulic or pneumatic methods to remove the soft sediment, which is assumed to average a depth of four feet. The excavated area would be backfilled with substrate to design grade. The Reservoir would be re-filled with water from Wissahickon Creek, re-vegetated, and re-populated with native species.

For the four remediation zones, significant amounts of imported fill would be required in addition to the stockpiled cover and clean fill material on the Site. Monitoring would be implemented throughout the construction duration on a semiannual basis and would include ambient air sampling and surface water sampling.

A significantly large volume of material would need to be transported from the Site for off-Site disposal, and a large volume of clean backfill material would need to be delivered to the Site. Assuming a truck capacity of 18 tons, approximately 48,900 truckloads[9] over a period of 13 years is estimated for hauling the total volume of excavated material away from the Site for off-Site disposal, and approximately 41,100 truckloads of clean fill material and topsoil would need to be transported to the Site for backfilling.

At the completion of the excavation and disposal phase of Alternative WSS3, one round of confirmation sampling would be conducted in previous locations of high asbestos levels to demonstrate that waste, soil, and Reservoir sediment have been removed from the Site and Site-related COCs have been addressed. Components of confirmation sampling would be the same as those listed under Alternative WSS2.

The estimated present value cost for Alternative WSS3 is approximately $269M. The cost of Alternative WSS3 is driven by soil excavation, soil disposal, and the addition of clean fill material. Because all contaminated soil, waste, and Reservoir sediment would be removed from the Site, only one FYR is assumed to occur during construction activities to evaluate the protectiveness of the remedy. EPA would evaluate the need for further FYRs pending the results of the first FYR. Property reuse options for the Site would be the same as those discussed under Alternative WSS2, with the exception that ICs would not be required to restrict future use of the Site parcels since contaminated soil, waste, and Reservoir sediment would no longer remain on-Site.

Alternative WSS4: In Situ Joule Heating
Estimated Capital Cost: $256.6M
Estimated Annual O&M Cost: $58,000 (includes periodic costs for one FYR)
Estimated Present Value Cost: $257M
Estimated Construction Timeframe: 15 to 20 years (from Site preparation and treatment through confirmation sampling)
Estimated Time to Reach RAOs: 15 to 20 years

Alternative WSS4 includes the following major components:

- Covers and linings previously installed as part of EPA's Removal Action would remain in place
- Dewatering of the Reservoir
- In situ joule heating of contaminated material at the
    - Stream Banks
    - Asbestos Pile
    - Park
    - Reservoir
- Placement of imported fill where necessary to meet future land use(s), grading and hydroseeding
- Refilling of Reservoir
- Confirmation sampling
- FYR (one)

[7] The conversion factors for loose dirt and compacted soil range from 1.01 to 1.35 tons per cy. With the assumption that material on-Site would be similar to sand and to account for moisture in some locations, a conservative conversion factor of 1.5 tons per cy was used to estimate the number of truckloads.

Alternative WSS4 would include in situ thermal treatment of waste, contaminated soil, and Reservoir sediment with electrodes that cause in-place contaminated materials to melt. The melted matrix is then allowed to cool in place into a solid inert, vitrified mass. Electrical power consumption is a major cost driver for Alternative WSS4. Costs for energy use and construction of a sub-station have been estimated and incorporated into the treatment unit costs for Alternative WSS4. Site conditions, specifically moisture content and the presence of groundwater, will significantly influence power efficiency and costs.

Some on-Site consolidation of materials within parcels may be required to meet geotechnical and/or grading requirements. Physical separation of large ACM debris from soil or sediment may be required in some areas. This remedy would require a treatability study and a pre-design investigation to support detailed design specifications, including performance in heterogeneous materials and the need for off-gas collection and treatment. Additional remedy components required would include H&S controls, E&S controls, and grubbing and clearing. It is assumed that the soil cap placed by the Removal Action would be left in place for the remedy. Portions of the Site may need to be covered with geosynthetic material in addition to soil to support the future land use for each parcel.

At the Stream Banks, Park, and Reservoir berm, boreholes would be advanced to one foot below the greatest depth of waste or historical fill and electrodes would be installed. At the Asbestos Pile and in the Reservoir, boreholes would be advanced to bedrock, and electrodes would be installed. For the Reservoir berm and in the Reservoir, this alternative would require temporary draining of surface water with on-Site water treatment (e.g., filtration and activated carbon) and discharge of treated water to Wissahickon Creek.

Based on the size of the Site, it is assumed that at least three in situ joule heating machines would operate simultaneously and equipment would be utilized 24 hours per day. Subsequent melts would occur until the entire Site was treated. The boreholes would subsequently be abandoned, followed by re-grading and hydroseeding at the Stream Banks, Park, Asbestos Pile, and Reservoir berm. The Reservoir would be re-filled with water, re-vegetated, and re-populated with native species. Off-gases (e.g., VOCs, SVOCs, and metals) produced during the melt would be collected in steel containment hoods (two per machine) and directed to an off-gas treatment system consisting of particulate filtration, quenching, wet scrubbing, two stages of high efficiency particulate filtration, and carbon adsorption or thermal oxidation. Depending on the results of the treatability/pilot study, additional treatment steps may be required.

A volume reduction of 30 percent is assumed for all contaminated waste, soil, and Reservoir sediment that would be treated. If the remaining treated material does not allow all parcels to meet grade requirements, additional fill would need to be obtained. The duration of the active implementation phase of Alternative WSS4 is projected to be approximately 15 to 20 years.

At the completion of the treatment phase of the alternative, one round of confirmation sampling would be conducted in previous locations of high asbestos levels to demonstrate that waste, soil, and Reservoir sediment were treated as designed and Site-related COCs have been addressed. Components of confirmation sampling would be the same as those listed under Alternative WSS2 and would include confirmation that the treatment has rendered the waste inert.
The estimated present value cost for Alternative WSS4 is approximately $257M. Fuel and equipment costs are the major drivers of capital costs. Estimated costs associated with connecting to

a gas supply source have been included in the Site preparation and mobilization cost estimate for Alternative WSS4 based on the technology vendor's estimate.

Because all contaminated soil, waste, and Reservoir sediment would be treated in situ on-Site and the contaminated material would be rendered inert, only one policy FYR is assumed to occur during construction activities to evaluate the protectiveness of the remedy. EPA would evaluate the need for further FYRs pending the results of the first FYR. Property reuse options for the Site would be the same as those discussed under Alternative WSS2, with the exception that ICs would not be required to restrict future use of the Site parcels since all contaminated soil, waste, and Reservoir sediment would be treated in situ and rendered inert. Alternative WSS4 could increase flooding potential because of the inert material left in the subsurface after treatment.

Alternative WSS5: Excavation, On-Site Ex Situ TCCT, and On-Site Disposal
Estimated Capital Cost: $266.4M
Estimated Annual O&M Cost: $58,000 (includes periodic costs for one FYR)
Estimated Present Value Cost: $267M
Estimated Construction Timeframe: Twelve years (from removal and stockpiling of material through confirmation sampling)
Estimated Time to Reach RAOs: Twelve to 13 years

Alternative WSS5 includes the following major components:

- Removal and stockpiling of soil covers previously installed as part of EPA's Removal Action for reuse
- Dewatering of the Reservoir
- Excavation of contaminated material from
  - Stream Banks
  - Asbestos Pile
  - Park
  - Reservoir
- Treatment of excavated material in an on-Site ex situ TCCT unit
- Backfilling of excavated areas with treated and stockpiled material and Site restoration
- Refilling of the Reservoir
- Monitoring
- Confirmation sampling
- FYR (one)

Alternative WSS5 would include excavation of contaminated waste, soil, and Reservoir sediment and on-Site, ex situ TCCT. Excavation would be performed primarily via mechanical methods, which would include dredging of Reservoir sediment. However, hydraulic and/or pneumatic removal may also be required. Some on-Site consolidation of materials within parcels may be required to meet geotechnical and/or grading requirements. Contaminated waste, soil, and Reservoir sediment would pass through a shredding system to reduce particle size. Subsequent to shredding, the technology vendor's (ARI Global Technologies'[ARI]) fluxing solution would be added to the shredded waste and mixed. Mixed waste would then be transferred to a feed hopper that would push waste into a rotary hearth to be processed. Processing temperatures in the furnace are maintained around 1,200 degrees Celsius (°C). While in the hearth, the fluxing solution would facilitate fast reactions in which the fibrous morphology of asbestos fibers would be destroyed. Processed product would then be transferred to a water bath for cooling. The treated product would resemble a volcanic type mineral such as olivine or wollastonite, depending on the chemistry of the feed waste. Solidified material would be collected and disposed on-Site. Off-gas treatment and wastewater processing would be required to support TCCT operation and to protect human health and the environment. Portions of the Site may be covered with geosynthetic material and soil to support the future land use for each parcel.

ARI Global Technologies is the only vendor to supply the TCCT technology, and mobile TCCT treatment units are currently very limited. Alternative WSS5 would require mobilization and assembly of a full-scale TCCT treatment system and the installation of significant necessary utility infrastructure.

Alternative WSS5 would require a treatability study to support detailed design specifications, including the ability to treat contaminated materials containing various non-asbestos organic and inorganic hazardous substances, pollutants, or contaminants. Additional remedy components required would include H&S controls, E&S controls, grubbing and clearing, and the staged removal and stockpiling of the clean fill/cap for reuse. Prior to excavating waste, clean fill from the Removal Action stabilization work at the Stream Banks, Asbestos Pile parcel, Park parcel, and the Reservoir berm would be removed and stockpiled on the Site for reuse.

Waste excavation would be completed in stages, including one foot of native soil below the greatest depth of identified historical fill or waste. At the Stream Banks, temporary dewatering during excavation and/or pumping to divert stream water in work areas may be required. Excavated materials would be treated on the Site in stages in the TCCT equipment, and the treated product would be placed back into the excavation, followed by clean fill to design grade, six inches of topsoil, and hydroseeding.

At the Park parcel, the Asbestos Pile parcel, and the Reservoir berm, excavation of historical fill and waste to one foot of native soil below the greatest depth of identified historical fill or waste, or to bedrock, would be completed to ensure hazardous substances, pollutants, or contaminants have been removed. Excavated materials would be treated on Site in stages in the TCCT equipment, and the treated product would be placed back into the excavation and followed by clean fill to design grade, six inches of topsoil, and hydroseeding.

At the Asbestos Pile parcel, and the Reservoir berm, this alternative would require temporary dewatering during excavation of the waste located below the water table with on-Site water treatment (e.g., filtration and carbon) and discharge of treated water to the Wissahickon Creek.

In the Reservoir, sediment would be excavated in stages down to bedrock, using hydraulic or pneumatic methods to remove the soft sediment, which is assumed to average a depth of four feet. This alternative would require temporary draining of surface water with on-Site water treatment (e.g., filtration and carbon) and discharge of treated water to the Wissahickon Creek. Excavated materials would be dewatered and treated on the Site in stages in the TCCT equipment. The treated product would be placed back into the excavation, followed by clean natural substrate to design grade. The Reservoir would be re-filled with water, re-vegetated, and re-populated with native species.

A volume reduction of 70 percent is assumed (range of 50 to 90 percent) for all contaminated waste, soil, and Reservoir sediment that would be treated. If the remaining treated material does not allow all parcels to meet grade requirements, significant amounts of additional off-Site fill would need to be obtained. The duration of the active implementation phase of Alternative WSS5 is estimated to be approximately twelve years. At the completion of the treatment phase of the alternative, one round of confirmation sampling would be conducted in previous locations of high asbestos levels to demonstrate that waste, soil, and Reservoir sediment have been treated as designed and Site-related COCs have been addressed. Components of confirmation sampling would be the same as those listed under WSS2 and would be used to confirm that the treatment rendered the waste inert.

Because all contaminated soil, waste, and Reservoir sediment would be treated on-Site and would leave the contaminated material inert, only one policy FYR is assumed to occur during construction activities to evaluate the protectiveness of the remedy. EPA would evaluate the need for further FYRs pending the results of the first FYR.

The estimated present value cost for Alternative WSS5 is approximately $267M. Fuel and equipment costs are the major drivers of capital costs. Estimated costs associated with hooking up to a gas supply source have been included in the Site preparation and mobilization cost estimate for Alternative WSS5 based on the technology vendor’s estimate.

Property reuse options for the Site would be the same as those discussed under Alternative WSS2, with the exception that ICs would not be required to restrict future use of the Site parcels since all contaminated soil, waste, and Reservoir sediment would be treated in situ. Alternative WSS4 could increase flooding potential since treatment would render an inert material in the subsurface.

10.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

The remedial alternatives described above were evaluated in detail to determine which alternative would best meet the requirements of CERCLA, as amended, and the NCP, and achieve RAOs identified in Section 8.0 of this ROD. EPA used the nine criteria set forth in Section 300.430(e)(9)(iii) of the NCP to evaluate the remedial alternatives. The first two criteria are threshold criteria: (1) overall protection of human health and the environment and (2) compliance with ARARs. The Selected Remedy must meet both of these threshold criteria, except when an ARAR waiver is invoked. The next five criteria are the primary balancing criteria: (3) long-term effectiveness and permanence; (4) reduction of toxicity, mobility, or volume through treatment; (5) short-term effectiveness; (6) implementability; and (7) cost. The remaining two criteria are referred to as the modifying criteria and are taken into account after public comment is received on the PRAP: (8) state and (9) community acceptance.

The following discussion summarizes the evaluation of the remedial alternatives developed for the Site against the nine evaluation criteria. **Table 44** provides a summary of the comparative analysis. This comparative analysis is based on pre-Removal Action conditions, i.e., un-remediated conditions.

10.1 Overall Protection of Human Health and the Environment *(Threshold Criterion)*

This criterion addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, ECs, and/or ICs.

All the alternatives, except for Alternative WSS1 (No Action), would provide overall protection of human health and the environment. A no action alternative (Alternative WSS1) must be evaluated in accordance with CERCLA and the NCP to serve as a basis for comparison with the other alternatives. Alternative WSS1 is not protective of human health and the environment. Alternative WSS1 would allow continued release of asbestos fibers to unimpacted media (primarily air and surface water). If disturbed, contaminated waste and soil could release asbestos fibers to air and represent a potential inhalation exposure to human receptors. Disturbances from rain events and flooding would allow asbestos fibers to migrate via surface water runoff and potentially impact both human and ecological receptors. Contaminated soil transported by surface water would be able to travel and be deposited off-Site. Reservoir sediment would continue to contaminate surface water when disturbed, exposing fish and other aquatic animals. The No Action alternative fails to meet the threshold criterion of protectiveness and will not be considered further.

Alternative WSS2 (Capping) would be protective of human health and the environment as the proposed actions would prevent further migration of asbestos to unimpacted media (primarily air and surface water) by physically containing contaminated waste, soil, and Reservoir sediment on the Site. Specifically, capping completed at the Park parcel and the Asbestos Pile parcel would eliminate continued release and migration of asbestos fibers to non-impacted media (primarily soil and air) and would eliminate inhalation exposures to asbestos by human receptors. Stream bank stabilization work for Rose Valley Creek, Wissahickon Creek, and Tannery Run would prevent erosion of any underlying contaminated waste and soil and would eliminate hazardous substance, pollutant, or contaminant migration and deposition away from the Site. Dewatering of the Reservoir and treatment of surface water would eliminate the risk posed by asbestos to human and ecological aquatic receptors. Installation of a cover on the Reservoir bottom and berms would prevent the migration of asbestos from Reservoir sediment to Reservoir surface in the refilled Reservoir. Long-term protectiveness to human health and the environment would be dependent on ICs, O&M (inspection and maintenance of covers, liners and stabilized areas), and LTM.

Similar to Alternative WSS2, Alternative WSS3 (Excavation and Off-Site Disposal) would prevent further migration of asbestos to unimpacted media (primarily air and surface water) by physically containing contaminated waste, soil, and Reservoir sediment off-Site. Excavation and off-Site disposal of contaminated waste, soil, and Reservoir sediment would eliminate exposure pathways and significantly reduce the level of risk at the Site.

Alternatives WSS4 (In Situ Joule Heating) and WSS5 (Excavation, On-Site Ex Situ TCCT, and On-Site Disposal) both utilize on-Site treatment to chemically alter asbestos fibers present in contaminated waste, soil, and Reservoir sediment thereby eliminating the release of asbestos to unimpacted media (primarily soil and air) and eliminating inhalation exposures to asbestos by human receptors.

10.2 Compliance with ARARs *(Threshold Criterion)*

This criterion addresses whether a remedy will meet all of the ARARs of other federal and State environmental statutes, regulations, and other requirements that are pertinent to the Site, and/or justifies a waiver.

Tables 45a through 45c list the ARARs identified for the Selected Remedy. ARARs for WSS3, WSS4, and WSS5 are presented in the Proposed Plan. Alternatives WSS2, WSS3, WSS4, and WSS5 would address chemical-specific and action-specific ARARs. Alternatives WSS4 and WSS5 may have difficulty meeting location-specific ARARs related to floodplain management because changes to infiltration capacities could have significant impacts on floodplain hydraulics and could influence the extent of the 100-year floodplain. If pilot studies indicate that flood zone-related ARARs could not be met for Alternatives WSS4 or WSS5, ARAR waivers, if available, would be required.

10.3 Long-Term Effectiveness and Permanence *(Primary Balancing Criterion)*

This criterion addresses expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met.

Alternative WSS2 would provide a moderate to high degree of long-term protectiveness and permanence by containing contaminated waste, soil, and Reservoir sediment in place through capping. While migration of asbestos fibers would be significantly inhibited by implementation of a protective cap, long-term effectiveness and permanence would be dependent on continued inspection, monitoring, and maintenance of the cap. Alternative WSS3 would provide a high degree of long-term protectiveness and permanence because contaminated waste, soil, and Reservoir sediment would be removed from the Site.

Alternative WSS4 would provide a moderate to high degree of long-term protectiveness and permanence due to treatment variability. Because of the in situ subsurface nature of the treatment, however, it would be difficult to confirm that all the waste has been completely converted to a solid inert, vitrified mass. Alternative WSS5 would provide a high degree of long-term protectiveness and permanence because confirmation of treatment would be more certain as all waste would be excavated prior to treatment. Both remedies would chemically convert contaminated waste, soil, and Reservoir sediment to asbestos-free material that would be extremely stable. Site-specific treatability studies would be required to confirm that the treated waste would no longer pose a risk to human health and the environment.

10.4 Reduction of T/M/V through Treatment *(Primary Balancing Criterion)*

This criterion addresses the anticipated performance of the treatment technology a remedy may employ.

Alternatives WSS2 and WSS3 would not involve treatment of contaminated waste, soil, and Reservoir sediment; thus, the statutory preference for treatment as a principal element of the Remedial Action would not be met for these two alternatives.

Alternatives WSS4 and WSS5 would use treatment to eliminate the inherent hazards posed by contaminated waste, soil, and Reservoir sediment on-Site and would reduce contaminated volumes by approximately 30 to 70 percent, respectively. Alternative WSS4 is ranked moderate to high, and Alternative WSS5 is ranked high in reduction of toxicity, mobility, or volume through treatment. The toxicity of the contaminated waste, soil, and Reservoir sediment would be reduced significantly through chemical conversion to an inert asbestos-free material. Both alternatives would destroy asbestos fibers and eliminate the risks of asbestos fiber release and mobility. Alternatives WSS4 and WSS5 both satisfy the statutory preference for treatment as a principal element of the Remedial Action.

10.5 Short-Term Effectiveness *(Primary Balancing Criterion)*

This criterion addresses the period of time needed to achieve protection and prevent any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

Alternative WSS2 would provide a moderate to high degree of short-term effectiveness. The excavation work required under Alternative WSS2 was already completed by the Removal Action. Therefore, Alternative WSS2 would require the shortest duration to complete. The total duration for the active implementation of Alternative WSS2, as implemented by the Removal Action, is approximately nine years. The EPA Removal Program is expected to demobilize from the Site in August 2017. The remaining work to be completed by the EPA Remedial Program is expected to be completed in one to two years.

Alternatives WSS3 and WSS5 each would provide low to moderate degree of short-term effectiveness. Both alternatives would require complete excavation of contaminated waste, soil, and Reservoir sediment for either off-Site disposal or on-Site treatment. Excavation for the implementation of these remedies would present potential short-term exposures to workers, and would pose the risk of allowing contaminated waste, soil, and Reservoir sediment to release asbestos fibers to unimpacted media (primarily air and surface water) and would pose inhalation exposures to asbestos by human receptors. In addition, trucks hauling contaminated waste, soil, and Reservoir sediment away from the Site and trucks hauling off-Site backfill material to the Site would greatly impact the local community through increased truck traffic and pose a safety risk to workers on the Site. In addition, Alternative WSS5 would require construction of utility infrastructure capable of supplying a reliable source of natural gas to the treatment unit. The active implementation durations for WSS3 and WSS5 are estimated to be 13 and twelve years, respectively.

Alternative WSS4 would provide a moderate degree of short-term effectiveness. Alternative WSS4 would require high energy use and construction of a substation. In addition, Alternative WSS4 would present potential short-term exposures to workers and equipment operators when installing electrodes. Temperature and electric hazards would be a concern for workers. Elevated temperatures of the subsurface during Alternative WSS4 treatment could also affect water quality of Wissahickon Creek, Rose Valley Creek, and Tannery Run and groundwater temperatures. The active implementation of Alternative WSS4 is estimated to be the longest duration at 15 to 20 years.

10.6 Implementability *(Primary Balancing Criterion)*

This criterion addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

Alternative WSS2 would provide a moderate to high degree of implementability. Implementation of ICs, confirmation sampling, LTM, and FYRs would be routine. O&M, including comprehensive inspection, monitoring, and maintenance of covers and stabilized stream banks, would be required to maintain the integrity of the caps. Inspection, maintenance, and replacement of the soil cover systems, ECs, and stream bank stabilization work could be easily implemented using available materials, equipment, and labor resources. In addition, Alternative WSS2 is implementable because regulatory approval can be obtained for capping of contaminated waste, soil, and Reservoir sediment. Finally, a significant portion of Alternative WSS2 has already been completed by the Removal Action.

Alternative WSS3 would provide a low to moderate degree of implementability. A large volume of contaminated waste, soil, and Reservoir sediment, estimated at 590,300 cy, would require excavation and transportation to an off-Site disposal facility. Approximately 48,900 truckloads are estimated to be needed to haul the total volume of excavated material away from the Site, and approximately 41,100 truckloads are estimated to be needed to transport clean fill material and topsoil to the Site for backfilling. It is estimated this work would take 13 to 14 years to complete. Logistics for working with a large quantity of heavy equipment, both on-Site and off-Site may be difficult to manage and could result in significant schedule delays. Backfill material would be required from off-Site sources, which could lead to delays in the schedule. Regulatory approval for excavation and off-Site transport of contaminated waste, soil, and Reservoir sediment should be obtainable. On-Site utility lines (if any) impacted by excavation would require coordination with the affected utility company.

Alternatives WSS4 and WSS5 would provide the lowest degree of implementability. Although both technologies have been demonstrated to treat asbestos waste on the pilot study-scale and/or small scale (i.e., ten tons per day for TCCT), no successful implementation has been demonstrated for a site of similar size to the BoRit Site. Alternative WSS4 would require a significant amount of coordination with local utility providers. Alternatives WSS4 and WSS5 would need to meet substantive requirements of permitting related to assembly and construction of the treatment unit (Alternative WSS4) or the on-Site TCCT treatment facility (Alternative WSS5). In addition, Alternatives WSS4 and WSS5 would need to meet the substantive requirements of permitting for the release of treated off-gas emissions. Because both remedies would result in a volume reduction of waste material on the Site, clean fill would be required for backfill to meet design grade requirements.

The portions of Alternative WSS2 that have already been installed by the Removal Action would need to be removed to implement Alternatives WSS3 and WSS5.

10.7 Costs *(Primary Balancing Criterion)*

This criterion includes estimated capital and operation and maintenance costs, compared as present worth costs.

When comparing costs among retained alternatives, Alternative WSS2 has the lowest present value cost ($27.1M) while Alternative WSS3 has the highest present value cost ($269M).

10.8 State/Support Agency Acceptance *(Modifying Criterion)*

This criterion indicates whether the support agency concurs with or has comments on the Selected Remedy.

PADEP has reviewed the ROD and comments from the public, and concurred with the Selected Remedy in a letter dated June 29, 2017.

10.9 Community Acceptance *(Modifying Criterion)*

This criterion summarizes the public's general responses to the alternatives described in the PRAP and RI/FS Report. Specific responses to public comments are addressed in the Responsiveness Summary included with this ROD.

EPA held an extended 90-day public comment period from December 4, 2016 through March 3, 2017 to accept public comments on the remedial alternatives and EPA's preferred alternative presented in the PRAP and other documents contained within the Administrative Record for the Site. On January 10, 2017, EPA held a public meeting to discuss the PRAP and accept comments. A transcript of this meeting is included in the Administrative Record. EPA received a number of written comments during the public comment period. A summary of significant comments received during the public comment period and EPA's responses are included in the Responsiveness Summary, which is part of the ROD, in Section III, below.

11.0 GREEN AND SUSTAINABLE REMEDIATION ASSESSMENT

Although not a selection criterion in the NCP, in September 2010, EPA released its *Superfund Green Remediation Strategy*, which sets out EPA's current plans to reduce the demand placed on the environment during implementation of a Selected Remedy and to conserve natural resources. Green remediation is the "*practice of considering all environmental effects of remedy implementation and incorporating options to minimize the environmental footprint of cleanup actions*." Green and sustainable remediation (GSR) is the "*site-specific employment of products, processes, technologies, and procedures that mitigate contaminant risk to receptors while making decisions that are cognizant of balancing community goals, economic impacts, and environmental effects*." A GSR assessment entitled Green and Sustainable Remediation Assessment of Proposed Plan Alternatives was conducted for the Site to evaluate the environmental, economic, and social impacts (i.e., "triple bottom line") associated with the four retained remedial alternatives. The complete GSR report is included in the FS located in the Administrative Record.

The GSR assessment for the Site was comprised of considering the following impacts and corresponding evaluation methodologies for each of the retained alternatives:

- Environmental impacts: Environmental metrics evaluated as part of the footprint analysis include total energy and water resources to be utilized; waste to be generated; materials to be used; and nitrogen oxides, sulfur oxides, particulate matter, and hazardous air pollutants to be emitted. Environmental impacts were quantified using EPA's Spreadsheets for Environmental Footprint Analysis (SEFA) tool.
- Socio-economic impacts: Results of the environmental footprint analysis were extended to quantify the long-term impacts attributed from the environmental metrics based on modeling.
- Community impacts: Includes the qualitative evaluation of potential detrimental and beneficial impacts to the surrounding community such as increased truck traffic or short-term risks to workers and the community.

Results from the GSR assessment suggest that Alternative WSS2 would contribute the least overall impact under the triple bottom line (i.e., economic, social, and environment). Alternative WSS3 would have the most detrimental effect on the community due to increased truck hauling and anticipated congestion. Alternatives WSS4 and WSS5 would contribute the most toward the environmental footprint while Alternative WSS4 would significantly contribute to long-term global impacts from emissions and energy use. Alternatives WSS4 and WSS5 likely would result in additional infrastructure on the property to supply an electricity source and thus could devalue the aesthetics of the parcel.

12.0 PRINCIPAL THREAT WASTE

Principal threat wastes are source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present significant risk to human health or the environment should exposure occur. The waste material at the Site is considered a principal threat waste. The waste material is the source for asbestos and acts as a source for direct exposure when these materials are encountered.

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site, wherever practicable (40 C.F.R. § 300.430(9)(1)(iii)(A)). The FS evaluated and screened a range of treatment technologies for ACM and asbestos containing soils and waste as described in Section 9, above. However, the Selected Remedy does not use treatment of principal threat wastes as a principal element of the remedy primarily because the large volume of asbestos waste/soil and complexity of the Site make treatment impracticable. The Selected Remedy will physically contain the asbestos to prevent migration from the Site and to prevent exposure to human and ecological receptors.

13.0 SELECTED REMEDY

Following review and consideration of the information in the Administrative Record, the requirements of CERCLA and the NCP, and public comments, EPA has selected Alternative WSS2 Capping as the Selected Remedy for the Site. The Selected Remedy will address contaminated waste, soil, and Reservoir sediment at the Site.

13.1 Summary of the Rationale for the Selected Remedy

EPA's Selected Remedy meets the threshold criteria of overall protection of human health and the environment and compliance with ARARs. Based on the information currently available, EPA (the lead agency) has determined that the Selected Remedy provides the best balance of advantages and disadvantages among the alternatives when evaluating them using the balancing criteria. EPA's Selected Remedy for the Site:

1. Will be protective of human health and the environment in the short-term and long-term.
2. Is the most readily implementable action alternative with available resources and requires the shortest duration to implement.
3. Provides a higher degree of short-term effectiveness than Alternatives WSS3 and WSS5, which both require the disturbance of large volumes of waste.
4. Eliminates exposure to the source materials by eliminating the exposure pathway associated with disturbance of the source materials by in-place containment (capping to contain waste, contaminated soil, and Reservoir sediment).
5. Represents the most cost-effective option by an order of magnitude.

Overall, EPA's Selected Remedy, Alternative WSS2, meets the threshold criteria and provides the best balance among the other alternatives with respect to the balancing criteria. ICs, O&M (inspection and maintenance of covers, liners, and stabilized areas), and LTM will be implemented to track effectiveness and ensure protectiveness of the remedy. EPA expects the Selected Remedy to satisfy the following statutory requirements of Section 121 of CERCLA: (1) be protective of human health and the environment, (2) comply with alternative-specific ARARs, (3) be cost-effective, and (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

The Selected Remedy does not satisfy the statutory preference for treatment as a principal element. The treatment alternatives developed for the Site have significant implementability concerns, including uncertainties regarding full scale performance of the technologies to address a site as large as the BoRit Site, the availability of an adequate energy source, and/or the limited availability of vendors. In addition, by an order of magnitude, the treatment alternatives, as well as the excavation and off-Site disposal alternative, would be substantially more expensive to complete. EPA's Selected Remedy, capping, is cost-effective and will physically contain hazardous substances, pollutants, or contaminants on-Site, and will prevent the release and migration of hazardous substances, pollutants, or contaminants off-Site.

13.2 Description of the Selected Remedy and Performance Standards

Based on the comparison of the nine criteria, EPA's Selected Remedy is Alternative WSS2 Capping.

The Selected Remedy will encompass and enhance the Removal Action conducted at the Site. The Selected Remedy will include capping of waste, contaminated soil, and Reservoir sediment with clean material, along with implementation of associated H&S controls, erosion and sediment (E&S) controls, grubbing and clearing, and re-grading to meet design grade to facilitate capping. Because the Selected Remedy will be a continuation/completion of the Removal Action, the majority of the construction of the Selected Remedy has already been completed. Components of the Selected Remedy that have been already been completed by the EPA Removal Program or that would be completed by the EPA Remedial Program are noted below.

The Selected Remedy includes the following major components:

EPA Removal Program
- Stream bank stabilization at Rose Valley Creek, Tannery Run, and Wissahickon Creek (completed)
- Installation of cover at Asbestos Pile (completed)
- Installation of cover at Park (completed)
- Dewatering of Reservoir with treatment of surface water prior to discharge (completed)
- Re-grading and lining of Reservoir berm interior slopes (completed)
- Installation of a cover on the Reservoir bottom (completed)
- Refilling of the Reservoir (completed)
- ABS at residences adjacent to the Site (completed)

EPA Remedial Program
- Implementation of ICs
- Confirmation Sampling (to be completed)
- LTM for Site-related COCs (to be completed)
- O&M (to be completed)
- FYRs (to be completed)

The Selected Remedy shall meet all ARARs as set forth in **Tables 45a through 45c**. Major components of the Selected Remedy that have already been completed by the EPA Removal Program include:

13.2.1 Stream Bank Stabilization at Rose Valley Creek, Tannery Run, and Wissahickon Creek
Stream bank stabilization was completed as follows:
- Phase 1 – (December 2008 to June 2009): Addressed approximately 1,350 linear feet of Wissahickon Creek from the north end of the Park to the confluence of Rose Valley Creek and Wissahickon Creek. After 475 tons of ACM waste were removed and properly disposed in an off-Site landfill, the east bank of Wissahickon Creek was cleared and stabilized from the water's edge to the 100-year floodplain elevation using ten to 15 inches clean fill, geotextile fabric, geo-cells, and rip-rap followed by hydroseeding.
- Phase 2 – (July 2009 to May 2010): Addressed banks of Rose Valley Creek as well as the adjacent Reservoir berm exterior and floodplain. A 104-foot stone wall was constructed on the left side of the headwall, and a six-foot reinforced concrete retaining wall was constructed on the right side of the headwall. The Park-side slope was cleared of large ACM material and covered with ten to twelve inches of clean fill followed by a two to three-inch layer of topsoil and then hydroseeded. The slope was further covered with an erosion control mat. The Reservoir-side slope was cleared of ACM material, covered with ten to twelve inches of clean fill and a layer of topsoil, and hydroseeded for erosion control. Rose Valley Creek from Chestnut Avenue to the confluence of Wissahickon Creek was cleared of ACM and re-graded at a constant slope. CCMs were installed and infilled with concrete at the four stream bend locations. Approximately 1,073 tons of ACM material were collected and properly disposed in an off-Site landfill during Phase 2.

- Phase 3 – (March 2010 to June 2010): Addressed a 600-foot section along the Reservoir berm parallel to Wissahickon Creek. Uncontaminated material excavated during Phase 2 activities was placed on the berm slope and covered with twelve to 15 inches of clean fill and six inches of topsoil. No ACM material was collected or disposed of during this phase.
- Phase 4 – (March 2010 to June 2011): Addressed a 720-foot section of Tannery Run. Approximately 290 linear feet of stream bed downstream of Maple Street was re-graded at a constant slope and stabilized with CCM along the stream bed and banks. The remaining section of Tannery Run, approximately 380 linear feet, was enclosed in an eight-foot diameter pipe that terminates at the confluence of Wissahickon Creek. During the preparation stages of the Tannery Run stream banks, the bulk (big pieces) of ACM debris and stumps was removed and collected into roll-off containers and sent to an off-Site landfill for proper disposal.
- Phase 5 – (June 2011 to September 2011): Addressed 297 linear feet of Wissahickon Creek between the old dam and the Tannery Run confluence. The first 65 linear feet of slope along the Wissahickon Creek banks was re-graded with stone and then topsoil was added, hydroseeded, and covered with an erosion control mat. The remaining Wissahickon Creek slope area was covered with geotextile fabric and overlaid with geocells, which were in-filled with stone and/or soil, and four inches of topsoil were placed on top, hydroseeded, and covered with straw mats for erosion control. Numerous pieces of ACM (e.g., pipes, shingles, and tiles) were found along the Phase 5 area. During the preparation stages of the Wissahickon Creek slope, the bulk (big pieces) of the ACM debris and stumps were removed and collected into roll-off containers and sent to an off-Site landfill for proper disposal.

13.2.2 Installation of Cover at Park

The major components of Park parcel work completed by the EPA Removal Program are:

- Clearing Activities – The storage structure north of the Oak Street entrance was demolished, the far northern portion of the Park area along Wissahickon Creek was cleared and grubbed, and asphalt from the tennis courts was disposed of off-Site.
- Excavation Activities – Excavation was undertaken to prepare for curb installation. Excavated areas were lined with geotextile fabric and pinned in place. ACM waste was relocated within the Park parcel.
- Cover Installation – Backfill was installed in the slope and curb areas. Geotextile fabric and clean fill were placed in areas at the north end of the Site. Cover elements followed the same design as the Asbestos Pile, i.e., with geotextile fabric, a minimum of two feet of clean material, and approximately six inches of topsoil to support a vegetative cover.

13.2.3 Installation of Cover at Asbestos Pile

The design for the Asbestos Pile involved cutting the slopes back to a stable three horizontal: one vertical gradient, placing a geotextile fabric, covering the area with a minimum of two feet of clean material, and approximately six inches of topsoil to support a vegetative cover. The major components of Asbestos Pile work completed by the EPA Removal Program are:

- Clearing Activities – The area was cleared of trees and ACM material, and access roads were constructed.
- Excavation activities – ACM waste was re-located to different areas on the Asbestos Pile to create the desired subgrade prior to the placement of geotextile, clean fill, and topsoil. All areas with exposed ACM were covered at the end of each day with clean material, straw mats, or geotextile fabric (if the desired subgrade had been achieved).
- Cover Installation – Waste cells were graded, covered with geotextile fabric, and then covered with lifts of compacted clean fill to a depth of two feet to match the grade of the rest

of the Asbestos Pile. The cover installation was completed with an application of the topsoil layer across the Asbestos Pile, which was then hydroseeded and covered with straw mats for erosion control.

13.2.4 Dewatering, Re-grading, Capping, and Refilling the Reservoir

Work at the Reservoir parcel conducted by the EPA Removal Program addressed the Reservoir interior berms, bottom, and surface water and included the following major components:

- Clearing and Initial Earthwork Activities – Activities included tree removal, placement of clean fill to widen the West Maple Street side of the Reservoir to stabilize and widen the area for brush clearing operations. A platform was constructed (using clean fill) for placement of a pump and treat system needed to dewater the Reservoir.
- Dewatering – In order to allow sufficient access to the Reservoir bottom and interior of the berms, it was necessary to completely dewater the Reservoir. Approximately 31 MG of water were pumped out of the Reservoir, treated, and discharged to Wissahickon Creek, with dewatering operations completed at the beginning of August 2014. Thereafter, until the Reservoir was refilled, water was pumped intermittently to remove collected stormwater runoff. Throughout EPA's Removal Action, more than 37 MG of water was treated.
- Cover Installation – The Reservoir berms were covered with a geotextile fabric, a minimum of 2 feet of clean material, and a layer of topsoil to support a vegetative cover (on the berms). Certain areas of the Reservoir berm include up to ten feet of clean material. Cover installation on the Reservoir bottom was completed in October 2015 and included a geotextile fabric and a minimum of two feet of clean material.
- Refilling of Reservoir – After construction activities were completed at the Reservoir in October 2015, the Reservoir was filled by pumping water from Wissahickon Creek into the reservoir.

13.2.5 ABS at Residences Adjacent to the Site

ABS was conducted by the EPA Removal Program in September 2016 at ten residential yards located adjacent to the Site. The purpose of the ABS sampling was to confirm that no ACM migrated off-Site as a result of the Removal Action. The ABS simulated a raking scenario that was conducted for approximately two hours per yard. Both adult-height and child-height sampling cassette pumps were worn by sampling personnel, with high-flow and low-flow samples collected for each height. For each yard, the ABS also included three perimeter samples collected at the edge of the raking area, plus one background sample.

As with previous ABS events, all samples were analyzed in accordance with International Organization for Standardization (ISO) Method 10312. None of the samples revealed asbestos concentrations in excess of the risk-based triggers for ABS (0.04 f/cc) or ambient perimeter air (0.001 f/cc). The maximum observed concentrations for ABS and ambient perimeter air were 0 (non-detect) and 0.0006 f/cc, respectively. Based on these results, no threats associated with airborne asbestos are expected under a residential exposure scenario.

Major components of the Selected Remedy that will be completed by the EPA Remedial Program include:

13.2.6 Implementation of ICs

The Selected Remedy includes the implementation of ICs to restrict future use of the Site parcels and protect the engineered remedy. Specifically, the ICs will prohibit activities at the Site that may adversely impact the remedy and compromise the protection of human health and the environment.

ICs that will be implemented as part of the Selected Remedy are listed below and in **Figure 12**. ICs may be implemented and enforced via a number of different mechanisms, including, but not limited to, consent decrees, deed restrictions, environmental covenants and/or administrative orders.

Site-Wide ICs:

1. Activities or modifications that could disturb or otherwise adversely impact the two-foot soil cover on the capped areas are prohibited unless prior written approval from EPA, in consultation with PADEP, is obtained authorizing the specific activity. Any proposed future use of the Site shall be reviewed by EPA, in consultation with PADEP, to ensure that such activity will not adversely impact the Selected Remedy or compromise the protection of human health and the environment.
2. Construction activities are prohibited unless prior written approval from EPA, in consultation with PADEP, is obtained authorizing the specific activity. Prohibited construction activities include, but are not limited to, piling installation, dredging, drilling, digging, excavation, or use of heavy equipment in the capped areas.
3. Any modifications to the drainage pattern on-Site are prohibited unless EPA, in consultation with PADEP, determines that such activity will not adversely impact the Selected Remedy.
4. Public access shall be restricted after significant weather events until the property has been inspected for any signs of damage or erosion, especially in the 100-year floodplain.
5. The Selected Remedy will be protective for maintenance workers, recreational visitors, and commercial workers. Any other use of the parcels shall require further investigations and plans, which shall be reviewed and approved by EPA, in consultation with PADEP.
6. Maintain vegetation at stabilized stream banks.

Parcel Specific ICs:

Asbestos Pile Parcel:

7. Construction of structures that may undermine the slope stability of the Asbestos Pile parcel shall be prohibited unless prior written approval from EPA, in consultation with PADEP, is obtained authorizing the specific activity.
8. Trees are prohibited on the Asbestos Pile parcel slopes.
9. Trees are prohibited on the stream banks adjacent to Tannery Run, where CCM is present to stabilize the slope.

Reservoir Parcel:

10. Maintain suitable vegetation and/or water levels on the capped areas of the Reservoir parcel (berms and Reservoir floor) to ensure protection from erosion.
11. Trees are prohibited along the berm of the Reservoir adjacent to the Wissahickon Creek.

Park Parcel:

12. Trees are prohibited along the stream banks of Wissahickon Creek (where geocells were utilized to stabilize the slope), and on the stream banks of Rose Valley Creek and Tannery Run (where CCM is present to stabilize the slope).

13.2.7 Confirmation Sampling

At the completion of the construction phase of the Selected Remedy, at least one round of confirmation sampling will be conducted in locations where asbestos was detected prior to capping to demonstrate that the cover is operating as designed. The components of confirmation sampling shall include:

- ABS in previous locations of asbestos detections in the Park and Asbestos Pile parcels
- Ambient air sampling

- Surface water sampling in Wissahickon Creek, Rose Valley Creek, Tannery Run and the Reservoir

ABS sampling will be limited to one activity (e.g., hiking or raking) and will include collection of both soil samples and air samples in locations where asbestos was previously detected. Ambient air monitoring would be conducted in the same locations sampled during the RI.

13.2.8 LTM for Site-related COCs

LTM is included as a component of the Selected Remedy. LTM will be conducted annually for the first four years leading up to the first FYR, and then at least once during every FYR cycle thereafter. LTM will include ABS, ambient air, soil, sediment, and surface water sampling to confirm cleanup levels continue to be achieved and to demonstrate that the capping remedy continues to perform as designed. The specific LTM protocols will be designed based on confirmation sampling conducted after remedy completion, and may be modified based on results indicating the Selected Remedy is protective of human health and the environment. It is anticipated that the number of sample locations and analyses likely will decrease as the O&M period progresses, if sample results demonstrate that the cap continues to perform as designed.

13.2.9 O&M

O&M will be performed throughout the life of the Selected Remedy to ensure capping and stream bank stabilization work remains protective of human health and the environment. EPA will develop an O&M Plan for the Site which details activities for inspecting and maintaining all components of the remedy. The O&M plan will be a living document that will be updated at a minimum of every five years, coinciding with FYRs, or as needed.

Major activities associated with O&M would include:

- ***Site Inspections:*** Non-intrusive visual Site inspections will be conducted to ensure integrity of the cap, vegetation, and stabilized stream bank areas. Site inspections would be performed at least quarterly as well as concurrently with the FYR.
- ***Post-Significant Weather Event Inspection:*** Following a significant weather event, a non-intrusive visual Site inspection will be conducted to ensure the integrity of the cap, vegetation, and stabilized stream bank areas were not impacted by the weather event.
- ***Cap and Physical Remedy Maintenance:*** Damage to the cap, vegetation, and stabilized stream bank areas observed during quarterly and post-significant weather event Site inspections will be repaired to eliminate exposure of underlying contaminated waste, soil, and Reservoir sediment. Maintenance will include the repair of minor and major breaches or other damage as a result of construction or significant weather events.
- ***IC Evaluation and Updates:*** ICs will be evaluated on an annual basis at a minimum and updated as necessary (e.g., post-significant weather events) to ensure protectiveness.
- ***Reporting:*** Routine reports summarizing O&M activities will be prepared on an annual basis, at minimum, and will be submitted to EPA and PADEP for review. Routine reporting will also involve regular review and updates as necessary to the O&M plan, H&S plan, and as-built drawings when necessary.

13.2.10 Five-Year Reviews

Section 121(c) of CERCLA, 42 U.S.C. § 9621(c), requires FYRs for any remedy that will result in hazardous substances, pollutants, or contaminants remaining on-Site above levels that allow for unlimited use and unrestricted exposure. FYRs will be included as a component of the Selected

Remedy because contaminated waste, soil, and Reservoir sediment will remain on-Site above levels that allow for unlimited use and unrestricted exposure.

FYRs of the Site will be required to evaluate the implementation and performance of the Selected Remedy and to determine whether the Selected Remedy remains protective of human health and the environment. EPA will be responsible for performing and funding the FYRs as long as they are required. The FYR process consists of six components: (1) community involvement and notification, (2) document review, (3) data review and analysis, (4) Site inspection, (5) interviews, and (6) protectiveness determination.

13.3 Summary of the Estimated Selected Remedy Costs

The estimated total present value cost to implement the Selected Remedy is $27.1 Million. This cost estimate includes $25.5M that was incurred by the EPA Removal Program for completed capping work, $900,000 to be incurred by the EPA Remedial Program to demonstrate that the Selected Remedy is Operational and Functional (O&F), $545,000 for thirty years of O&M, and $165,000 for FYRs. The estimated total present value cost of $900,000 to be incurred by the EPA Remedial Program includes implementation of ICs, confirmation sampling, preparation of the Remedial Action Report, and performance of O&M activities until the Selected Remedy is O&F. The estimated total present value cost of $545,000 for O&M includes LTM, inspections, physical maintenance, IC evaluations, and reporting. **Table A** below summarizes the total estimated present value cost for the Selected Remedy. **Tables 46a through 46e** provide the detailed cost estimate.

Table A: Selected Remedy Total Costs

Entire Site Present Value of Total Estimated Costs	**$27,100,000**
Estimated Total Capital Costs incurred by the EPA Removal Program for Implementing Capping Remedy	$25,500,000
Estimated Present Value Costs to be Incurred by the EPA Remedial Program (includes Confirmation Sampling, Remedial Action Report, IC Implementation, and O&M activities until O&F)	$900,000
Estimated Present Value Costs for O&M, LTM, (30 years)	$545,000

The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the Remedial Action. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project costs. Changes in the cost elements may occur as a result of new information and data during confirmation sampling, LTM, and O&M activities. Minor changes may be documented in the form of a memorandum in the Administrative Record. Changes that are significant, but not fundamental, may be documented in an Explanation of Significant Differences (ESD). Any fundamental changes would be documented in a ROD Amendment.

13.4 Expected Outcomes of the Selected Remedy

The Selected Remedy will eliminate continued release and migration of Site COCs to unimpacted media (primarily soil/sediment and air) and would eliminate COC exposures to human and ecological receptors. ICs will provide assurance that the integrity of the Selected Remedy will be protected.

The Selected Remedy will allow the Site to be used for recreational, non-residential purposes. EPA expects the remaining components of the Remedial Action will take approximately two years to complete. After the Remedial Action is completed, the Site will be suitable for its intended future uses, to the extent that they have been identified. Of the three parcels on-Site, beneficial reuses are already planned by the owners of two of the three parcels. The Reservoir Parcel will remain a waterfowl preserve owned by the WWP. During capping of the Reservoir, the EPA Removal Action added habitat features (small island for bird nesting and rock formations) to improve ecological habitat. The Park parcel owned by Whitpain Township is expected to become a community park.

Successful remediation of the Site will be assessed by achievement of the Site-specific cleanup levels presented in **Table 42**. The cleanup levels established for the Site are risk-based values that fall within EPA's acceptable risk range.

14.0 STATUTORY DETERMINATIONS

Under CERCLA Section 121 and the NCP, EPA must select a remedy that is protective of human health and the environment, complies with or appropriately waives ARARs, is cost effective, and utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that include treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element. The following sections discuss how the Selected Remedy meets these statutory requirements.

14.1 Protection of Human Health and the Environment

The Selected Remedy will protect human health and the environment through in-place containment (capping to contain waste, contaminated soil, and Reservoir sediment). Capping will eliminate continued release and migration of Site COCs to unimpacted media (primarily soil/sediment and air) and would eliminate COC exposures to human and ecological receptors. Implementation of ICs, O&M, LTM, and FYRs would ensure long-term protectiveness of the Selected Remedy.

14.2 Compliance with Applicable or Relevant and Appropriate Requirements

The Selected Remedy complies with all ARARs. ARARs are discussed below and presented in more detail in **Tables 45a through 45c**.

The Selected Remedy physically addresses erosion and prevents the release of asbestos fibers to unimpacted media (primarily air and surface water). Chemical-specific ARARs for surface water (25 PA Code § 250.309) will be achieved by containing contaminated waste, soil, and Reservoir sediment in place through capping and stream bank stabilization work. The Selected Remedy also will meet the asbestos and visible emission requirements of the applicable NESHAP regulations (40 C.F.R. § 61.151).

In addition, location-specific ARARs related to construction in floodplains and ARARs related to protection of wildlife and migratory birds will be achieved through appropriate design and implementation of the Selected Remedy elements. The Selected Remedy will also meet Clean Water Act requirements to control the discharge of fill material into creeks adjacent to the Site (40 C.F.R. § 230.10).

Action-specific ARARs applicable to this Selected Remedy include cover requirements specified under the applicable NESHAP regulations (40 C.F.R. § 61.151) as relevant and appropriate requirements for terrestrial portions of the Site. Implementation of the Selected Remedy will be designed to adhere to applicable NESHAP cover requirements and E&S control requirements.

14.3 Cost-Effectiveness

The Selected Remedy is cost-effective in that it eliminates the risk posed by Site COCs and meets all requirements of CERCLA and the NCP at a cost that is significantly lower than the other alternatives that were evaluated. Further, the Selected Remedy is readily implementable with available resources and requires the shortest duration to implement due to the fact that the majority of the remedy has already been implemented by EPA's Removal Program. In addition, the Selected Remedy provides a high degree of short-term effectiveness since the disturbance of large volumes of waste would not be required.

14.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Possible

EPA has determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the Selected Remedy provides the best balance of advantages and disadvantages in terms of long-term effectiveness and permanence, reduction in T/M/V through treatment, short-term effectiveness, implementability, and cost while also considering the statutory preference for treatment as a principal element and state and community acceptance.

14.5 Preference for Treatment as a Principal Element

The Selected Remedy does not satisfy the statutory preference for treatment as a principal element. However, the treatment alternatives developed for the Site have significant implementability concerns, including uncertainties regarding full scale performance of the technologies to address a site as large as the BoRit Site, the availability of an adequate energy source, and/or the limited availability of vendors. In addition, the treatment alternatives, as well as the excavation and off-Site disposal alternative, would be substantially more expensive to complete, by an order of magnitude. EPA's Selected Remedy is cost-effective and will physically contain hazardous substances, pollutants, or contaminants on-Site, and will prevent the release and migration of hazardous substances, pollutants, or contaminants off-Site.

14.6 Five-Year Review Requirements

Because the Selected Remedy will result in hazardous substances, pollutants or contaminants remaining on-Site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted no less often than every five years to ensure that the Selected Remedy is, or will be, protective of human health and the environment pursuant to Section 121(c) of CERCLA and Section 300.430(f)(5)(iii)(C) of the NCP. The first FYR will be conducted five years after the initiation of Remedial Action at the Site and will continue every five years thereafter.

15.0 DOCUMENTATION OF SIGNIFICANT CHANGES

There have been no significant or fundamental changes to the proposed remedy as a result of public comments.

III. RESPONSIVENESS SUMMARY

BORIT ASBESTOS SUPERFUND SITE

BOROUGH OF AMBLER, WHITPAIN TOWNSHIP AND
UPPER DUBLIN TOWNSHIP,
MONTGOMERY COUNTY, PENNSYLVANIA

1.0 INTRODUCTION

This Responsiveness Summary provides a summary of significant public comments and concerns regarding the Proposed Plan for the BoRit Site and provides EPA's responses to those comments. After reviewing and considering all public comments received during the public comment period, EPA's Selected Remedy is Alternative WSS2 Capping to address contaminated waste, soil, and Reservoir sediment at the Site.

The Proposed Plan and supporting documentation were made available to the public in the Administrative Record at https://semspub.epa.gov/src/collection/03/AR64805. EPA provided notice to the public that the Administrative Record could also be viewed at the following locations:

Wissahickon Valley Public Library
Ambler Branch
209 Race Street
Ambler, PA 19002
(215) 646-1072

U.S. EPA Region 3
Public Reading Room
1650 Arch Street - 6th Floor
Philadelphia, PA 19103-2029
(215) 814-3157

The notice of the availability of these documents and a summary of the preferred remedial alternative were published in the Proposed Plan released to the public on December 4, 2016. From December 4, 2016 to March 3, 2017, EPA held an extended 90-day public comment period to accept public comments on the remedial alternatives presented in the Feasibility Study (FS), the Proposed Plan, and other documents contained within the Administrative Record. On January 10, 2017, EPA held a public meeting to discuss the Proposed Plan and accept oral comments. A transcript of this meeting, including EPA's responses to questions asked at the meeting, is included in the Administrative Record.

This Responsiveness Summary provides a comprehensive summary of significant questions, comments, concerns, and responses by summarizing oral and written comments received during the public comment period and EPA's responses. Section 2 includes a summary of recurring or frequently repeated significant comments raised during the comment period. Significant recurring comments included in Section 2 are grouped into the following categories:

- Acceptable Risk Range
- Enforcement and Management of Institutional Controls (ICs)
- 500-Year Storm
- Preference for Treatment or Removal Alternatives
- Future Use Plans for the Asbestos Pile Parcel
- Human Health Monitoring

- Operation and Maintenance (O&M) Frequency and Components
- Lead Agency
- Identification of Potentially Responsible Parties (PRPs)
- Water Quality (Sediment and Nutrient Reduction)
- Five-Year Review (FYR) Components
- Signage
- Surface Water and Groundwater Monitoring

Section 3 includes responses to other significant miscellaneous questions or comments not included in Section 2.

2.0 SIGNIFICANT RECURRING COMMENTS

Significant issues or comments that were frequently repeated during the public comment period are summarized below along with EPA's responses.

2.1 Acceptable Risk Range

Issue: *Multiple commenters requested that EPA strengthen the acceptable risk range so that cancer risks do not exceed a target risk of $1x10^{-6}$.*

EPA Response: EPA's Office of Solid Waste and Emergency Response (OSWER) Directive #9355.0-30, "*Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*" (EPA 1991) provides guidance on the interpretation of estimated cancer risks in the human health risk assessment (HHRA). EPA considers cumulative excess cancer risks less than $1x10^{-6}$ to be so small as to be negligible. When cancer risks are greater than $1x10^{-4}$, some type of Remedial Action is generally warranted. Cancer risks between $1x10^{-6}$ and $1x10^{-4}$ are generally considered to be protective, and generally do not warrant Remedial Action. For the purposes of risk management decision-making, cancer risk estimates are based on reasonable maximum exposure (RME), which ensures that decisions are adequately protective of all individuals within the exposure population.

In accordance with the OSWER Directive #9355.0-30, "waste management strategies achieving reductions in Site risks anywhere within the [cancer] risk range may be deemed acceptable by the EPA risk manager." When deriving preliminary cleanup levels, although $1x10^{-6}$ is generally used as a screening level, the results of the HHRA are used to refine preliminary cleanup levels into final cleanup levels. Final cleanup levels may also be modified taking into consideration the nine criteria used for remedy selection. Review of the HHRA shows estimated RME cancer risks were well below $1x10^{-6}$ for ambient air exposures, and estimated RME cancer risks were less than $1x10^{-5}$ for most off-Site exposures and the Reservoir parcel. RME cancer risks only approach $1x10^{-4}$ for on-Site worker exposure scenarios. The selection of a target risk of $1x10^{-4}$ is consistent with EPA guidance and considered to be adequately protective.

2.2 Enforcement and Management of ICs

Issue: *Several commenters noted that the success of the capping remedy is dependent on effective enforcement and management of ICs and deed restrictions. To ensure this happens, all responsibilities and enforcement actions should be clearly articulated in the Record of Decision*

(ROD). Specific comments requested restrictions on potable use of surface water or groundwater, woody vegetation, construction, excavation, and well drilling.

EPA Response: In the ROD, EPA acknowledges that effective implementation and enforcement of ICs are critical components of the Selected Remedy. Section 13.2.6 of the ROD describes the Site-wide and parcel-specific ICs that are required for the Site, and also provides examples of the instruments that may be used to enforce these ICs. Specific plans to implement the ICs selected in the ROD will be identified in the Remedial Design.

2.3 500-Year Storm

Issue: Multiple commenters requested that EPA design remediation efforts to be protective of the 500-year storm. Due to the history of flooding at the Site, there may be a need to further protect various cap and slope stabilization elements associated with the Site remediation in all areas that could be exposed to a 500-year flood or a 0.2 percent probability storm.

EPA Response: The selected capping remedy has been designed to comply with current regulations regarding design and construction within a floodplain. Section 264a.1 of the Pennsylvania Code, 25 PA Code § 264a.1, incorporating by reference 40 C.F.R. § 264.18(b)(1), mandates that a facility located in the 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood, not a 500-year flood. It should also be noted that the 100-year floodplain is not significantly different from the 500-year floodplain on the Site. Capping will be maintained throughout the life of the remedy to prevent any washout by a 100-year flood.

As noted in the FS and the Proposed Plan, the 100-year floodplain was recently updated by the Federal Emergency Management Agency (FEMA), and these changes were taken into consideration during the Removal Action. In addition, EPA will evaluate any future updates to the 100-year floodplain during the FYRs. To further ensure that the capping remedy remains protective, the ICs specified in Section 13.2.6 of the ROD and the O&M requirements specified in Section 13.2.9 of the ROD require that public access shall be restricted after significant weather events until the property has been inspected for any signs of damage.

2.4 Preference for Treatment or Removal Alternatives

Issue: Several commenters requested EPA to justify the selection of capping as the preferred alternative compared to treatment and removal alternatives. Alternatives WSS4 and WSS5 provide treatment, reduction in toxicity/mobility/volume (T/M/V), and ensure long-term protection. Alternative WSS3 would remove contamination from the Site.

EPA Response: As noted in the Proposed Plan and the FS, the Selected Remedy, capping (Alternative WSS2), meets the threshold criteria of overall protection of human health and the environment and compliance with applicable or relevant and appropriate requirements (ARARs) [NESHAP, etc…]. While Alternatives WSS2, WSS3, WSS4 and WSS5 each meet the threshold criteria, based on the information currently available, EPA has determined that the Selected Remedy provides the best balance of advantages and disadvantages among the alternatives when evaluating them using the balancing criteria evaluated during the FS.

Capping is a practice commonly used to address asbestos waste sites and is an acceptable remedy for this Site because it will prevent dermal contact and will limit the mobility of air-borne contaminants, such as asbestos fibers. The most significant exposure route for asbestos is inhalation. The capping remedy takes the necessary precautions to minimize disturbance to the asbestos-containing waste, soils, and sediment and to prevent asbestos from becoming airborne during and after remedy construction.

One of the most significant drawbacks to the treatment alternatives developed for the Site (Alternatives WSS4 and WSS5) is that both present an increased risk of exposing on-Site and off-Site receptors to asbestos contamination during excavation and transportation activities. These risks could be further exacerbated due to the extended period of time needed to implement Alternatives WSS4 and WSS5 compared to Alternative WSS2. Alternatives WSS4 and WSS5 also have significant implementability concerns, including uncertainties regarding full scale performance of the technologies to address a site as large as BoRit, availability of an adequate energy source, and/or the limited availability of vendors. In addition, by an order of magnitude, the treatment alternatives, as well as the excavation and off-Site disposal alternative (Alternative WSS3), would be substantially more expensive to implement. EPA's Selected Remedy, capping, is cost-effective and will physically contain Site contaminants and prevent contaminant release and off-Site migration.

2.5 Future Use Plans for the Asbestos Pile Parcel

Issue: *Several commenters raised concern over future use plans for the Asbestos Pile parcel. Commenters requested that the ROD identify a responsible party or a line of succession for the Asbestos Pile parcel in case of default. One commenter requested that EPA consider future use plans for the Asbestos Pile published in the 2010 BoRit Community Advisory Group (CAG) Future Uses Group Vision Plan.*

EPA Response: The Asbestos Pile parcel is owned by a private party. EPA does not have the authority to dictate the future use of Site parcels. This decision is ultimately the responsibility of Site property owners and each individual property owner will determine whether to comply with the CAG Future Uses Group Vision Plan. EPA's primary responsibility, under the law, is to make sure that the final cleanup of the Site is protective of human health and the environment, based on reasonably anticipated future use. However, the private property owner (and any future owners) will be responsible for ensuring that the ICs specified in Section 13.2.6 of the ROD are properly maintained and that O&M is performed in accordance with Section 13.2.9 of the ROD.

2.6 Human Health Monitoring

Issue: *Several commenters noted that future comprehensive human health monitoring needs to be incorporated into the annual and five-year monitoring at the Site in perpetuity to ensure that the population surrounding the Site is being adequately protected by the Selected Remedy. The purpose of human health monitoring efforts would be to determine whether the remedy at the Site is protective of human health and to track human health data for the Ambler community and surrounding local community. The methods, findings, and conclusions of reviews could be adequately documented in FYR reports and shared with the public.*

EPA Response: EPA consulted with PADOH and ATSDR in responding to this question. EPA does not perform health screening or monitoring. Community-based health screening, if necessary as part of a public health study, may be conducted by public health agencies like PADOH and/or ATSDR. PADOH, ATSDR, and EPA are aware that there is an interest in health screenings (e.g., medical monitoring for asbestos exposures such as X-rays, CT scans, etc.) at this Site. However, ATSDR and PADOH do not provide direct medical care. The purpose of health screening investigations, when they are conducted by public health agencies, is to provide additional information about exposures not available through other means. Screening health studies cannot replace individual follow up with personal physicians.

Based on available historical information, former workers, household contacts of former workers, and former or current residents who lived near the K&M asbestos manufacturing plant may have been exposed to airborne asbestos at a level of health concern in the past. PADOH and ATSDR recommend that concerned citizens discuss their possible exposure history with a medical professional such as their family doctor, who is in the best position to assess their potential for harmful health effects. Preventative health actions such as reducing exposure to smoke, second-hand smoke, and radon and getting an annual flu shot can greatly reduce health risks for individuals with past exposures to asbestos and asbestos-related lung disease. Since 2007, PADOH and ATSDR have collaborated with several partners in the community to share this preventative health information with health professionals and community members in Ambler, including the Montgomery County Health Department, the Montgomery County Health Alliance, University of Pennsylvania, the Visiting Nurses Association, and the Montgomery County Medical Society.

Based on EPA's findings in the community surrounding the Site, there is no current or ongoing exposure to asbestos at a level at which PADOH and ATSDR expect to see harmful health effects. That said, given the potential for past exposures in the local community, PADOH and ATSDR have committed to continuing to review available cancer statistics for the areas surrounding the Site, and will share this information with EPA and the public.

2.7 O&M Frequency and Components

Issue: Multiple commenters raised concern that the capping alternative requires perpetual O&M. It was requested that inspections occur on a more frequent basis during the initial years after cap completion.

EPA Response: As indicated in Section 13.2.9 of the ROD, O&M for the Site will be performed perpetually throughout the life of the Selected Remedy to ensure capping and stream bank stabilization work remains protective of human health and the environment. O&M tasks will generally consist of Site inspections, post-significant weather event inspections, cap and physical remedy maintenance, IC evaluations and updates, and reporting.

EPA is currently preparing the O&M Plan for the Site which will provide additional detail on the O&M requirements. The O&M Plan will include protocols for Site inspections, maintenance of vegetative cover, repair to breaches in the cap, and reporting requirements. The O&M Plan for the Site will require Site inspections to occur at least quarterly and immediately following any significant weather event. Reports summarizing O&M activities will be prepared on an annual basis and will identify the need to increase or decrease inspection frequency. O&M reports will be posted on the Site webpage at: https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0301842. In addition, EPA will also evaluate O&M activities during the FYR process and amend inspection activities and frequency when needed.

2.8 Lead Agency

Issue: Multiple commenters requested that EPA remain the lead agency throughout long-term O&M instead of the PADEP. One commenter requested that, given the proximity and similarity of the nearby Ambler Asbestos Pile Superfund Site, EPA should combine some of the monitoring and maintenance activities for both sites over time.

EPA Response: The Site is an EPA Fund Lead Project, which means that EPA is using federal appropriations to remediate the Site. For Fund-financed remedies, Section 104(c) of CERCLA, 42 U.S.C. § 9604(c), requires States to pay for or ensure payment of all future maintenance. Although States are responsible for the O&M at the Site, EPA retains responsibility for determining when O&M is complete and for conducting FYRs. As previously stated, EPA is currently preparing the O&M Plan for the Site which will describe all requirements for implementation and maintenance of ICs and O&M activities to ensure that the remedy remains protective of human health and the environment in the long term.

With respect to the comment that EPA combine monitoring and maintenance activities at both the BoRit and Ambler Asbestos Piles Sites, EPA notes that these are two different sites, with different LTM requirements and different O&M schedules. The fact that different parties are responsible for LTM and O&M at these two sites also would complicate efforts to combine monitoring and maintenance activities. LTM and O&M of the Ambler Asbestos Piles Site is being performed by potentially responsible parties (PRPs), whereas LTM and O&M at the BoRit Site will ultimately be performed by the State and/or the property owners. However, for efficiency and when possible, EPA may perform inspections concurrently at both sites.

2.9 Identification of PRPs

Issue: *EPA should publicly identify any potential PRPs for the Site that are still under investigation and/or have those PRPs bear some of the economic burden of the remediation and O&M.*

EPA Response: The Superfund law requires that EPA identify PRPs, where possible, and compel them to clean up Superfund sites under EPA oversight, as appropriate. EPA may also clean-up sites through the Superfund program, using federal funding, and seek reimbursement from PRP(s) at a future date. With respect to the BoRit Site, EPA is currently investigating potential PRPs and their liability at the Site. EPA cannot comment on ongoing investigations of potential PRPs or other parties' liability at the Site because this information is confidential. Until then, the ongoing work at the Site is being funded by EPA's Superfund program until the Site is declared O&F, at which point O&M of the Site will be performed by PADEP.

2.10 Water Quality (Sediment and Nutrient Reduction)
Issue: *Several commenters expressed concern, noting that the Wissahickon Creek is listed under Section 303(d) of the Federal Clean Water Act (CWA) as impaired and is subject to total maximum daily load (TMDL) requirements for sediment and certain nutrients. Commenters requested that future land management at the Site be carried out in a way that utilizes best management practices that reduce future sediment and nutrient pollution loads to the creek.*

EPA Response: While EPA does not have the final say on the future land use at the Site parcels, EPA agrees that reductions in pollutant loads to Wissahickon Creek should be considered as part of future land management decisions at the Site. The ICs required under Section 13.2.6 of the ROD require maintenance of vegetative cover along streambanks and prohibit digging, dredging, or any other type of earth disturbance without prior approval from EPA, in consultation with PADEP. Enforcement of these ICs will help limit pollutant loads to Wissahickon Creek, regardless of future land use.

2.11 FYR Components
Issue: *The FYR process noted in the Proposed Plan should consider any changes to the standards, not only for asbestos, but also for the organic and inorganic contaminants, that occurred since the last assessment and whether (or not) the Site meets those revised standards.*

EPA Response: The main objective of the FYR process is to ensure that the remedy remains protective of human health and the environment. During each FYR, EPA will review any changes that affect the validity of remediation goals identified in the ROD, including, but not limited to, ARARs, advancements or changes to analytical procedures, new or emerging contaminants not identified in the cleanup phase, and assumptions about contaminant characteristics. Changes to standards affecting cleanup levels and health risks will be considered along with the assessment of the remedy. After completing each FYR, EPA will identify any follow-up actions needed to improve remedy protectiveness, incorporate any needed changes into the Site O&M Plan, notify the public of changes, and identify the party responsible for implementing any necessary changes.

2.12 Signage
Issue: *Several comments were submitted suggesting that permanent signage be implemented at the Site to note Site restrictions, safety hazards, and contact information for Site healthy and safety issues.*

EPA Response: Because capping covers asbestos waste left in place, the selected remedy has to comply with actions identified under the applicable NESHAP regulations, 40 C.F.R. Part 61, Subpart M, for asbestos. Specifically, § 61.151(a) provides that inactive waste disposal sites like the BoRit Site shall:

> (a) Comply with one of the following: * * *
> (2) Cover the [ACM] with ***at least*** ***6 inches*** of compacted [non-ACM], and grow and maintain a cover of vegetation on the area adequate to prevent exposure of the [ACM]. . . . ; or

(3) Cover the [ACM] with ***at least 2 feet*** of compacted [non-ACM], and maintain it to prevent exposure of the [ACM]; * * *

(b) Unless a natural barrier adequately deters access by the general public, install and maintain warning signs and fencing as follows, ***or comply with paragraph (a)(2) or (a)(3) of this section***. (emphasis added)

The Selected Remedy includes geotextile, at least 2 feet of clean fill, and another 6 inches of topsoil to support a vegetative cover. EPA believes that signage is not required because the Selected Remedy provides a deeper cover than is required by § 61.151, and requires long term stewardship requirements to ensure that the integrity of the Capped Areas are protected through O&M, ICs, and FYRs.

2.13 Surface Water and Groundwater Monitoring
Issue: Several commenters requested that EPA continue to monitor groundwater and surface water at the Site.

EPA Response: As indicated in Section 7.4 of the ROD, groundwater was included in the Site's conceptual site model and considered in the Chemical and Asbestos HHRAs; however, no action or additional monitoring is anticipated for groundwater at the Site. Groundwater contamination identified in on-Site wells was either: (1) at concentrations lower than those found in the upgradient wells; (2) included isolated or one-time detections that do not suggest the presence of a contaminant plume; and/or (3) does not appear to emanate from contaminated media at the Site. Additionally, asbestos, the only human-health COC at the Site, is present in the source material (waste, soil, and Reservoir sediment), but was not found above its MCL in groundwater.

Following construction of the Selected Remedy, in accordance with Section 13.2.7 of the ROD, Reservoir surface water and creek surface water will be sampled for Site COCs to demonstrate that the capping remedy is operating as designed. In accordance with Section 13.2.8 of the ROD, LTM of the surface water will be conducted annually for the first four years leading up to the first FYR, and then once every FYR cycle thereafter, to confirm cleanup levels continue to be achieved and to demonstrate that the capping remedy continues to perform as designed.

3.0 RESPONSES TO OTHER SPECIFIC SIGNIFICANT COMMENTS SUBMITTED DURING THE PUBLIC COMMENT PERIOD

This section provides EPA's responses to other specific comments not included among the Significant Recurring Comments presented in Section 2. These comments are numbered for reference purposes.

1. *Comment: What is the meaning and/or derivation of the word "BoRit"?*

   EPA Response: BoRit Corporation, named after Bob Rittenhouse, previously owned of one of the Site properties.

2. *Comment:* *The Removal Action costs $25M of the $27.5M budgeted funds. Under this emergency action, the EPA chose to implement the chosen remedy of capping. This leaves only $2.5M for the Remedial Action. I question why other remedies were not considered before the work took place and is now completed.*

   EPA Response: The purpose of the Removal Action at the Site was to address the immediate threats to human health and the environment in the shortest amount of time possible. In the 2008 Action Memo, EPA determined that actual and threatened release of hazardous substances and/or pollutants or contaminants from this Site, if not addressed by implementing the Removal Action, may present an imminent and substantial endangerment to public health, welfare, and/or the environment. Capping was used during the removal action because it is a safe, quick, effective way to prevent exposure to asbestos waste, and is commonly used at other asbestos waste disposal sites throughout the country. The Selected Remedy will encompass and enhance the Removal Action conducted at the Site. EPA considered all remedial alternatives that were screened and evaluated during the FS. EPA's analysis of the five proposed alternatives, and its rationale for selecting the Selected Remedy over the other alternatives, was presented to the public in the PRAP and is described in Section 10.0 of this ROD.

   The estimated total cost to implement the Selected Remedy is $27.1 Million. This cost estimate includes EPA Remedial Program costs to achieve O&F status, which is expected to occur two years after completion of the Removal Action on-Site. As noted in Section 13.3 of the ROD, the EPA Removal Program incurred $25.5M for completed capping work. The estimated total present value cost to be incurred by the EPA Remedial Program is $900,000. The estimated cost for the Remedial Action includes implementation of ICs, confirmation sampling, preparation of the Remedial Action Report, and performance of O&M activities over years one and two. The estimated present value cost to perform LTM, FYRs, and O&M (over years three through 30) is $700,000. **Tables 46a through 46e** of the ROD provide the detailed cost summary.

3. *Comment:* *Why was Temple chosen to carry out the study? Why was BoRit not included in the original Temple Study, and why were portions added back?*

   EPA Response: The *Flooding and Stormwater Management Plan for Ambler Watersheds*, prepared by Temple University's Center for Sustainable Communities (CSC), was sponsored by several agencies including EPA, the U.S. Army Corps of Engineers (USACE), and the U.S. Department of Housing and Urban Development (HUD). Temple's CSC received partial funding from EPA for this study based upon a competitive grant application process.

   As part of the stormwater management plan, Temple's CSC performed watershed studies to update the 1996 FEMA flood hazard zones for the Ambler area, including the BoRit Site, specifically to update the 100-year and 500-year floodplains. As noted in the Proposed Plan, relative to the 1996 FEMA maps, recent updates to the 100-year flood zone show the extent of the 100-year flood expanding to surround the entire perimeter of the Reservoir and extending northwest up West Maple Street. The preliminary updated 100-year and 500-year floodplains generated by CSC were reviewed by USACE and finalized by FEMA in a Letter of Map Revision, dated March 21, 2016. EPA understands that FEMA published a public notice in the February 24, 2016 edition of the *Times Herald,* proposing the inclusion of homes above the Rose Valley sluiceway, on Maple Street, into the new floodplain mapping proposal.

4. *Comment:* *What precautions are being taken to ensure the Reservoir does not flood again? What precautions and assistance are the local residents being given by EPA and Whitpain Township? How is stormwater runoff managed now? Will that change in the future?*

   EPA Response: The reservoir berms were constructed with an emergency spillway to allow water to escape in the event of flooding. Additionally, the O&M requirements of this ROD, as described in Section 13.2.9, include measures to monitor potential impacts of severe weather on the remedy and to implement precautionary measures to ensure that the remedy is resilient to impacts of significant weather events.

   The Pennsylvania Emergency Management Agency (PEMA) and FEMA are tasked with providing assistance to residents impacted by flooding. EPA has organized numerous meetings and outreach events where PEMA and FEMA were on hand to discuss concerns raised by individual property owners on a one-on-one basis. EPA will continue to coordinate with PEMA and FEMA on future Site-related outreach events.

   Currently, erosion and sediment control features to manage stormwater runoff are in place on the Site and will remain until vegetation is permanently established. In addition, the EPA Removal Program implemented best management practices including construction of berms, swales, and spillways to handle stormwater runoff. As previously indicated, Section 13.2.9 of this ROD requires post-significant weather event inspections to ensure the integrity of the cap, vegetation, and stabilized stream bank areas were not impacted by the weather event. Section 13.2.9 also requires quarterly Site inspections. One objective of the Site inspections is to identify necessary changes or improvements to stormwater management features throughout the life of the remedy.

5. *Comment:* *The Proposed Plan discusses implications for homeowners and suggests: long-term maintenance; keep yards vegetated; and avoid very dusty outdoor activities. Please state how the EPA is going to enforce this?*

   EPA Response: Neither the PRAP nor the ROD contain any suggestions regarding activities that homeowners should or should not perform in their homes. As explained in Section 5.2.7 of the ROD, during the RI, EPA collected soil samples and ABS air samples at eight off-Site residential areas, and none of those samples exceeded the Site-specific screening levels for asbestos. Based on this information, in Section 7.1.1 of the ROD EPA concludes there is no unacceptable risk of asbestos exposure in current or future off-Site residential or recreational areas.

That said, per Section 13.2.9 of this ROD, O&M activities for the Site are required for the Asbestos Pile parcel, the Reservoir parcel, and the Park parcel. O&M for the Site does not include plans for adjacent residential properties, which are not part of the Site.

6. _Comment:_ *Due to the floodplain status of BoRit, flood conditions should be identified and included in the O&M Plan that would trigger investigative work to assure that the clean fill cap is not contaminated or ruptured during a flooding event.*

   EPA Response: Section 13.2.9 of this ROD includes requirements for post-significant weather event inspections and cap and physical remedy maintenance to address potential storm-related damage. The O&M Plan being prepared for the Site will provide additional details on activities required immediately following a significant storm event. The O&M Plan will require that the Site be closed to the public and inspected for any major signs of erosion or breaches to the cap. Inspections will focus on areas within the extent of the 100-year floodplain. Repair or maintenance activities to address affected areas will be conducted in accordance with the O&M Plan.

7. _Comment:_ *Can you please explain to me the consequences to the water near the project for the different options?*

   EPA Response: Each of the remedial alternatives presented in the PRAP pose short-term environmental impacts to surface water at the Site during construction. Alternatives WSS2, WSS3, and WSS5 include some degree of excavation. Excavation or earth disturbance activities generate dust and increase the potential for contaminant migration in runoff. Alternative WSS4 relies on thermal treatment in situ, and elevated temperatures (1,400 degrees Celsius [°C] – 2,000°C) of the subsurface during treatment could impact surface water quality of Wissahickon Creek, Rose Valley Creek, and Tannery Run and groundwater temperatures. The FS, included in the Administrative Record, discusses in detail the environmental impacts posed by each alternative presented in the PRAP.

8. _Comment:_ *The EPA explains that the remedy must meet environmental regulations known as ARARs. What are the ARARs for asbestos waste disposal sites in Pennsylvania (PA)? Will all the regulations be met? Will any of the ARARs be waived?*

   EPA Response: The ARARs for this Selected Remedy include Pennsylvania Air Quality regulations (25 PA Code Chapter 124), which were adopted verbatim from EPA's NESHAP regulations, 40 C.F.R. Part 61, which documents the federal standards for asbestos. The applicable NESHAP regulations for inactive waste disposal sites are found at 40 C.F.R § 61.151(a). See Section 2.12 of this Responsiveness Summary, for a detailed description of those regulations that apply to the Site. Capping across the Site was designed in accordance with these applicable NESHAP regulations. EPA provided additional layers of protection, above and beyond what is required, for areas most susceptible to erosion and flooding (i.e., stream banks). No ARARs will be waived under the Selected Remedy.

9. <u>*Comment:*</u> *The recommended cap for BoRit is defined as two feet of clean fill with six inches of top soil to facilitate growth of vegetation. Yet on the stream banks, where appropriate, the Proposed Plan calls for 10 to 15 inches of clean fill and top soil. Is this because of the placement of cable concrete mats (CCM) that look to be approximately nine inches deep to make up the difference? The two together would constitute the two feet required by the definition of the cap. If this is the explanation, perhaps that should be explained and clarified in the ROD documentation.*

   <u>EPA Response:</u> Capping at the Site was designed in accordance with the applicable NESHAP regulations listed in the response to Comment 8. Along the stream banks, EPA exceeded the applicable NESHAP requirements, discussed above in Section 2.12 and Comment 8 of this Responsiveness Summary. The applicable NESHAP regulations for inactive waste disposal sites, 40 C.F.R. § 61.151(a)(2), require that ACM be covered with at least 6 inches of compacted non-ACM, along with a cover of vegetation on the area adequate to prevent exposure of the ACM. The performance standard of the stream banks is more stringent than the applicable NESHAP requirement, because the ROD calls for 10 to 15 inches of clean fill, a layer of topsoil, and vegetation. Because the streambanks are susceptible to erosion and flood damage, additional layers of protection, including CCM, geocells, and erosion control mats were added to increase stability against flooding.

10. <u>*Comment:*</u> *Costs as calculated only take into account inspections for the next 30 years. If capping is the chosen solution, the Site should be inspected in perpetuity, and costs should be recalculated to reflect same.*

   <u>EPA Response:</u> EPA concurs that O&M of the Site will be necessary in perpetuity; however, EPA guidance recommends the use of a 30-year period of analysis for estimating present value costs of remedial alternatives considered during the FS. Increasing the O&M duration further into the future increases the inaccuracy of present value costs. O&M costs will be reviewed during FYRs to identify optimization opportunities and to determine whether O&M costs reported match estimates prepared during the Remedial Design.

11. <u>*Comment:*</u> *Replace NESHAP standards with more stringent parameters than just visually seeing if asbestos is airborne.*

   <u>EPA Response</u>: EPA believes the NESHAP regulations are relevant and appropriate for the Selected Remedy. The applicable NESHAP regulations are not based on visual inspection to determine if asbestos becomes airborne. As discussed in Section 2.12 of this Responsiveness Summary, the capping remedy for the Site is based on the applicable NESHAP regulations, specifically 40 C.F.R. § 61.151(a). The NESHAP regulations for asbestos are contained in 40 C.F.R. Part 61, Subpart M.

   Further, LTM is included as a component of the capping remedy, as described in Section 13.2.8 of this ROD. LTM will be conducted annually for the first four years leading to the first FYR and then once every FYR cycle thereafter. LTM may include activity-based sampling (ABS), and sampling of ambient air, soil, sediment, and surface water to confirm that the capping remedy continues to perform as designed. Additional discussion of LTM is provided in Comment 14, below.

12. *<u>Comment:</u> Asbestos aside, many other contaminants - dioxin, arsenic, cobalt, lead, mercury, chromium – remain on-Site and continue to seep into the Wissahickon Creek. The creek itself is a source of drinking water for the City of Philadelphia. Simply capping this Site will allow for the continuous seepage of these toxic chemicals into our drinking water.*

    <u>EPA Response:</u> As explained in Section 7.4 of the ROD, sampling conducted as part of the RI concluded that surface water and groundwater at the Site do not contain any Site-related COCs, thus confirming that hazardous substances, pollutants, or contaminants are not seeping into groundwater or surface water. Further, the only Site COC that presents unacceptable risk to human health is asbestos. As explained in Section 7.3 of the ROD there are six other Site COCs (i.e., bis(2-ethylhexyl)phthalate, dioxins and furans, chromium, nickel, zinc and carbon disulfide) present in Site soil, in addition to asbestos, that present unacceptable risk to ecological receptors, but not to humans. However, these 'ecological' COC's present unacceptable risk only if wildlife comes in direct contact with contaminated media. Since the Selected Remedy, which includes capping, is designed to stabilize, contain, and prevent both human and wildlife exposure to contaminated media, the unacceptable risks and associated exposure pathways posed by all Site COC's (not just asbestos) will be addressed by the Selected Remedy. LTM and regular O&M will be performed in accordance with Sections 13.2.8 and 13.2.9, respectively, of this ROD to ensure long-term protection of human health and the environment.

13. *<u>Comment:</u> The EPA identifies two asbestos professionals that reviewed the FS for the Site and support a soil cap remediation. What are these professionals' credentials? Do either or both professionals work for the EPA? Has the EPA sought asbestos professionals in the public sector, independent of the EPA to review the FS? If not, would the EPA consider an independent review of the FS?*

    <u>EPA Response:</u> The BoRit CAG requested the use of EPA's Technical Assistance Services for Communities (TASC) program for assistance reviewing, summarizing and commenting on the FS for the BoRit Site. Technical assistance was provided by Skeo Solutions, Inc. (Skeo), an independent environmental consulting firm. As part of their review process, Skeo subcontracted with two outside environmental consulting firms with experience in asbestos remediation to review the RI/FS and provide their opinions on the FS report. The three individuals that reviewed the FS are independent professionals not employed by EPA. Their credentials are as follows:

    <u>Michael Longman, Vertase FLI Limited</u>
    Mr. Longman has over 20 years of experience within quarrying, waste management, and contaminated land assessment and remediation in the United Kingdom. Mr. Longman's experience includes remediation of asbestos-contaminated soils on military bases and fuel storage facilities; remediation of landfills, including excavating, processing and treating

landfill wastes; and designing and managing projects to classify waste soils and demolition materials contaminated with loose asbestos fibers.

Alexis Fricke, LT Environmental, Inc.
Ms. Fricke has 37 years of experience in interpretation and implementation of environmental regulations. Ms. Fricke's experience includes managing a refinery reclamation project that included asbestos-impacted soil. She has also developed materials management plans for ACM removal along light rail lines. Ms. Fricke participated in the stakeholder process for drafting revised asbestos in soil regulations for Colorado. She has developed asbestos management guides and standards for controlling asbestos exposures and air monitoring for several international corporations.

Susan Borden, LT Environmental, Inc.
Ms. Borden has 30 years of experience as a professional geologist, with significant experience in asbestos-containing solid waste remediation efforts. Ms. Borden was an active participant in rewriting the Colorado Department of Public Health and Environment regulations pertaining to solid waste sites and facilities related to asbestos-contaminated soil management. In 2014 and 2015, Ms. Borden oversaw the removal of 47,000 cubic yards of regulated asbestos contaminated soil at a redevelopment project. She was the senior project manager for asbestos contaminated soil remediation efforts on the former Lowry Air Force Base in Denver, Colorado.

14. *Comment: During CAG discussion of the FYRs, it was revealed that the EPA only visually inspects the capped asbestos piles. Microscopic analysis of soil, water and ambient air is not conducted. I find this problematic because asbestos in soils, water and in ambient air at dangerously high percentages can only be determined through microscopic analysis and not visually.*

EPA Response: The purpose of the FYR is to evaluate the implementation and performance of a remedy to determine whether it remains protective of human health and the environment. As noted in the response to Comment 11, LTM is included as a component of the capping remedy (Section 13.2.8 of this ROD) and will include ABS and sampling of ambient air, soil, sediment, and surface water to confirm that the capping remedy continues to perform as designed. As indicated in Section 13.2.10 of this ROD, during the FYR process, in addition to visually inspecting the Site, EPA will review LTM data collected over the five-year period between each FYR cycle to evaluate remedy performance and to identify any follow-up actions needed to improve remedy protectiveness.

15. *Comment: I strongly disagree with the Green and Sustainable Remediation Assessment (GSR). Trying to adequately maintain an enormous asbestos waste disposal site in a floodplain of the Wissahickon Creek with burrowing animals and severe weather is a lesson in futility. The BoRit Site will need constant maintenance, constant repair and constant tax payer money.*

EPA Response: EPA agrees that the Selected Remedy will require continual LTM and O&M. The anticipated future costs associated with these activities are included in the cost estimates provided in Tables 46a through 46d of the ROD. As indicated in Section 11, although not a selection criterion in the NCP, in September 2010, EPA released its *Superfund Green Remediation Strategy,* which sets out EPA's current plans to reduce the demand placed on the environment during implementation of a Selected Remedy and to conserve natural resources. Overall, the Selected Remedy (Alternative WSS2), has the smallest environmental footprint, because it requires significantly less on-Site grid electricity use than Alternatives WSS4 and WSS5 and because it reduces excavation activities and waste hauling congestion by approximately 35 percent to 40 percent compared to Alternative WSS3. In addition, both Alternatives WSS4 and WSS5 may require construction of sub-station infrastructure which could impact local air quality and affect the aesthetic value of the redeveloped greenspace.

In summary, the Selected Remedy meets EPA's threshold criteria of overall protection of human health and the environment and compliance with ARARs, provides the best balance among the other alternatives with respect to the balancing criteria, and leaves the smallest environmental footprint as indicated by GSR assessment.

16. *Comment: I request the Site to remain undeveloped with restricted public access until the studies of the University of Pennsylvania are completed and the mobility of asbestos through soils is completely understood. I request that the agency do its utmost to keep the community informed of any changes or proposed changes to the BoRit Site in the future.*

EPA Response: EPA does not have the authority to dictate the future use of Site parcels. This decision is ultimately the responsibility of Site property owners. However, the ICs specified in Section 13.2.6 of the ROD are based on the Site being used as recreational open space. Any other use of the parcels shall require further investigations and plans, which shall be reviewed and approved by EPA, in consultation with PADEP. Before the Site is opened to the public for recreational use, confirmation sampling will be performed to confirm that the capping remedy achieves the RAOs for Site-related contaminants of concern (COCs). In addition, the ICs restrict public access after significant weather events until the property has been inspected for any signs of damage or erosion, especially in the 100-year floodplain

An analysis published by EPA in April 1977, *Movement of Selected Metals, Asbestos, and Cyanide in Soil: Applications to Waste Disposal Problems,* EPA Publication Number EPA-600/2-77-020, describes the potential for asbestos movement through soil. An excerpt from the publication follows:

> Although there are no data on mobility of asbestos in soil, predictions about its behavior can be made with reasonable confidence. Since the weathering products of asbestos are the common nonhazardous salts of Ca, Mg, and Si, physical transport is the only mode of movement in soil which is of significance. The

> extensive data on movement of clay sized (<2 microns [μ] diameter) particles by strictly physical processes provide a convenient yardstick for gaging the probable behavior of asbestos in soil. Clay particles 0.1 to 2.0μ in diameter are estimated to move at a rate of 1 to 10 centimeters per 3,000 to 40,000 years, depending on the soil texture (Berkland, 1974). There is no reason to expect that asbestos particles of similar size would move differently from this. Consequently, asbestos migration through soil will not be a problem of any significance.

In addition, larger particles (i.e., the longer fibers of the asbestiform minerals) are expected to be even more resistant to movement due to physical impedance.

As part of the FYR process, EPA will continue to evaluate and consider any new research regarding asbestos mobility in soil as it becomes available and will continue to keep the community informed on updates and changes to the Site.

17. <u>*Comment:*</u> *Is there a way to reconnect the twenty-four-inch conveyance pipe to provide a continuous source of water to the Reservoir thereby enabling the Reservoir to maintain an appropriate and attractive water level?*

    <u>*EPA Response:*</u> No, it is not possible to reconnect the 24-inch polyvinyl chloride (PVC) pipe that extends from the Reservoir Manhole into the Reservoir is connected to the 24-inch North vitrified clay pipe (VCP) that runs along West Maple Street and connects to the American Legion Manhole (located at the intersection of Maple Street and Mount Pleasant Avenue). The 24-inch North VCP was plugged in the American Legion Manhole in Spring 2014 to alleviate flooding issues in the area. During the time the Reservoir was empty, standing water was observed in the Reservoir adjacent to the 24-inch PVC pipe. It is believed that the standing water was a result of groundwater entering the more than 100-year old 24-inch North VCP Pipe along West Maple Street. Potential sources of inflow into the Reservoir are discussed in detail in the FS and in the Remedial Investigation (RI) Addendum Report included in the Administrative Record, as well as in Section 5.1.2 of this ROD.

    The Selected Remedy does not require a specific water level to be maintained in the Reservoir. However, IC number 10, specified in Section 13.2.6 of the ROD, requires that suitable vegetation and/or water levels be maintained on the Reservoir berms and Reservoir floor to ensure protection from erosion. Thus, the party(s) responsible for performing O&M at the Reservoir Parcel have the option to maintain a specific water level and/or suitable vegetation in the Reservoir as a means of complying with this IC. O&M for the Reservoir parcel will include ensuring that the Reservoir water levels and/or vegetative cover are maintained at levels that remain protective of human health and the environment.

18. <u>*Comment:*</u> *Can stormwater runoff from adjacent properties be discharged into the Reservoir?*

EPA Response: No, it is not within EPA's Superfund authority to directly address stormwater management and flooding issues not related to implementation of the Selected Remedy. O&M for stormwater and flooding impacts at the Site will be performed in accordance with Section 13.2.9 of this ROD.

19. _Comment:_ *The EPA is pressuring municipalities to clean up the water quality in our watershed, specifically the Wissahickon Creek. It is disconcerting, therefore, that potential exists for contaminants to escape from the BoRit Site, as was noted in the Technical Assistance Services for Communities (TASC) review of the BoRit Site Proposed Remedial Action Plan. Specifically, dioxin, arsenic, and metals such as cobalt, lead, mercury, chromium and others remain at the Site, at concentrations exceeding unidentified soil screening levels. The actual concentrations of these aforesaid contaminants have not been reported by EPA, and Borough of Ambler respectfully requests this information.*

    EPA Response: During the RI, soil, sediment, creek surface water, Reservoir surface water, and groundwater were all sampled and analyzed for Total Analyte List (TAL) metals, which include arsenic, cobalt, lead, mercury, and chromium. Because dioxins can be a product of combustion, samples analyzed for dioxins were collected from the fire training area and the slag area located on the Asbestos Pile parcel. The RSL screening criteria that were established by EPA Region 3 in May 2013 for residential soil, sediment, and groundwater were used to select contaminants at the Site that pose a potential risk to human health and ecological receptors. RSL tap water screening values were used to evaluate exposure to groundwater and surface water, and RSL residential soil screening values were used to evaluate exposure to sediment. Analytical results and RSLs used in the RI are provided in the RI Report located in the Administrative Record.

    All contaminants listed in the above comment were evaluated in the Chemical HHRA prepared for the Site. Dioxins and furans and chromium present in waste and soil are Site-related COCs that present unacceptable risk to ecological receptors only, and are addressed by the cap as part of the Selected Remedy. All other contaminants listed in the above comment are not Site-related COCs because they do not present unacceptable risk to human health or the environment.

20. _Comment:_ *If EPA ABS results are showing off-Site ambient air samples with higher asbestos levels than ABS at the Site, perhaps the agency should continue the soil testing off-Site where the old asbestos factory facilities are still standing and currently being used without any remediation whatsoever. I, personally, have brought this potential risk to the agency publicly in writing and verbally at CAG meetings. Please state why the EPA has not tested the old factory facilities in West Ambler.*

    EPA Response: As explained in Section 5.2.7, all off-Site ABS sampling results were lower than the preliminary cleanup level of 0.04 f/cc. The only ABS samples that exceeded 0.04 f/cc were collected on-Site.

EPA has not tested the old factory buildings referenced in the above comment because they are being managed and redeveloped under PADEP's Land Recycling and Environmental Remediation Standards Act (Act 2) voluntary clean-up program. The old factory buildings have been extensively tested as part of investigations specifically performed for those parcels under Act 2. PADEP's Act 2 program is designed to clean up contaminated sites that are suitable for redevelopment. In 2004, EPA and PADEP entered into a Memorandum of Agreement (MOA) that discusses roles and responsibilities at such properties. For more information about the MOA, please visit https://www.epa.gov/sites/production/files/2015-11/documents/pa_moa.pdf.

21. <u>*Comment:*</u> *Why did the RI determine that asbestos is to be the primary source of environmental concern at the Site when clearly other harmful contaminants are present including VOCs (volatile organic compounds), SVOCs (semi-volatile organic compounds), pesticides, and metals that are harmful when ingested, and metals – arsenic and chromium and need to be addressed as well?*

    <u>EPA Response:</u> The HHRA and the SLERA presented the initial list of COPCs resulting from the completion of the HHRA and SLERA based on pre-Removal Action conditions. During the preparation of the FS, the COPCs identified in Site media were further evaluated using Site history, the range of detections, background concentrations, regulatory criteria, and the results of the HHRA and SLERA to develop the list of Site-related COCs and Site media to address. Asbestos is the dominant environmental concern at the Site, because it is historically related to past Site practices and drives human health risk (inhalation) at the Site. Although the HHRA and the SLERA considered additional COPCs, including COPCs for groundwater, surface water, and seep water beyond the COCs identified in the FS and the Proposed Plan, those remaining COPCs were not included as COCs because they are not considered to be related to past Site activities (i.e., they come from off-Site or occur naturally at elevated levels in the soil), do not constitute a groundwater contamination plume, or they no longer occur at concentrations of concern. Refer to Tables 1 through 3 of the Proposed Plan for additional information regarding the identification of COCs for the development of remedial alternatives.

22. <u>*Comment:*</u> *Please state why the former Wendy's restaurant site which is directly adjacent to BoRit was not tested at all before it was paved. At some point, it is safe to assume, the paved area will be modified. It is possible/probable that asbestos and toxin laden soil will be under the paved road. I request that the EPA investigate either now or when changes are made to the property, even if it is private property as it is contiguous with the Site.*

    <u>EPA Response:</u> EPA assumes this comment refers to the former McDonald's (not Wendy's) located at 119 West Butler Pike. The former McDonald's property is located outside the Site boundary and was paved during the time of EPA's Removal Program work. Prior to paving, asbestos air sample results from 14 samples collected on the McDonald's property between July 10 – 11, 2008 detected one asbestos fiber (chrysotile) in one sample at a concentration of less than 0.0003 fibers/cubic centimeter (f/cc), which is comparable to the non-activity-based off-Site and on-Site results obtained during previous sample collection events. All other samples, including those located along the McDonald's back-parking lot, were non-detect for asbestos. This is consistent with historical aerial photography of the Site dating back to 1937, which indicates that the former McDonald's property was historically used as a band-stand and/or parking lot. and was not used as a waste disposal area. Based on this information, EPA, ATSDR, and the PADOH concluded that off-Site exposure does not pose a public health threat and that it is safe to walk near the Site and/or visit the nearby businesses (e.g., former McDonald's, Southeastern Pennsylvania Transit Authority (SEPTA)).

23. *Comment: It has been mentioned that additional work needs to be done to correct the slopes on the three creeks. When will this commence?*

    EPA Response: The EPA Removal Program has completed all capping work along the stream banks and EPA is not aware, nor does it agree, that additional work needs to be done. No additional work aside from O&M activities is anticipated for the slopes of the three creeks.

24. *Comment: Please describe how you can permit a building to be erected on the Site without disturbing the cap. How could a building be erected without the use of pilings on such an unstable site?*

    EPA Response: As discussed at the Public Meeting on January 10, 2017, EPA will assemble the necessary team to review any building plans prior to accepting or approving any future use plans for the Site to ensure that the integrity of the cap will be protected and that human health and the environment are protected during construction and in the long-term.

25. *Comment: Early in the BoRit CAG process, there was a formal CAG subgroup --the Future Uses Group -- which met and considered most preferred scenarios for use of the 38 acres of the BoRit Site. The Future Uses Group prepared a generally accepted Vision Plan of how the parcels as a whole could best serve the communities. [Note: not all members of the CAG agreed to this reuse vision. There was never a formal vote of acceptance by the CAG.]*

    There is a parcel by parcel description of preferred uses, a vision for the combined parcels, and a vision for the natural resources of all the parcels and the whole. Under General Recommendations was an item for EPA to "work with property owners to explain recommendations and establish collaboration." Collaboration has been done with Whitpain Township for future park uses and with the Waterfowl Preserve for the reservoir parcel. Planning for community uses of the Asbestos Piles has been absent. A few salient points from the Future Uses Group's Draft 2010 Vision Plan are highlighted below:

- *On Kane Core Parcel: implement uses and improvements that are complementary to those on other BoRit site parcels and on adjoining open space, conservation, and recreation areas.*
- *Identify and implement opportunities to improve [the KaneCore] parcel as gateway to the Wissahickon Greenway Park, including interpretive amenities and facilities for park-related demonstrations, program, and performances.*
- *Promote concept of a comprehensive Greenway Park.*
- *Encourage landowners to prepare a collaborative comprehensive park master plan*
- *Focus on the Wissahickon Green Ribbon and connective opportunities*
- *Evaluate local land use regulations to create consistency and sustainability for the Greenway Park concept.*
- *Develop a unified interpretive theme based on Wissahickon heritage*
- *Create a unified pedestrian greenway edge along rear of the BoRit properties with new pedestrian bridge to other side of Wissahickon.*
- *Institute an interpretive program to educate and understand the Wissahickon's nature history; foster ethic of stewardship for creek and greenway.*

The Ambler Environmental Advisory Council (EAC) holds a member seat on the BoRit CAG. The EAC is interested in urging the EPA to design bench locations, lighting, and historical and educational sign locations to be installed on the Asbestos Piles portion of the BoRit Site. Benches, lighting, and signage will require cooperation by EPA to put footings in place before Remedial Actions are completed. Signage could focus on Ambler's asbestos history, this BoRit Superfund Site findings and chosen treatments, why the Wissahickon Creek is important, and measures for homeowners to take to reduce stormwater run-off.

I request that EPA as fully as possible embrace the Vision Plan (2010). By embracing the vision plan, EPA will earnestly incorporate the very most of the recommendations that are possible -- for all three interior parcels -- but especially for the what is referred to in the Vision Plan as the Kane Core Parcel. I request genuine consideration of the highlighted points above. A scanned copy of the entire Vision Plan is attached.

EPA Response: Beneficial reuse or redevelopment at all three Site parcels could include a wide range of possibilities from open-space plans and improved natural habitat to economic redevelopment scenarios. As long as redevelopment does not damage the capping remedy that EPA put in place, it is up to the property owners of each parcel to decide how each parcel may be reused. Anticipated future use plans for the Park parcel and the Reservoir parcel are described in detail in the Proposed Plan and are presented briefly in Section 6.0 of this ROD.

26. Comment: *While the remainder of that first institutional control implies that EPA and PADEP will determine whether such an adverse impact occurs, Whitpain Township respectfully requests that the language of the first IC be revised as follows: "Activities or modifications that could disturb or otherwise adversely impact the 2-foot soil cover on the capped areas are prohibited, unless prior written approval from EPA, in consultation with PADEP, is obtained authorizing the specific activity..." Without the suggested*

change, the first IC could be interpreted as an absolute prohibition to that potential re-use.

EPA Response: Section 13.2.6 of the ROD has been modified as suggested in this comment.

27. Comment: *The Fourth IC restricts access after major storm events until the property has been inspected for any signs of damage or erosion especially in the 100-year floodplain. The Township believes this proposed IC is overly broad. The vast majority of the Park Parcel, including all areas that the Township intends for reuse, is at an elevation that cannot be affected by a major storm event. The only portion of the Park Parcel that could be affected by a storm event would be the banks of Wissahickon and Rose Valley creeks. Therefore, the ICs should be amended to state that the banks of Wissahickon and Rose Valley creeks will be inspected for any sign of erosion after a major storm event, but that public access will not be denied to any other portion of the Park Parcel.*

    EPA Response: Although EPA agrees that the vast majority of the Park Parcel is unlikely to be impacted by a major storm event, EPA believes full Site closure is a prudent and necessary step until an inspection is conducted.

28. Comment: *Taking into consideration the real-world possibilities of environmental and accidental damage to any part of the 2-foot soil layer comprising the cap, what are the public health and environmental impacts of foot, vehicle, and construction vehicle traffic to exposed areas at these depths either caused directly or indirectly from human use on and around the BoRit site to areas .25 miles, .5 miles, .75 miles, and 1 mile adjacent to the BoRit site?*

    EPA Response: The capping remedy is designed to be protective of human health and the environment with the intent that the Site would be used for recreational use in the future. Specifically, the capping remedy is designed to immobilize asbestos-containing materials, prevent erosion along the stream banks, and resist flooding events. In accordance with Section 13.2.6 of this ROD, any future construction at the Site requires EPA and PADEP approval to ensure construction activities (including heavy equipment) will not damage the cap and expose waste or soil. O&M will be performed in accordance with Section 13.2.9 of this ROD to ensure that any breaches to the cap observed during inspection activities are repaired in a timely matter throughout the life of the remedy. With respect to the area of concern, EPA anticipates that Whitpain Township will pave any areas that would be used for vehicle traffic. Any paved surfaces would enhance the existing cap.

29. Comment: *Taking into consideration the real-world possibilities of environmental and accidental damage to any part of the 2-foot soil layer comprising the cap, what are the direct and indirect effects of surface water run-off on the 2-foot soil layer comprising the cap at the following levels from surface exposure to simulate erosion and or accidental damage; 6 inches, 12 inches, 18 inches, and 24 inches, and the geotextile cover to areas .25 miles, .5 miles, .75 miles, and 1 mile adjacent to the BoRit Site.*

EPA Response: In accordance with Section 13.2.9 of this ROD, during O&M, any breaches to the cap will be repaired in a timely manner to prevent additional erosion from surface water runoff. The two-foot soil cap is covered with an additional six inches of top soil and a vegetative cover. Vegetation (i.e. grass and plants) is a component of the capping remedy designed to provide a level of protection against erosion to maintain the minimum thickness of clean soil and to maintain proper Site drainage.

30. *Comment: One commenter questioned how the proposed ABS procedures accurately simulate child activity and exposure and if another methodology would show more exposure and change the risk levels.*

    EPA Response: While it may be true that children will occasionally engage in highly intensive soil disturbance activities, it is unlikely that these types of activities would occur with sustained frequency in areas with exposed soil over a long-term, multi-year exposure scenario. The ABS that was conducted to quantify child exposures utilized a raking scenario to represent a variety of soil disturbance activities and intensities. As discussed in EPA's *Framework for Investigating Asbestos-Contaminated Superfund Sites* (EPA 2008), a raking scenario is recommended as a surrogate for high-end disturbance activities. Placement of the air monitor at an adult waist-height is appropriate as this is likely to be the location that best represents a child's breathing zone.

31. *Comment: It was also questioned whether local children will only play on the Site 50 days out of the year*.

    EPA Response: There are two points to consider when looking at the assumed number of play days. First, it is important to distinguish between the amount of time spent playing and the amount of time spent engaging in active soil disturbances when airborne releases of asbestos can occur. While it may be true that children will play at the Site more frequently than assumed in the preliminary cleanup level calculation, only a fraction of this time on the Site is spent actively engaging in soil disturbance activities. In addition, only a fraction of the time spent engaging in soil disturbance activities is likely to result in airborne releases of asbestos. Airborne releases of asbestos are unlikely to occur when soils are covered by snow or when soil moisture is high (i.e. exposure primarily occurs during the driest months of the year [May-October]). Thus, exposures during soil disturbance activities occurring outside of this timeframe, when the soil moisture is high, are likely to be negligible.

    Second, while it is correct that the *off-Site residential* child exposure scenario (which is the basis of the ABS air preliminary cleanup level) assumed an RME exposure of 4 hours per day and 50 days per year, the *on-Site recreational* child exposure scenario assumed an RME exposure of 1 hour per day and 25 days per year. The selection of the ABS air preliminary cleanup level as the cleanup level for on-Site recreational exposures is intentionally conservative (i.e. the preliminary cleanup level is 8 times higher than is necessary to achieve the target cancer risk for the recreational exposure scenarios).

32. _Comment:_ *It was requested that EPA clarify why the maintenance worker is considered to be the most conservative approach.*

EPA Response: The RME exposure parameters used in the HHRA indicate that the maintenance worker has the highest potential for exposure compared to the other on-Site receptors, taking into consideration exposure time, frequency, and duration. (While the recreational visitor does have a longer exposure duration, this is offset by the shorter exposure time and frequency.) However, the receptor that has the highest potential for exposure across both on-Site and off-Site receptors, is the resident. It is for this reason that the ABS air preliminary cleanup level was derived based on a residential exposure scenario. The ROD includes language in Section 5.3.1.4 that makes it clear that reference to the maintenance worker as being the most conservative receptor is specific to *on-Site* receptors.

33. _Comment:_ *The CAG requests that the EPA specify International Organization for Standardization (ISO) air sample testing as the method to use to ensure accurate results and the increased protection of health and safety.*

EPA Response: The analytical method recommended by EPA OSWER Directive #9200.0-68, *Framework for Investigating Asbestos-Contaminated Superfund Sites*. for quantifying asbestos concentrations in air is transmission electron microscopy (TEM)-ISO 10312. EPA recommends the TEM-ISO method at Superfund sites, because it allows recording of all fibers to inform future analysis should new toxicity models be developed. The TEM-ISO method is used for the determination of the concentration of asbestos structures in air samples, and includes measurement of the lengths, widths, and aspect ratio (ratio of length to width) of the asbestos structures. During the RI, all ABS and ambient air samples were analyzed by TEM-ISO 10312. Because the toxicity data used as the basis of the asbestos inhalation unit risk are based on analyses performed using phase contrast microscopy (PCM), TEM analysis results from the RI were reported as PCM-equivalent (PCME) structures per cubic centimeter (s/cc). It is anticipated that TEM-ISO 10312 will continue to be used in any future air sampling efforts for the Site. However, use of TEM-ISO 10312 is not required by the ROD so that other sampling methods may be used at the Site if determined to be appropriate in the future.

34. _Comment:_ *The CAG requests that asbestos removal from the entire Wissahickon Creek be added to the Proposed Plan. This should be done on a yearly basis until such time as the Creek is deemed to be clear of ACM.*

EPA Response: Section 13.2.9 of this ROD requires annual inspection and removal of any ACM observed in Wissahickon Creek adjacent to the Site. ACM observed further downstream in Wissahickon Creek will be removed as part of ongoing O&M at the Ambler Asbestos Piles Superfund Site.

35. _Comment:_ *The CAG notes that if soil testing after completion of the remediation shows migration of asbestos fibers into the clean fill above, the EPA may have to reopen the project and implement a whole new remedy.*

EPA Response: As indicated in Section 13.2.7 of this ROD, confirmation sampling upon construction completion will include ABS (in previous locations of high level asbestos detections in the Park parcel, the Asbestos Pile parcel, and off-Site residential areas), ambient air sampling, and surface water sampling. If results from confirmation sampling indicate that the remedy does not meet the cleanup levels and RAOs specified in this ROD, then EPA would invoke the options set forth in the NCP to modify the Selected Remedy.

36. *Comment: The CAG requests that regular air monitoring take place, especially during grass mowing and especially in the first five years. In addition, the CAG proposes a more rigorous and frequent sampling inspection program in the initial years after final installation of the cap.*

    EPA Response: EPA will perform ABS as part of confirmation sampling after construction of the remedy is complete in accordance with Section 13.2.7 of this ROD. In addition, as noted in Section 13.2.8 of the ROD, LTM is included as a component of the Selected Remedy. LTM, which includes ABS, will be conducted annually for the first four years leading to the first FYR and then once every FYR cycle thereafter. Both confirmation sampling and LTM will be used to ensure that capping remains protective over the lifetime of the remedy.

37. *Comment:* *The Proposed Plan proposes that the Site be closed after a catastrophic event until inspected and deemed safe for re-entry. The CAG would like to know how the EPA can secure a Site that is essentially open by design, especially after a catastrophic event. This should be addressed in the IC's.*

    EPA Response: Section 13.2.6 of this ROD requires that the Site be closed after a significant weather event (i.e., a storm or hurricane that resulted in flooding). Current fencing and lockable gates installed by the EPA Removal Program will remain in place and will be maintained at the Site to prevent access after storm events until the Site is determined to be safe. If a catastrophic event (i.e., tornado, hurricane) were to occur, EPA would consider invoking its emergency response authority via a Removal Action. However, it is not anticipated that a catastrophic event would occur based on the design standards used for the Selected Remedy.

38. *Comment:* *Due to the presence of other Site contaminants (organic and inorganic) that are not being remediated, the CAG requests that that there be a ban on potable use of either surface or groundwater on the entire Site in the ICs.*

    EPA Response: A ban on potable use of groundwater and surface water is not necessary. As noted in Section 7.4 of this ROD, groundwater at the Site is not considered a medium of concern. Groundwater in the shallow bedrock flows toward Wissahickon Creek and away from the public water supply wells, and any groundwater contamination present in on-Site wells would not be expected to impact the public water supply wells. Intrusive work at the Site, such as installation of a well, is restricted in accordance with

Section 13.2.6 if this ROD and would require approval from EPA, in consultation with PADEP.

The Reservoir does not serve as a drinking water source, and beneficial use of surface water in the creeks at the Site includes recreational use such as swimming and fishing in Wissahickon Creek and wading in Tannery Run or Rose Valley Creek.

39. *Comment: The CAG recommends that woody vegetation be NOT used, due to eventual plant death and potential asbestos exposure when the tree or shrub falls and the roots and soil are exposed.*

    EPA Response: The ICs required by Section 13.2.6 of this ROD prohibit trees in sloped areas and certain areas of the Reservoir berm. As required by Section 13.2.9, quarterly inspections for O&M will evaluate tree growth for other areas of the Site and any trees that shows signs of toppling will be removed.

40. *Comment: The CAG requests that EPA include economic figures for catastrophic replacement in its cost analysis.*

    EPA Response: EPA has not included economic figures for catastrophic damage to the Selected Remedy because, as noted in the response to Comment 37, any catastrophic event (i.e., tornado, hurricane) would be addressed under EPA's Removal Program. It is not anticipated that a catastrophic event would damage the Selected Remedy based on the design standards that were used.

41. *Comment: The CAG asks EPA to justify the cost of leaving contamination in place, with the associated costs of monitoring and maintenance in perpetuity versus the costs of the treatment scenarios.*

    EPA Response: As noted in Section 9.2 of the ROD, the treatment alternatives, as well as the excavation and off-Site disposal alternative, would be substantially more expensive to implement. O&M costs for the Selected Remedy are estimated at $545,000 for the entire Site over a 30-year duration. O&M costs are less than 1 percent of the total present value costs for treatment and removal alternatives which ranged between $256.7M to $268.8M. The Selected Remedy was determined after EPA conducted a detailed analysis of alternatives using the nine criteria set forth in 40 CFR § 300.430(e)9)(iii). These criteria address statutory requirements and considerations for cleanup actions in accordance with the NCP.

42. *Comment: The CAG recommends that the EPA use the more conservative discount of 1.5% in estimating future costs.*

    EPA Response: Cost estimates developed during the detailed analysis of alternatives were prepared in a manner consistent with EPA's *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, OSWER Directive 9355.0-75, which states the following:

EPA policy on the use of discount rates for RI/FS cost analyses is stated in the preamble to the National Contingency Plan (NCP) (55 FR 8722) and in Office of Solid Waste and Emergency Response (OSWER) Directive 9355.3-20 entitled "Revisions to OMB Circular A-94 on Guidelines and Discount Rates for Benefit-Cost Analysis" (USEPA 1993). Based on the NCP and this directive, a discount rate of 7% should be used in developing present value cost estimates for Remedial Action alternatives during the FS. This specified rate of 7% represents a "real" discount rate in that it approximates the marginal pretax rate of return on an average investment in the private sector in recent years and has been adjusted to eliminate the effect of expected inflation. Therefore, this rate should be used with "constant" or "real" dollars that have not been adjusted for inflation (i.e. a dollar spent in future years is worth the same as a dollar spent in the present year), which is the typical situation for RI/FS cost analyses.

43. *Comment: The Reservoir should be eliminated and changed into a designed flood control basin and managed by an authority having jurisdiction. See State of Pennsylvania Code Chapter 105. Dam Safety and Waterway Management. The Reservoir should be lined with an impervious liner like a below ground swimming pool that will not let ground water, water springs, sub-earth creatures, or above earth creatures from compromising the reservoir lining integrity.*

EPA Response: The Reservoir is not a regulated structure or activity as defined in 25 PA Code § 105.3. EPA does not believe the Reservoir should be converted into a flood control basin because doing so would require significant excavation, and therefore potential exposure, of contaminated media. While not designed specifically as a flood control basin, the reservoir does provide some flood mitigation benefits by capturing and retaining stormwater that falls on the Reservoir Parcel. The RI Addendum notes that while there is some hydraulic communication between groundwater and Reservoir surface water, the extent and degree of communication is limited. Groundwater inflow/recharge to the Reservoir can be considered a secondary contributor to the Reservoir surface water, and Reservoir surface water outflow to groundwater is sufficiently small as to not be measurable in monitoring wells.

As previously stated, because asbestos is a fiber, it does not move freely in soil. In addition, asbestos fibers are not soluble and therefore cannot be transported in a water solution like other, smaller contaminant molecules and ionic species. As a result, capping prevents asbestos migration from contaminated Reservoir sediment into Reservoir surface water.

44. *Comment: EPA should go yard to yard, identify ACM that is being used in unsafe ways, and remove it. I know it is a little more complex than that but something more needs to be done. Asking residents to self-report ACM when residents may not even know what ACM is unrealistic and ineffective. Offer it up as an amnesty ACM day. No cost removal.*

EPA Response: Residents in the Ambler area have expressed concerns about the possibility of having asbestos in their yards. To address these concerns, EPA has offered, and continues to offer to conduct visual inspections upon the request of the property owner. Since the offer was made to the community in December 2008, EPA has received three requests to conduct visual inspections.

45. *Comment: Geotextile porosity should be defined in the current Site and proposed remedial capping plan and how it specifically controls the movement of asbestos containing materials in soil.*

EPA Response: Asbestos is made up of fibers, and although the fibers and fiber fragments can be microscopic, these particles are still large, complex molecules in the microscopic environment. Asbestos fibers are not soluble and therefore cannot be transported in a water solution like other, smaller contaminant molecules and ionic species. The particles are also too large to be transported preferentially by other physical-chemical processes like diffusion. Therefore, asbestos fibers tend to remain stationary within the soil matrix. In other words, in a natural soil setting, asbestos fibers do not move through the soil. As noted in the response to Comment 16, numerous studies have shown that asbestos does not migrate through soil. The purpose of the geotextile material placed at the Site is to separate waste from clean fill. Water will be able to percolate down through the clean soil layer and through the geotextile material, but the asbestos fibers will be trapped within the contaminated soils and, thus, will not be able migrate up through the geotextile layer and into the clean soil cap.

46. *Comment: Leave the Proposed Remedial Action Plan open. Contract Geosciences Research Division at Scripps and Center of Excellence in Environmental Toxicology (CEET) to study and test the Ambler Pile right now before approving the Remedial Action plan. Use their study to evaluate and recommend the best remedy.*

EPA Response: Please refer to the response provided under Section 2.4 of this Responsiveness Summary for EPA's rationale for capping as the Selected Remedy. During the RI, the Asbestos Pile parcel was studied to determine the depth and distribution of contaminated waste and soil, and results from the RI were used in the HHRA to determine risks present at the Asbestos Pile parcel in the absence of any Remedial Action. The Selected Remedy was determined after EPA conducted a detailed analysis of alternatives using the nine criteria set forth in 40 CFR § 300.430(e)9)(iii). These criteria address statutory requirements and considerations for cleanup actions in accordance with the NCP and additional technical and policy considerations that have proven to be important for selecting among cleanup alternatives.

47. *Comment: Reservoir ICs should include: (a.) A procedure and escrow to control waterfowl from entering the Site should be accounted for if elevated levels of contamination are detected; (b) The Inspection, Maintenance and Operation of Dams in Pennsylvania 2009 Edition Reprinted 2013 should be followed and if not the following items should be included in the IC inspection program: contaminant testing, vegetation*

control, rodent control, earthwork, concrete inspection, conduits, internal maintenance, mechanical, electrical, hydraulic, access roads, monitoring devices, surveying to ensure berm integrity, winterizing, vandalism prevention, and signage.

EPA Response: Capping implemented at the Reservoir was designed to be protective of human health and the environment. As mentioned in the Proposed Plan and ROD, EPA anticipates that the Wissahickon Waterfowl Preserve will maintain ownership of the Reservoir parcel, and EPA understands that the parcel will continue to be used as a waterfowl preserve. Confirmation sampling will include sampling of Reservoir surface water to ensure protectiveness of the remedy (see ROD Section 13.2.7). LTM for Reservoir surface water will be determined based on the results of the confirmation sampling (see ROD Section 13.2.8). O&M Plans for the Reservoir parcel will include monitoring of the water levels, maintenance of vegetation, inspection after significant storm events, and maintenance of fencing (see ROD Section 13.2.9).

48. *Comment: The current Site and any proposed remedial plan needs to have adequate vegetation control that is in compliance with local ordinance for height and type.*

EPA Response: Local ordinance requires that vegetation not planted for a useful purpose not exceed a height of six inches. Vegetation for certain areas of the Site (i.e., Asbestos Pile slopes and stream banks) will be maintained at a height greater than six inches to deter burrowing animals (i.e., groundhogs). The O&M Plan being prepared for the Site describes vegetation maintenance requirements including a mowing schedule. EPA anticipates that vegetation along the Asbestos Pile slope and stream banks will be mowed annually and the remaining vegetation on the Site will be mowed on a more frequent basis depending on the recreational use.

49. *Comment: In keeping with the proposed open space future use of the property as discussed above, it is recommended that the cover vegetation used throughout the Site be carefully selected to provide habitat enhancement to attract appropriate non-burrowing animals and to provide color and attractive vistas to be enjoyed by the community. Overall, native grasses and wildflowers should be used, when possible, as cover vegetation. Appropriate native grasses with strong root systems can provide soil stability further strengthening the soil cap above wastes. Managing the natural meadow areas will require mowing at least once a year during the winter as well as other measures. No trees or shrubs should be planted on-site into the capping system due to eventual plant death and potential asbestos exposure when the tree or shrub uproots. Continuous maintenance will be required to remove any wooded plants that start to grow at the Site.*

EPA Response: The cap was hydro-seeded with native grasses and wildflowers that were carefully selected for their suitability to the local terrain and climate as well their stabilizing growth habits. The seeded areas were covered with erosion mats made of straw or, on steep slopes, woven, high performance, turf mats, which allowed the seeds time to sprout. As they mature, the plants will help to sustain and shelter migrating birds and native wildlife.

The O&M Plan being prepared for the Site outlines requirements for regular inspection for any evidence of disturbance to the cap by burrowing animals (i.e., groundhogs) as well as a mowing schedule for vegetated areas of the Site. The vegetation along the Asbestos Pile and the stream banks will be mowed annually, and the remaining vegetation on the Site will be mowed on a more frequent basis depending on the frequency of recreational activities in the area. The ICs for the Site designate areas of the Site where tree growth is prohibited (see ROD Section 13.2.6). Tree growth in allowed areas of the Site will be maintained to minimize the potential for wind throws or toppling of any dead trees.

50. _Comment:_ *O&M and ICs costs and escrow reserves should be increased for the following:*

(i.) *Wissahickon Stream Embankment Failure – The stream embankment has failed at least once after it was initially constructed due to heavy rain and water flow. This should be anticipated again. A cost basis could be set based upon the previous failure and re build costs/time.*

EPA Response: The cost estimates for the Selected Remedy include costs associated with repairing damage to the cap after storm events. EPA and USACE used damage caused by Tropical Storm Lee to fortify and strengthen stream bank stabilization work at the Site. Improvements included anchoring of CCM, adding a swing gate to Rose Valley Creek to control stormwater flow in future storm events, and adding a guard rail to Rose Valley Creek to prevent large debris from entering the channel..

(ii.) *Erosion Redesign and Construction – All areas that show water run-off point sources will fail and require redesign not just maintenance over time. A plan to identify all point source runs should be completed and funded for at least a 50% failure rate.*

EPA Response: As noted in Section 13.2.6 of this ROD, the Selected Remedy includes ICs which require that public access shall be restricted after significant weather events until the Site has been inspected. The Selected Remedy's ICs also require suitable vegetative cover to provide a level of protection against erosion, to maintain the minimum thickness of clean soil, and to maintain proper Site drainage. O&M will be performed in accordance with Section 13.2.9 of this ROD and includes quarterly inspections to ensure that vegetation remains in place and performs as designed. If necessary, modifications to vegetation and drainage at the Site will be evaluated during the FYRs.

(iii.) *Fence, curb, sidewalk, signage (all types), lighting, roadways and shared property should be anticipated to be vandalized, weathered and deteriorated/depreciated due to normal construction life expectancy. Escrow funding should include new signs every 5 years as they will fade, become damaged, stolen or otherwise altered.*

EPA Response: Fencing, curbs, sidewalks, and roadways are not considered a component of the capping remedy, and will be the responsibility of the property owners specific to each parcel. Any additional fencing or paved surface constructed at the Site would be implemented in accordance with the ICs specified in the ROD.

(iv.) *Rodent control services: It is noted that rodents are a significant and uncontrolled issue and concern at the adjacent Ambler Asbestos site under the FYR. It is still not under control. Professional and licensed services should be contracted and tested on the Ambler Asbestos site. A square footage estimate could be used as a comparison for future O&M at BORIT*.

EPA Response: Identification of animal burrowing will be included in the O&M Plan being prepared for the BoRit Site. EPA's experience at the Ambler Asbestos Pile Site has been considered for the BoRit Site, and preventative measures are being considered and implemented to prevent animal burrowing at the BoRit Site. One preventative measure includes mowing vegetation at least annually so that it will not become tall enough to provide shelter to groundhogs from predators. EPA is also considering the use of groundhog prevention fences.

(v.) *Reservoir (former hazardous waste holding pond) elimination and replacement. This is not in any estimate and should be added*.

EPA Response: During EPA's Removal Action, the Reservoir surface water was drained, treated, and discharged to Wissahickon Creek. The bottom of the Reservoir was covered with geotextile and overlain by two feet of clean material. The Reservoir was then refilled with water from Wissahickon Creek. The costs already incurred to remove and treat contaminated surface water previously present in the Reservoir were included in the detailed cost analysis for capping.

(vi.) *Reservoir (former hazardous waste holding pond) damage and repair, with integrity certification equal to that of the state requirements for dams and other man-made bodies of water should be calculated and added*.

EPA Response: The USACE was contracted by EPA during EPA's Removal Action to assess the structural integrity of the Reservoir berms. The only area that USACE identified with a slope stability concern was in the southwest corner of the Reservoir. The USACE report concluded that the berm in this area was not in immediate danger of a major failure from normal water levels in the Reservoir, but that measures to improve stability should be performed in the near future. The USACE-recommended solution to widen the interior slope of the berm by 30 feet to adequately address any slope stability problems was implemented as part of EPA's Removal Action.

(vii.) *Flocks of dead waterfowl due to Reservoir (former hazardous waste holding pond) contamination or spoilage should be anticipated and reserved for one occurrence. The reason for a single occurrence is after this happens,* item 53(v) *will need to be exercised*.

EPA Response: EPA's Removal Action addressed immediate environmental concerns at the Site. The capping remedy is designed to be protective of human health and the environment in the long term. EPA does not anticipate any risk associated with the BoRit Site that could lead to a flock of dead waterfowl in the future.

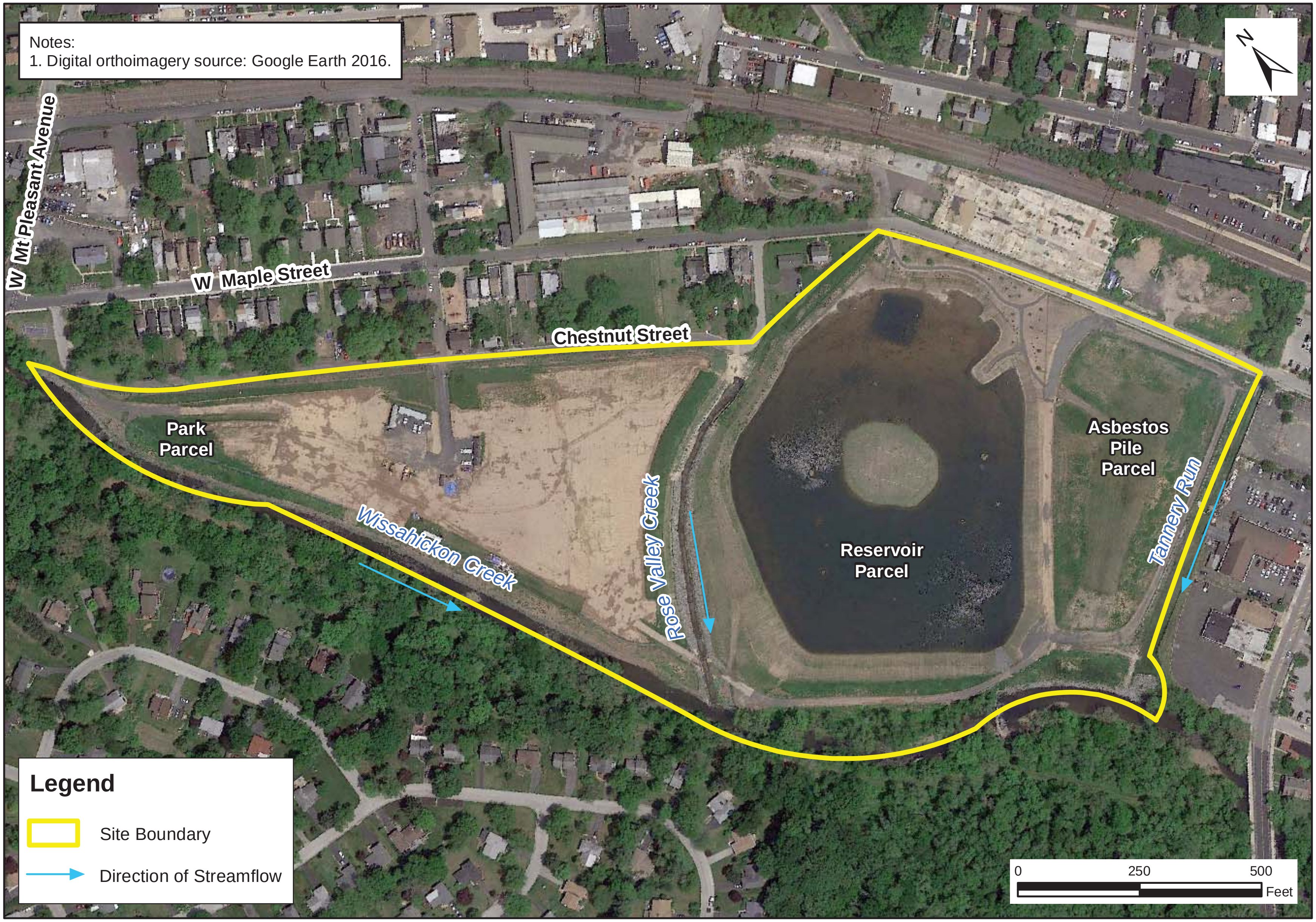
(viii.) *Funding to contract Geosciences Research Division at Scripps, CEET, and Perelman School of Medicine at the University of Pennsylvania to study and test the Ambler Pile and BoRit Site is needed right now and should be considered*.

EPA Response: Please refer to the response provided in Comment 46.

51. *Comment: According to the Proposed Plan there are metals that exceed soil screening levels at the Park parcel including aluminum, arsenic, cobalt, iron, lead, manganese, mercury, nickel, and vanadium. What is the potential for these metals to leach into the groundwater at toxic levels? Please explain why a full analysis has not been conducted on the groundwater and its potential to harm human health.*

EPA Response: An exceedance of a screening level does not necessarily mean there is unacceptable risk to human health or the environment. Rather, exceedance of a screening level simply means that the contaminant that exceeds its screening level must be evaluated further to determine whether it presents unacceptable risk. Site-wide groundwater was evaluated in the HHRA (Appendix A of the RI Report) and is summarized in Section 7.4 of this ROD. The HHRA identified Site-wide groundwater as a potential risk to future residents exposed to contaminated tap water and identified several chemicals as COPCs. Upon further analysis, the groundwater COPCs were identified as occurring at concentrations lower than those found upgradient, including isolated or one-time detections that did not suggest the presence of a contaminant plume, and/or did not appear to emanate from waste material or contaminated soil at the Site. In addition, Site groundwater flows toward Wissahickon Creek and away from the public water supply wells and is not expected to be a future drinking water source, because the potential future land use of the Site is considered recreational and non-residential. Therefore, no action is planned for groundwater at the Site.

Figures



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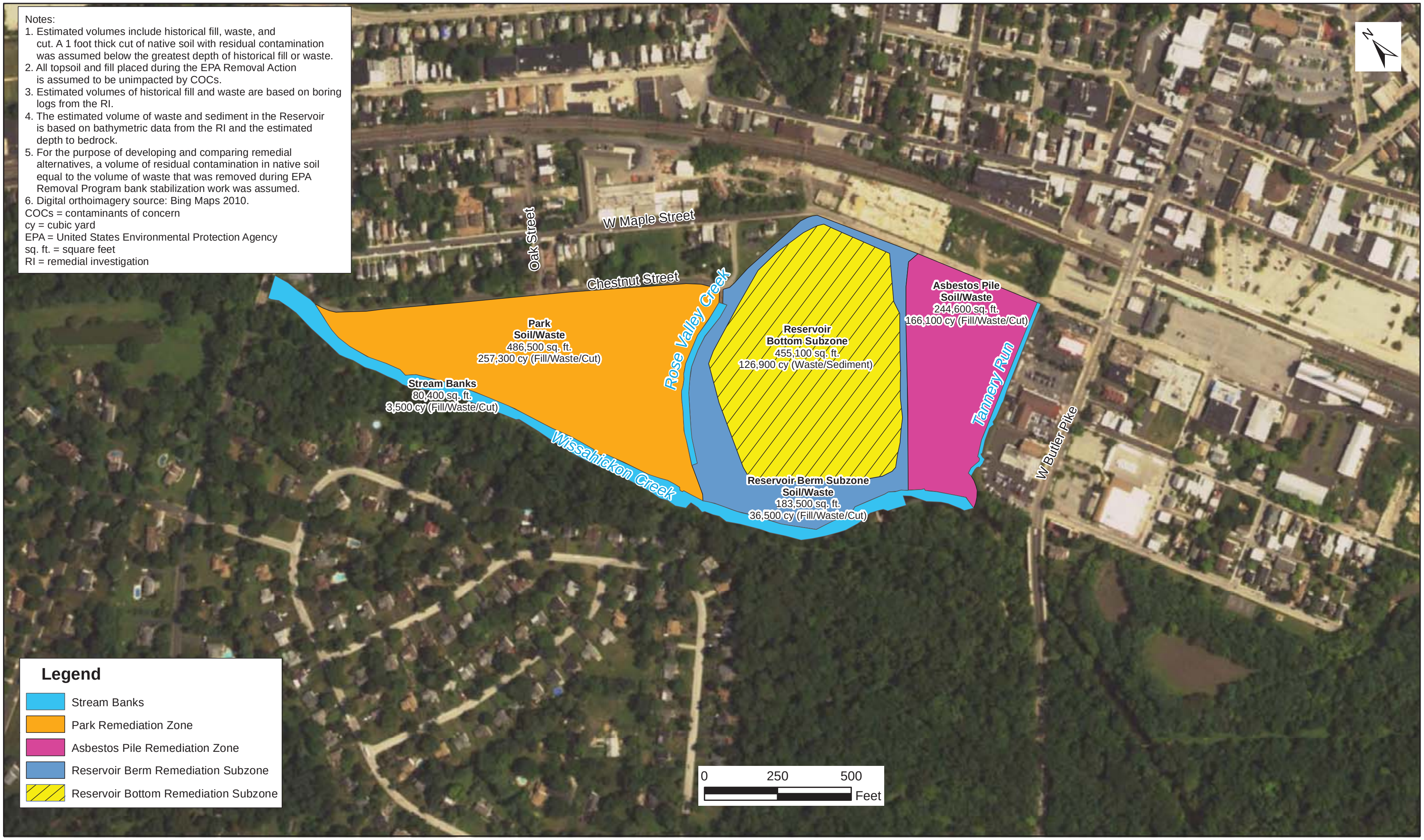
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Figure 1
Site Map

AR308572



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BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Figure 2
Remediation Zones

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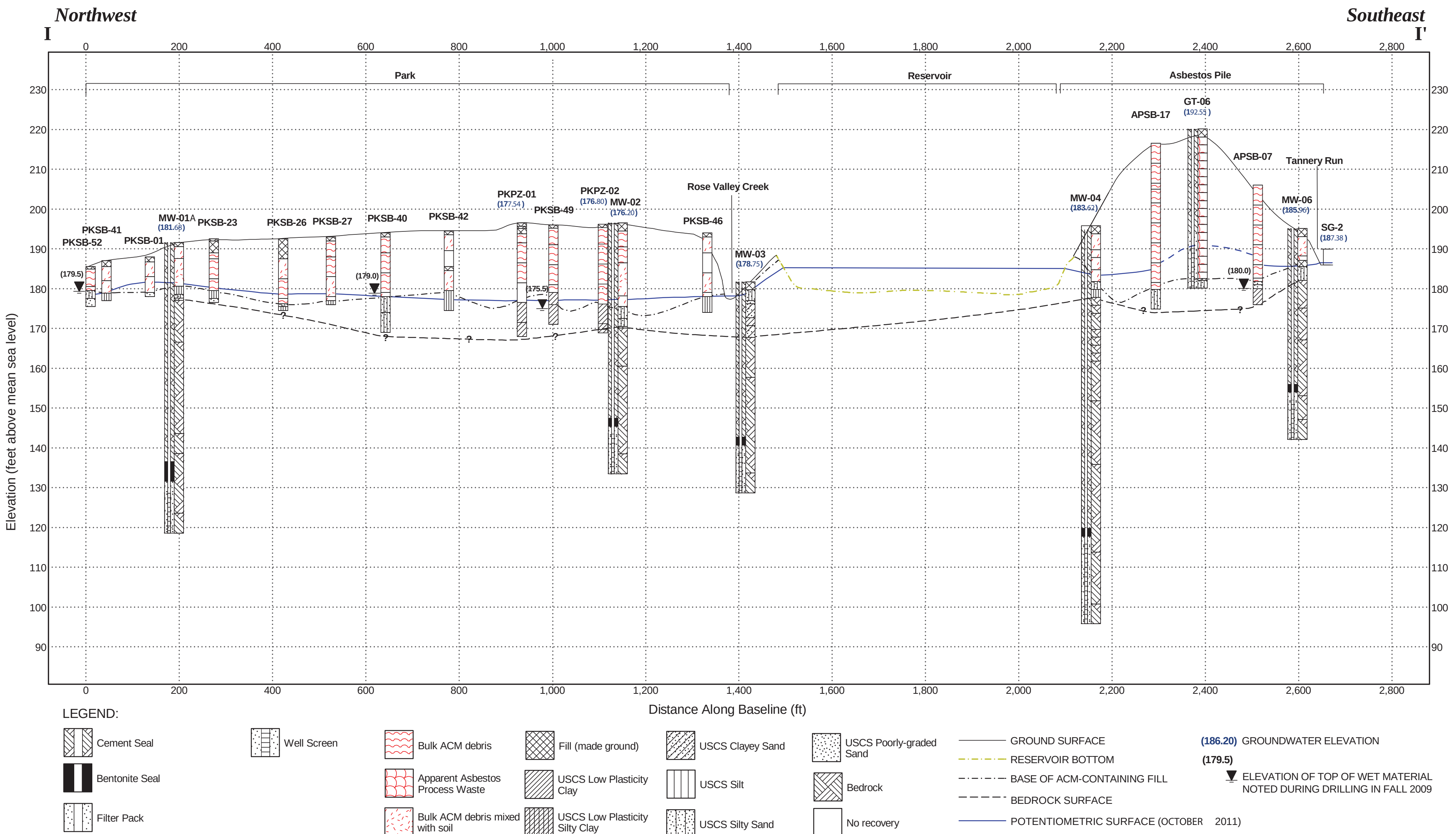
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Figure 3
Location of Cross Section I-I'



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).

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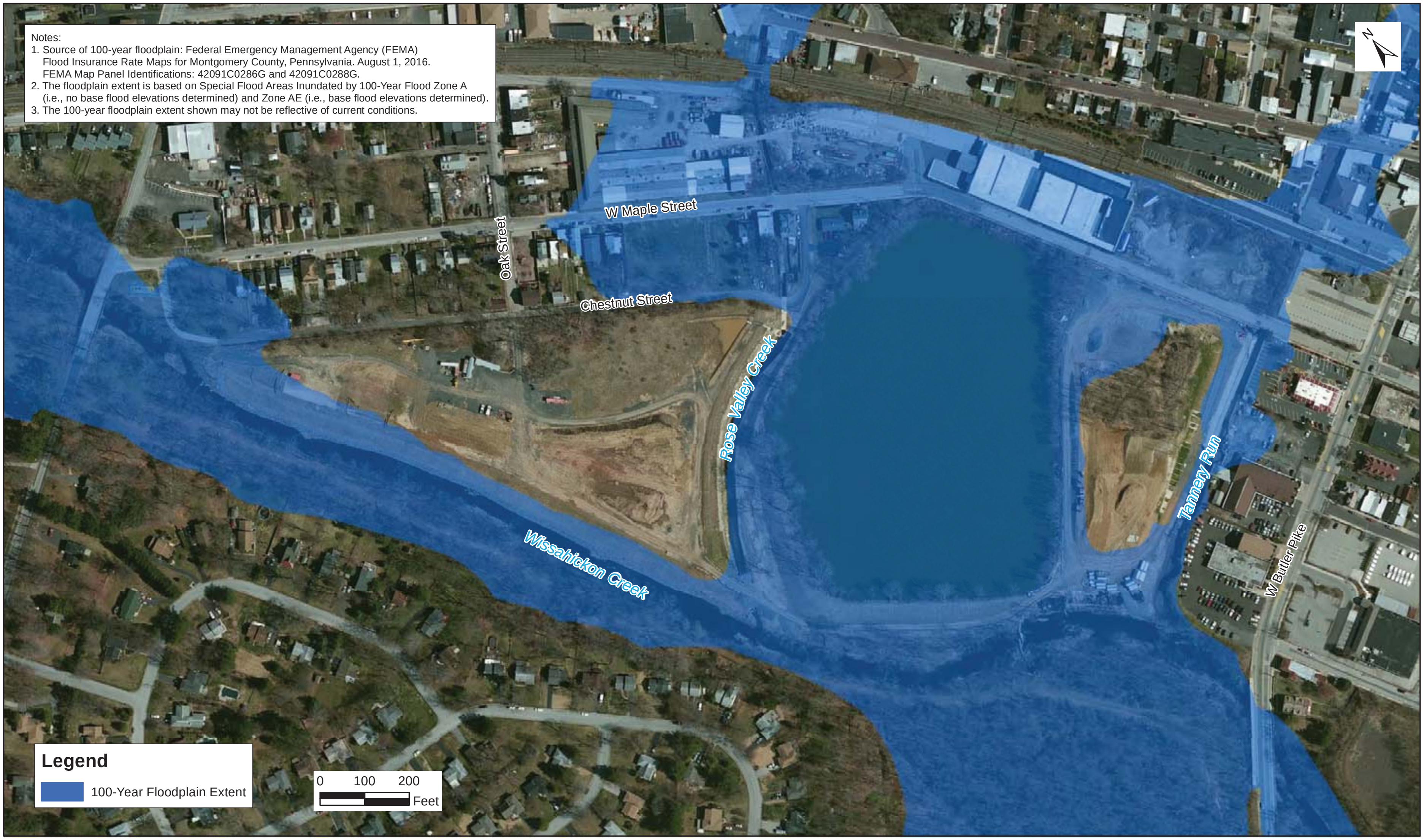
Figure 4
Cross Section I-I'
BoRit Asbestos Superfund Site
Ambler, Pennsylvania



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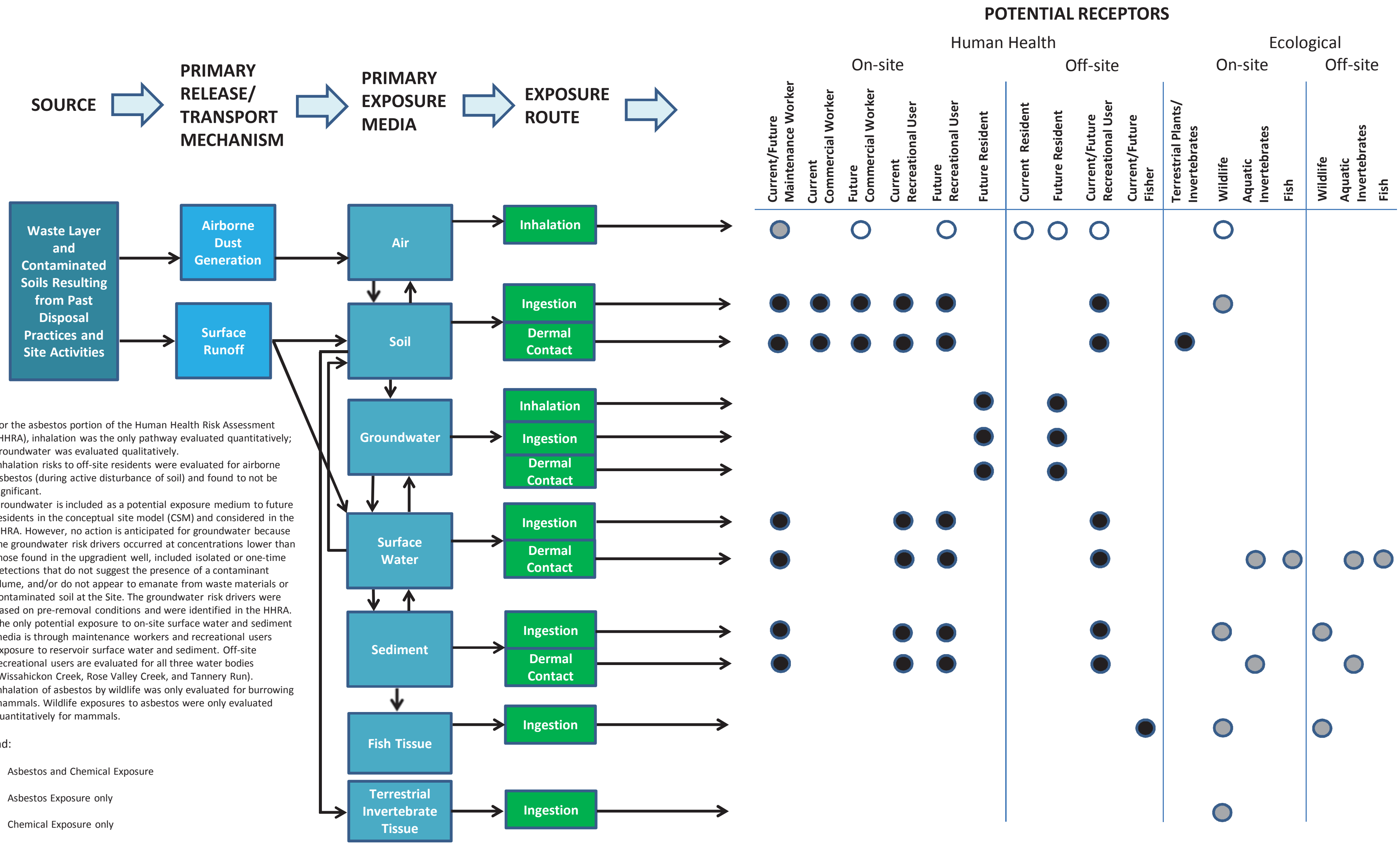
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Figure 5
100-Year Floodplain Extent



Notes:

1. For the asbestos portion of the Human Health Risk Assessment (HHRA), inhalation was the only pathway evaluated quantitatively; groundwater was evaluated qualitatively.
2. Inhalation risks to off-site residents were evaluated for airborne asbestos (during active disturbance of soil) and found to not be significant.
3. Groundwater is included as a potential exposure medium to future residents in the conceptual site model (CSM) and considered in the HHRA. However, no action is anticipated for groundwater because the groundwater risk drivers occurred at concentrations lower than those found in the upgradient well, included isolated or one-time detections that do not suggest the presence of a contaminant plume, and/or do not appear to emanate from waste materials or contaminated soil at the Site. The groundwater risk drivers were based on pre-removal conditions and were identified in the HHRA.
4. The only potential exposure to on-site surface water and sediment media is through maintenance workers and recreational users exposure to reservoir surface water and sediment. Off-site recreational users are evaluated for all three water bodies (Wissahickon Creek, Rose Valley Creek, and Tannery Run).
5. Inhalation of asbestos by wildlife was only evaluated for burrowing mammals. Wildlife exposures to asbestos were only evaluated quantitatively for mammals.

Legend:

- Asbestos and Chemical Exposure (grey circle)
- Asbestos Exposure only (open circle)
- Chemical Exposure only (black circle)

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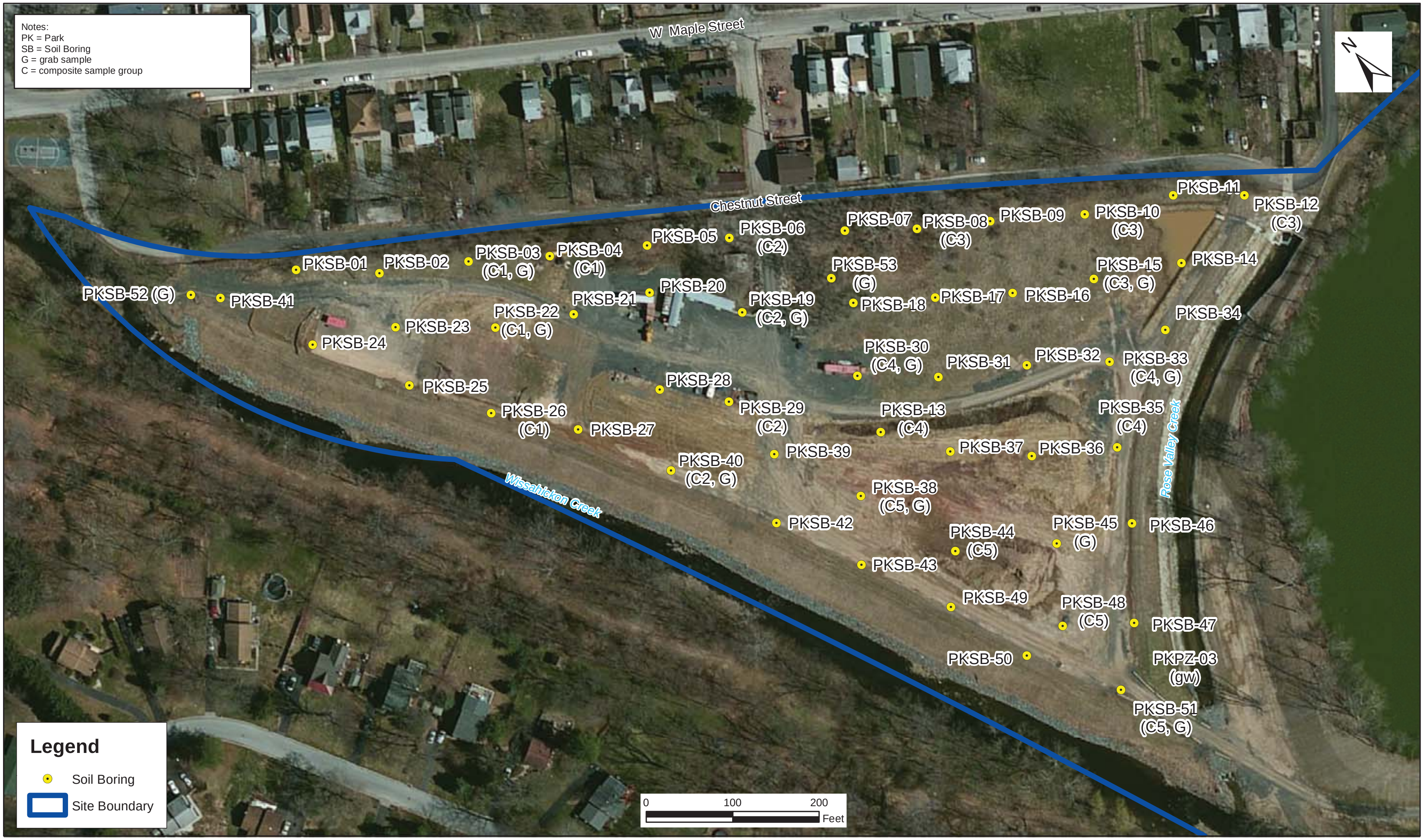
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Figure 6
Conceptual Site Model for Development of Remedial Alternatives



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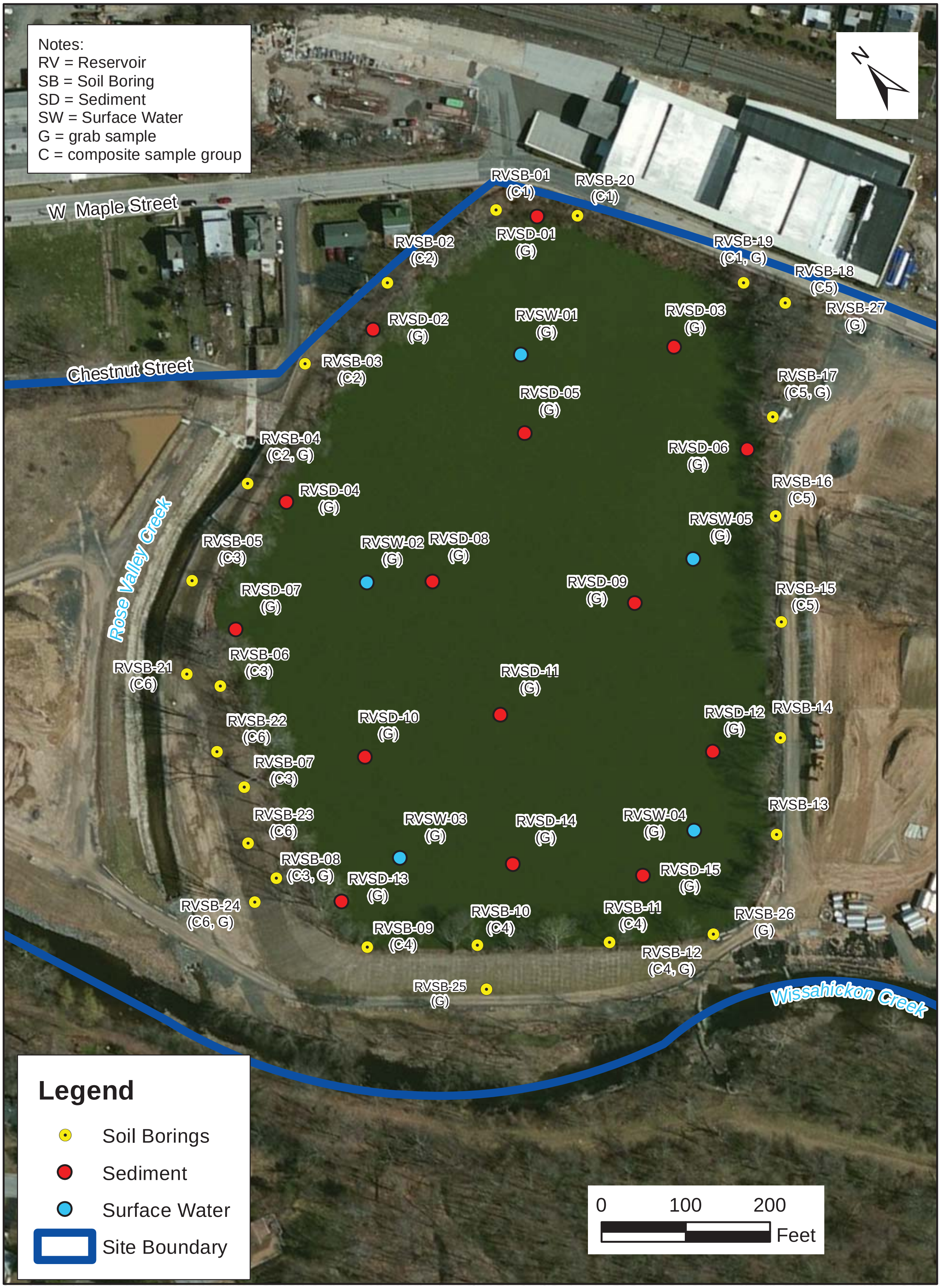
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Figure 7
Park Parcel Sample Locations



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BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Figure 8
Reservoir Parcel
Sample Locations
AR308579

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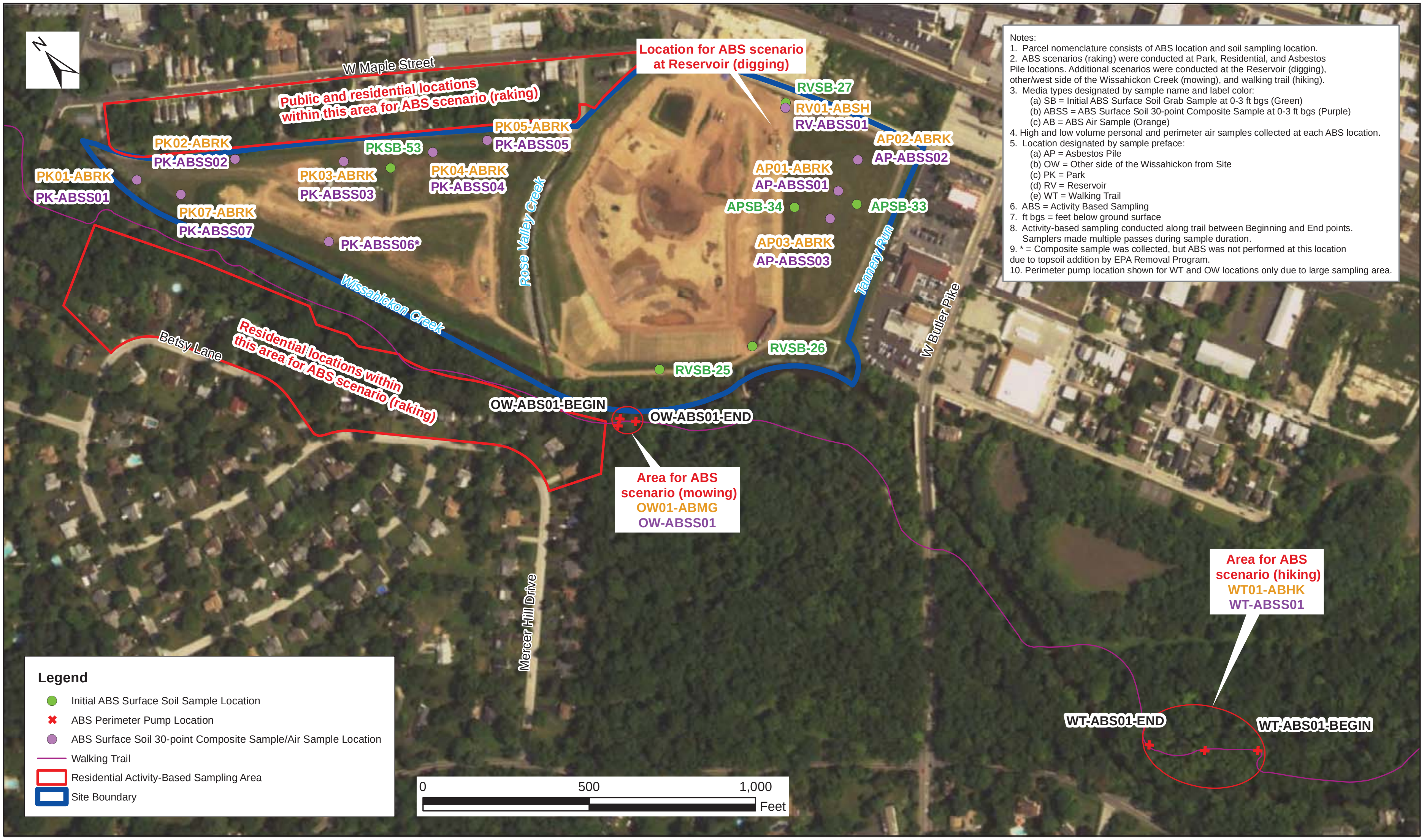
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Figure 9
Asbestos Pile Parcel
Sample Locations

BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Figure 10
Groundwater, Soil, and Creek Surface Water and Sediment Sample Locations



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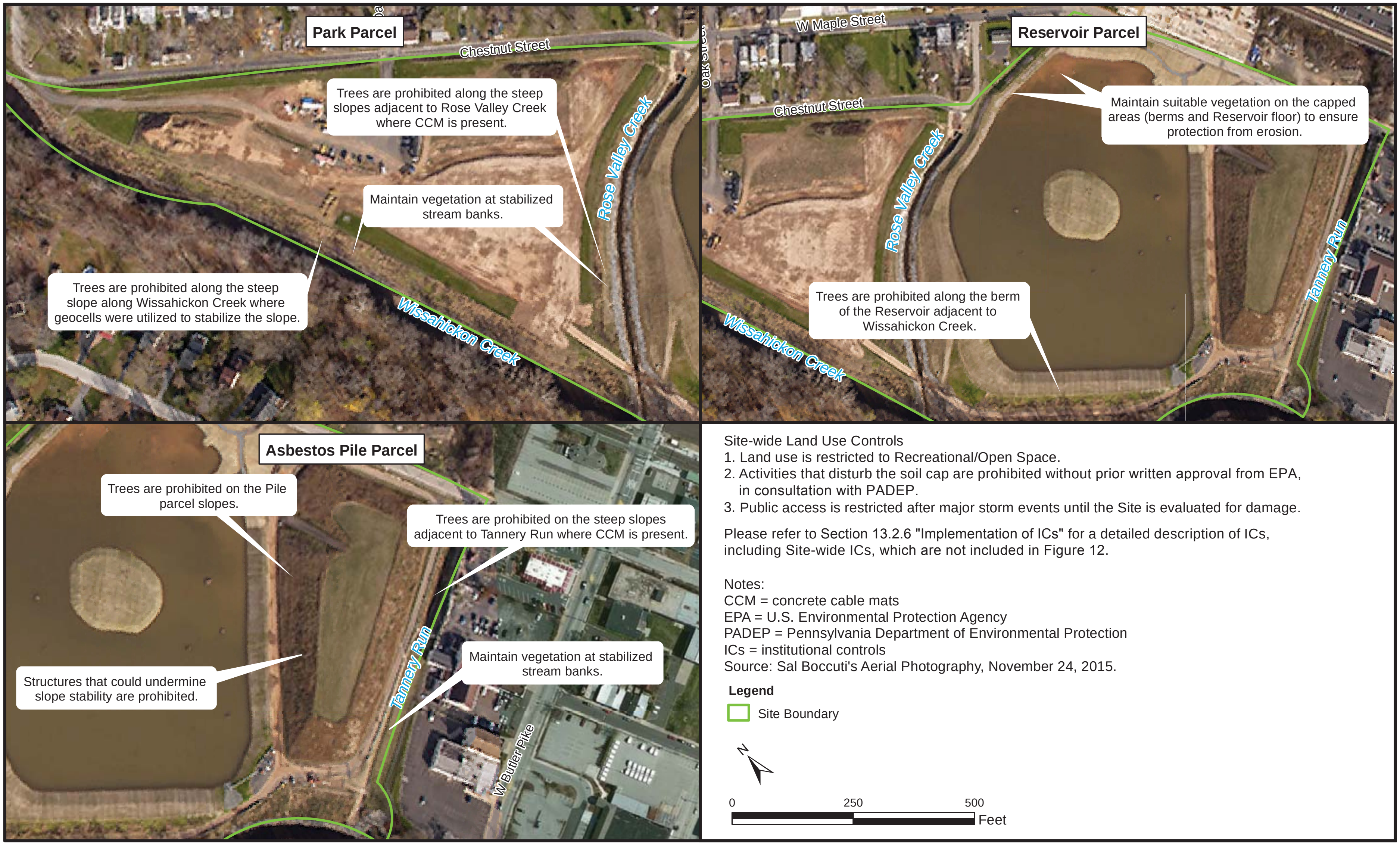
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Figure 11
ABS Sample Locations

AR308582



Site-wide Land Use Controls
1. Land use is restricted to Recreational/Open Space.
2. Activities that disturb the soil cap are prohibited without prior written approval from EPA, in consultation with PADEP.
3. Public access is restricted after major storm events until the Site is evaluated for damage.

Please refer to Section 13.2.6 "Implementation of ICs" for a detailed description of ICs, including Site-wide ICs, which are not included in Figure 12.

Notes:
CCM = concrete cable mats
EPA = U.S. Environmental Protection Agency
PADEP = Pennsylvania Department of Environmental Protection
ICs = institutional controls
Source: Sal Boccuti's Aerial Photography, November 24, 2015.

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BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Figure 12
Parcel-Specific Institutional Controls

Tables

Table 1
Previous Investigations Conducted at the BoRit Superfund Site
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Date	Description
1978-1979	EPA collected surface water samples from Wissahickon Creek, both upstream of the Park and downstream from the Site to the Belmont drinking water intake on the Schuylkill River. Most results were at or near detection limits, from 0.08 to 0.16 million fibers per liter (MFL); however, outfall samples had values ranging from non-detect to 1,060 MFL.
June 1983/October 1986	EPA's Field Investigation Team (FIT) 3 team collected surface water samples from the Wissahickon Creek. A sample collected near the Butler Pike Bridge contained 39 MFL total (18 MFL chrysotile), and a sample collected downstream from Church Street contained 310 MFL total (260 MFL chrysotile). When surface water samples were collected from similar locations in October 1986, all samples were negative for asbestos fibers.
December 1983	EPA and the Pennsylvania Department of Environmental Resources (PADER) (now Pennsylvania Department of Environmental Protection [PADEP]) collected a soil sample from the Asbestos Pile parcel that contained 3 percent (%) to 4% chrysotile asbestos. Soil samples collected in the Park area contained 5 to 35% chrysotile asbestos, and one sample contained crocidolite asbestos.
May 1984	PADER collected another sample from the Asbestos Pile which tested positive for asbestos.
October 1984	EPA collected surface soil samples from the Park parcel and adjacent areas, and several samples contained 1% or less chrysotile asbestos. In December 1984, EPA collected vacuum samples from the Park parcel surface, and no asbestos fibers were detected. Other vacuum samples collected from nearby yards and roads had inconclusive results because the levels could not be differentiated from background levels. Soil core and surface soil samples collected were all found to be negative for asbestos.
March 1987	During the Ambler Asbestos Piles Superfund Site Remedial Investigation/Feasibility Study (RI/FS), surface water samples were collected from Wissahickon Creek. A sample collected approximately 250 feet downstream of the Butler Pike Bridge contained 52 MFL chrysotile, a sample collected 1,050 feet downstream of the bridge contained 450 MFL chrysotile, and a sample collected across from Church Street contained 199 MFL chrysotile. Sediment samples collected at the surface water locations were negative for asbestos fibers. A surface water sample collected from Tannery Run contained 8,700 MFL chrysotile, and a sample collected from Rose Valley Creek contained 4,500 MFL chrysotile. Sediment samples collected at these two surface water locations contained 5 and 40 percent chrysotile, respectively.
March 1987	EPA performed a preliminary assessment of the BoRit Asbestos Pile parcel.
October 1987	EPA's FIT 3 team collected soil samples from the Asbestos Pile parcel and surface water samples from Tannery Run and Wissahickon Creek as part of a site inspection (SI). The soil samples contained up to 22% total asbestos, and the aqueous samples contained non-detectable levels up to 2.5 MFL. Observations made during the SI indicated that people were gaining access to the Asbestos Pile parcel for unauthorized disposal of household wastes. In addition, although the Asbestos Pile was described as "95% to 99% covered with heavy vegetation," three small areas were devoid of vegetation and six abandoned vehicles were located on-site. Runoff was noted entering Tannery Run from the southwest portion of the Asbestos Pile parcel, four empty 55-gallon drums were located in the Reservoir north of the Asbestos Pile parcel, and asbestos shingles were observed on the ground throughout the Asbestos Pile parcel.
July 1996	EPA and PADEP collected numerous subsurface soil samples (0-14 inches below ground surface [bgs]), and surface soil samples from the Park area. Chrysotile asbestos was detected in 86 of the 93 samples, and amosite asbestos was detected in 6 of the 93 samples. Percentages of asbestos ranged from trace to 15%, with higher percentages generally found in the deeper samples.
Summer 2001	Gilmore and Associates conducted a Phase I and Phase 2 environmental assessment (EA) of the BoRit Asbestos Pile parcel. Eleven test pits were excavated, with layers of asbestos-containing material (ACM) observed in the excavated areas. Samples from seven of the test pits contained 1 to 35% asbestos. The volume of the pile was estimated to be 149,500 cubic yards (cy). An air sample analyzed by transmission electron microscopy (TEM) was included in this EA and reported as non-detect for asbestos fibers; however, the report did not provide a location of the air sample.
June 2004	O'Brien and Gere conducted a Phase I EA for the Wissahickon Valley Watershed Association (WVWA) at the Reservoir parcel. Surface water and sediment samples were collected from the Reservoir, and waste and soil samples from the banks of the Reservoir. The surface water and sediment samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals, but not for asbestos. Contaminant concentrations were not considered significant. Waste samples collected from the east side of the Reservoir (gray-white soil or soil-like material) and around the Reservoir below the vegetation were found to contain 20 to 30% chrysotile asbestos. The EA identified non-friable ACM along the banks of the Reservoir, which were constructed of asbestos shingles, millboard, and soil. ACM was also observed within the Reservoir. Cement-asbestos pipe sections and ACM were scattered around the Reservoir, along Rose Valley Creek, and along and in Wissahickon Creek. ACM observed near the reservoir was described as transite, a mixture of cement and asbestos. The transite was beginning to degrade and become friable at the weathered ends of the material. Two air samples were collected downwind of the Reservoir parcel to the west. Sample results were reported as approximately 0.004 fibers per cubic centimeter (f/cc).
March 2005	O'Brien and Gere conducted a Phase II EA at the Reservoir parcel, collecting additional samples in and around the Reservoir. Soil samples collected near a transformer in the southwest corner of the Reservoir parcel tested negative for poly-chlorinated biphenyls (PCBs). Surface soil samples collected near a metal storage tank tested positive for several polycyclic aromatic hydrocarbons (PAHs), with results of less than 10 milligrams per kilogram (mg/kg). Sediment samples collected from the bottom of the Reservoir near suspected ACM material and the reservoir outflow all tested negative for asbestos.
April 2006	As part of a site assessment (SA), EPA collected two soil samples from the Park parcel and two waste samples from the Asbestos Pile. All samples came back positive for chrysotile asbestos, and two samples were positive for amphibole asbestos, with values ranging from $2x10^6$ to $4x10^9$ structures/gram. Background samples also were collected from the west side of the Wissahickon Creek in the Montgomery County open space and were negative for asbestos. Surface water samples were collected from the northeast and southwest edges of the reservoir as well as at the Mount Pleasant Avenue Bridge. Sediment samples also were collected upstream and downstream of the Site in Wissahickon Creek. The surface water samples from the northeast corner of the Reservoir and Wissahickon Creek were negative for asbestos. The upstream sediment sample contained $2.9x10^6$ chrysotile structures/gram, the downstream sediment sample contained $8.9x10^6$ chrysotile structures/gram, and the southwest Reservoir surface water sample was found to contain 110 MFL of chrysotile asbestos. Also in April 2006, two surface soil and one waste sample at the Park parcel were collected and analyzed, with all samples containing chrysotile asbestos, ranging from $6x10^6$ to $6.4x10^8$ structures/gram. Six air samples at or adjacent to the Site were collected, and all samples were found to contain detectable asbestos fiber concentrations with values ranging from 0.00061 to 0.039 f/cc.

Table 1
Previous Investigations Conducted at the BoRit Superfund Site
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Date	Description
October 2006	Response Engineering and Analytical Contract (REAC) personnel submitted and analyzed 72 air samples (includes eight field blanks) from on-site and off-site perimeter air locations and activity based sampling (ABS) conducted at the Park. Seven off-site locations had detectable chrysotile asbestos concentrations ranging from 0.0005 to 0.005 f/cc. Five on-site locations had detectable chrysotile and amosite (only one sample) asbestos concentrations ranging from 0.0005 to 0.001 f/cc. Two ABS scenarios were also conducted at the Park. One scenario was brush clearing, which was negative for asbestos; however, it should be noted that the detection limit was 0.0029 f/cc. The second scenario was for soil sampling and had detectable chrysotile asbestos results in both samples, ranging from 0.003 to 0.015 f/cc.
October to December 2006	Sampling was performed at the Park parcel, in the floodplain, and in adjacent tributaries (Tannery Run, Rose Valley Creek, and Wissahickon Creek). Twenty-four soil samples were collected at the Park parcel, and one background sample was collected from a nearby parking lot. Five surface soil samples were collected from floodplain areas. Twenty sediment samples and eight surface water samples were collected from the three adjacent tributaries. Soil sampling results at the Park showed chrysotile in six samples <0.3%, crocidolite in six samples <0.1%, and amosite in two samples <0.1%. Three sediment samples collected from adjacent tributaries had detectable concentrations (0.1%, 0.1%, and <0.1%). No soil samples in the floodplain areas or surface water from adjacent tributaries had detectable concentrations.
November 2006	REAC personnel submitted and analyzed 61 air samples (including 6 field blanks) from on-site and off-site perimeter air locations and ABS conducted at the Park and the Asbestos Pile parcels. Four on-site locations had detectable chrysotile asbestos concentrations, ranging from 0.0005 to 0.001 f/cc. No off-site locations had detectable asbestos concentrations. The first ABS scenario was raking at the Asbestos Pile parcel. Four samples were submitted for analysis, and all four had detectable chrysotile asbestos concentrations, ranging from 0.017 to 0.046 f/cc. The second ABS scenario was raking at the Park parcel. Four samples were submitted for analysis and two had detectable chrysotile asbestos concentrations, ranging from 0.0029 to 0.015 f/cc. The third ABS scenario was walking and raking along the bank of the creek. Samples from four scenarios (Asbestos Pile parcel walking, Park parcel walking, bank of creek walking, and bank of creek raking) were collected, and one had detectable chrysotile asbestos concentrations at 0.076 f/cc (bank of creek raking). It should be noted that the detection limit for all ABS sample analysis was 0.0029 f/cc.
March 2007	REAC submitted and analyzed 34 air samples (including four field blanks) from on-site and off-site perimeter air locations. Nine on-site locations had detectable chrysotile asbestos concentrations, ranging from 0.0005 to 0.0009 f/cc. Three off-site locations had detectable chrysotile and crocidolite (only one sample) asbestos concentrations (all three had a concentration of 0.0005 f/cc).
May 2007	REAC personnel submitted and analyzed 29 air samples (including four field blanks) from on-site and off-site perimeter air locations and four soil samples for percent moisture. Eight on-site locations had detectable chrysotile and actinolite (only one sample) asbestos concentrations, ranging from 0.0005 to 0.002 f/cc. Three off-site locations had detectable chysotile and actinolite (two samples) asbestos concentrations (0.0005 f/cc).
June 2007	REAC personnel submitted and analyzed 35 air samples (includes four field blanks) from on-site and off-site perimeter air locations and ABS at the Park parcel. One on-site location had a detectable actinolite asbestos concentration (0.0005 f/cc). No off-site locations had detectable asbestos concentrations. The ABS scenario was brush clearing at the Park parcel. No asbestos was found in the ABS sample; however, it should be noted that the detection limit for that ABS sample was 0.01 f/cc.
July 2007	REAC personnel submitted and analyzed 34 air samples (including four field blanks) from on-site and off-site perimeter air locations and four soil samples for percent (Lockheed Martin 2007f). In August 2007, REAC personnel submitted and analyzed 34 air samples (including four field blanks) from on-site and off-site perimeter air locations and four soil samples for percent moisture. Samples from five on-site locations contained detectable chrysotile asbestos concentrations, ranging from 0.0005 to 0.0015 f/cc. Detectable chrysotile asbestos concentrations (0.0005 f/cc) were found in samples from four off-site locations.
August 2007	REAC personnel submitted and analyzed 34 air samples (including four field blanks) from on-site and off-site ambient air locations and four soil samples for percent moisture. Samples from five on-site locations contained detectable chrysotile asbestos concentrations, ranging from 0.0005 to 0.0015 f/cc. Detectable chrysotile asbestos concentrations (0.0005 f/cc) were found in samples from four off-site locations.
September 2007	REAC personnel submitted and analyzed 36 air samples (including four field blanks) from on-site and off-site perimeter air locations, four soil samples for percent moisture, and ABS at the Park parcel. Six on-site locations had detectable chrysotile and amosite (only one sample) asbestos concentrations, ranging from 0.0005 to 0.0029 f/cc. One off-site location had a detectable chrysotile asbestos concentration (0.0005 f/cc). The ABS scenario was brush clearing at the Park parcel. Three samples were submitted for analysis, and no asbestos was detected in any samples; however, it should be noted that the detection limits for the ABS samples ranged from 0.0099 to 0.017 f/cc.

Notes:
1. Investigations were conducted at the BoRit Superfund Site before it was listed on the National Priorities List.

Table 2
Chemicals of Potential Concern from the Human Health Risk Assessment
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Receptor	Exposure Area	Cancer Risk Exceeds $1x10^{-4}$ or Non-Cancer Risk Exceeds 1?	Chemicals of Potential Concern/Risk Drivers (RME)	Chemicals of Potential Concern/Risk Drivers (CTE)	Chemical of Concern	Develop RGs and Remedial Alternatives to directly address the impacted media?	Include in a Site Remedy Long-Term Monitoring Program?	Cleanup Level	Rationale
Current/Future Scenario Timeframe									
Maintenance Worker	Park Parcel	Yes	Asbestos	NA	Yes	Yes	Yes	Yes	Historically asbestos is related to past Site practices and drives risk (inhalation) at the Site. ACM waste and contaminated soil and Reservoir sediment could potentially impact other media (groundwater and surface water) in addition to air if not addressed. Note that while ABS did not result in an unacceptable risk at the Reservoir parcel, exposed ACM debris is located on the Reservoir berm.
	Reservoir Parcel	No	NA	NA	NA	Yes	Yes		
	Asbestos Pile Parcel	Yes	Asbestos	NA	Yes	Yes	Yes		
Recreational User	Other side of Wissahickon Creek along the Walking Trail	No	NA	NA	NA	No	No	NA	Risk within acceptable range.
	Tannery Run	No	NA	NA	NA	No	No	NA	Risk within acceptable range.
	Rose Valley Creek	No	NA	NA	NA	No	No	NA	Risk within acceptable range.
	Wissahickon Creek	Yes	Surface Water: Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene Sediment: Benzo(a)pyrene	Surface Water: Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene Sediment: Benzo(a)pyrene	No	No	No	NA	The source of SVOCs in creeks could be upstream sources, including road and parking area runoff. Benzo(a)pyrene is the only SVOC in sediments that exceeded its RSL (150 µg/kg). It was found in the upstream sample at a concentration of 540 µg/kg while detections at downstream locations ranged from 84 J to 1,000 µg/kg in heavy deposition areas and 150 J to 990 µg/kg in normal deposition areas. In addition, portions of the Wissahickon Creek, Rose Valley Creek, and Tannery Run stream banks were stabilized as part of the EPA Removal Program work at the Site in order to prevent and minimize future contamination of creek surface water and sediment. That work, as well as the response actions described in this Record of Decision, are all assumed to satisfactorily address creek surface water and sediment.
Fisher	Wissahickon Creek	Yes	Fish Tissue: Dieldrin, Benzo(a)pyrene, DDT, Aldrin, Aroclor 1254, Arsenic, Chromium	Fish Tissue: Dieldrin, Aroclor 1254, Arsenic, Chromium	No	No	No	NA	Pesticides were found in similar numbers and concentrations in upstream and Site sediment samples. The ubiquitous presence of pesticides suggests their presence may not be attributable to the waste material disposed on the Site. Only one PCB RSL exceedance was observed near the former electrical transformers, and the likelihood of extensive vertical migration is limited. As indicated above, benzo(a)pyrene was found at an elevated concentration in an upstream location. Metals are found throughout the Site, occurring as constituents of minerals, and can be present in non-impacted soils at concentrations greater than the RSLs. As indicated above, portions of the Wissahickon Creek, Rose Valley Creek, and Tannery Run stream banks were stabilized as part of the EPA Removal Program work at the Site in order to prevent and minimize future contamination of creek surface water and sediment.
Resident	Off-site Residences	No	NA	NA	NA	No	No	NA	Risk within acceptable range.
Future Scenario Timeframe									
Recreational User	Park Parcel	No	NA	NA	NA	No	No	NA	Risk within acceptable range.
	Reservoir Parcel	No	NA	NA	NA	No	No	NA	Risk within acceptable range.
	Asbestos Pile	No	NA	NA	NA	No	No	NA	Risk within acceptable range.
Commercial Worker	Park Parcel	No	NA	NA	NA	No	No	NA	Risk within acceptable range.
	Asbestos Pile	No	NA	NA	NA	No	No	NA	Risk within acceptable range.
Resident	Site-wide Groundwater	Yes	Carbon Tetrachloride, Chloroform, Tetrachloroethene, Trichloroethene, bis(2-ethylhexyl)phthalate, Aluminum, Arsenic, Chromium, Manganese, Thallium, Vanadium	Tetrachloroethene, Aluminum, Arsenic, Manganese, Thallium, Vanadium	No	No	No	No	**VOCs:** Detections of the listed VOCs were below the concentration found in the upgradient, off-site monitoring well (MW-07). Samples from MW-07 had detections of carbon tetrachloride, cis-1,2-DCE, MTBE, PCE, and TCE, but these VOCs were found only at low concentrations in on-site soil/waste. Due to the elevated concentrations found in groundwater, on-site soil/waste is not believed to be a large contributor to contamination in the shallow bedrock aquifer. **SVOCs:** Although PAHs were found above soil RSLs in many samples, they were not detected in the upper bedrock aquifer, and only one SVOC, bis(2- ethylhexyl)phthalate, was detected in groundwater at concentrations above the RSL. RSL exceedances of bis(2-ethylhexyl)phthalate were limited to MW-02, MW-05, and MW-06 in the first round of sampling (2010). However, bis(2-ethylhexyl)phthalate was not detected in any of the three subsequent rounds of sampling completed at these wells in 2013. **Metals:** While manganese has been detected frequently in groundwater samples collected at the Site, the occurrence of manganese concentrations above a risk-based cleanup level of 430 µg/L in filtered samples has been limited to MW -03 and MW-06. Manganese, which occurred at high concentrations in two wells that are not hydraulically connected to each other and which do not constitute a plume, is not a Site-related COPC in contaminated soil or waste and does not appear to be related to historical Site activities

Notes:
Confirmation sampling would be conducted upon construction completion of selected remedial alternative to assess the effectiveness of the completed remedial action in achieving remedial action objectives for the Site-related chemicals of concern.

µg/kg = microgram per kilogram
µg/L = microgram per liter
ABS = activity-based sampling
ACM = asbestos-containing material
AWQCs = Ambient Water Quality Criteria
cis-1,2-DCE = cis-1,2-dichloroethene
CTE = central tendency exposure
DDT = dichlorodiphenyltrichloroethane
EPA = United States Environmental Protection Agency
f/cc = fibers per cubic centimeter
FS = feasibility study
J = estimated value
MCL = maximum contaminant level
MTBE = methyl tert-butyl ether
NA = Not applicable
PAHs = polynuclear aromatic hydrocarbons
PCB = polychlorinated biphenyl
PCE = tetrachloroethene
PCME = phase contrast microscopy
RME = reasonable maximum exposure
RSL = regional screening level
SVOC = semi-volatile organic compound
TCE = trichloroethene
VOC = volatile organic compound

Table 3
Selection of Exposure Pathways - Asbestos
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Exposure Area	Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Park Parcel	Current/Future	Soil/Debris	Outdoor Air (disturbed)	Breathing zone of individual engaged in soil/debris disturbance activities at the Park Parcel	Maintenance Worker	Adult	Inhalation	Quant	Soil within the Park parcel is known to be mixed with ACM that was disposed of from local asbestos manufacturing facilities. ACM is exposed at ground surface. Maintenance workers may inhale particulates released from ACM contaminated soil/debris while engaging in soil/debris disturbance activities during their routine maintenance work.
			Outdoor Air (ambient)	Breathing zone of individual at the Park Parcel	Maintenance Worker	Adult	Inhalation	Quant	Soil within the Park Parcel is known to be mixed with ACM that was disposed of from local asbestos manufacturing facilities. ACM is exposed at ground surface. Ambient exposures are likely to encompass a larger portion of total exposure time than active disturbance scenarios. Maintenance workers may inhale particulates in ambient air while working at the Park Parcel.
	Future	Soil/Debris	Outdoor Air (ambient)	Breathing zone of individual at the Park Parcel	Commercial Worker	Adult	Inhalation	Quant	Soil within the Park Parcel is known to be mixed with ACM that was disposed of from local asbestos manufacturing facilities. ACM is exposed at ground surface. Ambient exposures are likely to encompass a larger portion of total exposure time than active disturbance scenarios. Commercial workers may inhale particulates in ambient air while working at the Park Parcel.
			Outdoor Air (disturbed)	Breathing zone of individual engaged in soil/debris disturbance activities at the Park Parcel	Recreational User	Child (0 to 6 yrs.) Adult Child/Adult (Lifetime)	Inhalation	Quant	The land use of the Park Parcel may remain the same in the future. Future recreational users may inhale particulates released from ACM contaminated soil/debris while engaging in soil/debris disturbance activities at the Park Parcel.
			Outdoor Air (ambient)	Breathing zone of individual at the Park Parcel	Recreational User	Child (0 to 6 yrs.) Adult Child/Adult (Lifetime)	Inhalation	Quant	Soil within the Park Parcel is known to be mixed with ACM that was disposed of from local asbestos manufacturing facilities. ACM is exposed at ground surface. Ambient exposures are likely to encompass a larger portion of total exposure time than active disturbance scenarios. Recreational users may inhale particulates in ambient air while visiting the park.
Reservoir Parcel	Current/Future	Soil/Debris	Outdoor Air (disturbed)	Breathing zone of individual engaged in soil/debris disturbance activities along berms at the Reservoir Parcel	Maintenance Worker	Adult	Inhalation	Quant	Reservoir berms were constructed with ACM. Maintenance workers may inhale particulates released from ACM contaminated soil/debris while engaging in soil/debris disturbance activities during their routine maintenance work.
			Outdoor Air (ambient)	Breathing zone of individual at the Reservoir Parcel	Maintenance Worker	Adult	Inhalation	Quant	Reservoir berms were constructed with ACM. Ambient exposures are likely to encompass a larger portion of total exposure time than active disturbance scenarios. Maintenance workers may inhale particulates in ambient air while working at the Reservoir Parcel.
		Sediment, Soil/Debris	Surface Water	Along berms at the Reservoir Parcel	Maintenance Worker	Adult	Incidental Ingestion	None	Risks from ingestion exposures to asbestos cannot be quantified; incidental ingestion exposures are likely to be minor relative to inhalation pathways.
	Future	Soil/Debris	Outdoor Air (disturbed)	Breathing zone of individual engaged in soil/debris disturbance activities along berms at the Reservoir Parcel	Recreational User	Child (0 to 6 yrs.) Adult Child/Adult (Lifetime)	Inhalation	None	Reservoir berms were constructed with ACM. Releases from berms are likely to be lower due to higher moisture content; no ABS data are available to evaluate quantitatively.
			Outdoor Air (ambient)	Breathing zone of individual at the Reservoir Parcel	Recreational User	Child (0 to 6 yrs.) Adult Child/Adult (Lifetime)	Inhalation	Quant	Reservoir berms were constructed with ACM. Ambient exposures are likely to encompass a larger portion of total exposure time than active disturbance scenarios. Recreational users may inhale particulates in ambient air while visiting the Reservoir Parcel.
		Sediment, Soil/Debris	Surface Water	Along berms at the Reservoir Parcel	Recreational User	Child (0 to 6 yrs.) Adult Child/Adult (Lifetime)	Incidental Ingestion	None	Risks from ingestion exposures to asbestos can not quantified; incidental ingestion exposures are likely to be minor relative to inhalation pathways.
Asbestos Pile Parcel	Current/Future	Soil/Debris	Outdoor Air (disturbed)	Breathing zone of individual engaged in soil/debris disturbance activities at the Asbestos Pile Parcel	Maintenance Worker	Adult	Inhalation	Quant	Soil within the Asbestos Pile parcel is known to be mixed with ACM that was disposed of from local asbestos manufacturing facilities. ACM is exposed at ground surface. Maintenance workers may inhale particulates released from ACM contaminated soil/debris while engaging in soil/debris disturbance activities during their routine maintenance work.
			Outdoor Air (ambient)	Breathing zone of individual at the Asbestos Pile Parcel	Maintenance Worker	Adult	Inhalation	Quant	Soil within the Asbestos Pile Parcel is known to be mixed with ACM that was disposed of from local asbestos manufacturing facilities. ACM is exposed at ground surface. Ambient exposures are likely to encompass a larger portion of total exposure time than active disturbance scenarios. Maintenance workers may inhale particulates in ambient air while working at the Asbestos Pile Parcel.
	Future	Soil/Debris	Outdoor Air (ambient)	Breathing zone of individual at the Asbestos Pile Parcel	Commercial Worker	Adult	Inhalation	Quant	Soil within the Asbestos Pile Parcel is known to be mixed with ACM that was disposed of from local asbestos manufacturing facilities. ACM is exposed at ground surface. Ambient exposures are likely to encompass a larger portion of total exposure time than active disturbance scenarios. Commercial workers may inhale particulates in ambient air while working at the Asbestos Pile Parcel.
			Outdoor Air (disturbed)	Breathing zone of individual engaged in soil/debris disturbance activities at the Asbestos Pile Parcel	Recreational User	Child (0 to 6 yrs.) Adult Child/Adult (Lifetime)	Inhalation	Quant	Future recreational users may inhale particulates released from ACM contaminated soil/debris while engaging in soil/debris disturbance activities at the Asbestos Pile Parcel.
			Outdoor Air (ambient)	Breathing zone of individual at the Asbestos Pile Parcel	Recreational User	Child (0 to 6 yrs.) Adult Child/Adult (Lifetime)	Inhalation	Quant	Soil within the Park Parcel is known to be mixed with ACM that was disposed of from local asbestos manufacturing facilities. ACM is exposed at ground surface. Ambient exposures are likely to encompass a larger portion of total exposure time than active disturbance scenarios. Recreational users may inhale particulates in ambient air while visiting the parcel.

Table 3
Selection of Exposure Pathways - Asbestos
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Exposure Area	Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
On-site/Off-site	Future	Groundwater	Groundwater	Tap water drawn from private well	Resident	Child (0 to 6 yrs.)	Ingestion	Qual	Local groundwater may be impacted due to on-site contamination. Risks from ingestion exposures to asbestos cannot be quantified; however, groundwater concentrations can be compared to drinking water MCL.
						Adult (6-24 yrs.)			
						Child/Adult (Lifetime)			
Off-site	Current/Future	Soil	Outdoor Air (disturbed)	Breathing zone of individual engaged in soil disturbance activities in residential yards	Resident	Child (0 to 6 yrs.)	Inhalation	Quant	Residential properties are located near the Site, and yard soil may be impacted due to possible bulk disposal of ACM, surface water run-off, and/or airborne deposition. Residents may inhale particulates released from ACM contaminated soil while engaging in soil disturbance activities in their yards.
						Adult (6 to 24 yrs.)			
						Child/Adult (Lifetime)			
				Breathing zone of individual engaged in soil disturbance activities at off-site walking trails	Recreational User	Child (0 to 6 yrs.)	Inhalation	Quant	Recreational areas are located near the Site, and soils may be impacted due to surface water run-off and/or airborne deposition. Hikers may inhale particulates released from ACM contaminated soil while engaging in soil disturbance activities along the trails.
						Adult			
						Child/Adult (Lifetime)			
				Breathing zone of individual engaged in soil disturbance activities at off-site parks (e.g., Tot Lot)	Recreational User	Child (0 to 6 yrs.)	Inhalation	Quant	Recreational areas are located near the Site, and soils may be impacted due to surface water run-off and/or airborne deposition. Visitors to the park may inhale particulates released from ACM contaminated soil while engaging in soil disturbance activities at the park.
						Adult			
						Child/Adult (Lifetime)			
				Breathing zone of individual engaged in soil/debris disturbance activities along creek banks on Tannery Run	Recreational User	Child (0 to 6 yrs.)	Inhalation	None	Creeks may be impacted due to surface water run-off and/or airborne deposition. Releases from creek banks are likely to be lower due to higher moisture content; no ABS data are available to evaluate quantitatively.
						Adult			
						Child/Adult (Lifetime)			
				Breathing zone of individual engaged in soil/debris disturbance activities along creek banks on Rose Valley Creek	Recreational User	Child (0 to 6 yrs.)	Inhalation	None	
						Adult			
						Child/Adult (Lifetime)			
				Breathing zone of individual engaged in soil/debris disturbance activities along creek banks on Wissahickon Creek	Recreational User	Child (0 to 6 yrs.)	Inhalation	None	
						Adult			
						Child/Adult (Lifetime)			
			Outdoor Air (ambient)	Breathing zone of individual at residential properties	Resident	Child (0 to 6 yrs.)	Inhalation	Quant	Residential properties are located near the Site, and ambient air may be impacted due to site-related releases. Residents may inhale particulates in ambient air while engaging in outdoor activities. Ambient exposures are likely to encompass a larger portion of total exposure time than active disturbance scenarios.
						Adult (6 to 24 yrs.)			
						Child/Adult (Lifetime)			
				Breathing zone of individual at off-site recreational areas (e.g., parks, walking trails)	Recreational User	Child (0 to 6 yrs.)	Inhalation	Quant	Recreational areas are located near the Site, and ambient air may be impacted due to site-related releases. Recreational users may inhale particulates in ambient air while engaging in outdoor activities. Ambient exposures are likely to encompass a larger portion of total exposure time than active disturbance scenarios.
						Adult			
						Child/Adult (Lifetime)			
				Breathing zone of individual along creek banks (i.e., Tannery Run, Rose Valley Creek, and Wissahickon Creek)	Recreational User	Child (0 to 6 yrs.)	Inhalation	Quant	Creeks are located near the Site, and ambient air may be impacted due to site-related releases. Recreational users may inhale particulates in ambient air while engaging in outdoor activities. Ambient exposures are likely to encompass a larger portion of total exposure time than active disturbance scenarios.
						Adult			
						Child/Adult (Lifetime)			
Off-site	Current/Future	Sediment, Soil/Debris	Surface Water	Along creek banks of Tannery Run	Recreational User	Child (0 to 6 yrs.)	Incidental Ingestion	None	Risks from ingestion exposures to asbestos cannot be quantified. Incidental ingestion exposures are likely to be minor relative to inhalation pathways.
						Adult			
						Child/Adult (Lifetime)			
				Along creek banks of Rose Valley Creek	Recreational User	Child (0 to 6 yrs.)	Incidental Ingestion	None	
						Adult			
						Child/Adult (Lifetime)			
				Along creek banks of Wissahickon Creek	Recreational User	Child (0 to 6 yrs.)	Incidental Ingestion	None	
						Adult			
						Child/Adult (Lifetime)			

Notes:

1. Exposure scenarios evaluated quantitatively in the asbestos risk assessment are shaded in grey.

Quant = Quantitative risk analysis performed
Qual = Qualitative risk analysis performed
ACM = asbestos-containing material
ABS = activity-based sampling
MCL = maximum contaminant level

Table 4
Asbestos Exposure Point Concentrations
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Exposure Area	ABS Receptor Type	Minimum Concentration (s/cc)	Maximum Concentration (s/cc)	Detection Frequency	Range of Analytical Sensitivities (cc)$^{-1}$	Mean PCME Air Concentration (s/cc)
Asbestos Pile Parcel	Child	0.040	0.065	3/3	0.0029 - 0.040	0.050
	Adult	0.058	0.13	3/3	0.0060 - 0.029	0.093
Park Parcel	Child	0.040	0.20	6/6	0.0026 - 0.10	0.084
	Adult	0.0012	0.46	6/6	0.00040 - 0.065	0.11
Reservoir Parcel	Child	0	0	0/1	0.00040	0
	Adult	0	0	0/1	0.00040	0
Off-Site Residential Property 1	Child	0	0	0/1	0.00040	0
	Adult	0	0	0/1	0.00040	0
Off-Site Residential Property 2	Child	0	0	0/1	0.00040	0
	Adult	0.0012	0.0012	1/1	0.00040	0.0012
Off-Site Residential Property 3	Child	0.014	0.014	1/1	0.0035	0.014
	Adult	0.010	0.010	1/1	0.0035	0.010
Off-Site Residential Property 4	Child	0.0094	0.0094	1/1	0.00059	0.0094
	Adult	0.0075	0.0075	1/1	0.00075	0.0075
Off-Site Residential Property 5	Child	0.0015	0.0015	1/1	0.00037	0.0015
	Adult	0.00073	0.00073	1/1	0.00037	0.00073
Off-Site Residential Property 6	Child	0.00040	0.00040	1/1	0.00040	0.00040
	Adult	0	0	0/1	0.00040	0
Off-Site Residential Property 7	Child	0	0	0/1	0.00040	0
	Adult	0	0	0/1	0.00040	0
Off-Site Residential Property 8	Child	0	0	0/1	0.00040	0
	Adult	0	0	0/1	0.00040	0
Off-site Wissahickon	Child	0.00080	0.00080	1/1	0.00040	0.00080
	Adult	0	0	0/1	0.00040	0
Walking Trail	Child	0	0	0/1	0.00040	0
	Adult	0	0	0/1	0.00040	0
Ambient Air	---	0	0.0012	3/84	0.00027 - 0.00041	0.000032

Notes:
ABS = activity-based sampling
PCME = phase contrast microscopy equivalent
cc^{-1} = per cubic centimeter
s/cc = structures per cubic centimeter

Table 5
Cancer Risk Estimates for Maintenance Workers from Asbestos Exposures at the Asbestos Pile Parcel and Park Parcel
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Receptor Population: Maintenance Worker (Current/Future)
Receptor Age: Adult

Exposure Area	Exposure Time [ET] (hours/day)	Exposure Frequency [EF] (days/year)	Time-weighting Factor [TWF]	Age at First Exposure [a] (years)	Exposure Duration [d] (years)	Inhalation Unit Risk [IURa,d] $(s/cc)^{-1}$	Mean PCME Air Concentration (s/cc)	Cancer Risk
RME Risks								
Park Parcel	4	50	0.023	18	20	0.067	0.11	**2E-04**
Asbestos Pile Parcel	4	50	0.023	18	20	0.067	0.093	**1E-04**
CTE Risks								
Park Parcel	4	25	0.011	18	20	0.067	0.11	**9E-05**
Asbestos Pile Parcel	4	25	0.011	18	20	0.067	0.093	**7E-05**

Notes:
CTE = central tendency exposure
PCME = phase contrast microscopy equivalent
RME = reasonable maximum exposure
s/cc = structures per cubic centimeter

Table 6
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil [1]

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening [2]	Background Value[3]	Screening Toxicity Value (n/c) [4]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion [5]
Surface Soil at Park Parcel [6]	110-82-7	Cyclohexane	0.63 J	0.63 J	µg/kg	PKSB30-SS	1 / 5	4.8 / 10.3	0.63	NA	117,000 ns	NA	NA	N	BSL
	218-01-9	1,2-Benzphenanthrene (a.k.a. Chrysene)	84 J	84 J	µg/kg	PKSB15-SS	1 / 5	184.7 / 570.5	84	160 J - 1300 J	15000 c	NA	NA	N	BSL
	56-55-3	Benzo(a)anthracene	58 J	58 J	µg/kg	PKSB15-SS	1 / 5	184.7 / 570.5	58	140 J - 1100 J	150 c	NA	NA	N	BSL
	50-32-8	**Benzo(a)pyrene**	**86 J**	**150 J**	**µg/kg**	**PKSB19-SS**	**2 / 5**	**184.7 / 570.5**	**150**	**130 J - 1100 J**	**15 c**	**NA**	**NA**	**Y**	**ASL**
	205-99-2	**Benzo(b)fluoranthene**	**25 J**	**150 J**	**µg/kg**	**PKSB19-SS**	**4 / 5**	**184.7 / 570.5**	**150**	**180 J - 1500 J**	**150 c**	**NA**	**NA**	**Y**	**= SL**
	191-24-2	Benzo(g,h,i)perylene	55 J	55 J	µg/kg	PKSB15-SS	1 / 5	184.7 / 570.5	55	310 J - 670 J	170000 n	NA	NA	N	BSL
	207-08-9	Benzo(K)fluoranthene	32 J	32 J	µg/kg	PKSB15-SS	1 / 5	185 / 571	32	280 J - 520 J	1500 c	NA	NA	N	BSL
	117-81-7	Bis(2-ethylhexyl)phthalate	44 J	400 J	µg/kg	PKSB19-SS	4 / 5	185 / 571	400	NA	35000 c*	NA	NA	N	BSL
	84-74-2	Di-n-butylphthalate	30 J	94 J	µg/kg	PKSB19-SS	4 / 5	185 / 571	94	NA	610000 n	NA	NA	N	BSL
	206-44-0	Fluoranthene	33 J	170 J	µg/kg	PKSB19-SS	4 / 5	185 / 571	170	96 J - 2500 J	230000 n	NA	NA	N	BSL
	193-39-5	Indeno(1,2,3-cd)Pyrene	35 J	110 J	µg/kg	PKSB19-SS	2 / 5	185 / 571	110	350 J - 710 J	150 c	NA	NA	N	BSL
	85-01-8	Phenanthrene	69 J	69 J	µg/kg	PKSB15-SS	1 / 5	185 / 571	69	150 J - 1300	170000 n	NA	NA	N	BSL
	129-00-0	Pyrene	27 J	200 J	µg/kg	PKSB19-SS	4 / 5	185 / 571	200	270 - 2000 J	170000 n	NA	NA	N	BSL
	72-54-8	4,4'-DDD	0.9 J	0.9 J	µg/kg	PKSB19-SS	1 / 5	3.6 / 5.3	0.9	NA	2000 c	NA	NA	N	BSL
	72-55-9	4,4'-DDE	0.1 J	0.22 J	µg/kg	PKSB19-SS	2 / 5	3.6 / 5.3	0.22	NA	1400 c	NA	NA	N	BSL
	50-29-3	4,4'-DDT	0.22 J	0.71 J	µg/kg	PKSB19-SS	2 / 5	3.6 / 5.3	0.71	NA	1700 c*	NA	NA	N	BSL
	309-00-2	Aldrin	0.092 J	0.092 J	µg/kg	PKSB19-SS	1 / 5	1.9 / 2.8	0.092	NA	29 c*	NA	NA	N	BSL
	319-84-6	alpha-BHC	0.013 J	0.025 J	µg/kg	PKSB19-SS	2 / 5	1.9 / 2.8	0.025	NA	77 c	NA	NA	N	BSL
	11096-82-5	Aroclor-1260	13 J	13 J	µg/kg	PKSB19-SS	1 / 5	33 / 49	13	NA	220 c	NA	NA	N	BSL
	319-85-7	beta-BHC	0.27 J	0.67 J	µg/kg	PKSB30-SS	2 / 5	1.9 / 2.8	0.67	NA	270 c	NA	NA	N	BSL
	60-57-1	Dieldrin	0.32 J	0.33 J	µg/kg	PKSB19-SS	2 / 5	3.6 / 5.3	0.33	NA	30 c	NA	NA	N	BSL
	33213-65-9	Endosulfan II	0.1 J	0.1 J	µg/kg	PKSB19-SS	1 / 5	3.6 / 5.3	0.1	NA	37000 n	NA	NA	N	BSL
	1031-07-8	Endosulfan Sulfate	0.38 J	0.38 J	µg/kg	PKSB19-SS	1 / 5	3.6 / 5.3	0.38	NA	37000 n	NA	NA	N	BSL
	72-20-8	Endrin	0.25 J	0.74 J	µg/kg	PKSB19-SS	2 / 5	3.6 / 5.3	0.74	NA	1800 n	NA	NA	N	BSL
	7421-93-4	Endrin Aldehyde	0.097 J	0.54 J	µg/kg	PKSB19-SS	2 / 5	3.6 / 5.3	0.54	NA	1800 n	NA	NA	N	BSL
	53494-70-5	Endrin Ketone	0.22 J	1 J	µg/kg	PKSB19-SS	4 / 5	3.6 / 5.3	1	NA	1800 n	NA	NA	N	BSL
	5103-74-2	gamma-Chlordane	0.019 J	0.27 J	µg/kg	PKSB30D-SS	3 / 5	1.9 / 2.8	0.27	NA	1600 c*	NA	NA	N	BSL
	7429-90-5	**Aluminum**	**3770 J**	**8260 J**	**mg/kg**	**PKSB19-SS**	**5 / 5**	**23 / 31**	**8260**	**8530 - 12400**	**7700 n**	**NA**	**NA**	**Y**	**ASL**
	7440-38-2	**Arsenic**	**2.8 L**	**6.4 L**	**mg/kg**	**PKSB30-SS**	**5 / 5**	**1.2 / 1.6**	**6.4**	**3 - 5.9**	**0.39 c***	**NA**	**NA**	**Y**	**ASL**
	7440-39-3	Barium	37	156	mg/kg	PKSB19-SS	5 / 5	23 / 31	156	65.6 - 174	1500 n	NA	NA	N	BSL
	7440-41-7	Beryllium	0.87	2.4	mg/kg	PKSB15-SS	5 / 5	0.6 / 0.8	2.4	0.69 - 1.4	16 n	NA	NA	N	BSL
	7440-43-9	Cadmium	0.36 J	0.94 L	mg/kg	PKSB19-SS	4 / 5	0.6 / 0.8	0.94	0.03 J- - 0.4 J	7 n	NA	NA	N	BSL
	7440-70-2	Calcium	2400 J	51100 J	mg/kg	PKSB19-SS	5 / 5	575 / 778	51100	248 J - 3660	NA NA	NA	NA	N	NUT
	7440-47-3	**Chromium**	**8.3**	**40.4**	**mg/kg**	**PKSB19-SS**	**5 / 5**	**1.2 / 1.6**	**40.4**	**13 - 21.1**	**0.29 c**	**NA**	**NA**	**Y**	**ASL**
	7440-48-4	**Cobalt**	**11.4**	**22.9**	**mg/kg**	**PKSB15-SS**	**5 / 5**	**5.8 / 7.8**	**22.9**	**5.3 J - 11.5 J**	**2.3 n**	**NA**	**NA**	**Y**	**ASL**
	7440-50-8	Copper	17.9 J	55.9 J	mg/kg	PKSB15-SS	5 / 5	2.9 / 3.9	55.9	3.9 - 26.7	310 n	NA	NA	N	BSL
	7439-89-6	**Iron**	**15500 J**	**18900 J**	**mg/kg**	**PKSB19-SS**	**5 / 5**	**12 / 16**	**18900**	**12500 - 21700**	**5500 n**	**NA**	**NA**	**Y**	**ASL**
	7439-92-1	Lead	16.3	164	mg/kg	PKSB19-SS	5 / 5	1.2 / 1.6	164	15.6 J - 80.5 J	400 n	NA	NA	N	BSL
	7439-95-4	Magnesium	3340 J	31700 J	mg/kg	PKSB30-SS	5 / 5	575 / 778	31700	1140 - 3020	NA NA	NA	NA	N	NUT

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Table 6
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil [1]

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)		Maximum Concentration (Qualifier)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening [2]	Background Value[3]	Screening Toxicity Value (n/c) [4]		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion [5]
Surface Soil at Park Parcel [6]	**7439-96-5**	**Manganese**	**655**	**J**	**1370**	**J**	**mg/kg**	**PKSB15-SS**	**5 / 5**	**1.7 / 2.3**	**1370**	**268 J - 1030 J**	**180**	**n**	**NA**	**NA**	**Y**	**ASL**
	7439-97-6	**Mercury**	**0.035**	**J**	**1.1**		**mg/kg**	**PKSB19-SS**	**4 / 5**	**0.1 / 0.2**	**1.1**	**0.025 J - 0.23**	**1**	**ns**	**NA**	**NA**	**Y**	**ASL**
	7440-02-0	Nickel	11.8		99.8		mg/kg	PKSB19-SS	5 / 5	4.6 / 6.2	99.8	8.8 J - 19.4 J	150	n	NA	NA	N	BSL
	7440-09-7	Potassium	399	J	644	J	mg/kg	PKSB30D-SS	5 / 5	575 / 778	644	105 J - 710	NA	NA	NA	NA	N	NUT
	7440-62-2	Vanadium	16.6		23.9		mg/kg	PKSB19-SS	5 / 5	5.8 / 7.8	23.9	18.6 J - 29.5 J	39	n	NA	NA	N	BSL
	7440-66-6	Zinc	51.7		241		mg/kg	PKSB19-SS	5 / 5	6.9 / 9.3	241	20.6 - 104	2300	n	NA	NA	N	BSL
Surface Soil around the Perimeter of the Reservoir [7]	87-61-6	1,2,3-Trichlorobenzene	0.48	J	0.48	J	µg/kg	RVSB08-SS	1 / 6	6.3 / 15	0.48	NA	4900	n	NA	NA	N	BSL
	78-93-3	2-Butanone	17		32		µg/kg	RVSB12-SS	3 / 6	13 / 30	32	NA	2800000	n	NA	NA	N	BSL
	67-64-1	Acetone	180		180		µg/kg	RVSB19-SS	1 / 6	13 / 30	180	NA	6100000	n	NA	NA	N	BSL
	75-09-2	Dichloromethane	2	J	2	J	µg/kg	RVSB12-SS	1 / 6	6.3 / 15	2	NA	36000	n**	NA	NA	N	BSL
	79-20-9	Methyl Acetate	2.6	J	2.6	J	µg/kg	RVSB04-SS	1 / 6	6.3 / 15	2.6	NA	7800000	ns	NA	NA	N	BSL
	108-88-3	Methylbenzene	1.4	J	1.4	J	µg/kg	RVSB24-SS	1 / 6	6.3 / 15	1.4	NA	720,000	ns	NA	NA	N	BSL
	218-01-9	1,2-Benzphenanthrene (a.k.a. Chrysene)	44	J	880		µg/kg	RVSB17-SS	6 / 6	214 / 508	880	160 J - 1300 J	15000	c	NA	NA	N	BSL
	91-57-6	2-Methylnaphthalene	36	J	36	J	µg/kg	RVSB24-SS	1 / 6	214 / 508	36	NA	23000	n	NA	NA	N	BSL
	83-32-9	Acenaphthene	45	J	45	J	µg/kg	RVSB17-SS	1 / 6	214 / 508	45	NA	340000	n	NA	NA	N	BSL
	208-96-8	Acenaphthylene	41	J	41	J	µg/kg	RVSB17-SS	1 / 6	214 / 508	41	NA	340000	n	NA	NA	N	BSL
	120-12-7	Anthracene	160	J	160	J	µg/kg	RVSB17-SS	1 / 6	214 / 508	160	190 J - 190 J	1700000	n	NA	NA	N	BSL
	56-55-3	**Benzo(a)anthracene**	**47**	**J**	**740**		**µg/kg**	**RVSB17-SS**	**6 / 6**	**214 / 508**	**740**	**140 J - 1100 J**	**150**	**c**	**NA**	**NA**	**Y**	**ASL**
	50-32-8	**Benzo(a)pyrene**	**140**	**J**	**850**		**µg/kg**	**RVSB17-SS**	**5 / 6**	**214 / 508**	**850**	**130 J - 1100 J**	**15**	**c**	**NA**	**NA**	**Y**	**ASL**
	205-99-2	**Benzo(b)fluoranthene**	**63**	**J**	**1200**		**µg/kg**	**RVSB17-SS**	**6 / 6**	**214 / 508**	**1200**	**180 J - 1500 J**	**150**	**c**	**NA**	**NA**	**Y**	**ASL**
	191-24-2	Benzo(g,h,i)perylene	360	J	360	J	µg/kg	RVSB17-SS	1 / 6	214 / 508	360	310 J - 670 J	170000	n	NA	NA	N	BSL
	207-08-9	Benzo(k)fluoranthene	26	J	480		µg/kg	RVSB17-SS	6 / 6	214 / 508	480	280 J - 520 J	1500	c	NA	NA	N	BSL
	85-68-7	Benzyl butyl phthalate	38	J	420	J	µg/kg	RVSB12-SS	3 / 6	214 / 508	420	NA	260000	c*	NA	NA	N	BSL
	117-81-7	Bis(2-Ethylhexyl)Phthalate	23	J	160	J	µg/kg	RVSB19-SS	6 / 6	214 / 508	160	NA	35000	c*	NA	NA	N	BSL
	86-74-8	**Carbazole**	**84**	**J**	**84**	**J**	**µg/kg**	**RVSB17-SS**	**1 / 6**	**214 / 508**	**84**	**170 J - 170 J**	**NA**	**NA**	**NA**	**NA**	**Y**	**NSV**
	53-70-3	**Dibenz(a,h)anthracene**	**28**	**J**	**28**	**J**	**µg/kg**	**RVSB08-SS**	**1 / 6**	**214 / 508**	**28**	**190 J - 190 J**	**15**	**c**	**NA**	**NA**	**Y**	**ASL**
	84-74-2	Di-N-Butylphthalate	28	J	91	J	µg/kg	RVSB19-SS	5 / 6	214 / 508	91	NA	610000	n	NA	NA	N	BSL
	206-44-0	Fluoranthene	68	J	1600		µg/kg	RVSB17-SS	6 / 6	214 / 508	1600	96 J - 2500 J	230000	n	NA	NA	N	BSL
	86-73-7	Fluorene	52	J	52	J	µg/kg	RVSB17-SS	1 / 6	214 / 508	52	NA	230000	n	NA	NA	N	BSL
	193-39-5	**Indeno(1,2,3-cd)pyrene**	**31**	**J**	**460**	**J**	**µg/kg**	**RVSB17-SS**	**6 / 6**	**214 / 508**	**460**	**350 J - 710 J**	**150**	**c**	**NA**	**NA**	**Y**	**ASL**
	85-01-8	Phenanthrene	96	J	720		µg/kg	RVSB17-SS	5 / 6	214 / 508	720	150 J - 1300	170000	n	NA	NA	N	BSL
	129-00-0	Pyrene	60	J	1300		µg/kg	RVSB17-SS	6 / 6	214 / 508	1300	270 - 2000 J	170000	n	NA	NA	N	BSL
	72-54-8	4,4'-DDD	0.1	J	0.9	J	µg/kg	RVSB24-SS	4 / 6	4.1 / 9.9	0.9	NA	2000	c	NA	NA	N	BSL
	72-55-9	4,4'-DDE	0.063	J	5.8	J	µg/kg	RVSB04-SS	6 / 6	4.1 / 9.9	5.8	NA	1400	c	NA	NA	N	BSL
	50-29-3	4,4'-DDT	0.86	J	21	J	µg/kg	RVSB08-SS	6 / 6	4.1 / 9.9	21	NA	1700	c*	NA	NA	N	BSL
	309-00-2	Aldrin	0.061	J	1.2	J	µg/kg	RVSB24-SS	3 / 6	2.1 / 5.1	1.2	NA	29	c*	NA	NA	N	BSL
	319-84-6	alpha-BHC	0.022	J	0.093	J	µg/kg	RVSB19-SS	6 / 6	2.1 / 5.1	0.093	NA	77	c	NA	NA	N	BSL
	5103-71-9	alpha-chlordane	0.09	J	1.5	J	µg/kg	RVSB24-SS	5 / 6	2.1 / 5.1	1.5	NA	1600	c*	NA	NA	N	BSL
	12672-29-6	Aroclor-1248	120		120		µg/kg	RVSB24-SS	1 / 6	42 / 99	120	NA	220	c	NA	NA	N	BSL

Table 6
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil [1]

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening [2]	Background Value[3]	Screening Toxicity Value (n/c) [4]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion [5]
Surface Soil around the Perimeter of the Reservoir [7]	**11097-69-1**	**Aroclor-1254**	**140**	**140**	**µg/kg**	**RVSB24-SS**	**1 / 6**	**42 / 99**	**140**	**NA**	**110 n****	**NA**	**NA**	**Y**	**ASL**
	11096-82-5	Aroclor-1260	5.1 J	8.1 J	µg/kg	RVSB08-SS	3 / 6	42 / 99	8.1	NA	220 c	NA	NA	N	BSL
	319-85-7	beta-BHC	0.1 J	0.56 J	µg/kg	RVSB24-SS	3 / 6	2.1 / 5.1	0.56	NA	270 c	NA	NA	N	BSL
	319-86-8	delta-BHC	0.024 J	0.16 J	µg/kg	RVSB17-SS	4 / 6	2.1 / 5.1	0.16	NA	520 c*	NA	NA	N	BSL
	60-57-1	Dieldrin	0.13 J	1.7 J	µg/kg	RVSB24-SS	6 / 6	4.1 / 9.9	1.7	NA	30 c	NA	NA	N	BSL
	959-98-8	Endosulfan I	0.16 J	0.97 J	µg/kg	RVSB24-SS	3 / 6	2.1 / 5.1	0.97	NA	37000 n	NA	NA	N	BSL
	33213-65-9	Endosulfan II	0.33 J	1.3 J	µg/kg	RVSB19-SS	6 / 6	4.1 / 9.9	1.3	NA	37000 n	NA	NA	N	BSL
	1031-07-8	Endosulfan Sulfate	0.038 J	0.44 J	µg/kg	RVSB19-SS	6 / 6	4.1 / 9.9	0.44	NA	37000 n	NA	NA	N	BSL
	72-20-8	Endrin	0.05 J	0.51 J	µg/kg	RVSB04-SS	6 / 6	4.1 / 9.9	0.51	NA	1800 n	NA	NA	N	BSL
	7421-93-4	Endrin Aldehyde	0.09 J	1.1 J	µg/kg	RVSB17-SS	6 / 6	4.1 / 9.9	1.1	NA	1800 n	NA	NA	N	BSL
	53494-70-5	Endrin Ketone	0.19 J	2.2 J	µg/kg	RVSB04-SS	6 / 6	4.1 / 9.9	2.2	NA	1800 n	NA	NA	N	BSL
	58-89-9	gamma-BHC (Lindane)	0.05 J	0.27 J	µg/kg	RVSB04-SS	4 / 6	2.1 / 5.1	0.27	NA	520 c*	NA	NA	N	BSL
	5103-74-2	gamma-chlordane	0.075 J	0.94 J	µg/kg	RVSB24-SS	4 / 6	2.1 / 5.1	0.94	NA	1600 c*	NA	NA	N	BSL
	76-44-8	Heptachlor	0.07 J	0.12 J	µg/kg	RVSB17-SS	3 / 6	2.1 / 5.1	0.12	NA	110 c	NA	NA	N	BSL
	1024-57-3	Heptachlor Epoxide	0.033 J	0.29 J	µg/kg	RVSB19-SS	6 / 6	2.1 / 5.1	0.29	NA	53 c*	NA	NA	N	BSL
	72-43-5	Methoxyclor	0.22 J	1 J	µg/kg	RVSB17-SS	3 / 6	21 / 51	1	NA	31000 n	NA	NA	N	BSL
	7429-90-5	**Aluminum**	**3220**	**9840**	**mg/kg**	**RVSB04-SS**	**6 / 6**	**25 / 63**	**9840**	**8530 - 12400**	**7700 n**	**NA**	**NA**	**Y**	**ASL**
	7440-38-2	**Arsenic**	**3.3**	**7.1**	**mg/kg**	**RVSB19-SS**	**6 / 6**	**1.2 / 3.1**	**7.1**	**3 - 5.9**	**0.39 c***	**NA**	**NA**	**Y**	**ASL**
	7440-39-3	Barium	68.4	100	mg/kg	RVSB17-SS	6 / 6	25 / 63	100	65.6 - 174	1500 n	NA	NA	N	BSL
	7440-41-7	Beryllium	0.36 J	1.2	mg/kg	RVSB17-SS	5 / 6	0.6 / 1.6	1.2	0.69 - 1.4	16 n	NA	NA	N	BSL
	7440-43-9	Cadmium	0.25 J	1.4 J	mg/kg	RVSB19-SS	6 / 6	0.6 / 1.6	1.4	0.03 J- - 0.4 J	7 n	NA	NA	N	BSL
	7440-70-2	Calcium	3840	23300	mg/kg	RVSB08-SS	6 / 6	622 / 1563	23300	248 J - 3660	NA NA	NA	NA	N	NUT
	7440-47-3	**Chromium**	**11.6**	**25**	**mg/kg**	**RVSB19-SS**	**6 / 6**	**1.2 / 3.1**	**25**	**13 - 21.1**	**0.29 c**	**NA**	**NA**	**Y**	**ASL**
	7440-48-4	**Cobalt**	**5.1 J**	**11.1**	**mg/kg**	**RVSB04-SS**	**5 / 6**	**6.2 / 16**	**11.1**	**5.3 J - 11.5 J**	**2.3 n**	**NA**	**NA**	**Y**	**ASL**
	7440-50-8	Copper	17.7	63.2	mg/kg	RVSB19-SS	6 / 6	3.1 / 7.8	63.2	3.9 - 26.7	310 n	NA	NA	N	BSL
	7439-89-6	**Iron**	**9030**	**22500**	**mg/kg**	**RVSB04-SS**	**6 / 6**	**12 / 31**	**22500**	**12500 - 21700**	**5500 n**	**NA**	**NA**	**Y**	**ASL**
	7439-92-1	Lead	21.6	153	mg/kg	RVSB19-SS	6 / 6	1.2 / 3.1	153	15.6 J - 80.5 J	400 n	NA	NA	N	BSL
	7439-95-4	Magnesium	1530 J	6030	mg/kg	RVSB17-SS	6 / 6	622 / 1563	6030	1140 - 3020	NA NA	NA	NA	N	NUT
	7439-96-5	**Manganese**	**108**	**890 J**	**mg/kg**	**RVSB17-SS**	**6 / 6**	**1.9 / 4.7**	**890**	**268 J - 1030 J**	**180 n**	**NA**	**NA**	**Y**	**ASL**
	7439-97-6	**Mercury**	**0.078 J**	**5**	**mg/kg**	**RVSB17-SS**	**5 / 6**	**0.1 / 0.3**	**5**	**0.025 J - 0.23**	**1 ns**	**NA**	**NA**	**Y**	**ASL**
	7440-02-0	Nickel	10.7	31.7	mg/kg	RVSB04-SS	6 / 6	5.0 / 13	31.7	8.8 J - 19.4 J	150 n	NA	NA	N	BSL
	7440-09-7	Potassium	628 J	1110	mg/kg	RVSB04-SS	6 / 6	622 / 1563	1110	105 J - 710	NA NA	NA	NA	N	NUT
	7440-62-2	Vanadium	15.2	29.7	mg/kg	RVSB04-SS	6 / 6	6.2 / 16	29.7	18.6 J - 29.5 J	39 n	NA	NA	N	BSL
	7440-66-6	**Zinc**	**45.8**	**2440**	**mg/kg**	**RVSB04-SS**	**6 / 6**	**7.5 / 19**	**2440**	**20.6 - 104**	**2300 n**	**NA**	**NA**	**Y**	**ASL**
Surface Soil at the Asbestos Pile Parcel [8]	78-93-3	2-Butanone	58	58	µg/kg	APSB21-SS	1 / 7	10.1 / 40.2	58	NA	2800000 n	NA	NA	N	BSL
	108-88-3	Methylbenzene	3.4 J	6.9 J	µg/kg	APSB32D-SS	2 / 7	5.1 / 20.1	6.9	NA	720,000 ns	NA	NA	N	BSL
	218-01-9	1,2-Benzphenanthrene (a.k.a. Chrysene)	42 J	2900	µg/kg	APFT-SS01-A	15 / 15	185 / 1043	2900	160 J - 1300 J	15000 n	NA	NA	N	BSL
	91-57-6	2-Methylnaphthalene	38 J	69 J	µg/kg	APFT-SS02-A	2 / 15	185 / 1043	69	NA	23000 n	NA	NA	N	BSL
	83-32-9	Acenaphthene	100 J	260	µg/kg	APSB24-SS	3 / 15	185 / 1043	260	NA	340000 n	NA	NA	N	BSL

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Table 6
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil [1]

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening [2]	Background Value[3]	Screening Toxicity Value (n/c) [4]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion [5]
Surface Soil at the Asbestos Pile Parcel [8]	208-96-8	Acenaphthylene	100 J	140 J	µg/kg	APFT-SS01-A	2 / 15	185 / 1043	140	NA	340000 n	NA	NA	N	BSL
	98-86-2	Acetophenone	460	460	µg/kg	APFT-SS02-A	1 / 15	185 / 1043	460	NA	780000 ns	NA	NA	N	BSL
	120-12-7	Anthracene	96 J	520	µg/kg	APSB10-SS	9 / 15	185 / 1043	520	190 J - 190 J	1700000 n	NA	NA	N	BSL
	100-52-7	Benzaldehyde	490	490	µg/kg	APFT-SS02-A	1 / 15	185 / 1043	490	NA	780000 ns	NA	NA	N	BSL
	56-55-3	**Benzo(a)anthracene**	**37 J**	**2700**	**µg/kg**	**APFT-SS01-A**	**14 / 15**	**185 / 1043**	**2700**	**140 J - 1100 J**	**150 c**	**NA**	**NA**	**Y**	**ASL**
	50-32-8	**Benzo(a)pyrene**	**48 J**	**2900**	**µg/kg**	**APFT-SS01-A**	**14 / 15**	**185 / 1043**	**2900**	**130 J - 1100 J**	**15 c**	**NA**	**NA**	**Y**	**ASL**
	205-99-2	**Benzo(b)fluoranthene**	**52 J**	**3200**	**µg/kg**	**APFT-SS01-A**	**14 / 15**	**185 / 1043**	**3200**	**180 J - 1500 J**	**150 c**	**NA**	**NA**	**Y**	**ASL**
	191-24-2	Benzo(g,h,i)perylene	79 J	1600	µg/kg	APFT-SS01-A	11 / 15	185 / 1043	1600	310 J - 670 J	170000 n	NA	NA	N	BSL
	207-08-9	**Benzo(k)fluoranthene**	**110 J**	**2600**	**µg/kg**	**APFT-SS01-A**	**12 / 15**	**185 / 1043**	**2600**	**280 J - 520 J**	**1500 c**	**NA**	**NA**	**Y**	**ASL**
	85-68-7	Benzyl butyl phthalate	22 J	120 J	µg/kg	APSB32D-SS	4 / 15	185 / 1043	120	NA	260000 c*	NA	NA	N	BSL
	117-81-7	Bis(2-ethylhexyl)phthalate	41 J	4400	µg/kg	APFT-SS01-A	3 / 15	185 1052	4400	NA	35000 c*	NA	NA	N	BSL
	86-74-8	**Carbazole**	**93 J**	**380**	**µg/kg**	**APFT-SS01-A**	**5 / 15**	**185 / 1043**	**380**	**170 J - 170 J**	**NA NA**	**NA**	**NA**	**Y**	**NSV**
	53-70-3	**Dibenz(a,h)anthracene**	**63 J**	**670**	**µg/kg**	**APFT-SS01-A**	**7 / 15**	**185 / 1043**	**670**	**190 J - 190 J**	**15 c**	**NA**	**NA**	**Y**	**ASL**
	132-64-9	Dibenzofuran	76 J	94 J	µg/kg	APFT-SS01D-A	3 / 15	185 / 1043	94	NA	7800 n	NA	NA	N	BSL
	206-44-0	Fluoranthene	78 J	5000	µg/kg	APFT-SS01-A	15 / 15	185 / 1052	5000	96 J - 2500 J	230000 n	NA	NA	N	BSL
	86-73-7	Fluorene	150 J	210 J	µg/kg	APSB10-SS	4 / 15	185 / 1043	210	NA	230000 n	NA	NA	N	BSL
	193-39-5	**Indeno(1,2,3-cd)pyrene**	**84 J**	**1800**	**µg/kg**	**APFT-SS01-A**	**13 / 15**	**185 / 1043**	**1800**	**350 J - 710 J**	**150 c**	**NA**	**NA**	**Y**	**ASL**
	91-20-3	Naphthalene	27 J	27 J	µg/kg	APSB24-SS	1 / 15	185 / 1043	27	NA	3600 c*	NA	NA	N	BSL
	85-01-8	Phenanthrene	42 J	1900	µg/kg	APFT-SS01-A	13 / 15	185 / 1043	1900	150 J - 1300	170000 n	NA	NA	N	BSL
	129-00-0	Pyrene	58 J	4900	µg/kg	APFT-SS01-A	15 / 15	185 / 1052	4900	270 - 2000 J	170000 n	NA	NA	N	BSL
	72-54-8	4,4'-DDD	0.083 J	0.21 J	µg/kg	APSB32-SS	5 / 15	3.6 / 10.1	0.21	NA	2000 c	NA	NA	N	BSL
	72-55-9	4,4'-DDE	0.028 J	0.73 J	µg/kg	APSB24-SS	5 / 15	3.6 / 10.1	0.73	NA	1400 c	NA	NA	N	BSL
	50-29-3	4,4'-DDT	0.11 J	4.2 J	µg/kg	APSB32-SS	9 / 15	3.6 / 10.1	4.2	NA	1700 c*	NA	NA	N	BSL
	309-00-2	Aldrin	0.069 J	0.071 J	µg/kg	APSB02-SS	2 / 15	1.8 / 5.2	0.071	NA	29 c*	NA	NA	N	BSL
	319-84-6	alpha-BHC	0.02 J	0.02 J	µg/kg	APSB02-SS	1 / 15	1.8 / 5.2	0.02	NA	77 c	NA	NA	N	BSL
	5103-71-9	alpha-Chlordane	0.096 J	0.28 J	µg/kg	APSB10-SS	4 / 15	1.8 / 5.2	0.28	NA	1600 c*	NA	NA	N	BSL
	11097-69-1	Aroclor-1254	11 J	32 J	µg/kg	APFT-SS03-A	5 / 18	36 / 101	32	NA	110 n**	NA	NA	N	BSL
	11096-82-5	**Aroclor-1260**	**5.6 J**	**370**	**µg/kg**	**APTF02-SS**	**12 / 18**	**36 / 101**	**370**	**NA**	**220 c**	**NA**	**NA**	**Y**	**ASL**
	319-85-7	beta-BHC	0.56 J	0.61 J	µg/kg	APSB13-SS	2 / 15	1.8 / 5.2	0.61	NA	270 c	NA	NA	N	BSL
	319-86-8	delta-BHC	0.043 J	0.073 J	µg/kg	APSB10-SS	2 / 15	1.8 / 5.2	0.073	NA	520 c*	NA	NA	N	BSL
	60-57-1	Dieldrin	0.26 J	0.64 J	µg/kg	APSB32-SS	5 / 15	3.6 / 10	0.64	NA	30 c	NA	NA	N	BSL
	959-98-8	Endosulfan I	0.024 J	0.12 J	µg/kg	APSB10-SS	3 / 15	1.8 / 5.2	0.12	NA	37000 n	NA	NA	N	BSL
	33213-65-9	Endosulfan II	0.11 J	2.3 J	µg/kg	APSB10-SS	6 / 15	3.6 / 10	2.3	NA	37000 n	NA	NA	N	BSL
	1031-07-8	Endosulfan Sulfate	0.068 J	0.45 J	µg/kg	APSB24-SS	7 / 15	3.6 / 10	0.45	NA	37000 n	NA	NA	N	BSL
	72-20-8	Endrin	0.07 J	0.58 J	µg/kg	APSB10-SS	5 / 15	3.6 / 10	0.58	NA	1800 n	NA	NA	N	BSL
	7421-93-4	Endrin Aldehyde	0.12 J	0.64 J	µg/kg	APSB10-SS	4 / 15	3.6 / 10	0.64	NA	1800 n	NA	NA	N	BSL
	53494-70-5	Endrin Ketone	0.19 J	3.3 J	µg/kg	APSB32D-SS	7 / 15	3.6 / 10	3.3	NA	1800 n	NA	NA	N	BSL
	58-89-9	gamma-BHC (Lindane)	0.035 J	1.7 J	µg/kg	APSB24-SS	5 / 15	1.8 / 5.2	1.7	NA	520 c*	NA	NA	N	BSL
	5103-74-2	gamma-Chlordane	0.069 J	0.29 J	µg/kg	APSB24-SS	6 / 15	1.8 / 5.2	0.29	NA	1600 c*	NA	NA	N	BSL
	76-44-8	Heptachlor	0.086 J	0.37 J	µg/kg	APSB24-SS	4 / 15	1.8 / 5.2	0.37	NA	110 c	NA	NA	N	BSL

Table 6
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil [1]

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)		Maximum Concentration (Qualifier)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening [2]	Background Value [3]	Screening Toxicity Value (n/c) [4]		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion [5]
Surface Soil at the Asbestos Pile Parcel [8]	1024-57-3	Heptachlor Epoxide	0.023	J	0.19	J	µg/kg	APSB32-SS	5 / 15	1.8 / 5.2	0.19	NA	53	c*	NA	NA	N	BSL
	NA	Dioxin/Furan TEQ	2.7263		46.1523		pg/g	APFT-SS01D-A	8 / 8	NA / NA	46.1523	NA	4.5	c*	NA	NA	Y	ASL
	7429-90-5	Aluminum	5480		20900		mg/kg	APSL-SS02-A	10 / 10	22 / 62	20900	8530 - 12400	7700	n	NA	NA	Y	ASL
	7440-36-0	Antimony	1.9	J	2.4	J	mg/kg	APSL-SS02-A	3 / 10	6.6 / 19	2.4	0.34 J - 0.81 J	3.1	n	NA	NA	N	BSL
	7440-38-2	Arsenic	2.3		5.2		mg/kg	APSL-SS02-A	10 / 10	1.1 / 3.1	5.2	3 - 5.9	0.39	c*	NA	NA	Y	ASL
	7440-39-3	Barium	45.3		112		mg/kg	APSL-SS01-A	10 / 10	22 / 62	112	65.6 - 174	1500	n	NA	NA	N	BSL
	7440-41-7	Beryllium	0.31	J	1.1		mg/kg	APSL-SS01D-A	6 / 10	0.5 / 1.6	1.1	0.69 - 1.4	16	n	NA	NA	N	BSL
	7440-43-9	Cadmium	0.21	J	2.3		mg/kg	APSB21-SS	9 / 10	0.5 / 1.6	2.3	0.03 J- - 0.4 J	7	n	NA	NA	N	BSL
	7440-70-2	Calcium	2930		130000		mg/kg	APSB13-SS	10 / 10	546 / 1627	130000	248 J - 3660	NA	NA	NA	NA	N	NUT
	7440-47-3	Chromium	13.3		134		mg/kg	APSB32D-SS	10 / 10	1.1 / 3.1	134	13 - 21.1	0.29	c	NA	NA	Y	ASL
	7440-48-4	Cobalt	5.4	J	22.2		mg/kg	APSB32D-SS	7 / 10	5.5 / 16	22.2	5.3 J - 11.5 J	2.3	n	NA	NA	Y	ASL
	7440-50-8	Copper	9.6		82.6		mg/kg	APSB32D-SS	10 / 10	2.7 / 7.8	82.6	3.9 - 26.7	310	n	NA	NA	N	BSL
	7439-89-6	Iron	11300	J	27300	J	mg/kg	APSL-SS01D-A	10 / 10	11 / 31	27300	12500 - 21700	5500	n	NA	NA	Y	ASL
	7439-92-1	Lead	14.9		206		mg/kg	APSB32D-SS	7 / 7	1.1 / 3.1	206	15.6 J - 80.5 J	400	n	NA	NA	N	BSL
	7439-95-4	Magnesium	2870		60100		mg/kg	APSB32D-SS	10 / 10	546 / 1553	60100	1140 - 3020	NA	NA	NA	NA	N	NUT
	7439-96-5	Manganese	167	J	659	J	mg/kg	APSL-SS01-A	10 / 10	1.6 / 4.7	659	268 J - 1030 J	180	n	NA	NA	Y	ASL
	7439-97-6	Mercury	0.037	J	0.23		mg/kg	APSB21-SS	5 / 7	0.1 / 0.3	0.23	0.025 J - 0.23	1	ns	NA	NA	N	BSL
	7440-02-0	Nickel	8.8		371		mg/kg	APSB32D-SS	10 / 10	4.4 / 12	371	8.8 J - 19.4 J	150	n	NA	NA	Y	ASL
	7440-09-7	Potassium	506	J	5860		mg/kg	APSL-SS01D-A	10 / 10	546 / 1553	5860	105 J - 710	NA	NA	NA	NA	N	NUT
	7440-23-5	Sodium	208	J	290	J	mg/kg	APSL-SS01D-A	3 / 10	546 / 1553	290	45.7 J- - 187 J-	NA	NA	NA	NA	N	NUT
	7440-28-0	Thallium	3.1		3.1		mg/kg	APSL-SS01-A	1 / 10	2.7 / 7.8	3.1	NA	0.078	n	NA	NA	Y	ASL
	7440-62-2	Vanadium	19		38.6		mg/kg	APSL-SS01-A	10 / 10	5.5 / 16	38.6	18.6 J - 29.5 J	39	n	NA	NA	N	BSL
	7440-66-6	Zinc	25.1		285		mg/kg	APSB32D-SS	10 / 10	6.6 / 19	285	20.6 - 104	2300	n	NA	NA	N	BSL
Surface Soil located along the Western Bank of Wissahickon Creek [9]	75-35-4	1,1-Dichloroethylene	0.71	J	0.71	J	µg/kg	OWSB03-SS	1 / 3	6.4 / 8.1	0.71	NA	24000	n	NA	NA	N	BSL
	218-01-9	1,2-Benzphenanthrene (a.k.a. Chrysene)	160		460		µg/kg	OWSB03-SS	3 / 3	216 / 250	460	160 J - 1300 J	15000	c	NA	NA	N	BSL
	120-12-7	Anthracene	44	J	72	J	µg/kg	OWSB03-SS	2 / 3	216 / 250	72	190 J - 190 J	1700000	n	NA	NA	N	BSL
	56-55-3	Benzo(a)anthracene	120		380		µg/kg	OWSB03-SS	3 / 3	216 / 250	380	140 J - 1100 J	150	c	NA	NA	Y	ASL
	50-32-8	Benzo(A)pyrene	140		360		µg/kg	OWSB03-SS	3 / 3	216 / 250	360	130 J - 1100 J	15	c	NA	NA	Y	ASL
	205-99-2	Benzo(B)fluoranthene	160		430		µg/kg	OWSB03-SS	3 / 3	216 / 250	430	180 J - 1500 J	150	c	NA	NA	Y	ASL
	191-24-2	Benzo(G,H,I)perylene	55	J	180	J	µg/kg	OWSB03-SS	2 / 3	216 / 250	180	310 J - 670 J	170000	n	NA	NA	N	BSL
	207-08-9	Benzo(K)fluoranthene	71	J	190	J	µg/kg	OWSB03-SS	3 / 3	216 / 250	190	280 J - 520 J	1500	c	NA	NA	N	BSL
	86-74-8	Carbazole	24	J	56	J	µg/kg	OWSB03-SS	2 / 3	216 / 250	56	170 J - 170 J	NA	NA	NA	NA	Y	NSV
	206-44-0	Fluoranthene	260		930		µg/kg	OWSB03-SS	3 / 3	216 / 250	930	96 J - 2500 J	230000	n	NA	NA	N	BSL
	86-73-7	Fluorene	40	J	40	J	µg/kg	OWSB03-SS	1 / 3	216 / 250	40	NA	230000	n	NA	NA	N	BSL
	193-39-5	Indeno(1,2,3-cd)pyrene	88	J	210	J	µg/kg	OWSB03-SS	2 / 3	216 / 250	210	350 J - 710 J	150	c	NA	NA	Y	ASL
	85-01-8	Phenanthrene	220		550		µg/kg	OWSB03-SS	3 / 3	216 / 250	550	150 J - 1300	170000	n	NA	NA	N	BSL
	129-00-0	Pyrene	230	J	790	J	µg/kg	OWSB03-SS	3 / 3	216 / 250	790	270 - 2000 J	170000	n	NA	NA	N	BSL
	72-54-8	4,4'-DDD	0.11	J	0.24	J	µg/kg	OWSB01-SS	3 / 3	4.4 / 4.7	0.24	NA	2000	c	NA	NA	N	BSL
	72-55-9	4,4'-DDE	0.11	J	0.37	J	µg/kg	OWSB03-SS	3 / 3	4.4 / 4.7	0.37	NA	1400	c	NA	NA	N	BSL

Table 6
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil [1]

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening [2]	Background Value[3]	Screening Toxicity Value (n/c) [4]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion [5]
Surface Soil located along the Western Bank of Wissahickon Creek [9]	50-29-3	4,4'-DDT	0.74 J	1.5 J	µg/kg	OWSB03-SS	3 / 3	4.4 / 4.7	1.5	NA	1700 c*	NA	NA	N	BSL
	309-00-2	Aldrin	0.015 J	0.062 J	µg/kg	OWSB01-SS	3 / 3	2.3 / 2.4	0.062	NA	29 c*	NA	NA	N	BSL
	319-84-6	alpha-BHC	0.035 J	0.042 J	µg/kg	OWSB02-SS	2 / 3	2.3 / 2.4	0.042	NA	77 c	NA	NA	N	BSL
	5103-71-9	alpha-Chlordane	0.11 J	0.17 J	µg/kg	OWSB02-SS	3 / 3	2.3 / 2.4	0.17	NA	1600 c*	NA	NA	N	BSL
	11097-69-1	Aroclor-1254	14 J	14 J	µg/kg	OWSB02-SS	1 / 3	42 / 49	14	NA	110 n**	NA	NA	N	BSL
	60-57-1	Dieldrin	0.078 J	0.54 J	µg/kg	OWSB03-SS	3 / 3	4.4 / 4.7	0.54	NA	30 c	NA	NA	N	BSL
	959-98-8	Endosulfan I	0.026 J	0.067 J	µg/kg	OWSB01-SS	3 / 3	2.3 / 2.4	0.067	NA	37000 n	NA	NA	N	BSL
	33213-65-9	Endosulfan II	0.15 J	0.23 J	µg/kg	OWSB03-SS	3 / 3	4.4 / 4.7	0.23	NA	37000 n	NA	NA	N	BSL
	1031-07-8	Endosulfan Sulfate	0.038 J	0.14 J	µg/kg	OWSB02-SS	3 / 3	4.4 / 4.7	0.14	NA	37000 n	NA	NA	N	BSL
	72-20-8	Endrin	0.027 J	0.029 J	µg/kg	OWSB03-SS	3 / 3	4.4 / 4.7	0.029	NA	1800 n	NA	NA	N	BSL
	7421-93-4	Endrin Aldehyde	0.13 J	0.19 J	µg/kg	OWSB02-SS	3 / 3	4.4 / 4.7	0.19	NA	1800 n	NA	NA	N	BSL
	53494-70-5	Endrin Ketone	0.034 J	0.22 J	µg/kg	OWSB03-SS	3 / 3	4.4 / 4.7	0.22	NA	1800 n	NA	NA	N	BSL
	58-89-9	gamma-BHC (Lindane)	0.047 J	0.056 J	µg/kg	OWSB03-SS	2 / 3	2.3 / 2.4	0.056	NA	520 c*	NA	NA	N	BSL
	5103-74-2	gamma-Chlordane	0.11 J	0.26 J	µg/kg	OWSB02-SS	3 / 3	2.3 / 2.4	0.26	NA	1600 c*	NA	NA	N	BSL
	1024-57-3	Heptachlor Epoxide	0.053 J	0.11 J	µg/kg	OWSB02-SS	3 / 3	2.3 / 2.4	0.11	NA	53 c*	NA	NA	N	BSL
	7429-90-5	**Aluminum**	**6860**	**8450**	**mg/kg**	**OWSB02-SS**	**3 / 3**	**27 / 32**	**8450**	**8530 - 12400**	**7700 n**	**NA**	**NA**	**Y**	**ASL**
	7440-38-2	**Arsenic**	**3.7**	**4.6**	**mg/kg**	**OWSB02-SS**	**3 / 3**	**1.4 / 1.6**	**4.6**	**3 - 5.9**	**0.39 c***	**NA**	**NA**	**Y**	**ASL**
	7440-39-3	Barium	109	141	mg/kg	OWSB02-SS	3 / 3	27 / 32	141	65.6 - 174	1500 n	NA	NA	N	BSL
	7440-41-7	Beryllium	0.6	0.77	mg/kg	OWSB01-SS	3 / 3	0.7 / 0.8	0.77	0.69 - 1.4	16 n	NA	NA	N	BSL
	7440-43-9	Cadmium	0.32 J	0.41 J	mg/kg	OWSB02-SS	2 / 3	0.7 / 0.8	0.41	0.03 J- - 0.4 J	7 n	NA	NA	N	BSL
	7440-70-2	Calcium	1620 J	2620 J	mg/kg	OWSB02-SS	3 / 3	681 / 803	2620	248 J - 3660	NA NA	NA	NA	N	NUT
	7440-47-3	**Chromium**	**17.6**	**24**	**mg/kg**	**OWSB02-SS**	**3 / 3**	**1.4 / 1.6**	**24**	**13 - 21.1**	**0.29 c**	**NA**	**NA**	**Y**	**ASL**
	7440-48-4	**Cobalt**	**8**	**9.1**	**mg/kg**	**OWSB02-SS**	**3 / 3**	**6.8 / 8.0**	**9.1**	**5.3 J - 11.5 J**	**2.3 n**	**NA**	**NA**	**Y**	**ASL**
	7440-50-8	Copper	18.4 J	23.6 J	mg/kg	OWSB02-SS	3 / 3	3.4 / 4.0	23.6	3.9 - 26.7	310 n	NA	NA	N	BSL
	7439-89-6	**Iron**	**14500**	**16000**	**mg/kg**	**OWSB01-SS**	**3 / 3**	**14 / 16**	**16000**	**12500 - 21700**	**5500 n**	**NA**	**NA**	**Y**	**ASL**
	7439-92-1	Lead	23 K	42.5 K	mg/kg	OWSB02-SS	3 / 3	1.4 / 1.6	42.5	15.6 J - 80.5 J	400 n	NA	NA	N	BSL
	7439-95-4	Magnesium	1850 J	2080 J	mg/kg	OWSB02-SS	3 / 3	681 / 803	2080	1140 - 3020	NA NA	NA	NA	N	NUT
	7439-96-5	**Manganese**	**518**	**769**	**mg/kg**	**OWSB02-SS**	**3 / 3**	**2.0 / 2.4**	**769**	**268 J - 1030 J**	**180 n**	**NA**	**NA**	**Y**	**ASL**
	7439-97-6	Mercury	0.16	0.23	mg/kg	OWSB03-SS	3 / 3	0.1 / 0.2	0.23	0.025 J - 0.23	1 ns	NA	NA	N	BSL
	7440-02-0	Nickel	11.6	13.2	mg/kg	OWSB02-SS	3 / 3	5.4 / 6.4	13.2	8.8 J - 19.4 J	150 n	NA	NA	N	BSL
	7440-09-7	Potassium	600	723	mg/kg	OWSB03-SS	3 / 3	681 / 803	723	105 J - 710	NA NA	NA	NA	N	NUT
	7440-62-2	Vanadium	21.9	24.9	mg/kg	OWSB02-SS	3 / 3	6.8 / 8.0	24.9	18.6 J - 29.5 J	39 n	NA	NA	N	BSL
	7440-66-6	Zinc	58.3	85.6	mg/kg	OWSB02-SS	3 / 3	8.2 / 9.6	85.6	20.6 - 104	2300 n	NA	NA	N	BSL

Notes:

1. Results of this screening table used for current/future maintenance workers, recreational users, and commercial workers for ingestion, dermal contact, and inhalation.
2. Maximum detected concentration used for screening.
3. Background values from BK-SS-03-052013, BK-SS-04A-052013, BK-SS-09-052013, and BK-SS-10-052013.
4. All compounds are screened against the Region 3 Regional Screening Levels (RSLs) dated May 2013 for Residential Soil using the cancer benchmark value of 1E-06 and an Hazard Quotient = 0.1.

Definitions:
NA = Not Applicable
COPC = Chemical of Potential Concern (in Bold Type)
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
n = noncarcinogen
c = carcinogen

AR308597

Table 6
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil [1]

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening [2]	Background Value[3]	Screening Toxicity Value (n/c) [4]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion [5]

When no RSLs available, surrogate RSLs are used as follows:
Acenaphthylene - use Acenaphthene
Benzo(g,h,i)perylene and Phenanthrene - use Pyrene
alpha-Chlordane and gamma-Chlordane - use Chlordane
delta-BHC - use gamma-BHC (Lindane)
Endosulfan I, II, and Endosulfan Sulfate - use Endosulfan
Endrin Aldehyde and Endrin Ketone - use Endrin
Cadmium - use Cadmium (diet)
Chromium - use Chromium VI
Manganese - use Manganese (non-diet)
Mercury - use Mercury (elemental)
Vanadium - use Vanadium and Compounds

5. Rationale Codes — Above Screening Level (ASL)
Selection Reason: No Screening Value (NSV) Available for Screening, so assume COPC
Equals Screening Level (=SL)
Below Screening Level (BSL)
Deletion Reason: Essential Nutrient (NUT)

6. Samples include: PKSB15-SS, PKSB19-SS, PKSB30-SS, PKSB30D-SS and PKSB38-SS.
7. Samples include: RVSB04-SS, RVSB08-SS, RVSB12-SS, RVSB17-SS, RVSB19-SS, and RVSB24-SS.
8. Samples include: APSB02-SS, APSB10-SS, APSB13-SS, APSB21-SS, APSB24-SS, APSB32-SS, APSB32D-SS, APFT01-SS, APFT02-SS, APFT03-SS, APFT-SS01-A, APFT-SS01D-A, APFT-SS02-A, APFT-SS03-A, APFT-SS04-A, APFT-SS05-A, APSL-SS01-A, APSL-SS01D-A, and APSL-SS02-A.
9. Samples include: OWSB01-SS, OWSB02-SS and OWSB03-SS.

Y = Yes
N = No
J = Analyte present. Reported value may not be accurate or precise.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
*= Noncancer screening level < 100X cancer screening level.
ns = noncancer saturation based RSL
** = Noncancer screening level using HQ = 0.1 used because it is more conservative than cancer screening value at 1E-06
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
TEQ = toxic equivalents

Table 7
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water [1]

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening [2]	Background Value [3]	Screening Toxicity Value (n/c) [4]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion [5]
Wissahickon Creek [6]	75-27-4	Bromodichloromethane	0.074 J	0.084 J	µg/L	CKSW07-RI-01	3 / 6	0.5 / 0.5	0.084	NA	1.2 c	NA	NA	N	BSL
	75-69-4	CFC-11 (a.k.a Trichlorofluoromethane)	0.08 J	0.08 J	µg/L	CKSW02-RI-01	1 / 6	0.5 / 0.5	0.08	NA	1100 n	NA	NA	N	BSL
	76-13-1	CFC - 113 (a.k.a 1,1,2-Trichloro-1,2,2-trifluoroethane)	0.13 J	0.13 J	µg/L	CKSW02-RI-01	1 / 6	0.5 / 0.5	0.13	NA	53000 n	NA	NA	N	BSL
	124-48-1	Dibromochloromethane	0.054 J	0.058 J	µg/L	CKSW07-RI-01	2 / 6	0.5 / 0.5	0.058	NA	1.5 c	NA	NA	N	BSL
	127-18-4	Tetrachloroethene	0.052 J	0.072 J	µg/L	CKSW05-RI-01	5 / 6	0.5 / 0.5	0.072	NA	35 n**	NA	NA	N	BSL
	191-24-2	Benzo(g,h,i)perylene	1.3 J	1.3 J	µg/L	CKSW04-RI-01	1 / 6	5 / 5	1.3	NA	87 n	NA	NA	N	BSL
	193-39-5	**Indeno(1,2,3-cd)pyrene**	**1.2 J**	**1.2 J**	**µg/L**	**CKSW04-RI-01**	**1 / 6**	**5 / 5**	**1.2**	**NA**	**0.29 c**	**NA**	**NA**	**Y**	**ASL**
	53-70-3	**Dibenzo(a,h)anthracene**	**1.1 J**	**1.1 J**	**µg/L**	**CKSW04-RI-01**	**1 / 6**	**5 / 5**	**1.1**	**NA**	**0.029 c**	NA	NA	**Y**	**ASL**
	7421-93-4	Endrin Aldehyde	0.0056 J	0.0056 J	µg/L	CKSW01-RI-01	1 / 6	0.1 / 0.1	0.0056	0.006	1.7 n	NA	NA	N	BSL
	7429-90-5	Aluminum	118 J	212	µg/L	CKSW05-RI-01	4 / 6	200 / 200	212	NA	16000 n	NA	NA	N	BSL
	7440-39-3	Barium	107 J	121 J	µg/L	CKSW05-RI-01	6 / 6	200 / 200	121	107	2900 n	NA	NA	N	BSL
	7440-70-2	Calcium	48200	54000	µg/L	CKSW05-RI-01	6 / 6	5000 / 5000	54000	53000	NA NA	NA	NA	N	NUT
	7440-47-3	**Chromium**	**4.4 J**	**4.4 J**	**µg/L**	**CKSW02-RI-01**	**1 / 6**	**10 / 10**	**4.4**	**NA**	**0.31 c**	**NA**	**NA**	**Y**	**ASL**
	7439-89-6	Iron	1050	1050 J	µg/L	CKSW05-RI-01	1 / 6	100 / 100	1050	NA	11000 n	NA	NA	N	BSL
	7439-92-1	Lead	6.3 J	6.3 J	µg/L	CKSW05-RI-01	1 / 6	10 / 10	6.3	3.0	150 n	NA	NA	N	BSL
	7439-95-4	Magnesium	16000	17700	µg/L	CKSW02-RI-01	6 / 6	5000 / 5000	17700	17800	NA NA	NA	NA	N	NUT
	7439-96-5	**Manganese**	**36.6**	**334**	**µg/L**	**CKSW05-RI-01**	**6 / 6**	**15 / 15**	**334**	**34.4**	**320 n**	**NA**	**NA**	**Y**	**ASL**
	7440-09-7	Potassium	3920 J	4800 J	µg/L	CKSW07-RI-01	6 / 6	5000 / 5000	4800	4110	NA NA	NA	NA	N	NUT
	7440-23-5	Sodium	112000	126000	µg/L	CKSW02-RI-01	6 / 6	5000 / 5000	126000	121000	NA NA	NA	NA	N	NUT
Tannery Run [7]	71-43-2	Benzene	0.068 J	0.068 J	µg/L	CKSW06-RI-01	1 / 1	0.5 / 0.5	0.06	NA	3.9 c*	NA	NA	N	BSL
	60-57-1	Dieldrin	0.0094 J	0.0094 J	µg/L	CKSW06-RI-01	1 / 1	0.1 / 0.1	0.0094	NA	0.015 c	NA	NA	N	BSL
	7440-39-3	Barium	179 J	179 J	µg/L	CKSW06-RI-01	1 / 1	200 / 200	179	107	2900 n	NA	NA	N	BSL
	7440-70-2	Calcium	52700	52700	µg/L	CKSW06-RI-01	1 / 1	5000 / 5000	52700	53000	NA NA	NA	NA	N	NUT
	7440-47-3	**Chromium**	**3.3 J**	**3.3 J**	**µg/L**	**CKSW02-RI-01**	**1 / 1**	**10 / 10**	**3.3**	**NA**	**0.31 c**	**NA**	**NA**	**Y**	**ASL**
	7439-92-1	Lead	2.8 J	2.8 J	µg/L	CKSW06-RI-01	1 / 1	10 / 10	2.8	3.0	150 n	NA	NA	N	BSL
	7439-95-4	Magnesium	15700	15700	µg/L	CKSW06-RI-01	1 / 1	5000 / 5000	15700	17800	NA NA	NA	NA	N	NUT
	7439-96-5	Manganese	41.2	41.2	µg/L	CKSW06-RI-01	1 / 1	15 / 15	41.2	34.4	320 n	NA	NA	N	BSL
	7440-09-7	Potassium	2760 J	2760 J	µg/L	CKSW06-RI-01	1 / 1	5000 / 5000	2760	4110	NA NA	NA	NA	N	NUT
	7440-23-5	Sodium	64100	64100	µg/L	CKSW06-RI-01	1 / 1	5000 / 5000	64100	121000	NA NA	NA	NA	N	NUT
Rose Valley Creek [8]	127-18-4	Tetrachloroethene	0.16 J	0.16 J	µg/L	CKSW03-RI-01	1 / 1	0.5 / 0.5	0.16	NA	35 n**	NA	NA	N	BSL
	60-57-1	Dieldrin	0.0093 J	0.0093 J	µg/L	CKSW03-RI-01	1 / 1	0.1 / 0.1	0.0093	NA	0.015 c	NA	NA	N	BSL
	7440-39-3	Barium	136 J	136 J	µg/L	CKSW03-RI-01	1 / 1	200 / 200	136	107	2900 n	NA	NA	N	BSL
	7440-70-2	Calcium	32300	32300	µg/L	CKSW03-RI-01	1 / 1	5000 / 5000	32300	53000	NA NA	NA	NA	N	NUT
	7439-95-4	Magnesium	12200	12200	µg/L	CKSW03-RI-01	1 / 1	5000 / 5000	12200	17800	NA NA	NA	NA	N	NUT
	7439-96-5	Manganese	13.6 J	13.6 J	µg/L	CKSW03-RI-01	1 / 1	15 / 15	13.6	34.4	320 n	NA	NA	N	BSL
	7440-09-7	Potassium	2170 J	2170 J	µg/L	CKSW03-RI-01	1 / 1	5000 / 5000	2170	4110	NA NA	NA	NA	N	NUT
	7440-23-5	Sodium	40700	40700	µg/L	CKSW03-RI-01	1 / 1	5000 / 5000	40700	121000	NA NA	NA	NA	N	NUT
Surface Water in the Reservoir [9]	117-81-7	Bis(2-Ethylhexyl)phthalate	0.52 J	0.52 J	µg/L	RVSW02-RI-01	1 / 6	5 / 5	0.52	NA	0.71 c*	NA	NA	N	BSL
	319-85-7	beta-BHC	0.0058 J	0.0075 J	µg/L	RVSW03D-RI-01	3 / 6	0.05 / 0.05	0.0075	NA	0.22 c	NA	NA	N	BSL
	7429-90-5	Aluminum	1470	3520	µg/L	RVSW03-RI-01	2 / 6	200 / 200	3520	NA	16000 n	NA	NA	N	BSL
	7440-38-2	**Arsenic**	**3.7 J**	**5.1 J**	**µg/L**	**RVSW03-RI-01**	**3 / 6**	**10 / 10**	**5.1**	**NA**	**0.45 c**	**NA**	**NA**	**Y**	**ASL**
	7440-39-3	Barium	69.1 J	297	µg/L	RVSW03-RI-01	6 / 6	200 / 200	297	NA	2900 n	NA	NA	N	BSL
	7440-70-2	Calcium	34400	43200	µg/L	RVSW03-RI-01	6 / 6	5000 / 5000	43200	NA	NA NA	NA	NA	N	NUT
	7440-47-3	**Chromium**	**5.8 J**	**10.4**	**µg/L**	**RVSW03-RI-01**	**2 / 6**	**10 / 10**	**10.4**	**NA**	**0.31 c**	**NA**	**NA**	**Y**	**ASL**
	7440-50-8	Copper	15.5 J	23.2 J	µg/L	RVSW03-RI-01	2 / 6	25 / 25	23.2	NA	620 n	NA	NA	N	BSL
Surface Water in the Reservoir [9]	7439-89-6	Iron	1840	3930	µg/L	RVSW03-RI-01	2 / 6	100 / 100	3930	NA	11000 n	NA	NA	N	BSL
	7439-92-1	Lead	3.6 J	54.4	µg/L	RVSW03-RI-01	5 / 6	10 / 10	54.4	NA	150 n	NA	NA	N	BSL
	7439-95-4	Magnesium	5670	7680	µg/L	RVSW03-RI-01	6 / 6	5000 / 5000	7680	NA	NA NA	NA	NA	N	NUT

Table 7
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water [1]

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening [2]	Background Value [3]	Screening Toxicity Value (n/c) [4]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion [5]
	7439-96-5	Manganese	40.2	311	µg/L	RVSW03-RI-01	6 / 6	15 / 15	311	NA	320 n	NA	NA	N	BSL
	7440-09-7	Potassium	9960	11100	µg/L	RVSW03D-RI-01	6 / 6	5000 / 5000	11100	NA	NA NA	NA	NA	N	NUT
	7440-23-5	Sodium	7080	7560	µg/L	RVSW03D-RI-01	6 / 6	5000 / 5000	7560	NA	NA NA	NA	NA	N	NUT
	7440-62-2	Vanadium	22.3 J	22.3 J	µg/L	RVSW03-RI-01	1 / 6	50 / 50	22.3	NA	78 n	NA	NA	N	BSL
	7440-66-6	Zinc	86	176	µg/L	RVSW03-RI-01	2 / 6	60 / 60	176	NA	4700 n	NA	NA	N	BSL

Notes:

1. Results of this screening table used for current/future other recreational persons and/or maintenance workers.
2. Maximum detected concentration used for screening.
3. Background sample for creeks is CKSW01-RI-01. There are no background samples for the reservoir.
4. All compounds are screened against the Region 3 Regional Screening Levels (RSLs) dated May 2013 for tapwater using the cancer benchmark value of 1E-05 and an Hazard Quotient = 1 to account for surface water exposure. For lead, use 10 times the EPA action level in water (EPA Region 3 recommended value).
   When no RSL available, surrogate RSL is used as follows:
   Benzo(g,h,i)perylene - use Pyrene
   Endrin Aldehyde - use Endrin
   Chromium - use Chromium VI
   Manganese - use Manganese (non-diet)
5. Rationale Codes
   Selection Reason: Above Screening Level (ASL)
   No Screening Value (NSV) Available for Screening, so assume COPC
   Deletion Reason: Below Screening Level (BSL)
   Essential Nutrient (NUT)
6. Samples include: CKSW02-RI-01, CKSW04-RI-01, CKSW05-RI-01, CKSW07-RI-01, CKSW08-RI-01 and CKSW08D-RI-01.
7. Samples include: CKSW06-RI-01.
8. Samples include: CKSW03-RI-01.
9. Samples include: RVSW01-RI-01, RVSW02-RI-01, RVSW03-RI-01, RVSW03D-RI-01, RVSW04-RI-01, and RVSW05-RI-01.

Definitions:
NA = Not Applicable
COPC = Chemical of Potential Concern (in Bold Type)
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
n = noncarcinogen
c = carcinogen
Y = Yes
N = No
J = Analyte present. Reported value may not be accurate or precise.
µg/L = micrograms per liter
*= Noncancer screening level < 100X cancer screening level.
** = Noncancer screening level using HQ = 1 used because it is more conservative than cancer screening value at 1E-05

Table 8
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment [1]

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening [2]	Background Value [3]	Screening Toxicity Value (n/c) [4]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion [5]
Wissahickon Creek [6]	75-35-4	1,1-Dichloroethylene	0.96 J	0.98 J	µg/kg	CKSD12D-RI-01	2 / 8	5 / 5	0.98	NA	240000 n	NA	NA	N	BSL
	78-93-3	2-Butanone	16	16	µg/kg	CKSD04-RI-01	1 / 8	10 / 10	16	NA	28000000 n	NA	NA	N	BSL
	218-01-9	1,2-Benzphenanthrene (a.k.a. Chrysene)	120 J	1300	µg/kg	CKSD10-RI-01	8 / 8	170 / 170	1300	82-850	150000 c	NA	NA	N	BSL
	208-96-8	Acenaphthylene	25 J	26 J	µg/kg	CKSD10-RI-01	2 / 8	170 / 170	26	NA	3400000 n	NA	NA	N	BSL
	83-32-9	Acenaphthene	25 J	140 J	µg/kg	CKSD07-RI-01	6 / 8	170 / 170	140	64	3400000 n	NA	NA	N	BSL
	120-12-7	Anthracene	44 `	320	µg/kg	CKSD07-RI-01	8 / 8	170 / 170	320	210	17000000 n	NA	NA	N	BSL
	56-55-3	Benzo(a)anthracene	170 J	1100	µg/kg	CKSD07-RI-01	8 / 8	170 / 170	1100	79-730	1500 c	NA	NA	N	BSL
	50-32-8	**Benzo(a)pyrene**	**150 J**	**1000**	**µg/kg**	**CKSD10-RI-01**	**7 / 8**	**170 / 170**	**1000**	**84-540**	**150 c**	**NA**	**NA**	**Y**	**ASL**
	205-99-2	Benzo(b)fluoranthene	170 J	1300	µg/kg	CKSD10-RI-01	8 / 8	170 / 170	1300	96-470	1500 c	NA	NA	N	BSL
	191-24-2	Benzo(g,h,i)perylene	46 J	360	µg/kg	CKSD07-RI-01	8 / 8	170 / 170	360	37-93	1700000 n	NA	NA	N	BSL
	207-08-9	Benzo(k)fluoranthene	64 J	540	µg/kg	CKSD10-RI-01	8 / 8	170 / 170	540	96-190	15000 c	NA	NA	N	BSL
	85-68-7	Benzyl butyl phthalate	26 J	42 J	µg/kg	CKSD12D-RI-01	2 / 8	170 / 170	42	NA	2600000 c*	NA	NA	N	BSL
	86-74-8	**Carbazole**	**30 J**	**190 J**	**µg/kg**	**CKSD07-RI-01**	**7 / 8**	**170 / 170**	**190**	**NA**	**NA NA**	**NA**	**NA**	**Y**	**NSV**
	132-64-9	Dibenzofuran	34 J	64 J	µg/kg	CKSD10-RI-01	5 / 8	170 / 170	64	NA	78000 n	NA	NA	N	BSL
	206-44-0	Fluoranthene	250	2700	µg/kg	CKSD10-RI-01	8 / 8	170 / 170	2700	110-810	2300000 n	NA	NA	N	BSL
	86-73-7	Fluorene	38 J	180 J	µg/kg	CKSD07-RI-01	6 / 8	170 / 170	180	56	2300000 n	NA	NA	N	BSL
	193-39-5	Indeno(1,2,3-cd)pyrene	69 J	570	µg/kg	CKSD10-RI-01	8 / 8	170 / 170	570	53-150	1500 c	NA	NA	N	BSL
	85-01-8	Phenanthrene	170 J	1900	µg/kg	CKSD07-RI-01	8 / 8	170 / 170	1900	61-570	1700000 n	NA	NA	N	BSL
	129-00-0	Pyrene	260	2100 J	µg/kg	CKSD10-RI-01	8 / 8	170 / 170	2100	130-1900	1700000 n	NA	NA	N	BSL
	72-54-8	4,4'-DDD	0.093 J	1.5 J	µg/kg	CKSD10-RI-01	8 / 8	3.3 / 3.3	1.5	0.08-0.20	20000 c	NA	NA	N	BSL
	72-55-9	4,4'-DDE	0.035 J	0.82 J	µg/kg	CKSD12-RI-01	8 / 8	3.3 / 3.3	0.82	0.09-0.15	14000 c	NA	NA	N	BSL
	50-29-3	4,4'-DDT	0.082 J	7.5	µg/kg	CKSD10-RI-01	8 / 8	3.3 / 3.3	7.5	0.15-0.19	17000 c*	NA	NA	N	BSL
	309-00-2	Aldrin	0.012 J	1.7 J	µg/kg	CKSD07-RI-01	8 / 8	1.7 / 1.7	1.7	0.03-0.05	290 c*	NA	NA	N	BSL
	319-84-6	alpha-BHC	0.033 J	0.039 J	µg/kg	CKSD12D-RI-01	3 / 8	1.7 / 1.7	0.039	0.02	770 c	NA	NA	N	BSL
	5103-71-9	alpha-Chlordane	0.091 J	1.5 J	µg/kg	CKSD10-RI-01	8 / 8	1.7 / 1.7	1.5	0.07-0.51	16000 c*	NA	NA	N	BSL
	1109-76-91	Aroclor-1254	5.2 J	71	µg/kg	CKSD10-RI-01	2 / 8	33 / 33	71	NA	1100 n**	NA	NA	N	BSL
	1109-68-25	Aroclor-1260	2.8 J	9.5 J	µg/kg	CKSD07-RI-01	2 / 8	33 / 33	9.5	NA	2200 c	NA	NA	N	BSL
	319-85-7	beta-BHC	0.014 J	0.014 J	µg/kg	CKSD02-RI-01	1 / 8	1.7 / 1.7	0.014	0.04	2700 c	NA	NA	N	BSL
	319-86-8	delta-BHC	0.04 J	0.11 J	µg/kg	CKSD12-RI-01	2 / 8	1.7 / 1.7	0.11	0.13	NA c	NA	NA	N	BSL
	60-57-1	Dieldrin	0.64 J	8.3	µg/kg	CKSD07-RI-01	8 / 8	3.3 / 3.3	8.3	0.24-0.26	300 c	NA	NA	N	BSL
	959-98-8	Endosulfan I	0.022 J	0.37 J	µg/kg	CKSD10-RI-01	8 / 8	1.7 / 1.7	0.37	0.09	370000 n	NA	NA	N	BSL
	33213-65-9	Endosulfan II	0.065 J	1.1 J	µg/kg	CKSD10-RI-01	8 / 8	3.3 / 3.3	1.1	0.06-0.09	370000 n	NA	NA	N	BSL
	1031-07-8	Endosulfan Sulfate	0.028 J	0.17 J	µg/kg	CKSD04-RI-01	7 / 8	3.3 / 3.3	0.17	0.12	370000 n	NA	NA	N	BSL
	72-20-8	Endrin	0.024 J	0.18 J	µg/kg	CKSD04-RI-01	8 / 8	3.3 / 3.3	0.18	0.05-0.07	18000 n	NA	NA	N	BSL
	7421-93-4	Endrin Aldehyde	0.074 J	0.53 J	µg/kg	CKSD04-RI-01	8 / 8	3.3 / 3.3	0.53	0.05-0.29	18000 n	NA	NA	N	BSL
	53494-70-5	Endrin Ketone	0.047 J	4.7 J	µg/kg	CKSD12-RI-01	8 / 8	3.3 / 3.3	4.7	0.09-4.7	18000 n	NA	NA	N	BSL
	58-89-9	gamma-BHC (Lindane)	0.061 J	0.099 J	µg/kg	CKSD10-RI-01	2 / 8	1.7 / 1.7	0.099	0.02	5200 c*	NA	NA	N	BSL
	5103-74-2	gamma-Chlordane	0.22 J	1 J	µg/kg	CKSD12-RI-01	8 / 8	1.7 / 1.7	1	0.19-0.59	16000 c*	NA	NA	N	BSL
	76-44-8	Heptachlor	0.027 J	0.15 J	µg/kg	CKSD04-RI-01	2 / 8	1.7 / 1.7	0.15	0.02-0.09	1100 c	NA	NA	N	BSL
	1024-57-3	Heptachlor Epoxide	0.06 J	0.26 J	µg/kg	CKSD04-RI-01	8 / 8	1.7 / 1.7	0.26	0.02-0.06	530 c*	NA	NA	N	BSL
	72-43-5	Methoxychlor	0.37 J	0.37 J	µg/kg	CKSD07-RI-01	1 / 8	17 / 17	0.37	0.13	310000 n	NA	NA	N	BSL
	7429-90-5	Aluminum	3250	6260	mg/kg	CKSD07-RI-01	8 / 8	20 / 20	6260	5730-6210	77000 n	NA	NA	N	BSL
	7440-38-2	**Arsenic**	**2**	**6.5**	**mg/kg**	**CKSD07-RI-01**	**8 / 8**	**1 / 1**	**6.5**	**3.1-4.6**	**3.9 c***	**NA**	**NA**	**Y**	**ASL**
	7440-39-3	Barium	47.7	216	mg/kg	CKSD07-RI-01	8 / 8	20 / 20	216	78.5-91.7	15000 n	NA	NA	N	BSL
	7440-41-7	Beryllium	0.33 J	1	mg/kg	CKSD02-RI-01	8 / 8	0.5 / 0.5	1	0.82-1.1	160 n	NA	NA	N	BSL
	7440-43-9	Cadmium	0.22 J	0.32 J	mg/kg	CKSD07-RI-01	4 / 8	0.5 / 0.5	0.32	0.2	70 n	NA	NA	N	BSL
	7440-70-2	Calcium	1130 J	26000 J	mg/kg	CKSD08-RI-01	8 / 8	500 / 500	26000	1240-3760	NA NA	NA	NA	N	NUT
	7440-47-3	**Chromium**	**8.4**	**25.2**	**mg/kg**	**CKSD07-RI-01**	**8 / 8**	**1 / 1**	**25.2**	**17.6-20.3**	**2.9 c**	**NA**	**NA**	**Y**	**ASL**
	7440-48-4	Cobalt	3.8 J	11.1	mg/kg	CKSD07-RI-01	8 / 8	5 / 5	11.1	9.7-11.7	23 n	NA	NA	N	BSL
	7440-50-8	Copper	9.1 J	25.4 J	mg/kg	CKSD07-RI-01	8 / 8	2.5 / 2.5	25.4	15.0-15.3	3100 n	NA	NA	N	BSL
	7439-89-6	Iron	9340	22100	mg/kg	CKSD02-RI-01	8 / 8	10 / 10	22100	18000-21200	55000 n	NA	NA	N	BSL

Table 8
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment [1]

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening [2]	Background Value [3]	Screening Toxicity Value (n/c) [4]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion [5]
Wissahickon Creek [6]	7439-92-1	Lead	13.1 K	53.2 K	mg/kg	CKSD10-RI-01	8 / 8	1 / 1	53.2	11.4-27.5	4000 n	NA	NA	N	BSL
	7439-95-4	Magnesium	1620 J	18300 J	mg/kg	CKSD08-RI-01	8 / 8	500 / 500	18300	2880-4320	NA NA	NA	NA	N	NUT
	7439-96-5	**Manganese**	**195**	**2010**	**mg/kg**	**CKSD07-RI-01**	**8 / 8**	**2 / 2**	**2010**	**341-447**	**1800 n**	**NA**	**NA**	**Y**	**ASL**
	7439-97-6	Mercury	0.038 J	0.091 J	mg/kg	CKSD10-RI-01	4 / 8	0.1 / 0.1	0.091	0.03-0.04	7.8 n	NA	NA	N	BSL
	7440-02-0	Nickel	6.5	16.2	mg/kg	CKSD07-RI-01	8 / 8	4 / 4	16.2	14.1-16.0	1500 n	NA	NA	N	BSL
	7440-09-7	Potassium	469 J	1510	mg/kg	CKSD02-RI-01	8 / 8	500 / 500	1510	1080-1370	NA NA	NA	NA	N	NUT
	7440-62-2	Vanadium	11.3	26.5	mg/kg	CKSD07-RI-01	8 / 8	5 / 5	26.5	21.4-27.4	390 n	NA	NA	N	BSL
	7440-66-6	Zinc	46.4	104	mg/kg	CKSD12D-RI-01	8 / 8	6 / 6	104	73.9-95.1	23000 n	NA	NA	N	BSL
Tannery Run [7]	218-01-9	1,2-Benzphenanthrene (a.k.a Chrysene)	1300	1300	µg/kg	CKSD06-RI-01	1 / 1	226.67 / 226.67	1300	82-850	150000 c	NA	NA	N	BSL
	83-32-9	Acenaphthene	120 J	120 J	µg/kg	CKSD06-RI-01	1 / 1	226.67 / 226.67	120	64	3400000 n	NA	NA	N	BSL
	120-12-7	Anthracene	330	330	µg/kg	CKSD06-RI-01	1 / 1	226.67 / 226.67	330	210	17000000 n	NA	NA	N	BSL
	56-55-3	Benzo(a)anthracene	1200	1200	µg/kg	CKSD06-RI-01	1 / 1	226.67 / 226.67	1200	79-730	1500 c	NA	NA	N	BSL
	50-32-8	**Benzo(a)pyrene**	**990**	**990**	**µg/kg**	**CKSD06-RI-01**	**1 / 1**	**226.67 / 226.67**	**990**	**84-540**	**150 c**	**NA**	**NA**	**Y**	**ASL**
	205-99-2	Benzo(b)fluoranthene	1300	1300	µg/kg	CKSD06-RI-01	1 / 1	226.67 / 226.67	1300	96-470	1500 c	NA	NA	N	BSL
	191-24-2	Benzo(g,h,i)perylene	420	420	µg/kg	CKSD06-RI-01	1 / 1	226.67 / 226.67	420	37-93	1700000 n	NA	NA	N	BSL
	207-08-9	Benzo(k)fluoranthene	500	500	µg/kg	CKSD06-RI-01	1 / 1	226.67 / 226.67	500	96-190	15000 c	NA	NA	N	BSL
	86-74-8	**Carbazole**	**230**	**230**	**µg/kg**	**CKSD06-RI-01**	**1 / 1**	**226.67 / 226.67**	**230**	**NA**	**NA NA**	**NA**	**NA**	**Y**	**NSV**
	132-64-9	Dibenzofuran	57 J	57 J	µg/kg	CKSD06-RI-01	1 / 1	226.67 / 226.67	57	NA	78000 n	NA	NA	N	BSL
	206-44-0	Fluoranthene	2600	2600	µg/kg	CKSD06-RI-01	1 / 1	226.67 / 226.67	2600	110-810	2300000 n	NA	NA	N	BSL
	86-73-7	Fluorene	140 J	140 J	µg/kg	CKSD06-RI-01	1 / 1	226.67 / 226.67	140	56	2300000 n	NA	NA	N	BSL
	193-39-5	Indeno(1,2,3-cd)pyrene	550	550	µg/kg	CKSD06-RI-01	1 / 1	226.67 / 226.67	550	53-150	1500 c	NA	NA	N	BSL
	85-01-8	Phenanthrene	1900	1900	µg/kg	CKSD06-RI-01	1 / 1	226.67 / 226.67	1900	61-570	1700000 n	NA	NA	N	BSL
	129-00-0	Pyrene	2200 J	2200 J	µg/kg	CKSD06-RI-01	1 / 1	226.67 / 226.67	2200	130-1900	1700000 n	NA	NA	N	BSL
	72-54-8	4,4'-DDD	0.54 J	0.54 J	µg/kg	CKSD06-RI-01	1 / 1	4.5 / 4.5	0.54	0.08-0.20	20000 c	NA	NA	N	BSL
	72-55-9	4,4'-DDE	0.45 J	0.45 J	µg/kg	CKSD06-RI-01	1 / 1	4.5 / 4.5	0.45	0.09-0.15	14000 c	NA	NA	N	BSL
	50-29-3	4,4'-DDT	1 J	1 J	µg/kg	CKSD06-RI-01	1 / 1	4.5 / 4.5	1	0.15-0.19	17000 c*	NA	NA	N	BSL
	309-00-2	Aldrin	0.039 J	0.039 J	µg/kg	CKSD06-RI-01	1 / 1	2.3 / 2.3	0.039	0.03-0.05	290 c*	NA	NA	N	BSL
	5103-71-9	alpha-Chlordane	2.1 J	2.1 J	µg/kg	CKSD06-RI-01	1 / 1	2.3 / 2.3	2.1	0.07-0.51	16000 c*	NA	NA	N	BSL
	60-57-1	Dieldrin	2.6 J	2.6 J	µg/kg	CKSD06-RI-01	1 / 1	4.5 / 4.5	2.6	0.24-0.26	300 c	NA	NA	N	BSL
	959-98-8	Endosulfan I	0.048 J	0.048 J	µg/kg	CKSD06-RI-01	1 / 1	2.3 / 2.3	0.048	0.09	370000 n	NA	NA	N	BSL
	1031-07-8	Endosulfan Sulfate	0.16 J	0.16 J	µg/kg	CKSD06-RI-01	1 / 1	4.5 / 4.5	0.16	0.12	370000 n	NA	NA	N	BSL
	72-20-8	Endrin	0.11 J	0.11 J	µg/kg	CKSD06-RI-01	1 / 1	4.5 / 4.5	0.11	0.05-0.07	18000 n	NA	NA	N	BSL
	7421-93-4	Endrin Aldehyde	0.45 J	0.45 J	µg/kg	CKSD06-RI-01	1 / 1	4.5 / 4.5	0.45	0.05-0.29	18000 n	NA	NA	N	BSL
	53494-70-5	Endrin Ketone	0.3 J	0.3 J	µg/kg	CKSD06-RI-01	1 / 1	4.5 / 4.5	0.3	0.09-4.7	18000 n	NA	NA	N	BSL
	5103-74-2	gamma-Chlordane	1.5 J	1.5 J	µg/kg	CKSD06-RI-01	1 / 1	2.3 / 2.3	1.5	0.19-0.59	16000 c*	NA	NA	N	BSL
	1024-57-3	Heptachlor Epoxide	0.36 J	0.36 J	µg/kg	CKSD06-RI-01	1 / 1	2.3 / 2.3	0.36	0.02-0.09	530 c*	NA	NA	N	BSL
	7429-90-5	Aluminum	3710	3710	mg/kg	CKSD06-RI-01	1 / 1	27.4 / 27.4	3710	5730-6210	77000 n	NA	NA	N	BSL
	7440-38-2	Arsenic	1.9	1.9	mg/kg	CKSD06-RI-01	1 / 1	1.4 / 1.4	1.9	3.1-4.6	3.9 c*	NA	NA	N	BSL
	7440-39-3	Barium	66.8	66.8	mg/kg	CKSD06-RI-01	1 / 1	27.4 / 27.4	66.8	78.5-91.7	15000 n	NA	NA	N	BSL
	7440-41-7	Beryllium	0.47 J	0.47 J	mg/kg	CKSD06-RI-01	1 / 1	0.7 / 0.7	0.47	0.82-1.1	160 n	NA	NA	N	BSL
	7440-43-9	Cadmium	0.22 J	0.22 J	mg/kg	CKSD06-RI-01	1 / 1	0.7 / 0.7	0.22	0.2	70 n	NA	NA	N	BSL
	7440-70-2	Calcium	6150 J	6150 J	mg/kg	CKSD06-RI-01	1 / 1	684.9 / 684.9	6150	1240-3760	NA NA	NA	NA	N	NUT
	7440-47-3	**Chromium**	**10.6**	**10.6**	**mg/kg**	**CKSD06-RI-01**	**1 / 1**	**1.4 / 1.4**	**10.6**	**17.6-20.3**	**2.9 c**	**NA**	**NA**	**Y**	**ASL**
	7440-48-4	Cobalt	4.6 J	4.6 J	mg/kg	CKSD06-RI-01	1 / 1	6.9 / 6.9	4.6	9.7-11.7	23 n	NA	NA	N	BSL
	7440-50-8	Copper	18.1 J	18.1 J	mg/kg	CKSD06-RI-01	1 / 1	3.4 / 3.4	18.1	15.0-15.3	3100 n	NA	NA	N	BSL
	7439-89-6	Iron	14800	14800	mg/kg	CKSD06-RI-01	1 / 1	13.7 / 13.7	14800	18000-21200	55000 n	NA	NA	N	BSL
	7439-92-1	Lead	41.6 K	41.6 K	mg/kg	CKSD06-RI-01	1 / 1	1.4 / 1.4	41.6	11.4-27.5	4000 n	NA	NA	N	BSL
	7439-95-4	Magnesium	4300 J	4300 J	mg/kg	CKSD06-RI-01	1 / 1	684.9 / 684.9	4300	2880-4320	NA NA	NA	NA	N	NUT
	7439-96-5	Manganese	366	366	mg/kg	CKSD06-RI-01	1 / 1	2.1 / 2.1	366	341-447	1800 n	NA	NA	N	BSL
	7440-02-0	Nickel	9.6	9.6	mg/kg	CKSD06-RI-01	1 / 1	5.5 / 5.5	9.6	14.1-16.0	1500 n	NA	NA	N	BSL
	7440-09-7	Potassium	867	867	mg/kg	CKSD06-RI-01	1 / 1	684.9 / 684.9	867	1080-1370	NA NA	NA	NA	N	NUT
	7440-62-2	Vanadium	13.1	13.1	mg/kg	CKSD06-RI-01	1 / 1	6.9 / 6.9	13.1	21.4-27.4	390 n	NA	NA	N	BSL
	7440-66-6	Zinc	153	153	mg/kg	CKSD06-RI-01	1 / 1	8.2 / 8.2	153	73.9-95.1	23000 n	NA	NA	N	BSL

Table 8
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment [1]

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening [2]	Background Value [3]	Screening Toxicity Value (n/c) [4]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion [5]
Rose Valley Creek [8]	218-01-9	1,2-Benzphenanthrene (a.k.a Chrysene)	680	680	µg/kg	CKSD03-RI-01	1 / 1	221.4 / 221.4	680	82-850	150000 c	NA	NA	N	BSL
	83-32-9	Acenaphthene	40 J	40 J	µg/kg	CKSD03-RI-01	1 / 1	221.4 / 221.4	40	64	3400000 n	NA	NA	N	BSL
	120-12-7	Anthracene	120 J	120 J	µg/kg	CKSD03-RI-01	1 / 1	221.4 / 221.4	120	210	17000000 n	NA	NA	N	BSL
	56-55-3	Benzo(a)anthracene	460	460	µg/kg	CKSD03-RI-01	1 / 1	221.4 / 221.4	460	79-730	1500 c	NA	NA	N	BSL
	50-32-8	**Benzo(a)pyrene**	**400**	**400**	**µg/kg**	**CKSD03-RI-01**	**1 / 1**	221.4 / 221.4	**400**	**84-540**	**150 c**	**NA**	**NA**	**Y**	**ASL**
	205-99-2	Benzo(b)fluoranthene	580	580	µg/kg	CKSD03-RI-01	1 / 1	221.4 / 221.4	580	96-470	1500 c	NA	NA	N	BSL
	191-24-2	Benzo(g,h,i)perylene	130 J	130 J	µg/kg	CKSD03-RI-01	1 / 1	221.4 / 221.4	130	37-93	1700000 n	NA	NA	N	BSL
	207-08-9	Benzo(k)fluoranthene	230	230	µg/kg	CKSD03-RI-01	1 / 1	221.4 / 221.4	230	96-190	15000 c	NA	NA	N	BSL
	85-68-7	Benzyl Butyl Phthalate	27 J	27	µg/kg	CKSD03-RI-01	1 / 1	221.4 / 221.4	27	NA	2600000 c*	NA	NA	N	BSL
	86-74-8	**Carbazole**	**120 J**	**120 J**	**µg/kg**	**CKSD03-RI-01**	**1 / 1**	221.4 / 221.4	**120**	**NA**	**NA NA**	**NA**	**NA**	**Y**	**NSV**
	132-64-9	Dibenzofuran	25 J	25 J	µg/kg	CKSD03-RI-01	1 / 1	221.4 / 221.4	25	NA	78000 n	NA	NA	N	BSL
	206-44-0	Fluoranthene	1400	1400	µg/kg	CKSD03-RI-01	1 / 1	221.4 / 221.4	1400	110-810	2300000 n	NA	NA	N	BSL
	86-73-7	Fluorene	49 J	49 J	µg/kg	CKSD03-RI-01	1 / 1	221.4 / 221.4	49	56	2300000 n	NA	NA	N	BSL
	193-39-5	Indeno(1,2,3-cd)pyrene	220	220	µg/kg	CKSD03-RI-01	1 / 1	221.4 / 221.4	220	53-150	1500 c	NA	NA	N	BSL
	85-01-8	Phenanthrene	810	810	µg/kg	CKSD03-RI-01	1 / 1	221.4 / 221.4	810	61-570	1700000 n	NA	NA	N	BSL
	129-00-0	Pyrene	1100	1100	µg/kg	CKSD03-RI-01	1 / 1	221.4 / 221.4	1100	130-1900	1700000 n	NA	NA	N	BSL
	72-54-8	4,4'-DDD	3.3 J	3.3 J	µg/kg	CKSD03-RI-01	1 / 1	4.3 / 4.3	3.3	0.08-0.20	20000 c	NA	NA	N	BSL
	72-55-9	4,4'-DDE	1.9 J	1.9 J	µg/kg	CKSD03-RI-01	1 / 1	4.3 / 4.3	1.9	0.09-0.15	14000 c	NA	NA	N	BSL
	50-29-3	4,4'-DDT	4.3	4.3	µg/kg	CKSD03-RI-01	1 / 1	4.3 / 4.3	4.3	0.15-0.19	17000 c*	NA	NA	N	BSL
	309-00-2	Aldrin	0.48 J	0.48 J	µg/kg	CKSD03-RI-01	1 / 1	2.2 / 2.2	0.48	0.03-0.05	290 c*	NA	NA	N	BSL
	319-84-6	alpha-BHC	0.028 J	0.028 J	µg/kg	CKSD03-RI-01	1 / 1	2.2 / 2.2	0.028	0.02	770 c	NA	NA	N	BSL
	5103-71-9	alpha-Chlordane	1.2 J	1.2 J	µg/kg	CKSD03-RI-01	1 / 1	2.2 / 2.2	1.2	0.07-0.51	16000 c*	NA	NA	N	BSL
	11097-69-1	Aroclor - 1254	66	66	µg/kg	CKSD03-RI-01	1 / 1	43.0 / 43.0	66	NA	1100 n**	NA	NA	N	BSL
	319-85-7	beta-BHC	0.22 J	0.22 J	µg/kg	CKSD03-RI-01	1 / 1	2.2 / 2.2	0.22	0.04	2700 c	NA	NA	N	BSL
	60-57-1	Dieldrin	1.3 J	1.3 J	µg/kg	CKSD03-RI-01	1 / 1	4.3 / 4.3	1.3	0.24-0.26	300 c	NA	NA	N	BSL
	959-98-8	Endosulfan I	0.25 J	0.25 J	µg/kg	CKSD03-RI-01	1 / 1	2.2 / 2.2	0.25	0.09	370000 n	NA	NA	N	BSL
	33213-65-9	Endosulfan II	0.83 J	0.83 J	µg/kg	CKSD03-RI-01	1 / 1	4.3 / 4.3	0.83	0.06-0.09	370000 n	NA	NA	N	BSL
	1031-07-8	Endosulfan Sulfate	0.091 J	0.091 J	µg/kg	CKSD03-RI-01	1 / 1	4.3 / 4.3	0.091	0.12	370000 n	NA	NA	N	BSL
	72-20-8	Endrin	0.072 J	0.072 J	µg/kg	CKSD03-RI-01	1 / 1	4.3 / 4.3	0.072	0.05-0.07	18000 n	NA	NA	N	BSL
	7421-93-4	Endrin Aldehyde	0.53 J	0.53 J	µg/kg	CKSD03-RI-01	1 / 1	4.3 / 4.3	0.53	0.05-0.29	18000 n	NA	NA	N	BSL
	53494-70-5	Endrin Ketone	4.1 J	4.1 J	µg/kg	CKSD03-RI-01	1 / 1	4.3 / 4.3	4.1	0.09-4.7	18000 n	NA	NA	N	BSL
	58-89-9	gamma-BHC (Lindane)	0.13 J	0.13 J	µg/kg	CKSD03-RI-01	1 / 1	2.2 / 2.2	0.13	0.02	5200 c*	NA	NA	N	BSL
	5103-74-2	gamma-Chlordane	0.73 J	0.73 J	µg/kg	CKSD03-RI-01	1 / 1	2.2 / 2.2	0.73	0.19-0.59	16000 c*	NA	NA	N	BSL
	76-44-8	Heptachlor	0.1 J	0.1 J	µg/kg	CKSD03-RI-01	1 / 1	2.2 / 2.2	0.1	0.02-0.09	1100 c	NA	NA	N	BSL
	1024-57-3	Heptachlor Epoxide	0.22 J	0.22 J	µg/kg	CKSD03-RI-01	1 / 1	2.2 / 2.2	0.22	0.02-0.06	530 c*	NA	NA	N	BSL
	72-43-5	Methoxychlor	0.27 J	0.27 J	µg/kg	CKSD03-RI-01	1 / 1	22.1 / 22.1	0.27	0.13	310000 n	NA	NA	N	BSL
	7429-90-5	Aluminum	3020	3020	mg/kg	CKSD03-RI-01	1 / 1	26.7 / 26.7	3020	5730-6210	77000 n	NA	NA	N	BSL
	7440-38-2	Arsenic	1.7	1.7	mg/kg	CKSD03-RI-01	1 / 1	1.3 / 1.3	1.7	3.1-4.6	3.9 c*	NA	NA	N	BSL
	7440-39-3	Barium	84.4	84.4	mg/kg	CKSD03-RI-01	1 / 1	26.7 / 26.7	84.4	78.5-91.7	15000 n	NA	NA	N	BSL
	7440-41-7	Beryllium	0.25 J	0.25 J	mg/kg	CKSD03-RI-01	1 / 1	0.7 / 0.7	0.25	0.82-1.1	160 n	NA	NA	N	BSL
	7440-70-2	Calcium	5140 J	5140 J	mg/kg	CKSD03-RI-01	1 / 1	667.66 / 667.66	5140	1240-3760	NA NA	NA	NA	N	NUT
	7440-47-3	**Chromium**	**6.3**	**6.3**	**mg/kg**	**CKSD03-RI-01**	**1 / 1**	**1.3 / 1.3**	**6.3**	**17.6-20.3**	**2.9 c**	**NA**	**NA**	**Y**	**ASL**
	7440-48-4	Cobalt	2.8 J	2.8 J	mg/kg	CKSD03-RI-01	1 / 1	6.7 / 6.7	2.8	9.7-11.7	23 n	NA	NA	N	BSL
	7440-50-8	Copper	18.2	18.2	mg/kg	CKSD03-RI-01	1 / 1	3.3 / 3.3	18.2	15-15.3	3100 n	NA	NA	N	BSL
	7439-89-6	Iron	6250	6250	mg/kg	CKSD03-RI-01	1 / 1	13.4 / 13.4	6250	18000-21200	55000 n	NA	NA	N	BSL
	7439-92-1	Lead	24.2 K	24.2 K	mg/kg	CKSD03-RI-01	1 / 1	1.3 / 1.3	24.2	11.4-27.5	4000 n	NA	NA	N	BSL
	7439-95-4	Magnesium	3380 J	3380 J	mg/kg	CKSD03-RI-01	1 / 1	667.66 / 667.66	3380	2880-4320	NA NA	NA	NA	N	NUT
	7439-96-5	Manganese	240	240	mg/kg	CKSD03-RI-01	1 / 1	2.0 / 2.0	240	341-447	1800 n	NA	NA	N	BSL
	7440-02-0	Nickel	5.2 J	5.2 J	mg/kg	CKSD03-RI-01	1 / 1	5.3 / 5.3	5.2	14.1-16.0	1500 n	NA	NA	N	BSL
	7440-09-7	Potassium	332 J	332 J	mg/kg	CKSD03-RI-01	1 / 1	667.66 / 667.66	332	1080-1370	NA NA	NA	NA	N	NUT
	7440-62-2	Vanadium	8.6	8.6	mg/kg	CKSD03-RI-01	1 / 1	6.7 / 6.7	8.6	21.4-27.4	390 n	NA	NA	N	BSL
	7440-66-6	Zinc	49.2	49.2	mg/kg	CKSD03-RI-01	1 / 1	8.0 / 8.0	49.2	73.9-95.1	23000 n	NA	NA	N	BSL

Table 8
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment [1]

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening [2]	Background Value [3]	Screening Toxicity Value (n/c) [4]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion [5]
Sediment Located in the Reservoir[9]	75-35-4	1,1-Dichloroethylene	1.9 J	7.8 J	ug/kg	RVSD08-RI-01	3 / 16	7.0 / 65.9	7.8	NA	240000 n	NA	NA	N	BSL
	78-93-3	2-Butanone	32	210	ug/kg	RVSD07-RI-01	15 / 16	14.0 / 131.8	210	NA	28000000 n	NA	NA	N	BSL
	67-64-1	Acetone	210	990	ug/kg	RVSD07-RI-01	2 / 16	14.0 / 131.8	990	NA	61000000 n	NA	NA	N	BSL
	75-15-0	Carbon Disulfide	4.1 J	46 J	ug/kg	RVSD09-RI-01	12 / 16	7.0 / 65.9	46	NA	820000 ns	NA	NA	N	BSL
	218-01-9	1,2-Benzphenanthrene (a.k.a Chrysene)	32 J	410 J	ug/kg	RVSD06-RI-01	5 / 16	237.1 / 3400	410	NA	150000 c	NA	NA	N	BSL
	120-12-7	Anthracene	120 J	120 J	ug/kg	RVSD06-RI-01	1 / 16	237.1 / 3400	120	NA	17000000 n	NA	NA	N	BSL
	56-55-3	Benzo(a)anthracene	35 J	410 J	ug/kg	RVSD06-RI-01	4 / 16	237.1 / 3400	410	NA	1500 c	NA	NA	N	BSL
	50-32-8	**Benzo(a)pyrene**	**31 J**	**370 J**	**ug/kg**	**RVSD06-RI-01**	**7 / 16**	**237.1 / 3400**	**370**	**NA**	**150 c**	**NA**	**NA**	**Y**	**ASL**
	205-99-2	Benzo(b)fluoranthene	44 J	470	ug/kg	RVSD06-RI-01	8 / 16	237.1 / 3400	470	NA	1500 c	NA	NA	N	BSL
	207-08-9	Benzo(k)fluoranthene	85 J	170 J	ug/kg	RVSD06-RI-01	2 / 16	237.1 / 3400	170	NA	15000 c	NA	NA	N	BSL
	85-68-7	Benzyl Butyl Phthalate	200 J	200 J	ug/kg	RVSD11-RI-01	1 / 16	237.1 / 3400	200	NA	2600000 c*	NA	NA	N	BSL
	117-81-7	Bis(2-Ethylhexyl)Phthalate	51 J	230 J	ug/kg	RVSD15-RI-01	5 / 16	237.1 / 3400	230	NA	350000 c*	NA	NA	N	BSL
	86-74-8	**Carbazole**	**47 J**	**47 J**	**ug/kg**	**RVSD06-RI-01**	**1 / 16**	**237.1 / 3400**	**47**	**NA**	**NA NA**	**NA**	**NA**	**Y**	**NSV**
	53-70-3	Dibenzo(A,H)Anthracene	65 J	65 J	ug/kg	RVSD06-RI-01	1 / 16	237.1 / 3400	65	NA	150 c	NA	NA	N	BSL
	84-74-2	Di-N-Butylphthalate	29 J	340 J	ug/kg	RVSD15-RI-01	7 / 16	237.1 / 3400	340	NA	6100000 n	NA	NA	N	BSL
	206-44-0	Fluoranthene	50 J	910	ug/kg	RVSD06-RI-01	10 / 16	237.1 / 3400	910	NA	2300000 n	NA	NA	N	BSL
	193-39-5	Indeno(1,2,3-cd)Pyrene	82 J	190 J	ug/kg	RVSD06-RI-01	3 / 16	237.1 / 3400	190	NA	1500 c	NA	NA	N	BSL
	85-01-8	Phenanthrene	480	480	ug/kg	RVSD06-RI-01	1 / 16	237.1 / 3400	480	NA	1700000 n	NA	NA	N	BSL
	129-00-0	Pyrene	43 J	720	ug/kg	RVSD06-RI-01	9 / 16	237.1 / 3400	720	NA	1700000 n	NA	NA	N	BSL
	72-43-5	1,1,1-Trichloro-2,2-Bis (P-Methoxphenyl)-Ethane	12 J	12 J	ug/kg	RVSD08-RI-01	1 / 16	23.7 / 224.0	12	NA	310000 n	NA	NA	N	BSL
	72-54-8	4,4'-DDD	0.4 J	1.4 J	ug/kg	RVSD06-RI-01	2 / 16	4.6 / 43.5	1.4	NA	20000 c	NA	NA	N	BSL
	72-55-9	4,4'-DDE	0.03 J	2.6 J	ug/kg	RVSD15-RI-01	16 / 16	4.6 / 43.5	2.6	NA	14000 c	NA	NA	N	BSL
	319-84-6	alpha-BHC	0.035 J	0.63 J	ug/kg	RVSD15-RI-01	14 / 16	2.4 / 22.4	0.63	NA	770 c	NA	NA	N	BSL
	5103-71-9	alpha-Chlordane	0.036 J	0.83 J	ug/kg	RVSD06-RI-01	9 / 16	2.4 / 22.4	0.83	NA	16000 c*	NA	NA	N	BSL
	60-57-1	Dieldrin	0.039 J	1.1 J	ug/kg	RVSD12-RI-01	15 / 16	4.6 / 43.5	1.1	NA	300 c	NA	NA	N	BSL
	959-98-8	Endosulfan I	0.037 J	0.33 J	ug/kg	RVSD14-RI-01	10 / 16	2.4 / 22.4	0.33	NA	370000 n	NA	NA	N	BSL
	33213-65-9	Endosulfan Ii	0.058 J	1.4 J	ug/kg	RVSD15-RI-01	12 / 16	4.6 / 43.5	1.4	NA	370000 n	NA	NA	N	BSL
	72-20-8	Endrin	0.12 J	1.3 J	ug/kg	RVSD06-RI-01	10 / 16	4.6 / 43.5	1.3	NA	18000 n	NA	NA	N	BSL
	7421-93-4	Endrin Aldehyde	0.026 J	0.58 J	ug/kg	RVSD06-RI-01	7 / 16	4.6 / 43.5	0.58	NA	18000 n	NA	NA	N	BSL
	53494-70-5	Endrin Ketone	0.057 J	3.5 J	ug/kg	RVSD06-RI-01	14 / 16	4.6 / 43.5	3.5	NA	18000 n	NA	NA	N	BSL
	58-89-9	gamma-BHC (Lindane)	0.13 J	0.52 J	ug/kg	RVSD15-RI-01	13 / 16	2.4 / 22.4	0.52	NA	5200 c*	NA	NA	N	BSL
	5103-74-2	gamma-Chlordane	0.6 J	0.6 J	ug/kg	RVSD06-RI-01	1 / 16	2.4 / 22.4	0.6	NA	16000 c*	NA	NA	N	BSL
	1024-57-3	Heptachlor Epoxide	0.14 J	0.49 J	ug/kg	RVSD09-RI-01	11 / 16	2.4 / 22.4	0.49	NA	530 c*	NA	NA	N	BSL
	7429-90-5	Aluminum	1430	12700	mg/kg	RVSD08-RI-01	16 / 16	23.6 / 215.1	12700	NA	77000 n	NA	NA	N	BSL
	7440-38-2	**Arsenic**	**0.55 J**	**7.6 J**	**mg/kg**	**RVSD15-RI-01**	**16 / 16**	**1.2 / 10.8**	**7.6**	**NA**	**3.9 c***	**NA**	**NA**	**Y**	**ASL**
	7440-39-3	Barium	10 J	197 J	mg/kg	RVSD15-RI-01	16 / 16	23.6 / 215.1	197	NA	15000 n	NA	NA	N	BSL
	7440-41-7	Beryllium	0.24 J	0.4 J	mg/kg	RVSD06-RI-01	2 / 16	0.6 / 5.4	0.4	NA	160 n	NA	NA	N	BSL
	7440-43-9	Cadmium	0.3 J	2 J	mg/kg	RVSD08-RI-01	8 / 16	0.6 / 5.4	2	NA	70 n	NA	NA	N	BSL
	7440-70-2	Calcium	465 J	21300	mg/kg	RVSD12-RI-01	16 / 16	590.3 / 5376.3	21300	NA	NA NA	NA	NA	N	NUT
	7440-47-3	**Chromium**	**2.8**	**65.5**	**mg/kg**	**RVSD08-RI-01**	**16 / 16**	**1.2 / 10.8**	**65.5**	NA	**2.9 c**	**NA**	**NA**	**Y**	**ASL**
	7440-48-4	Cobalt	2.6 J	11.1 J	mg/kg	RVSD02-RI-01	7 / 16	5.9 / 53.8	11.1	NA	23 n	NA	NA	N	BSL
	7440-50-8	Copper	2.7 J	90.9	mg/kg	RVSD08-RI-01	16 / 16	3.0 / 26.9	90.9	NA	3100 n	NA	NA	N	BSL
	7439-89-6	Iron	1590	25600	mg/kg	RVSD08-RI-01	16 / 16	11.8 / 107.5	25600	NA	55000 n	NA	NA	N	BSL
	7439-92-1	Lead	2.8	96	mg/kg	RVSD08-RI-01	16 / 16	1.2 / 10.8	96	NA	4000 n	NA	NA	N	BSL
	7439-95-4	Magnesium	356 J	11600	mg/kg	RVSD02-RI-01	16 / 16	590.3 / 5376.3	11600	NA	NA NA	NA	NA	N	NUT
	7439-96-5	Manganese	38.3	542	mg/kg	RVSD06-RI-01	16 / 16	1.8 / 16.1	542	NA	1800 n	NA	NA	N	BSL
	7439-97-6	Mercury	0.12 J	0.36 J	mg/kg	RVSD11-RI-01	9 / 16	0.1 / 1.1	0.36	NA	7.8 ns	NA	NA	N	BSL
	7440-02-0	Nickel	1.8 J	82.9	mg/kg	RVSD02-RI-01	16 / 16	4.7 / 43.0	82.9	NA	1500 n	NA	NA	N	BSL
	7440-09-7	Potassium	320 J	993 J	mg/kg	RVSD04-RI-01	7 / 16	590.3 / 5376.3	993	NA	NA NA	NA	NA	N	NUT
	7440-62-2	Vanadium	2.2 J	35 J	mg/kg	RVSD11-RI-01	16 / 16	5.9 / 53.8	35	NA	390 n	NA	NA	N	BSL
	7440-66-6	Zinc	11.3	354	mg/kg	RVSD08-RI-01	16 / 16	7.1 / 64.5	354	NA	23000 n	NA	NA	N	BSL

Table 8
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment [1]

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening [2]	Background Value [3]	Screening Toxicity Value (n/c) [4]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion [5]

Notes:
1. Results of this screening table used for current/future other recreational persons (adult and children) for ingestion and dermal contact.
2. Maximum detected concentration used for screening.
3. Background samples are CKSD01-RI-01 and CKSD09-RI-01.
4. All compounds are screened against the Region 3 Regional Screening Levels (RSLs) dated May 2013 for Residential Soil using the cancer benchmark value of 1E-05 and an Hazard Quotient = 1 to account for surface water exposure. For lead, use 10 times the EPA residential soil level (EPA Region 3 recommended value).
   When no RSL available, surrogate RSL used as follows:
   Acenaphthylene - use Acenaphthene
   Benzo(g,h,i)perylene and Phenanthrene - use Pyrene
   alpha-Chlordane and gamma-Chlordane - use Chlordane
   delta-BHC - use gamma-BHC (Lindane)
   Endosulfan I, II, and Endosulfan Sulfate - use Endosulfan
   Endrin Aldehyde and Endrin Ketone - use Endrin
   Cadmium - use Cadmium (diet)
   Chromium - use Chromium VI
   Manganese - use Manganese (non-diet)
   Nickel - use Nickel Soluble Salts
   Mercury - use methyl mercury (conservative)
   Vanadium - use Vanadium and Compounds
5. Rationale Codes
   Selection Reason: Above Screening Level (ASL)
   No Screening Value (NSV) Available for Screening, so assume COPC
   Deletion Reason: Below Screening Level (BSL)
   Essential Nutrient (NUT)
6. Samples include: CKSD02-RI-01, CKSD04-RI-01, CKSD05-RI-01, CKSD07-RI-01, CKSD08-RI-01, CKSD10-RI-01, CKSD12-RI-01 and CKSD12D-RI-01.
7. Samples include: CKSD06-RI-01.
8. Samples include: CKSD03-RI-01.
9. Samples include: RVSD01-RI-01, RVSD02-RI-01, RVSD03-RI-01, RVSD04-RI-01, RVSD05-RI-01, RVSD05D-RI-01, RVSD06-RI-01, RVSD07-RI-01, RVSD08-RI-01, RVSD09-RI-01, RVSD10-RI-01, RVSD11-RI-01, RVSD12-RI-01, RVSD13-RI-01, RVSD14-RI-01, and RVSD15-RI-01.

Definitions:
NA = Not Applicable
COPC = Chemical of Potential Concern (in Bold Type)
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/
To Be Considered
n = noncarcinogen
c = carcinogen
Y = Yes
N = No
J = Analyte present. Reported value may not be accurate or precise.
K = Analyte present. Reported value may be biased high. Actual value
is expected to be lower.
*= Noncancer screening level < 100X cancer screening level.
ns = Lower of the Csat and noncancer values were used in the screening.
** = Noncancer screening level using HQ = 1 used because it is more conservative
than cancer screening value at 1E-05
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

Table 9
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Fish Tissue [1]

Exposure Point	CAS Number	Chemical	Sediment Minimum Concentration (Qualifier)		Sediment Maximum Concentration (Qualifier)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	BSAF [2]	Fish Tissue Concentration Used for Screening [3]	Background Value	Fish Tissue Screening Toxicity Value (n/c) [4]		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion [5]
Wissahickon Creek [6]	75-35-4	1,1-Dichloroethylene	0.96	J	0.98	J	µg/kg	CKSD12D-RI-01	2 / 8	5 / 5	NA	NA	NA	6.8E+03	n	NA	NA	N	NBA
	78-93-3	2-Butanone	16		16		µg/kg	CKSD04-RI-01	1 / 8	10 / 10	NA	NA	NA	8.1E+04	n	NA	NA	N	NBA
	218-01-9	1,2-Benzphenanthrene (a.k.a. Chrysene)	120	J	1300		µg/kg	CKSD10-RI-01	8 / 8	170 / 170	0.000911	1.18	NA	4.3E+02	c	NA	NA	N	BSL
	208-96-8	Acenaphthylene	25	J	26	J	µg/kg	CKSD10-RI-01	2 / 8	170 / 170	2.18	57	NA	8.1E+03	n	NA	NA	N	BSL
	83-32-9	Acenaphthene	25	J	140	J	µg/kg	CKSD07-RI-01	6 / 8	170 / 170	4.23	593	NA	8.1E+03	n	NA	NA	N	BSL
	120-12-7	Anthracene	44	J	320		µg/kg	CKSD07-RI-01	8 / 8	170 / 170	1.59	509	NA	4.1E+04	n	NA	NA	N	BSL
	56-55-3	**Benzo(a)anthracene**	**170**	**J**	**1100**		**µg/kg**	**CKSD07-RI-01**	**8 / 8**	**170 / 170**	**0.00401**	**4.411**	**NA**	**4.3E+00**	**c**	**NA**	**NA**	**Y**	**ASL**
	50-32-8	**Benzo(a)pyrene**	**150**	**J**	**1000**		**µg/kg**	**CKSD10-RI-01**	**8 / 8**	**170 / 170**	**0.00404**	**4.04**	**NA**	**4.3E-01**	**c**	**NA**	**NA**	**Y**	**ASL**
	205-99-2	**Benzo(b)fluoranthene**	**170**	**J**	**1300**		**µg/kg**	**CKSD10-RI-01**	**8 / 8**	**170 / 170**	**0.00431**	**5.603**	**NA**	**4.3E+00**	**c**	**NA**	**NA**	**Y**	**ASL**
	191-24-2	Benzo(g,h,i)perylene	46	J	360		µg/kg	CKSD07-RI-01	8 / 8	170 / 170	0.00404	1.4544	NA	4.1E+03	n	NA	NA	N	BSL
	207-08-9	Benzo(k)fluoranthene	64	J	540		µg/kg	CKSD10-RI-01	8 / 8	170 / 170	0.00407	2.1978	NA	4.3E+01	c	NA	NA	N	BSL
	85-68-7	Benzyl butyl phthalate	26	J	42	J	µg/kg	CKSD12D-RI-01	2 / 8	170 / 170	NA	NA	NA	1.7E+03	c	NA	NA	N	NBA
	86-74-8	Carbazole	30	J	190	J	µg/kg	CKSD07-RI-01	7 / 8	170 / 170	NA	NA	NA	NA	NA	NA	NA	N	NBA/NSV
	132-64-9	Dibenzofuran	34	J	64	J	µg/kg	CKSD10-RI-01	5 / 8	170 / 170	0.0179	1.1	NA	1.4E+02	n	NA	NA	N	BSL
	206-44-0	Fluoranthene	250		2700		µg/kg	CKSD10-RI-01	8 / 8	170 / 170	0.144	389	NA	5.4E+03	n	NA	NA	N	BSL
	86-73-7	Fluorene	38	J	180	J	µg/kg	CKSD07-RI-01	6 / 8	170 / 170	0.656	118	NA	5.4E+03	n	NA	NA	N	BSL
	193-39-5	Indeno(1,2,3-cd)pyrene	69	J	570		µg/kg	CKSD10-RI-01	8 / 8	170 / 170	0.0043	2.5	NA	4.3E+00	c	NA	NA	N	BSL
	85-01-8	Phenanthrene	170	J	1900		µg/kg	CKSD07-RI-01	8 / 8	170 / 170	0.622	1182	NA	4.1E+03	n	NA	NA	N	BSL
	129-00-0	Pyrene	260		2100	J	µg/kg	CKSD10-RI-01	8 / 8	170 / 170	0.115	242	NA	4.1E+03	n	NA	NA	N	BSL
	72-54-8	**4,4'-DDD**	**0.093**	**J**	**1.5**	**J**	**µg/kg**	**CKSD10-RI-01**	**8 / 8**	**3.3 / 3.3**	**8.91**	**13.4**	**NA**	**1.3E+01**	**c**	**NA**	**NA**	**Y**	**ASL**
	72-55-9	**4,4'-DDE**	**0.035**	**J**	**0.82**	**J**	**µg/kg**	**CKSD12-RI-01**	**8 / 8**	**3.3 / 3.3**	**22.2**	**18**	**NA**	**9.3E+00**	**c**	**NA**	**NA**	**Y**	**ASL**
	50-29-3	**4,4'-DDT**	**0.082**	**J**	**7.5**		**µg/kg**	**CKSD10-RI-01**	**8 / 8**	**3.3 / 3.3**	**32.9**	**247**	**NA**	**9.3E+00**	**c**	**NA**	**NA**	**Y**	**ASL**
	309-00-2	**Aldrin**	**0.012**	**J**	**1.7**	**J**	**µg/kg**	**CKSD07-RI-01**	**8 / 8**	**1.7 / 1.7**	**1**	**1.7**	**NA**	**1.9E-01**	**c**	**NA**	**NA**	**Y**	**ASL**
	319-84-6	alpha-BHC	0.033	J	0.039	J	µg/kg	CKSD12D-RI-01	3 / 8	1.7 / 1.7	1	0.039	NA	5.0E-01	c	NA	NA	N	BSL
	5103-71-9	**alpha-Chlordane**	**0.091**	**J**	**1.5**	**J**	**µg/kg**	**CKSD10-RI-01**	**8 / 8**	**1.7 / 1.7**	**8.9**	**13.3**	**NA**	**9.0E+00**	**c**	**NA**	**NA**	**Y**	**ASL**
	1109-76-91	**Aroclor-1254**	**5.2**	**J**	**71**		**µg/kg**	**CKSD10-RI-01**	**2 / 8**	**33 / 33**	**1**	**71**	**NA**	**1.6E+00**	**c**	**NA**	**NA**	**Y**	**ASL**
	1109-68-25	**Aroclor-1260**	**2.8**	**J**	**9.5**	**J**	**µg/kg**	**CKSD07-RI-01**	**2 / 8**	**33 / 33**	**1**	**9.5**	**NA**	**1.6E+00**	**c**	**NA**	**NA**	**Y**	**ASL**
	319-85-7	beta-BHC	0.014	J	0.014	J	µg/kg	CKSD02-RI-01	1 / 8	1.7 / 1.7	1	0.014	NA	1.8E+00	c	NA	NA	N	BSL
	319-86-8	delta-BHC	0.04	J	0.11	J	µg/kg	CKSD12-RI-01	2 / 8	1.7 / 1.7	1	0.11	NA	2.9E+00	c	NA	NA	N	BSL
	60-57-1	**Dieldrin**	**0.64**	**J**	**8.3**		**µg/kg**	**CKSD07-RI-01**	**8 / 8**	**3.3 / 3.3**	**202**	**1680**	**NA**	**2.0E-01**	**c**	**NA**	**NA**	**Y**	**ASL**
	959-98-8	Endosulfan I	0.022	J	0.37	J	µg/kg	CKSD10-RI-01	8 / 8	1.7 / 1.7	1	0.37	NA	8.1E+02	n	NA	NA	N	BSL
	33213-65-9	Endosulfan II	0.065	J	1.1	J	µg/kg	CKSD10-RI-01	8 / 8	3.3 / 3.3	1	1.1	NA	8.1E+02	n	NA	NA	N	BSL
	1031-07-8	Endosulfan Sulfate	0.028	J	0.17	J	µg/kg	CKSD04-RI-01	8 / 8	3.3 / 3.3	1	0.17	NA	8.1E+02	n	NA	NA	N	BSL
	72-20-8	Endrin	0.024	J	0.18	J	µg/kg	CKSD04-RI-01	8 / 8	3.3 / 3.3	1	0.18	NA	4.1E+01	n	NA	NA	N	BSL
	7421-93-4	Endrin Aldehyde	0.074	J	0.53	J	µg/kg	CKSD04-RI-01	8 / 8	3.3 / 3.3	1	0.53	NA	4.1E+01	n	NA	NA	N	BSL
	53494-70-5	Endrin Ketone	0.047	J	4.7	J	µg/kg	CKSD12-RI-01	8 / 8	3.3 / 3.3	1	4.7	NA	4.1E+01	n	NA	NA	N	BSL
	58-89-9	gamma-BHC (Lindane)	0.061	J	0.099	J	µg/kg	CKSD10-RI-01	2 / 8	1.7 / 1.7	1	0.099	NA	2.9E+00	c	NA	NA	N	BSL
	5103-74-2	gamma-Chlordane	0.22	J	1	J	µg/kg	CKSD12-RI-01	8 / 8	1.7 / 1.7	3.20	3.2	NA	9.0E+00	c	NA	NA	N	BSL

Table 9
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Fish Tissue [1]

Exposure Point	CAS Number	Chemical	Sediment Minimum Concentration (Qualifier)		Sediment Maximum Concentration (Qualifier)		Units	Location of Maximum Concentration	Detection Frequency			Range of Detection Limits			BSAF [2]	Fish Tissue Concentration Used for Screening [3]	Background Value	Fish Tissue Screening Toxicity Value (n/c) [4]		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion [5]
Wissahickon Creek [6]	**76-44-8**	**Heptachlor**	**0.027**	**J**	**0.15**	**J**	**µg/kg**	**CKSD04-RI-01**	**2**	**/**	**8**	**1.7**	**/**	**1.7**	**7.58**	**1.1**	**NA**	**7.0E-01**	**c**	**NA**	**NA**	**Y**	**ASL**
	1024-57-3	**Heptachlor Epoxide**	**0.06**	**J**	**0.26**	**J**	**µg/kg**	**CKSD04-RI-01**	**8**	**/**	**8**	**1.7**	**/**	**1.7**	**12.7**	**3.3**	**NA**	**3.5E-01**	**c**	**NA**	**NA**	**Y**	**ASL**
	72-43-5	Methoxychlor	0.37	J	0.37	J	µg/kg	CKSD07-RI-01	1	/	8	17	/	17	1	0.37	NA	6.8E+02	n	NA	NA	N	BSL
	7429-90-5	Aluminum	3250		6260		mg/kg	CKSD07-RI-01	8	/	8	20	/	20	NA	NA	NA	1.4E+02	n	NA	NA	N	NBA
	7440-38-2	**Arsenic**	**2**		**6.5**		**mg/kg**	**CKSD07-RI-01**	**8**	**/**	**8**	**1**	**/**	**1**	**0.12**	**0.8**	**NA**	**2.1E-03**	**c**	**NA**	**NA**	**Y**	**ASL**
	7440-39-3	Barium	47.7		216		mg/kg	CKSD07-RI-01	8	/	8	20	/	20	NA	NA	NA	2.7E+01	n	NA	NA	N	NBA
	7440-41-7	Beryllium	0.33	J	1		mg/kg	CKSD02-RI-01	8	/	8	0.5	/	0.5	NA	NA	NA	2.7E-01	n	NA	NA	N	NBA
	7440-43-9	**Cadmium**	**0.22**	**J**	**0.32**	**J**	**mg/kg**	**CKSD07-RI-01**	**4**	**/**	**8**	**0.5**	**/**	**0.5**	**2**	**0.64**	**NA**	**1.4E-01**	**n**	**NA**	**NA**	**Y**	**ASL**
	7440-70-2	Calcium	1130	J	26000	J	mg/kg	CKSD08-RI-01	8	/	8	500	/	500	NA	NA	NA	NA	NA	NA	NA	N	NBA
	7440-47-3	**Chromium**	**8.4**		**25.2**		**mg/kg**	**CKSD07-RI-01**	**8**	**/**	**8**	**1**	**/**	**1**	**0.043**	**1.1**	**NA**	**6.3E-03**	**c**	**NA**	**NA**	**Y**	**ASL**
	7440-48-4	Cobalt	3.8	J	11.1		mg/kg	CKSD07-RI-01	8	/	8	5	/	5	NA	NA	NA	4.1E-02	n	NA	NA	N	NBA
	7440-50-8	**Copper**	**9.1**	**J**	**25.4**	**J**	**mg/kg**	**CKSD07-RI-01**	**8**	**/**	**8**	**2.5**	**/**	**2.5**	**1**	**25.4**	**NA**	**5.4E+00**	**n**	**NA**	**NA**	**Y**	**ASL**
	7439-89-6	Iron	9340		22100		mg/kg	CKSD02-RI-01	8	/	8	10	/	10	NA	NA	NA	9.5E+01	n	NA	NA	N	NBA
	7439-92-1	**Lead**	**13.1**	**K**	**53.2**	**K**	**mg/kg**	**CKSD10-RI-01**	**8**	**/**	**8**	**1**	**/**	**1**	**0.43**	**22.9**	**NA**	**NA**	**NA**	**NA**	**NA**	**Y**	**NSV**
	7439-95-4	Magnesium	1620	J	18300	J	mg/kg	CKSD08-RI-01	8	/	8	500	/	500	NA	NA	NA	NA	NA	NA	NA	N	NBA
	7439-96-5	Manganese	195		2010		mg/kg	CKSD07-RI-01	8	/	8	1.5	/	1.5	NA	NA	NA	1.9E+01	n	NA	NA	N	NBA
	7439-97-6	**Mercury**	**0.038**	**J**	**0.091**	**J**	**mg/kg**	**CKSD10-RI-01**	**4**	**/**	**8**	**0.1**	**/**	**0.1**	**0.62**	**0.056**	**NA**	**1.4E-02**	**n**	**NA**	**NA**	**Y**	**ASL**
	7440-02-0	**Nickel**	**6.5**		**16.2**		**mg/kg**	**CKSD07-RI-01**	**8**	**/**	**8**	**4**	**/**	**4**	**1**	**16.2**	**NA**	**2.7E+00**	**n**	**NA**	**NA**	**Y**	**ASL**
	7440-09-7	Potassium	469	J	1510		mg/kg	CKSD02-RI-01	8	/	8	500	/	500	NA	NA	NA	NA	NA	NA	NA	N	NBA
	7440-62-2	Vanadium	11.3		26.5		mg/kg	CKSD07-RI-01	8	/	8	5	/	5	NA	NA	NA	6.8E-01	n	NA	NA	N	NBA
	7440-66-6	**Zinc**	**46.4**		**104**		**mg/kg**	**CKSD12D-RI-01**	**8**	**/**	**8**	**6**	**/**	**6**	**5**	**520**	**NA**	**4.1E+01**	**n**	**NA**	**NA**	**Y**	**ASL**

Notes:

1. Results of this screening table used for current/future fishers (adult and children) for ingestion.
2. Biota-sediment accumulation factor (BSAF) - Selected based on the following hierarchy:
- BSAF Data Set for fillet (Organic) (EPA 2007)
- BSAF Data Set for whole fish (organic) (EPA 2007)
- Table 1 - Selected BSAF Values for Metals (Washington State Department of Ecology 1995.)
- If no BSAF available in BSAF data set, then assumes BSAF = 1 (conservative) for compounds listed in on Table 4-2, Important Bioaccumulative Compounds (EPA 2000)
- If compounds are not found in the data set or in Table 4-2, then they are not considered to bioaccumulate in fish tissue and are noted as "NA".

Refer to Section 4.1.5 in HHRA document for additional details on the selection of the BSAF.

3. Maximum detected sediment concentration x BSAF
4. All compounds are screened against the Region 3 Fish Tissue Screening Levels (May 2012) using the cancer benchmark value of 1E-06 and an Hazard Quotient = 0.1.

When no RBC available, surrogate RBC used as follows:
Acenaphthylene - use Acenaphthene
Chromium - use Chromium VI

Definitions:
NA = Not Applicable
COPC = Chemical of Potential Concern (in Bold Type)
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
n = noncarcinogen
c = carcinogen
Y = Yes
N = No
J = Analyte present. Reported value may not be accurate or precise.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

Table 9
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Fish Tissue [1]

Exposure Point	CAS Number	Chemical	Sediment Minimum Concentration (Qualifier)	Sediment Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	BSAF [2]	Fish Tissue Concentration Used for Screening [3]	Background Value	Fish Tissue Screening Toxicity Value (n/c) [4]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion [5]

Benzo(g,h,i)perylene and Phenanthrene - use Pyrene
alpha-Chlordane and gamma-Chlordane - use Chlordane
Endosulfan I, II, and Endosulfan Sulfate - use Endosulfan
Endrin Aldehyde and Endrin Ketone - use Endrin
Cadmium - use Cadmium (diet)

Manganese - use Manganese (diet)
Mercury - use methyl mercury (conservative)
Vanadium - use Vanadium and Compounds
Nickel - use Nickel Soluble Salts
delta - BHC - use gamma-BHC (Lindane)

5. Rationale Codes

Selection Reason: Above Screening Level (ASL)
No Screening Value (NSV) Available for Screening, so assume COPC

Deletion Reason: Below Screening Level (BSL)
Assumed not to Bioaccumulate (NBA)

6. Samples include: CKSD02-RI-01, CKSD04-RI-01, CKSD05-RI-01, CKSD07-RI-01, CKSD08-RI-01, CKSD10-RI-01, CKSD12-RI-01 and CKSD12D-RI-01.

Sources:

EPA 2000. Testing and Interpretation for the Purpose of Sediment Quality Assessment Status and Needs. EPA-823-R-00-001. February.

EPA 2007. BSAF Data Set– Version 1.0. Office of Research and Development, National Health and Environmental Research Laboratory, Mid-Continent Ecology Division, Duluth, MN.

Washington State Department of Ecology. 1995. *Bioaccumulation Factor Approach Analysis for Metals and Polar Organic Compounds, Final* Report. Submitted by PTI Environmental Services to Washington Department of Ecology, Central Program, Environmental Review and Sediment Section, Olympia, Washington. October.

Table 10
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater [1]

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening[2]	Background Value[3]	Screening Toxicity Value (n/c)[4]		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection of Deletion[5]
Tap Water drawn from Bedrock Shallow Aquifer[6]	75-35-4	1,1-Dichloroethylene	0.066 J	0.066 J	µg/L	AP-MW06-021213	1/28	0.5 - 5	0.066 J	ND	26	n	7	MCL	N	BSL
	79-34-5	1,1,2,2-Tetrachloroethane	0.046 J	0.046 J	µg/L	AP-MW06-021213	1/28	0.5 - 5	0.046 J	ND	0.066	c	NA	NA	N	BSL
	87-61-6	**1,2,3-Trichlorobenzene**	**0.68 J**	**0.68 J**	**µg/L**	**PK-MW02-052113**	**1/28**	**0.5 - 5**	**0.68 J**	**ND**	**0.52**	**n**	**NA**	**NA**	**Y**	**ASL**
	120-82-1	1,2,4-Trichlorobenzene	0.14 J	0.27 J	µg/L	PK-MW02-052113	2/28	0.5 - 5	0.27 J	ND	0.39	n	70	MCL	N	BSL
	71-43-2	Benzene	0.03 J	0.03 J	µg/L	AP-MW06-021213	1/28	0.5 - 5	0.03 J	ND	0.39	c **	5	MCL	N	BSL
	56-23-5	**Carbon Tetrachloride**	**5**	**6.6**	**µg/L**	**PK-MW02-021113**	**4/28**	**0.5 - 5**	**6.6**	**0.31 J - 0.48 J**	**0.39**	**c ***	**5**	**MCL**	**Y**	**ASL**
	75-69-4	CFC-11 (Trichlorofluoromethane	17	32	µg/L	PK-MW02-052113	4/28	0.5 - 10	32	ND	110	n	NA	NA	N	BSL
	67-66-3	**Chloroform**	**4.5**	**5.5**	**µg/L**	**PK-MW02-052113**	**3/28**	**0.5 - 5**	**5.5**	**ND**	**0.19**	**c ***	**80 [7]**	**MCL**	**Y**	**ASL**
	74-87-3	Chloromethane	0.12 J	0.12 J	µg/L	AP-MW06-021213	1/28	0.5 - 5	0.12 J	ND	19	n	NA	NA	N	BSL
	156-59-2	cis-1,2-Dichloroethene	1	1.1	µg/L	PK-MW02-052113	3/28	0.5 - 5	1.1	4.7 J - 5.1	2.8	n	70	MCL	N	BSL
	10061-01-5	cis-1,3-Dichloropropene	0.29 J	0.29 J	µg/L	AP-MW06-021213	1/28	0.5 - 5	0.29 J	ND	0.41	c **	NA	NA	N	BSL
	110-82-7	Cyclohexane	1.4 J	1.4 J	µg/L	AP-MW06-021213	1/28	0.5 - 5	1.4 J	ND	1300	n	NA	NA	N	BSL
	1634-04-4	Methyl tert-butyl ether	0.15 J	0.38 J	µg/L	PK-MW02-052113	4/28	0.5 - 5	0.38 J	0.45 J - 0.46 J	12	c *	NA	NA	N	BSL
	127-18-4	**Tetrachloroethene**	**0.057 J**	**37**	**µg/L**	**PK-MW02-052113**	**5/28**	**0.5 - 10**	**37**	**240 - 270**	**3.5**	**n**	**5**	**MCL**	**Y**	**ASL**
	10061-02-6	trans-1,3-Dichloropropene	0.21 J	0.21 J	µg/L	AP-MW06-021213	1/28	0.5 - 5	0.21 J	ND	0.41	c **	NA	NA	N	BSL
	79-01-6	**Trichloroethylene**	**1.5**	**1.7**	**µg/L**	**PK-MW02-021113**	**3/28**	**0.5 - 5**	**1.7**	**12 - 14**	**0.26**	**n**	**5**	**MCL**	**Y**	**ASL**
	117-81-7	**Bis(2-ethylhexyl)phthalate**	**3 J**	**55**	**µg/L**	**PKMW02-1011**	**5/28**	**5 - 5.3**	**55**	**ND**	**4.8**	**c ****	**6**	**MCL**	**Y**	**ASL**
	131-11-3	**Dimethyl Phthalate**	**7.8**	**7.8**	**µg/L**	**AP-MW06-021213**	**1/28**	**5 - 7**	**7.8**	**ND**	**NA**	**NA**	**NA**	**NA**	**Y**	**NSV**
	7429-90-5	**Aluminum**	**21.7 J**	**9540**	**µg/L**	**RV-MW04D-021313**	**16/28**	**200 - 200**	**9540**	**ND**	**1600**	**n**	**NA**	**NA**	**Y**	**ASL**
	7440-38-2	**Arsenic**	**2 J**	**10.1**	**µg/L**	**AP-MW05-052213**	**5/28**	**10 - 10**	**10.1**	**ND**	**0.045**	**c ***	**10**	**MCL**	**Y**	**ASL**
	7440-39-3	**Barium**	**7.1 J**	**540**	**µg/L**	**RV-MW03-071713**	**28/28**	**200 - 200**	**540**	**88 J - 88.8 J**	**290**	**n**	**2300**	**MCL**	**Y**	**ASL**
	7440-41-7	Beryllium	0.93 J	0.93 J	µg/L	AP-MW06-071613	1/28	0.5 - 5	0.93 J	ND	1.6	n	4	MCL	N	BSL
	7440-43-9	**Cadmium**	**0.65 J**	**0.74 J**	**µg/L**	**RV-MW04D-021313**	**2/28**	**0.5 - 5**	**0.74 J**	**ND**	**0.69**	**n**	**5**	**MCL**	**Y**	**ASL**
	7440-70-2	Calcium	58000	164000	µg/L	APMW05-1011	28/28	5000 - 5000	164000	111000 - 119000	NA	NA	NA	NA	N	NUT
	7440-47-3	**Chromium**	**1.7 J**	**18.2**	**µg/L**	**RV-MW04D-021313**	**4/28**	**10 - 10**	**18.2**	**0.9 J - 0.9 J**	**0.031**	**c ***	**100 [8]**	**MCL**	**Y**	**ASL**
	7440-48-4	**Cobalt**	**1.5 J**	**3.8 J-**	**µg/L**	**RV-MW03-052313**	**3/28**	**50 - 50**	**3.8 J-**	**ND**	**0.47**	**n**	**NA**	**NA**	**Y**	**ASL**
	7440-50-8	Copper	0.67 J	5.8 J	µg/L	PK-MW02-071513	10/28	25 - 25	5.8 J	ND	62	n	1300 [9]	MCL	N	BSL
	57-12-5	**Cyanide**	**3.8 J**	**8.2 J**	**µg/L**	**RVMW03-1011**	**2/28**	**10 - 10**	**8.2 J**	**ND**	**0.14**	**n**	**200**	**MCL**	**Y**	**ASL**
	7439-89-6	**Iron**	**22.9 J**	**15300**	**µg/L**	**RV-MW04D-021313**	**21/28**	**100 - 100**	**15300**	**ND**	**1100**	**n**	**NA**	**NA**	**Y**	**ASL**
	7439-92-1	Lead	1.8 J	14.8	µg/L	RV-MW04-021313	9/28	10 - 10	14.8	2.4 J - 2.4 J	NA	n	15 [9]	MCL	N	BSL
	7439-95-4	Magnesium	3900 J	21800	µg/L	AP-MW06-021213	28/28	5000 - 5000	21800	14900 - 17000	NA	NA	NA	NA	N	NUT
	7439-96-5	**Manganese**	**8.4 J**	**9190**	**µg/L**	**RVMW03-1011**	**26/28**	**15 - 15**	**9190**	**23.2 - 23.2**	**32**	**n**	**NA**	**NA**	**Y**	**ASL**
	7440-02-0	Nickel	0.52 J	8.2 J	µg/L	RVMW03-1011	5/28	40 - 40	8.2 J	ND	30	n	NA	NA	N	BSL
	7440-09-7	Potassium	1490 J	5800	µg/L	RV-MW04D-021313	8/28	5000 - 5000	5800	ND	NA	NA	NA	NA	N	NUT
	7440-22-4	Silver	0.76 J	0.76 J	µg/L	RV-MW03-021313	1/28	10 - 10	0.76 J	ND	7.1	n	NA	NA	N	BSL
	7440-23-5	Sodium	11000	1120000 J	µg/L	RVMW04-1011	28/28	5000 - 5000	1120000 J	24400 - 26700	NA	NA	NA	NA	N	NUT
	7440-28-0	**Thallium**	**1.1 J**	**8 J**	**µg/L**	**RV-MW03-021313**	**2/28**	**25 - 25**	**8 J**	**ND**	**0.016**	**n**	**2**	**MCL**	**Y**	**ASL**
	7440-62-2	**Vanadium**	**0.87 J**	**27.1 J**	**µg/L**	**RV-MW04-021313**	**10/28**	**50 - 50**	**27.1 J**	**ND**	**6.3**	**n**	**NA**	**NA**	**Y**	**ASL**
	7440-66-6	Zinc	2.1 J	46.9 J	µg/L	AP-MW06-052213	11/28	60 - 60	46.9 J	9.9 J - 9.9 J	470	n	NA	NA	N	BSL

Table 10
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater [1]

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening[2]	Background Value[3]	Screening Toxicity Value (n/c)[4]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection of Deletion[5]

Notes:
1. Results of this screening table used for future resident (adult and children) for ingestion and dermal contact.
2. Maximum detected concentration used for screening.
3. Background values from BKMW07-052113 and BKMW07-071513.
4. All compounds are screened against the Region 3 Regional Screening Levels (RSLs) dated May 2013 for tapwater using the cancer benchmark value. of 1E-06 and an Hazard Quotient = 0.1.
   When no RSL available, surrogate RSL is used as follows:
   Cadmium - use Cadmium (water)
   Chromium - use Chromium VI
   Manganese - use Manganese (non-diet)
   trans and cis-1,3-Dichloropropene - use 1,3-Dichloropropene
5. Rationale Codes
   Selection Reason: Above Screening Level (ASL)
   Deletion Reason: Below Screening Level (BSL)
   No Screening Value (NSV)
   Essential Nutrient (NUT)
6. Samples include: PK-MW01A-1011, PK-MW02-1011, RV-MW03-1011, RV-MW04-1011, AP-MW05-1011, AP-MW05D-1011, AP-MW06-1011
   PK-MW01A-021113, PK-MW02-021113, RV-MW03-021313, RV-MW04-021313, RV-MW04D-021313, AP-MW05-021213, AP-MW06-02121
   PK-MW01A-052313, PK-MW02-052113, RV-MW03-052313, RV-MW04-052213, RV-MW04D-052213, AP-MW05-052213, AP-MW06-05221
   PK-MW01A-071813, PK-MW02-071513, RV-MW03-071713, RV-MW04-071713, RV-MW04D-071713, AP-MW05-071613, AP-MW06-07161
7. Total Trihalomethanes
8. Total Chromium
9. Action Level

Definitions:
NA = Not Applicable
ND = Not Detected
COPC = Chemical of Potential Concern (in Bold Type)
ARAR/TBC = Applicable or Relevant and Appropriate Requirement / To Be Considered
n = noncarcinogen
c = carcinogen
Y = Yes
N = No
J = Analyte present. Reported value may not be accurate or precise.
J- = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
µg/L = micrograms per liter
** = Noncancer screening level using HQ = 0.1 used because it is more conservative
*= Noncancer screening level < 100X cancer screening level.

Table 11
Summary of Chemicals of Potential Concern
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Compound	Site Media												
	Surface Soil				Surface Water				Sediment				GW
	Park Parcel	Reservoir Parcel	Asbestos Pile Parcel	West Bank of Wissahickon Creek	Wissahickon Creek	Rose Valley Creek	Tannery Run	Reservoir	Wissahickon Creek	Rose Valley Creek	Tannery Run	Reservoir	Site-Wide
Volatile Organic Compounds													
Carbon tetrachloride													√
Tetrachloroethene													√
Semi-volatile Organic Compounds													
Benzo(a)anthracene		√	√	√					√[1]				
Benzo(a)pyrene	√	√	√	√					√[1,2]	√	√	√	
Benzo(b)fluoranthene	√	√	√	√					√[1]				
Benzo(k)fluoranthene			√										
Bis-2(ethyl hexyl)phthalate													√
Carbazole		√	√	√					√[2]	√	√	√	
Dibenz(a,h)anthracene		√	√		√								
Indeno(1,2,3-cd)pyrene		√	√	√	√								
Pesticides/Polychlorinated Biphenyls													
4,4'-DDD									√[1]				
4,4'-DDE									√[1]				
4,4'-DDT									√[1]				
Aldrin									√[1]				
alpha-Chlordane									√[1]				
Aroclor-1254		√							√[1]				
Aroclor-1260			√						√[1]				
Dieldrin									√[1]				
Heptachlor									√[1]				
Heptachlor Epoxide									√[1]				
Dioxins/Furans													
Dioxin/Furan Toxic Equivalency			√										
Inorganics													
Aluminum	√	√	√	√									
Arsenic	√	√	√	√				√	√[1,2]			√	√
Barium													√
Cadmium									√[1]				
Chromium	√	√	√	√	√		√	√	√[1,2]	√	√	√	
Cobalt	√	√	√	√									
Copper									√[1]				
Cyanide													√
Iron	√	√	√	√									
Lead									√[1]				
Manganese	√	√	√	√	√				√[2]				√
Mercury	√	√							√[1]				
Nickel			√						√[1]				
Thallium			√										
Vanadium													√
Zinc		√							√[1]				

Notes:
1. Fish tissue chemicals of potential concern modeled from sediment
2. Sediment chemicals of potential concern

GW = groundwater

AR308611

Table 12
Exposure Point Concentration Summary
Reasonable Maximum Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Point	Chemical of Potential Concern [1]	Units	Arithmetic Mean [2]	95% UCL (Distribution) [3]	Maximum Concentration (Qualifier)		Exposure Point Concentration (EPC) [4]			
							Value	Units	Statistic [5]	Rationale [6]
Wissahickon Creek	Dibenz(a,h)anthracene	µg/L	NA	NA	1.2	J	1.2	µg/L	Maximum Concentration	a
	Indeno(1,2,3-cd)pyrene	µg/L	NA	NA	1.1	J	1.1	µg/L	Maximum Concentration	a
	Chromium	µg/L	NA	NA	4.4	J	4.4	µg/L	Maximum Concentration	a
	Manganese	µg/L	98.6	355.2	334		334	µg/L	Maximum Concentration	b

Notes:
1. Compounds on this table exceed their respective risk-based concentrations for surface water.
2. Mean is arithmetic mean of the detected values. If only one detected value in grouping, then NA.
3. 95% UCL values are calculated using ProUCL software, Version 4.1.01. See Appendix F of the HHRA for full ProUCL statistics.
4. EPC values used for current/future recreational users and maintenance workers for incidental ingestion and dermal contact.
5. Statistics:
   Maximum Concentration = Maximum concentration used as no ProUCL datum is available for the sample set.
6. EPC Selection Rationale:
   a. ProUCL did not provide computed UCL values based on limited sample sets and/or distinct values; therefore, maximum concentration used as the EPC.
   b. 95% UCL exceeds maximum detected value so use maximum detected value.

J = Analyte present. Reported value may not be accurate or precise.
NA = not applicable
UCL = upper confidence limit
µg/L = microgram per liter
Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion
ROD = Record of Decision
HHRA = Human Health Risk Assessment

Table 13
Exposure Point Concentration Summary
Reasonable Maximum Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	Chemical of Potential Concern [1]	Units	Arithmetic Mean [2]	95% UCL (Distribution) [3]	Maximum Concentration (Qualifier)	Exposure Point Concentration (EPC) [4]			
						Value	Units	Statistic [5]	Rationale [6]
Wissahickon Creek	Benzo(a)pyrene	µg/kg	648.6	899.1	1000	899.1	µg/kg	95% Student's-t UCL	a
	Carbazole	µg/kg	107.5	144	190 J	144	µg/kg	95% KM (t) UCL	a
	Arsenic	mg/kg	58.6	4.681	6.5	4.681	mg/kg	95% Modified-t UCL	a
	Chromium	mg/kg	14.73	18.84	25.2	18.84	mg/kg	95% Student's-t UCL	a
	Manganese	mg/kg	630	1458	2010	1458	mg/kg	95% H-UCL	a

Notes:
1. Compounds on this table exceed their respective risk-based concentrations for exposure to sediment.
2. Mean is arithmetic mean of the detected values. If only one detected value in grouping, then NA.
3. 95% UCL values are calculated using ProUCL software, Version 4.1.01. See Appendix F of the HHRA for full ProUCL statistics.
4. EPC values used for current/future recreational users for incidental ingestion and dermal contact.
5. Statistics:
   Student's-t UCL = 95% UCL of the mean based upon the student's-t statistic
   95% H-UCL = 95% H-statistical based H-UCL of mean
   95% KM (t) UCL = 95% UCL based upon the Kaplan-Meier estimates using the student's t-distribution cutoff value
   95% Modified-t = modified t-statistic (adjusted for skewness) based UCL
6. EPC Selection Rationale:
   a. ProUCL recommended UCL value is used as the EPC value.

J = Analyte present. Reported value may not be accurate or precise.
NA = not applicable
UCL = upper confidence limit
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion
ROD = Record of Decision
HHRA = Human Health Risk Assessment

Table 14
Exposure Point Concentration Summary
Reasonable Maximum Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Fish Tissue

Exposure Point	Chemical of Potential Concern [1]	Units	Arithmetic Mean [2]	95% UCL (Distribution) [3]	Maximum Concentration	Fish Tissue Exposure Point Concentration (EPC) [4]			
						Value	Units	Statistic [5]	Rationale [6]
Wissahickon Creek [6]	Benzo(a)anthracene	µg/kg	2.2	3.0	4.411	3.0	µg/kg	95% Student's-t UCL	a
	Benzo(a)pyrene	µg/kg	2.0	2.7	4.04	2.7	µg/kg	95% Student's-t UCL	a
	Benzo(b)fluoranthene	µg/kg	2.6	3.5	5.603	3.5	µg/kg	95% Student's-t UCL	a
	4,4'-DDD	µg/kg	4.9	7.7	13.4	7.7	µg/kg	95% Student's-t UCL	a
	4,4'-DDE	µg/kg	5.6	8.8	18	8.8	µg/kg	95% Student's-t UCL	a
	4,4'-DDT	µg/kg	42.8	143	247	143.4	µg/kg	95% Approx. Gamma UCL	a
	Aldrin	µg/kg	0.2	2.0	1.7	1.7	µg/kg	Maximum Concentration	b
	alpha-Chlordane	µg/kg	5.2	7.3	13.3	7.3	µg/kg	95% Student's-t UCL	a
	Aroclor-1254	µg/kg	26	62	71	62.4	µg/kg	97.5% KM (Chebyshev) UCL	a
	Aroclor-1260	µg/kg	4.7	7.3	9.5	7.3	µg/kg	95% KM (Percentile Bootstrap) UCL	a
	Dieldrin	µg/kg	312	1029	1680	1029.0	µg/kg	95% Chebyshev (Mean, Sd) UCL	a
	Heptachlor	µg/kg	0.51	0.9	1.1	0.9	µg/kg	95% KM (BCA) UCL	a
	Heptachlor Epoxide	µg/kg	0.9	1.2	3.3	1.2	µg/kg	95% Student's-t UCL	a
	Arsenic	mg/kg	0.3	0.5	0.8	0.5	mg/kg	95% Approx. Gamma UCL	a
	Cadmium	mg/kg	0.4	0.45	0.64	0.5	mg/kg	95% KM (t) UCL	a
	Chromium	mg/kg	0.5	0.62	1.1	0.6	mg/kg	95% Student's-t UCL	a
	Copper	mg/kg	12	15	25.4	15.2	mg/kg	95% Student's-t UCL	a
	Lead	mg/kg	8	11.1	22.9	11.1	mg/kg	95% Student's-t UCL	a
	Mercury	mg/kg	0.028	0.038	0.056	0.04	mg/kg	95% KM (Percentile Bootstrap) UCL	a
	Nickel	mg/kg	8.7	10.94	16.2	11	mg/kg	95% Student's-t UCL	a
	Zinc	mg/kg	303	371	520	371	mg/kg	95% Student's-t UCL	a

Table 14
Exposure Point Concentration Summary
Reasonable Maximum Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Fish Tissue

Exposure Point	Chemical of Potential Concern [1]	Units	Arithmetic Mean [2]	95% UCL (Distribution) [3]	Maximum Concentration	Fish Tissue Exposure Point Concentration (EPC) [4]			
						Value	Units	Statistic [5]	Rationale [6]

Notes:

1. Compounds on this table exceed their respective risk-based concentrations for fish tissue.
2. Mean is arithmetic mean of the detected values.
3. 95% UCL values are calculated using ProUCL software, Version 4.1.01. See Appendix F of the HHRA for full ProUCL results tables.
4. EPC values used for current/future fishers (adult and children) for ingestion.
5. Statistics:

95% Approx. Gamma UCL = 95% approximate gamma UCL using chi-square

95% Chebyshev (Mean, Std) UCL = 95% Chebyshev UCL of mean computed using the sample arithmetic mean and standard deviation

95% KM (Percentile Bootstrap) UCL = 95% UCL based upon the Kaplan-Meier estimates using the percentile bootstrap method.

95% KM (t) UCL = 95% UCL based upon the Kaplan-Meier estimates using the student's t-distribution cutoff value

95% KM (BCA) UCL

95% Modified-t = modified t-statistic (adjusted for skewness) based UCL

95% Student's-t UCL = 95% UCL of the mean based upon the student's-t statistic

Maximum Concentration = Maximum concentration used as no ProUCL data is available for the sample set.

6. EPC Selection Rationale:
   a. ProUCL recommended UCL value is used as the EPC value.
   b. ProUCL recommended UCL value exceeds maximum concentration. Use maximum concentration as EPC.

UCL = upper confidence limit
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilograms
Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion
ROD = Record of Decision
HHRA = Human Health Risk Assessment

Table 15
Exposure Point Concentration Summary
Reasonable Maximum Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Chemical of Potential Concern [1]	Units	Arithmetic Mean [2]	95% UCL (Distribution)[3]	Maximum Concentration (Qualifier)		Exposure Point Concentration (EPC) [4]			
							Value	Units	Statistic [5]	Rationale [6]
Tap Water drawn from Shallow Bedrock Aquifer	1,2,3-Trichlorobenzene	µg/L	0.68	NA	0.68	J	0.68	µg/L	Maximum Concentration	a
	Carbon Tetrachloride	µg/L	5.95	6.4	6.6		6.6	µg/L	95% KM (Percentile Bootstrap) UCL	b
	Chloroform	µg/L	4.87	NA	5.5		5.5	µg/L	Maximum Concentration	a
	Tetrachloroethene	µg/L	22.81	27.5	37		27.5	µg/L	95% KM (Percentile Bootstrap) UCL	b
	Trichloroethene	µg/L	1.6	NA	1.7		1.7	µg/L	Maximum Concentration	a
	Bis(2-ethylhexyl)phthalate	µg/L	28.5	43.6	55		43.6	µg/L	95% KM (Percentile Bootstrap) UCL	b
	Dimethyl Phthalate	µg/L	7.8	NA	7.8		7.8	µg/L	Maximum Concentration	a
	Aluminum	µg/L	955.2	4538	9540		4538	µg/L	99% KM (Chebyshev) UCL	b
	Arsenic	µg/L	5.0	5.6	10.1		5.6	µg/L	95% KM (Percentile Bootstrap) UCL	b
	Barium	µg/L	165.1	250.5	540		250.5	µg/L	95% Approximate Gamma UCL	b
	Cadmium	µg/L	0.74	NA	0.74	J	0.74	µg/L	Maximum Concentration	a
	Chromium	µg/L	7.7	18.2	18.2		18.2	µg/L	95% KM (Percentile Bootstrap) UCL	b
	Cobalt	µg/L	2.73	NA	3.8	J-	3.8	µg/L	Maximum Concentration	a
	Cyanide	µg/L	6.0	NA	8.2	J	8.2	µg/L	Maximum Concentration	a
	Iron	µg/L	1144	4801	15300		4801	µg/L	97.5% KM (Chebyshev) UCL	b
	Manganese	µg/L	1897	8458	9190		8458	µg/L	99% KM (Chebyshev) UCL	b
	Thallium	µg/L	4.55	NA	8	J	8	µg/L	Maximum Concentration	a
	Vanadium	µg/L	5.81	11.5	27.1	J	11.5	µg/L	95% KM (BCA) UCL	b

Table 15
Exposure Point Concentration Summary
Reasonable Maximum Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Chemical of Potential Concern [1]	Units	Arithmetic Mean [2]	95% UCL (Distribution)[3]	Maximum Concentration (Qualifier)	Exposure Point Concentration (EPC) [4]			
						Value	Units	Statistic [5]	Rationale [6]

Notes:

1. Compounds on this table exceed their respective risk-based concentrations for groundwater.
2. Mean is arithmetic mean of the detected values. If only one detected value in grouping, then NA.
3. 95% UCL values are calculated using ProUCL software, Version 4.1.01 (EPA 2011) for data sets with at least 4 detected values and 5 sample units in the data set. See Appendix F of the HHRA for full ProUCL results tables.
4. EPC values used for future resident receptors for incidental ingestion and dermal contact.
5. Statistics:
   Maximum Concentration = Maximum concentration used as no ProUCL datum is available for the sample set.
   95% Approximate Gamma UCL = 95% UCL using the gamma approximate-UCL method.
   95% KM (BCA) UCL = 95% UCL based upon the Kaplan-Meier estimates using the percentile bias-corrected accelerated method.
   95% KM (Chebyshev) UCL = 95% UCL based upon the Kaplan-Meier estimates using the Chebyshev inequality.
   97.5% KM (Chebyshev) UCL = 97.5% UCL based upon the Kaplan-Meier estimates using the Chebyshev inequality.
   99% KM (Chebyshev) UCL = 99% UCL based upon the Kaplan-Meier estimates using the Chebyshev inequality.
   95% KM (Percentile Bootstrap) UCL = 95% UCL based upon the Kaplan-Meier estimates using the percentile bootstrap method.
6. EPC Selection Rationale:
   a. Limited sample sets and/or distinct values (less than 4 or more detects in sample sets greater than 5 samples); therefore, maximum concentration used as the EPC.
   b. ProUCL recommended UCL value is used as the EPC.

J = Analyte present. Reported value may not be accurate or precise.
UCL = upper confidence limit
µg/L = micrograms per liter
Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion
NA = not applicable
ROD = Record of Decision
HHRA = Human Health Risk Assessment

Table 16
Selection of Potential Exposure Pathways - Chemical
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Exposure Area	Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Park Parcel	Current/Future	Surface Soil	Surface Soil	Surface Soil at the Park Parcel	Maintenance Worker	Adult	Incidental Ingestion	Quant	Workers may be exposed to contaminated surface soil during routine maintenance activities.
							Dermal Contact	Quant	
			Air	Breathing Zone of Individual at the Park Parcel	Maintenance Worker	Adult	Inhalation	Quant	
	Future		Surface Soil	Surface Soil at the Park Parcel	Recreational User	Adult	Incidental Ingestion	Quant	Visitors may be exposed to contaminated surface soil during recreational use.
							Dermal Contact	Quant	
						Child (0 to 6 yrs.)	Incidental Ingestion	Quant	
							Dermal Contact	Quant	
						Child/Adult (Lifetime)	Incidental Ingestion	Quant	
							Dermal Contact	Quant	
					Commercial Worker	Adult	Incidental Ingestion	Quant	Workers may be exposed to contaminated surface soil during workday activities.
							Dermal Contact	Quant	
			Air	Breathing Zone of Individual at the Park Parcel	Recreational User	Adult	Inhalation	None	Minimal inhalation exposure is expected from this pathway.
						Child (0 to 6 yrs.)	Inhalation	None	
						Child/Adult (Lifetime)	Inhalation	None	
					Commercial Worker	Adult	inhalation	None	Minimal inhalation exposure is expected from this pathway.
Reservoir Parcel	Current/Future		Surface Soil	Surface Soil around the Perimeter of the Reservoir	Maintenance Worker	Adult	Incidental Ingestion	Quant	Workers may be exposed to contaminated surface soil during routine maintenance activities.
							Dermal Contact	Quant	
			Air	Breathing Zone of Individual around the Perimeter of the Reservoir	Maintenance Worker	Adult	Inhalation	Quant	
		Surface Water	Surface Water	Surface Water in the Reservoir	Maintenance Worker	Adult	Incidental Ingestion	Quant	Workers may be exposed to contaminated surface water during routine maintenance activities.
							Dermal Contact	Quant	
			Air	Breathing Zone of Individual at Surface Water in the Reservoir	Maintenance Worker	Adult	Inhalation	None	Minimal inhalation exposure is expected from this pathway.
		Sediment	Sediment	Sediment located in the Reservoir	Maintenance Worker	Adult	Incidental Ingestion	Quant	Workers may be exposed to contaminated sediment during routine maintenance activities.
							Dermal Contact	Quant	

Table 16
Selection of Potential Exposure Pathways - Chemical
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Exposure Area	Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Reservoir Parcel	Future	Surface Soil	Surface Soil	Surface Soil around the Perimeter of the Reservoir	Recreational User	Adult	Incidental Ingestion	Quant	Visitors may be exposed to contaminated surface soil during recreational use.
							Dermal Contact	Quant	
						Child (0 to 6 yrs.)	Incidental Ingestion	Quant	
							Dermal Contact	Quant	
						Child/Adult (Lifetime)	Incidental Ingestion	Quant	
							Dermal Contact	Quant	
			Air	Breathing Zone of Individual around the Perimeter of the Reservoir	Recreational User	Adult	Inhalation	None	Minimal inhalation exposure is expected from this pathway.
						Child (0 to 6 yrs.)	Inhalation	None	
						Child/Adult (Lifetime)	Inhalation	None	
		Surface Water	Surface Water	Surface Water in the Reservoir	Recreational User	Adult	Incidental Ingestion	Quant	Visitors may be exposed to contaminated surface water during recreational use (i.e., wading).
							Dermal Contact	Quant	
						Child (0 to 6 yrs.)	Incidental Ingestion	Quant	
							Dermal Contact	Quant	
						Child/Adult (Lifetime)	Incidental Ingestion	Quant	
							Dermal Contact	Quant	
			Air	Breathing Zone of Individual at Surface Water in the Reservoir	Recreational User	Adult	Inhalation	None	Minimal inhalation exposure is expected from this pathway.
						Child (0 to 6 yrs.)	Inhalation	None	
						Child/Adult (Lifetime)	Inhalation	None	
		Sediment	Sediment	Sediment Located in the Reservoir	Recreational User	Adult	Incidental Ingestion	Quant	Visitors may be exposed to contaminated sediment during recreational use (i.e., wading).
							Dermal Contact	Quant	
						Child (0 to 6 yrs.)	Incidental Ingestion	Quant	
							Dermal Contact	Quant	
						Child/Adult (Lifetime)	Incidental Ingestion	Quant	
							Dermal Contact	Quant	

Table 16
Selection of Potential Exposure Pathways - Chemical
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Exposure Area	Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Asbestos Pile Parcel	Current/Future	Surface Soil	Surface Soil	Surface Soil at the Asbestos Pile Parcel	Maintenance Worker	Adult	Incidental Ingestion	Quant	Workers may be exposed to contaminated surface soil during routine maintenance activities.
							Dermal Contact	Quant	
			Air	Breathing Zone of Individual at the Asbestos Pile Parcel	Maintenance Worker	Adult	Inhalation	Quant	
	Future		Surface Soil	Surface Soil at the Asbestos Pile Parcel	Recreational User	Adult	Incidental Ingestion	Quant	Visitors may be exposed to contaminated surface soil during recreational use.
							Dermal Contact	Quant	
						Child (0 to 6 yrs.)	Incidental Ingestion	Quant	
							Dermal Contact	Quant	
						Child/Adult (Lifetime)	Incidental Ingestion	Quant	
							Dermal Contact	Quant	
					Commercial Worker	Adult	Incidental Ingestion	Quant	Workers may be exposed to contaminated surface soil during workday activities.
							Dermal Contact	Quant	
			Air	Breathing Zone of Individual at the Asbestos Pile Parcel	Recreational User	Adult	Inhalation	None	Minimal inhalation exposure is expected from this pathway.
						Child (0 to 6 yrs.)	Inhalation	None	
						Child/Adult (Lifetime)	Inhalation	None	
					Commercial Worker	Adult	inhalation	None	Minimal inhalation exposure is expected from this pathway.
On-site/Off-site		Groundwater	Groundwater	Tap Water Drawn from Shallow Bedrock Aquifer	Resident	Adult	Ingestion	Quant	Residents may be potentially exposed to contaminated groundwater if future wells are drilled into the bedrock aquifer for residential use (drinking and showering).
							Dermal Contact	Quant	
						Child (0 to 6 yrs.)	Ingestion	Quant	
							Dermal Contact	Quant	
						Child/Adult (Lifetime)	Ingestion	Quant	
							Dermal Contact	Quant	
			Air	Tap Water Drawn from Shallow Bedrock Aquifer	Resident	Adult	Inhalation	Quant	Residents may be exposed to contaminated groundwater in future wells drilled into the bedrock aquifer for residential use (showering).
						Child (0 to 6 yrs.)	Inhalation	None	Children are not assumed to shower and minimal inhalation exposure from bathing is expected.
						Child/Adult (Lifetime)	Inhalation	Quant	Residents may be exposed to contaminated groundwater in future wells drilled into the bedrock aquifer for residential use (showering).

Table 16
Selection of Potential Exposure Pathways - Chemical
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Exposure Area	Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Off-site	Current/Future	Surface Soil	Surface Soil	Surface Soil at ABS Property 1	Resident	Adult	Incidental Ingestion	None	Non-asbestos compounds that were typically detected in on-site soils may be attributed to background. Future background sampling is planned for the Site. Results of the background sampling will determine if this pathway will need to be reevaluated (i.e., if off-site soils will need to be investigated for non-asbestos compounds).
							Dermal Contact	None	
						Child (0 to 6 yrs.)	Ingestion	None	
							Dermal Contact	None	
						Child/Adult (Lifetime)	Ingestion	None	
							Dermal Contact	None	
				Surface Soil at ABS Property 2	Resident	Adult	Ingestion	None	Non-asbestos compounds that were typically detected in on-site soils may be attributed to background. Future background sampling is planned for the Site. Results of the background sampling will determine if this pathway will need to be reevaluated (i.e., if off-site soils will need to be investigated for non-asbestos compounds).
							Dermal Contact	None	
						Child (0 to 6 yrs.)	Incidental Ingestion	None	
							Dermal Contact	None	
						Child/Adult (Lifetime)	Incidental Ingestion	None	
							Dermal Contact	None	
				Surface Soil at ABS Property 3	Resident	Adult	Incidental Ingestion	None	Non-asbestos compounds that were typically detected in on-site soils may be attributed to background. Future background sampling is planned for the Site. Results of the background sampling will determine if this pathway will need to be reevaluated (i.e., if off-site soils will need to be investigated for non-asbestos compounds).
							Dermal Contact	None	
						Child (0 to 6 yrs.)	Incidental Ingestion	None	
							Dermal Contact	None	
						Child/Adult (Lifetime)	Incidental Ingestion	None	
							Dermal Contact	None	
				Surface Soil at ABS Property 4	Resident	Adult	Incidental Ingestion	None	Non-asbestos compounds that were typically detected in on-site soils may be attributed to background. Future background sampling is planned for the Site. Results of the background sampling will determine if this pathway will need to be reevaluated (i.e., if off-site soils will need to be investigated for non-asbestos compounds).
							Dermal Contact	None	
						Child (0 to 6 yrs.)	Incidental Ingestion	None	
							Dermal Contact	None	
						Child/Adult (Lifetime)	Incidental Ingestion	None	
							Dermal Contact	None	

Table 16
Selection of Potential Exposure Pathways - Chemical
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Exposure Area	Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Off-site	Current/Future	Surface Soil	Surface Soil	Surface Soil at ABS Property 5	Resident	Adult	Incidental Ingestion	None	Non-asbestos compounds that were typically detected in on-site soils may be attributed to background. Future background sampling is planned for the Site. Results of the background sampling will determine if this pathway will need to be reevaluated (i.e., if off-site soils will need to be investigated for non-asbestos compounds).
							Dermal Contact	None	
						Child (0 to 6 yrs.)	Incidental Ingestion	None	
							Dermal Contact	None	
						Child/Adult (Lifetime)	Incidental Ingestion	None	
							Dermal Contact	None	
				Surface Soil at ABS Property 6	Resident	Adult	Incidental Ingestion	None	Non-asbestos compounds that were typically detected in on-site soils may be attributed to background. Future background sampling is planned for the Site. Results of the background sampling will determine if this pathway will need to be reevaluated (i.e., if off-site soils will need to be investigated for non-asbestos compounds).
							Dermal Contact	None	
						Child (0 to 6 yrs.)	Incidental Ingestion	None	
							Dermal Contact	None	
						Child/Adult (Lifetime)	Incidental Ingestion	None	
							Dermal Contact	None	
				Surface Soil at ABS Property 7	Resident	Adult	Incidental Ingestion	None	Non-asbestos compounds that were typically detected in on-site soils may be attributed to background. Future background sampling is planned for the Site. Results of the background sampling will determine if this pathway will need to be reevaluated (i.e., if off-site soils will need to be investigated for non-asbestos compounds).
							Dermal Contact	None	
						Child (0 to 6 yrs.)	Incidental Ingestion	None	
							Dermal Contact	None	
						Child/Adult (Lifetime)	Incidental Ingestion	None	
							Dermal Contact	None	
			Air	Breathing Zone of Individual at ABS Property 1	Resident	Adult	Inhalation	None	Non-asbestos compounds that were typically detected in on-site soils may be attributed to background. Future background sampling is planned for the Site. Results of the background sampling will determine if this pathway will need to be reevaluated (i.e., if off-site soils will need to be investigated for non-asbestos compounds).
						Child (0 to 6 yrs.)	Inhalation	None	
						Child/Adult (Lifetime)	Inhalation	None	
				Breathing Zone of individual at ABS Property 2	Resident	Adult	Inhalation	None	Non-asbestos compounds that were typically detected in on-site soils may be attributed to background. Future background sampling is planned for the Site. Results of the background sampling will determine if this pathway will need to be reevaluated (i.e., if off-site soils will need to be investigated for non-asbestos compounds).

Table 16
Selection of Potential Exposure Pathways - Chemical
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Exposure Area	Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Off-site	Current/Future	Surface Soil	Air	Breathing Zone of individual at ABS Property 2	Resident	Child (0 to 6 yrs.)	Inhalation	None	Non-asbestos compounds that were typically detected in on-site soils may be attributed to background. Future background sampling is planned for the Site. Results of the background sampling will determine if this pathway will need to be reevaluated (i.e., if off-site soils will need to be investigated for non-asbestos compounds).
						Child/Adult (Lifetime)	Inhalation	None	
				Breathing Zone of individual at ABS Property 3	Resident	Adult	Inhalation	None	Non-asbestos compounds that were typically detected in on-site soils may be attributed to background. Future background sampling is planned for the Site. Results of the background sampling will determine if this pathway will need to be reevaluated (i.e., if off-site soils will need to be investigated for non-asbestos compounds).
						Child (0 to 6 yrs.)	Inhalation	None	
						Child/Adult (Lifetime)	Inhalation	None	
				Breathing Zone of Individual at ABS Property 4	Resident	Adult	Inhalation	None	Non-asbestos compounds that were typically detected in on-site soils may be attributed to background. Future background sampling is planned for the Site. Results of the background sampling will determine if this pathway will need to be reevaluated (i.e., if off-site soils will need to be investigated for non-asbestos compounds).
						Child (0 to 6 yrs.)	Inhalation	None	
						Child/Adult (Lifetime)	Inhalation	None	
				Breathing Zone of individual at ABS Property 5	Resident	Adult	Inhalation	None	Non-asbestos compounds that were typically detected in on-site soils may be attributed to background. Future background sampling is planned for the Site. Results of the background sampling will determine if this pathway will need to be reevaluated (i.e., if off-site soils will need to be investigated for non-asbestos compounds).
						Child (0 to 6 yrs.)	Inhalation	None	
						Child/Adult (Lifetime)	Inhalation	None	
				Breathing Zone of individual at ABS Property 6	Resident	Adult	Inhalation	None	Non-asbestos compounds that were typically detected in on-site soils may be attributed to background. Future background sampling is planned for the Site. Results of the background sampling will determine if this pathway will need to be reevaluated (i.e., if off-site soils will need to be investigated for non-asbestos compounds).
						Child (0 to 6 yrs.)	Inhalation	None	
						Child/Adult (Lifetime)	Inhalation	None	
				Breathing Zone of Individual at ABS Property 7	Resident	Adult	Inhalation	None	Non-asbestos compounds that were typically detected in on-site soils may be attributed to background. Future background sampling is planned for the Site. Results of the background sampling will determine if this pathway will need to be reevaluated (i.e., if off-site soils will need to be investigated for non-asbestos compounds).
						Child (0 to 6 yrs.)	Inhalation	None	
						Child/Adult (Lifetime)	Inhalation	None	

Table 16
Selection of Potential Exposure Pathways - Chemical
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Exposure Area	Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Off-site	Current/Future	Surface Water	Surface Water	Wissahickon Creek	Recreational User[1]	Adult	Incidental Ingestion	Quant	Wissahickon Creek is used for swimming or fishing. While swimming or fishing, recreational users may incidentally ingest contaminated surface water.
							Dermal Contact	Quant	Wissahickon Creek is used for swimming or fishing. While swimming or fishing, recreational users may come into contact with contaminated surface water.
						Child (0 to 6 yrs.)	Incidental Ingestion	Quant	Wissahickon Creek is used for swimming or fishing. While swimming or fishing, recreational users may incidentally ingest contaminated surface water.
							Dermal Contact	Quant	Wissahickon Creek is used for swimming or fishing. While swimming or fishing, recreational users may come into contact with contaminated surface water.
						Child/Adult (Lifetime)	Incidental Ingestion	Quant	Wissahickon Creek is used for swimming or fishing. While swimming or fishing, recreational users may incidentally ingest contaminated surface water.
							Dermal Contact	Quant	Wissahickon Creek is used for swimming or fishing. While swimming or fishing, recreational users may come into contact with contaminated surface water.
				Rose Valley Creek	Recreational User[2]	Adult	Incidental Ingestion	Quant	Rose Valley Creek is a shallow creek, which is primarily used for stormwater conveyance from upstream locations to the Wissahickon Creek. This water body may be used for wading. While wading, recreational users may incidentally ingest contaminated surface water.
							Dermal Contact	Quant	Rose valley Creek is a shallow creek, which is primarily used for stormwater conveyance from upstream locations to the Wissahickon Creek. This water body may be used for wading. While wading, recreational users may come into contact with contaminated surface water.
						Child (0 to 6 yrs.)	Incidental Ingestion	Quant	Rose Valley Creek is a shallow creek, which is primarily used for stormwater conveyance from upstream locations to the Wissahickon Creek. This water body may be used for wading. While wading, recreational users may incidentally ingest contaminated surface water.
							Dermal Contact	Quant	Rose valley Creek is a shallow creek, which is primarily used for stormwater conveyance from upstream locations to the Wissahickon Creek. This water body may be used for wading. While wading, recreational users may come into contact with contaminated surface water.
						Child/Adult (Lifetime)	Incidental Ingestion	Quant	Rose Valley Creek is a shallow creek, which is primarily used for stormwater conveyance from upstream locations to the Wissahickon Creek. This water body may be used for wading. While wading, recreational users may incidentally ingest contaminated surface water.
							Dermal Contact	Quant	Rose valley Creek is a shallow creek, which is primarily used for stormwater conveyance from upstream locations to the Wissahickon Creek. This water body may be used for wading. While wading, recreational users may come into contact with contaminated surface water.
				Tannery Run	Recreational User [2]	Adult	Incidental Ingestion	Quant	Tannery Run is a shallow creek, which is primarily used for stormwater conveyance from upstream locations to the Wissahickon Creek. This water body may be used for wading. While wading, recreational users may incidentally ingest contaminated surface water.
							Dermal Contact	Quant	Tannery Run is a shallow creek, which is primarily used for stormwater conveyance from upstream locations to the Wissahickon Creek. This water body may be used for wading. While wading, recreational users may come into contact with contaminated surface water.
						Child (0 to 6 yrs.)	Incidental Ingestion	Quant	Tannery Run is a shallow creek, which is primarily used for stormwater conveyance from upstream locations to the Wissahickon Creek. This water body may be used for wading. While wading, recreational users may incidentally ingest contaminated surface water.
							Dermal Contact	Quant	Tannery Run is a shallow creek, which is primarily used for stormwater conveyance from upstream locations to the Wissahickon Creek. This water body may be used for wading. While wading, recreational users may come into contact with contaminated surface water.
						Child/Adult (Lifetime)	Incidental Ingestion	Quant	Tannery Run is a shallow creek, which is primarily used for stormwater conveyance from upstream locations to the Wissahickon Creek. This water body may be used for wading. While wading, recreational users may incidentally ingest contaminated surface water.

Table 16
Selection of Potential Exposure Pathways - Chemical
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Exposure Area	Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Off-site	Current/Future	Surface Water	Surface Water	Tannery Run	Recreational User [2]		Dermal Contact	Quant	Tannery Run is a shallow creek, which is primarily used for stormwater conveyance from upstream locations to the Wissahickon Creek. This water body may be used for wading. While wading, recreational users may come into contact with contaminated surface water.
			Air	Wissahickon Creek	Recreational User [1]	Adult	Inhalation	None	Minimal inhalation exposure is expected from this pathway.
						Child (0 to 6 yrs.)	Inhalation	None	
						Child/Adult (Lifetime)	Inhalation	None	
				Rose Valley Creek	Recreational User	Adult	Inhalation	None	Minimal inhalation exposure is expected from this pathway.
						Child (0 to 6 yrs.)	Inhalation	None	
						Child/Adult (Lifetime)	Inhalation	None	
				Tannery Run	Recreational User	Adult	Inhalation	None	Minimal inhalation exposure is expected from this pathway.
						Child (0 to 6 yrs.)	Inhalation	None	
						Child/Adult (Lifetime)	Inhalation	None	
		Sediment	Sediment	Wissahickon Creek	Recreational User [1]	Adult	Incidental Ingestion	Quant	The creek may be used for swimming or fishing. While swimming or fishing, recreational users may incidentally ingest contaminated sediment.
							Dermal Contact	Quant	The creek may be used for swimming or fishing. While swimming or fishing, recreational users may come into contact with contaminated sediment.
						Child (0 to 6 yrs.)	Incidental Ingestion	Quant	The creek may be used for swimming or fishing. While swimming or fishing, recreational users may incidentally ingest contaminated sediment.
							Dermal Contact	Quant	The creek may be used for swimming or fishing. While swimming or fishing, recreational users may come into contact with contaminated sediment.
						Child/Adult (Lifetime)	Incidental Ingestion	Quant	The creek may be used for swimming or fishing. While swimming or fishing, recreational users may incidentally ingest contaminated sediment.
							Dermal Contact	Quant	The creek may be used for swimming or fishing. While swimming or fishing, recreational users may come into contact with contaminated sediment.
				Rose Valley Creek	Recreational User [2]	Adult	Incidental Ingestion	Quant	The creek may be used for wading. While wading, recreational users may incidentally ingest contaminated sediment.
							Dermal Contact	Quant	The creek may be used for wading. While wading, recreational users may come into contact with contaminated sediment.
						Child (0 to 6 yrs.)	Incidental Ingestion	Quant	The creek may be used for wading. While wading, recreational users may incidentally ingest contaminated sediment.
							Dermal Contact	Quant	The creek may be used for wading. While wading, recreational users may come into contact with contaminated sediment.
						Child/Adult (Lifetime)	Incidental Ingestion	Quant	The creek may be used for wading. While wading, recreational users may incidentally ingest contaminated sediment.
							Dermal Contact	Quant	The creek may be used for wading. While wading, recreational users may come into contact with contaminated sediment.
				Tannery Run	Recreational User [2]	Adult	Incidental Ingestion	Quant	The water body may be used for wading. While wading, recreational users may incidentally ingest contaminated sediment.

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Table 16
Selection of Potential Exposure Pathways - Chemical
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Exposure Area	Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Off-site	Current/Future	Sediment	Sediment	Tannery Run	Recreational User [2]		Dermal Contact	Quant	The water body may be used for wading. While wading, recreational users may come into contact with contaminated sediment.
						Child (0 to 6 yrs.)	Incidental Ingestion	Quant	The water body may be used for wading. While wading, recreational users may incidentally ingest contaminated sediment.
							Dermal Contact	Quant	The water body may be used for wading. While wading, recreational users may come into contact with contaminated sediment.
						Child/Adult (Lifetime)	Incidental Ingestion	Quant	The water body may be used for wading. While wading, recreational users may incidentally ingest contaminated sediment.
							Dermal Contact	Quant	The water body may be used for wading. While wading, recreational users may come into contact with contaminated sediment.
			Fish Tissue	Wissahickon Creek	Fisher	Adult	Ingestion	Quant	Fishing occurs in Wissahickon Creek. There may be potential for site-related contaminants to bioaccumulation in fish tissue.
						Child (0 to 6 yrs.)	Ingestion	Quant	Fishing occurs in Wissahickon Creek. There may be potential for site-related contaminants to bioaccumulation in fish tissue.
				Rose Valley Creek	Fisher	Adult	Ingestion	None	This creek is intermittently dry. No fish live in this creek.
						Child (0 to 6 yrs.)	Ingestion	None	This creek is intermittently dry. No fish live in this creek.
				Tannery Run	Fisher	Adult	Ingestion	None	No fish were observed to live in this water body.
						Child (0 to 6 yrs.)	Ingestion	None	No fish were observed to live in this water body.
		Surface Soil	Surface Soil	Surface Soil located along Western Bank of Wissahickon Creek	Recreational User	Adult	Incidental Ingestion	Quant	Hikers may potentially be exposed to contaminated surface soil while trail walking.
							Dermal Contact	Quant	
						Child (0 to 6 yrs.)	Incidental Ingestion	Quant	
							Dermal Contact	Quant	
						Child/Adult (Lifetime)	Incidental Ingestion	Quant	
							Dermal Contact	Quant	
			Air	Breathing Zone of Individual along Western Bank of Wissahickon Creek	Recreational User	Adult	Inhalation	None	Minimal inhalation exposure is expected from this pathway.
						Child	Inhalation	None	
						Child/Adult (Lifetime)	Inhalation	None	

Notes:
1. Swimmer
2. Wader

Quant = Quantitative risk analysis performed.
ABS = activity-based sampling

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Table 17
Non-Cancer Toxicity Data - Oral/Dermal
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD [1]		Oral Absorption Efficiency for Dermal [2]	Absorbed RfD for Dermal [3]		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD: Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Organics										
1,2,3-Trichlorobenzene	Chronic	8.0E-04	mg/kg-day	1	8.0E-04	mg/kg/day	Body Weight/Thyroid/Liver	1000	PPRTV Appendix	09/11/2010
Carbon Tetrachloride	Chronic	4.0E-03	mg/kg-day	1	4.0E-03	mg/kg/day	Liver	1000	IRIS	03/31/2010
Chloroform	Chronic	1.0E-02	mg/kg-day	1	1.0E-02	mg/kg/day	Liver	100	IRIS	10/19/2001
Tetrachloroethene	Chronic	6.0E-03	mg/kg-day	1	6.0E-03	mg/kg/day	Central Nervous System	1000	IRIS	02/10/2012
Trichloroethene	Chronic	5.0E-04	mg/kg-day	1	5.0E-04	mg/kg/day	Immune System/Cardiovascular System	Multiple	IRIS	09/28/2011
Benzo(a)anthracene	NA	NA	NA	1	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	1	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	1	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	1	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate	Chronic	2.0E-02	mg/kg-day	1	2.0E-02	mg/kg/day	Liver	1000	IRIS	05/01/1991
Carbazole	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	1	NA	NA	NA	NA	NA	NA
Dimethyl Phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	1	NA	NA	NA	NA	NA	NA
4,4'-DDD	NA	NA	NA	1	NA	NA	NA	NA	NA	NA
4,4'-DDE	NA	NA	NA	1	NA	NA	NA	NA	NA	NA
4,4'-DDT	Chronic	5.0.E-04	mg/kg-day	1	5.0E-04	mg/kg/day	Liver	100	IRIS	02/01/1996
Aldrin	Chronic	3.0.E-05	mg/kg-day	1	3.0E-05	mg/kg/day	Liver	1000	IRIS	03/01/1988
Aroclor 1254	Chronic	2.0.E-05	mg/kg-day	1	2.0E-05	mg/kg/day	Eyes	300	IRIS	11/01/1996
Aroclor 1260	NA	NA	NA	1	NA	NA	NA	NA	NA	NA
alpha-BHC	Chronic	8.0.E-03	mg/kg-day	1	8.0E-03	mg/kg/day	Liver	100	ATSDR	09/01/2005
delta-BHC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
alpha-Chlordane[4]	Chronic	5.0E-04	mg/kg-day	1	5.0E-04	mg/kg/day	Liver	300	IRIS	02/07/1998
Dieldrin	Chronic	5.0E-05	mg/kg-day	1	5.0E-05	mg/kg/day	Liver	100	IRIS	09/01/1990
Heptachlor	Chronic	5.0E-04	mg/kg-day	1	5.0E-04	mg/kg/day	Liver	300	IRIS	03/01/1991
Heptachlor Epoxide	Chronic	1.3E-05	mg/kg-day	1	1.3E-05	mg/kg/day	Liver	1000	IRIS	03/01/1991
2,3,7,8-TCDD	Chronic	7.0E-10	mg/kg-day	1	7.0E-10	mg/kg/day	Reproductive System	30	IRIS	02/17/2012

Table 17
Non-Cancer Toxicity Data - Oral/Dermal
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD [1]		Oral Absorption Efficiency for Dermal [2]	Absorbed RfD for Dermal [3]		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD: Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Inorganics										
Aluminum	Chronic	1.0E+00	mg/kg-day	1	1.0E+00	mg/kg-day	Central Nervous System	100	IRIS	10/23/2006
Arsenic	Chronic	3.0E-04	mg/kg-day	1	3.0E-04	mg/kg-day	Skin/Cardiovascular System	3	IRIS	02/01/1993
Barium	Chronic	2.0E-01	mg/kg-day	0.07	1.4E-02	mg/kg-day	Kidney	300	IRIS	07/11/2005
Cadmium (diet)	Chronic	1.0E-03	mg/kg-day	0.025	2.5E-05	mg/kg-day	Kidney	10	IRIS	02/01/1994
Cadmium (water)	Chronic	5.0E-04	mg/kg-day	0.05	2.5E-05	mg/kg-day	Kidney	10	IRIS	02/01/1994
Chromium [7]	Chronic	3.0E-03	mg/kg-day	0.025	7.5E-05	mg/kg-day	No-Observed-Adverse Effect Level	300	IRIS	09/03/1998
Cobalt	Chronic	3.0E-04	mg/kg-day	1	3.0E-04	mg/kg-day	Thyroid	3000	PPRTV	08/25/2008
Copper[5]	Chronic	4.0E-02	mg/kg-day	1	4.0E-02	mg/kg-day	GI Tract	NA	HEAST	07/01/1997
Cyanide	Chronic	6.0E-04	mg/kg-day	1	6.0E-04	mg/kg-day	Reproductive System	3000	IRIS	09/28/2010
Iron	Chronic	7.0E-01	mg/kg-day	1	7.0E-01	mg/kg-day	Gastrointestinal Tract	1.5	PPRTV	09/11/2006
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese (non-diet)	Chronic	2.4E-02	mg/kg-day	0.04	9.6E-04	mg/kg-day	Central Nervous System	6	IRIS[6]	05/01/2012
Mercury (elemental)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercuric Chloride (and other Mercury Salts)	Chronic	3.0E-04	mg/kg-day	0.07	2.1E-05	mg/kg-day	Autoimmune System	1000	IRIS	05/01/1995
Nickel	Chronic	2.0E-02	mg/kg-day	0.04	8.0E-04	mg/kg-day	Body Weight	300	IRIS	12/01/1996
Thallium[5]	Chronic	1.0E-05	mg/kg-day	1	1.0E-05	mg/kg-day	Hair	3000	PPRTV Appendix	10/25/2012
Vanadium	Chronic	5.0E-03	mg/kg-day	1	5.0E-03	mg/kg-day	Hair	NA	IRIS[6]	05/01/2012
Zinc	Chronic	3.0E-01	mg/kg-day	1	3.0E-01	mg/kg-day	Blood	3	IRIS	08/03/2005

Notes:

1. Toxicity values selected following the hierarchy of human health toxicity values generally recommended for use in risk assessments (EPA 2003).
2. Oral to Dermal Adjustment Factor from Exhibit 4-1, RAGS Part E, Supplemental Guidance for Dermal Risk Assessment. Final. EPA/540/R/99/005. July 2004.
3. Adjusted Dermal RfD (mg/kg/day) = Oral RfD (mg/kg/day) x Oral to Dermal Adjustment Factor
4. Chlordane (CAS no. 12789-03-6) used as surrogate for alpha-chlordane (CAS no. 5103-71-9).
5. EPA Region 3 recommended value.
6. Modified (EPA 2012).
7. Chromium VI used as surrogate.

Source: EPA 2003. Human Health Toxicity Values in Superfund Risk Assessments. OSWER Directive 9285.7-53. December 5.
EPA 2012. Regional Screening Levels for Chemical Contaminants at Superfund Sites. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm

NA = Not Available
RfD = Reference Dose
ATSDR = Agency for Toxic Substances and Disease Registry
HEAST = Health Effects Assessment Summary Tables
IRIS = Integrated Risk Information System
PPRTV = EPA provisional peer-reviewed toxicity value
Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion
ROD = Record of Decision
mg/kg-day = milligram per kilogram per day
RAGS = Risk Assessment Guidance for Superfund

Table 18
Non-Cancer Toxicity Data - Inhalation
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC [1]		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Organics							
1,2,3-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA
Carbon Tetrachloride	Chronic	1.0E-01	mg/m^3	Liver	100	IRIS	03/31/2010
Chloroform	Chronic	9.8E-02	mg/m^3	Liver	100	ATSDR	09/01/1997
Tetrachloroethene	Chronic	4.0E-02	mg/m^3	Central Nervous System	1000	IRIS	02/10/2012
Trichloroethene	Chronic	2.0E-03	mg/m^3	Immune System/Cardiovascular System	Multiple	IRIS	09/28/2011
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate	NA	NA	NA	NA	NA	NA	NA
Carbazole	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA
Dimethyl Phthalate	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	NA
4,4'-DDD	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	NA	NA	NA	NA	NA	NA	NA
Aldrin	NA	NA	NA	NA	NA	NA	NA
Aroclor 1254	NA	NA	NA	NA	NA	NA	NA
Aroclor 1260	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA
alpha-Chlordane [2]	Chronic	7.0E-04	mg/m^3	Liver	1000	IRIS	04/01/2012
Dieldrin	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA
Heptachlor Epoxide	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDD	Chromic	4.0E-08	mg/m^3	Liver, Reproductive System, Endocrine System, Respiratory System, Blood	NA	CAL EPA	12/01/2000

Table 18
Non-Cancer Toxicity Data - Inhalation
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC [1]		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Inorganics							
Aluminum	Chronic	5.0E-03	mg/m^3	Central Nervous System	300	PPRTV	10/23/1006
Arsenic	Chronic	1.5E-05	mg/m^3	Development/Cardiovascular System/Central Nervous System/ Respiratory System/Skin	NA	CAL EPA	12/01/2008
Barium	Chronic	5.0E-04	mg/m^3	Fetus	1000	HEAST	07/01/1997
Cadmium	Chronic	1.0E-05	mg/m^3	Kidney	9	ATSDR	09/01/2012
Chromium [3]	Chronic	1.0E-04	mg/m^3	Respiratory System	300	IRIS	09/03/1998
Cobalt	Chronic	6.0E-06	mg/m^3	Respiratory System	300	PPRTV	08/25/2008
Cyanide	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA
Manganese	Chronic	5.0E-05	mg/m^3	Central Nervous System	1000	IRIS	12/01/1993
Mercury (elemental)	Chronic	3.0E-04	mg/m^3	Central Nervous System	30	IRIS	06/01/1995
Mercuric Chloride	Chronic	3.0E-05	mg/m^3	Central Nervous System	NA	CAL EPA	12/01/2008
Nickel	Chromic	9.0E-05	mg/m^3	Respiratory System	30	ATSDR	09/01/2005
Thallium	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA	NA

Notes:

1. Toxicity values selected following the hierarchy of human health toxicity values generally recommended for use in risk assessments (EPA 2003).
2. Chlordane (CAS no. 12789-03-6) used as surrogate for alpha-chlordane (CAS no. 5103-71-9).
3. Chromium VI (particulates) used as surrogate.

Source: EPA 2003. Human Health Toxicity Values in Superfund Risk Assessments.

mg/m^3 = milligram per cubic meter
NA = Not Available
RfC = Reference Concentration

ATSDR = Agency for Toxic Substances and Disease Registry
CAL EPA = California Environmental Protection Agency
IRIS = Integrated Risk Information System
PPRTV = EPA provisional peer-reviewed toxicity value
Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion
ROD = Record of Decision

Table 19
Cancer Toxicity Data - Oral/Dermal
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Chemical of Potential Concern	Oral Cancer Slope Factor [1]		Oral Absorption Efficiency for Dermal [2]	Absorbed Cancer Slope Factor for Dermal [3]		Mutagen	Weight of Evidence/ Cancer Guideline Description	Oral Cancer Slope Factor	
	Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Organics									
1,2,3-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Tetrachloride	7.0E-02	$(mg/kg\text{-}day)^{-1}$	1	7.0E-02	$(mg/kg\text{-}day)^{-1}$	No	Likely to be carcinogenic to humans	IRIS	03/31/2010
Chloroform	3.1E-02	$(mg/kg\text{-}day)^{-1}$	1	3.1E-02	$(mg/kg\text{-}day)^{-1}$	No	NA	CAL EPA	07/21/2009
Tetrachloroethene	2.1E-03	$(mg/kg\text{-}day)^{-1}$	1	2.1E-03	$(mg/kg\text{-}day)^{-1}$	No	Likely to be carcinogenic to humans	IRIS	02/10/2012
Trichloroethene *	4.6E-02	$(mg/kg\text{-}day)^{-1}$	1	4.6E-02	$(mg/kg\text{-}day)^{-1}$	Yes	Carcinogenic to humans	IRIS	09/28/2011
Benzo(a)anthracene[5]	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1	7.3E-01	$(mg/kg\text{-}day)^{-1}$	Yes	B2	ECAO	NA
Benzo(a)pyrene[5]	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1	7.3E+00	$(mg/kg\text{-}day)^{-1}$	Yes	B2	IRIS	11/01/1994
Benzo(b)fluoranthene[5]	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1	7.3E-01	$(mg/kg\text{-}day)^{-1}$	Yes	B2	ECAO	NA
Benzo(k)fluoranthene[5]	7.3E-02	$(mg/kg\text{-}day)^{-1}$	1	7.3E-02	$(mg/kg\text{-}day)^{-1}$	Yes	B2	ECAO	NA
Bis(2-ethylhexyl)phthalate	1.4E-02	$(mg/kg\text{-}day)^{-1}$	1	1.4E-02	$(mg/kg\text{-}day)^{-1}$	No	B2	IRIS	02/01/1993
Carbazole	NA	NA	NA	NA	NA	No	NA	NA	NA
Dibenz(a,h)anthracene[5]	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1	7.3E+00	$(mg/kg\text{-}day)^{-1}$	Yes	B2	ECAO	NA
Dimethyl Phthalate	NA	NA	NA	NA	NA	NA	D	IRIS	03/01/1994
Indeno(1,2,3-cd)pyrene[5]	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1	7.3E-01	$(mg/kg\text{-}day)^{-1}$	Yes	B2	ECAO	NA
4,4'-DDD	2.4E-01	$(mg/kg\text{-}day)^{-1}$	1	2.4E-01	$(mg/kg\text{-}day)^{-1}$	No	B2	IRIS	08/22/1988
4,4'-DDE	3.4E-01	$(mg/kg\text{-}day)^{-1}$	1	3.4E-01	$(mg/kg\text{-}day)^{-1}$	No	B2	IRIS	08/22/1988
4,4'-DDT	3.4E-01	$(mg/kg\text{-}day)^{-1}$	1	3.4E-01	$(mg/kg\text{-}day)^{-1}$	No	B2	IRIS	05/01/1991
Aldrin	1.7E+01	$(mg/kg\text{-}day)^{-1}$	1	1.7E+01	$(mg/kg\text{-}day)^{-1}$	No	B2	IRIS	07/01/1993
Aroclor 1254	2.0E+00	$(mg/kg\text{-}day)^{-1}$	1	2.0E+00	$(mg/kg\text{-}day)^{-1}$	No	B2	IRIS	06/01/1997
Aroclor 1260	2.0E+00	$(mg/kg\text{-}day)^{-1}$	1	2.0E+00	$(mg/kg\text{-}day)^{-1}$	No	B2	IRIS	06/01/1997
alpha-BHC	6.3E+00	$(mg/kg\text{-}day)^{-1}$	1	6.3E+00	$(mg/kg\text{-}day)^{-1}$	No	B2	IRIS	07/01/1993
alpha-Chlordane [4]	3.5E-01	$(mg/kg\text{-}day)^{-1}$	1	3.5E-01	$(mg/kg\text{-}day)^{-1}$	No	Known/Likely Human Carcinogen	IRIS	02/07/1998
Dieldrin	1.6E+01	$(mg/kg\text{-}day)^{-1}$	1	1.6E+01	$(mg/kg\text{-}day)^{-1}$	No	B2	IRIS	07/01/1993
Heptachlor	4.5E+00	$(mg/kg\text{-}day)^{-1}$	1	4.5E+00	$(mg/kg\text{-}day)^{-1}$	No	B2	IRIS	07/01/1993
Heptachlor Epoxide	9.1E+00	$(mg/kg\text{-}day)^{-1}$	1	9.1E+00	$(mg/kg\text{-}day)^{-1}$	No	B2	IRIS	07/01/1993
2,3,7,8-TCDD	1.3E+05	$(mg/kg\text{-}day)^{-1}$	1	1.3E+05	$(mg/kg\text{-}day)^{-1}$	No	B2	CAL EPA	07/01/2009

Table 19
Cancer Toxicity Data - Oral/Dermal
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Chemical of Potential Concern	Oral Cancer Slope Factor [1]		Oral Absorption Efficiency for Dermal [2]	Absorbed Cancer Slope Factor for Dermal [3]		Mutagen	Weight of Evidence/ Cancer Guideline Description	Oral Cancer Slope Factor	
	Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Inorganics									
Aluminum	NA	NA	NA	NA	NA	No	NA	NA	NA
Arsenic	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1	1.5E+00	$(mg/kg\text{-}day)^{-1}$	No	A	IRIS	04/10/1998
Barium	NA	NA	NA	NA	NA	No	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	No	NA	NA	NA
Chromium [6]	5.0E-01	$(mg/kg\text{-}day)^{-1}$	1	5.0E-01	$(mg/kg\text{-}day)^{-1}$	No	D	NJDEP	04/08/2009
Cobalt	NA	NA	NA	NA	NA	No	NA	NA	NA
Copper	NA	NA	NA	NA	NA	No	NA	NA	NA
Cyanide	NA	NA	NA	NA	NA	No	NA	NA	NA
Iron	NA	NA	NA	NA	NA	No	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	No	NA	NA	NA
Mercury (elemental)	NA	NA	NA	NA	NA	No	NA	NA	NA
Nickel	NA	NA	NA	NA	NA	No	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	No	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	No	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	No	NA	NA	NA

Notes:
1. Toxicity values selected following the hierarchy of human health toxicity values generally recommended for use in risk assessments (EPA 2003).
2. Oral to Dermal Adjustment Factor from Exhibit 4-1, RAGS Part E, Supplemental Guidance for Dermal Risk Assessment. Final. EPA/540/R/99/005. July 2004.
3. Adjusted Dermal Cancer Slope Factor (1/mg/kg/day) = Oral Cancer Slope Factor (1/mg/kg/day) / Oral to Dermal Adjustment Factor
4. Chlordane (CAS no. 12789-03-6) used as surrogate for alpha-chlordane (CAS No. 5103-71-9).
5. EPA Region 3 recommended value.
6. Chromium VI used as surrogate.

Source: EPA 2003. Human Health Toxicity Values in Superfund Risk Assessments. OSWER Directive 9285.7-53. December 5.

* Slope factor is 9.3E-03 $(mg/kg\text{-}day)^{-1}$ for evaluation of kidney cancer.

$(mg/kg\text{-}day)^{-1}$ = per milligram per kilogram-day
NA = Not Available
OWSER = Office of Solid Waste and Emergency Response

IRIS = Integrated Risk Information System
ECAO = EPA Environmental Criteria and Assessment Office
NJDEP = New Jersey Department of Environmental Protection
EPA Group:
- A - Human carcinogen
- B1 - Probable human carcinogen - indicates that limited human data are available
- B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
- C - Possible human carcinogen
- D - Not classifiable as a human carcinogen
- E - Evidence of noncarcinogenicity

Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion
EPA = United States Environmental Protection Agency
RAGS = Risk Assessment Guidance for Superfund

Table 20
Cancer Toxicity Data - Inhalation
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Chemical of Potential Concern	Unit Risk [1]				Mutagen	Weight of Evidence/ Cancer Guideline Description	Unit Risk: Inhalation Cancer Slope Factor	
	Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Organics								
1,2,3-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Tetrachloride	6.0E-03	$(mg/m^3)^{-1}$	6.0E-06	$(\mu g/m^3)^{-1}$	No	Likely to be carcinogenic to humans	IRIS	03/31/2010
Chloroform	2.3E-02	$(mg/m3)^{-1}$	2.3E-05	$(\mu g/m^3)^{-1}$	**No**	B2	IRIS	10/19/2001
Tetrachloroethene	2.6E-04	$(mg/m^3)^{-1}$	2.6E-07	$(\mu g/m^3)^{-1}$	No	Likely to be carcinogenic to humans	IRIS	02/10/2012
Trichloroethene *	4.1E-03	$(mg/m3)^{-1}$	4.1E-06	$(\mu g/m^3)^{-1}$	Yes	Carcinogenic to humans	IRIS	09/28/2011
Benzo(a)anthracene	1.1E-01	$(mg/m^3)^{-1}$	1.1E-04	$(\mu g/m^3)^{-1}$	Yes	B2	CAL EPA	07/21/2009
Benzo(a)pyrene	1.1E+00	$(mg/m^3)^{-1}$	1.1E-03	$(\mu g/m^3)^{-1}$	Yes	B2	CAL EPA	07/21/2009
Benzo(b)fluoranthene	1.1E-01	$(mg/m^3)^{-1}$	1.1E-04	$(\mu g/m^3)^{-1}$	Yes	B2	CAL EPA	07/21/2009
Benzo(k)fluoranthene	1.1E-01	$(mg/m^3)^{-1}$	1.1E-04	$(\mu g/m^3)^{-1}$	Yes	B2	CAL EPA	07/21/2009
Bis(2-ethylhexyl)phthalate	2.4E-03	$(mg/m^3)^{-1}$	2.4E-06	$(\mu g/m^3)^{-1}$	No	NA	CAL EPA	07/21/2009
Carbazole	NA	NA	NA	NA	no	NA	NA	NA
Dibenz(a,h)anthracene	1.2E+00	$(mg/m^3)^{-1}$	1.2E-03	$(\mu g/m^3)^{-1}$	Yes	B2	CAL EPA	07/21/2009
Dimethyl Phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1.1E-01	$(mg/m^3)^{-1}$	1.1E-04	$(\mu g/m^3)^{-1}$	Yes	B2	CAL EPA	07/21/2009
4,4'-DDD	6.9E-02	$(mg/m^3)^{-1}$	6.9E-05	$(\mu g/m^3)^{-1}$	No	B2	CAL EPA	07/21/2009
4,4'-DDE	9.7E-02	$(mg/m^3)^{-1}$	9.7E-05	$(\mu g/m^3)^{-1}$	No	B2	CAL EPA	07/21/2009
4,4'-DDT	9.7E-02	$(mg/m^3)^{-1}$	9.7E-05	$(\mu g/m^3)^{-1}$	No	B2	IRIS	05/01/1999
Aldrin	4.9E+00	$(mg/m^3)^{-1}$	4.9E-03	$(\mu g/m^3)^{-1}$	No	B2	IRIS	07/01/1993
Aroclor 1254[2]	1.0E-01	$(mg/m^3)^{-1}$	1.0E-04	$(\mu g/m^3)^{-1}$	No	B2	IRIS	06/01/1997
Aroclor 1260[2]	1.0E-01	$(mg/m^3)^{-1}$	1.0E-04	$(\mu g/m^3)^{-1}$	No	B2	IRIS	06/01/1997
alpha-BHC	1.8E+00	$(mg/m^3)^{-1}$	1.8E-03	$(\mu g/m^3)^{-1}$	No	B2	IRIS	07/01/1993
delta-BHC	NA	NA	NA	NA	No	NA	NA	NA

Table 20
Cancer Toxicity Data - Inhalation
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Chemical of Potential Concern	Unit Risk [1]				Mutagen	Weight of Evidence/ Cancer Guideline Description	Unit Risk: Inhalation Cancer Slope Factor	
	Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
alpha-Chlordane [3]	1.0E-01	$(mg/m^3)^{-1}$	1.0E-04	$(\mu g/m^3)^{-1}$	No	Known/Likely Human Carcinogen	IRIS	02/07/1998
Dieldrin	4.6E+00	$(mg/m^3)^{-1}$	4.6E-03	$(\mu g/m^3)^{-1}$	No	B2	IRIS	07/01/1993
Heptachlor	1.3E+00	$(mg/m^3)^{-1}$	1.3E-03	$(\mu g/m^3)^{-1}$	No	B2	IRIS	07/01/1993
Heptachlor Epoxide	2.6E+00	$(mg/m^3)^{-1}$	2.60E-03	$(\mu g/m^3)^{-1}$	No	B2	IRIS	07/01/1993
2,3,7,8-TCDD	3.8E+04	$(mg/m^3)^{-1}$	3.80E+01	$(\mu g/m^3)^{-1}$	No	B2	CAL EPA	07/01/2009
Inorganics								
Aluminum	NA	NA	NA	NA	No	NA	NA	NA
Arsenic	4.3E+00	$(mg/kg\text{-}day)^{-1}$	4.3E-03	$(\mu g/m^3)^{-1}$	No	A	IRIS	04/10/1998
Barium	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	1.8E+00	$(mg/m^3)^{-1}$	1.8E-03	$(\mu g/m^3)^{-1}$	No	B1	IRIS	06/01/1992
Chromium [4]	8.4E+01	$(mg/m^3)^{-1}$	8.4E-02	$(\mu g/m^3)^{-1}$	Yes	A	IRIS	09/03/1998
Cobalt	9.0E+00	$(mg/m^3)^{-1}$	9.0E-03	$(\mu g/m^3)^{-1}$	No	Likely to be carcinogenic to humans	PPRTV	08/25/2008
Copper	NA	NA	NA	NA	No	NA	NA	NA
Cyanide	NA	NA	NA	NA	No	NA	NA	NA
Iron	NA	NA	NA	NA	No	NA	NA	NA
Lead	NA	NA	NA	NA	No	NA	NA	NA
Manganese (non-diet)	NA	NA	NA	NA	No	NA	NA	NA
Manganese (diet)	NA	NA	NA	NA	No	NA	NA	NA
Mercury (elemental)	NA	NA	NA	NA	No	NA	NA	NA
Mercuric Chloride	NA	NA	NA	NA	No	NA	NA	NA
Nickel	2.6E-01	$(mg/m^3)^{-1}$	2.6E-04	$(\mu g/m^3)^{-1}$	No	A	CAL EPA	07/09/2009
Thallium	NA	NA	NA	NA	No	NA	NA	NA
Vanadium	NA	NA	NA	NA	No	NA	NA	NA
Zinc	NA	NA	NA	NA	No	NA	NA	NA

Table 20
Cancer Toxicity Data - Inhalation
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Chemical of Potential Concern	Unit Risk [1]				Mutagen	Weight of Evidence/ Cancer Guideline Description	Unit Risk: Inhalation Cancer Slope Factor	
	Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)

Notes:

1. Toxicity values selected following the hierarchy of human health toxicity values generally recommended for use in risk assessments (EPA 2003).
2. EPA Region 3 recommended value.
3. Chlordane (CAS no. 12789-03-6) used as surrogate for alpha-chlordane (CAS no. 5103-71-9).
4. Chromium VI used as surrogate.

Source: EPA 2003. Human Health Toxicity Values in Superfund Risk Assessments. OSWER Directive 9285.7-53. December 5.

* Inhalation Unit Risk is 1.0E-06 (μg/m3)$^{-1}$ for evaluation of kidney cancer.

(mg/m^3)$^{-1}$ = per milligram per cubic meter
(μg/m^3)$^{-1}$ = per microgram per cubic meter
NA = Not Available
CAL EPA = California EPA
IRIS = Integrated Risk Information System

PPRTV = EPA provisional peer-reviewed toxicity value
EPA Group:
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity
Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion
EPA = United States Environmental Protection Agency
OWSER = Office of Solid Waste and Emergency Response

Table 21
Chemical HHRA Risk Summary
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

		RME Risk						CTE Risk					
	Exposure	Adult		Child		Lifetime		Adult		Child		Lifetime	
Receptor	Area	Cancer	Non-Cancer	Cancer	Non-Cancer	Cancer	Risk Drivers	Cancer	Non-Cancer	Cancer	Non-Cancer	Cancer	Risk Drivers
Current/Future Scenario Timeframe													
Maintenance Worker	Park Parcel	5E-06	0.08	NE	NE	NE	None	NE	NE	NE	NE	NE	NE
	Reservoir Parcel	1E-05	0.08	NE	NE	NE	None	NE	NE	NE	NE	NE	NE
	Asbestos Pile	1E-05	0.2	NE	NE	NE	None	NE	NE	NE	NE	NE	NE
Recreational User	Other side of Wissahickon Creek along the Walking Trail	4E-06	0.05	1E-05	0.4	2E-05	None	NE	NE	NE	NE	NE	NE
	Tannery Run	6E-06	0.003	1E-05	0.01	2E-05	None	NE	NE	NE	NE	NE	NE
	Rose Valley Creek	2E-06	0.0004	4E-06	0.004	7E-06	None	NE	NE	NE	NE	NE	NE
Recreational User	Wissahickon Creek	4E-04	0.01	5E-04	0.04	1E-03	Surface Water: Dibenz(a,h)anthracene , Indeno(1,2,3-cd)pyrene, Sediment: Benzo(a)pyrene	2E-04	NE	5E-04	NE	6E-04	Surface Water: Dibenz(a,h)anthracene , Indeno(1,2,3-cd)pyrene, Sediment: Benzo(a)pyrene
Fisher	Wissahickon Creek	2E-03	8	1E-03	30	NE	Dieldrin, Benzo(a)pyrene, DDT, Aldrin, Aroclor 1254, Aroclor 1260, Arsenic, Chromium	3E-04	3	2E-04	4	NE	Dieldrin, Aroclor 1254, Arsenic, Chromium
Future Scenario Timeframe													
Recreational User	Park Parcel	5E-06	0.08	1E-05	0.7	2E-05	None	NE	NE	NE	NE	NE	NE
	Reservoir Parcel	1E-05	0.08	3E-05	0.6	4E-05	None	NE	NE	NE	NE	NE	NE
	Asbestos Pile	1E-05	0.2	6E-05	2	7E-05	None	NE	NE	NE	NE	NE	NE
Commercial Worker	Park Parcel	1E-05	0.2	NE	NE	NE	None	NE	NE	NE	NE	NE	NE
	Asbestos Pile	3E-05	0.5	NE	NE	NE	None	NE	NE	NE	NE	NE	NE
Resident	Site-wide Groundwater	2E-04	40	1E-04	100	3E-04	Carbon Tetrachloride, Chloroform, Tetrachloroethene, Trichloroethene, bis(2-ethylhexyl)phthalate, Aluminum, Arsenic, Chromium, Manganese , Thallium, Vanadium	3E-05	20	5E-05	40	9E-05	Tetrachloroethene, Manganese, Thallium

Notes:
HHRA = human health risk assessment
RME = reasonable maximum exposure
CTE = central tendency exposure
NE = not evaluated
Shading = receptors with chemicals associated with unacceptable potential risk and the focus of the ROD discussion

Table 22
Risk Summary
Reasonable Maximum Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Surface Water	Surface Water	Wissahickon Creek	Dibenz(a,h)anthracene	1E-06		4E-04		4E-04
			Indeno(1,2,3-cd)pyrene	--		--		--
			Chromium	--		--		--
			Manganese	--		--		--
			Chemical Total	1E-06		4E-04		4E-04
		Exposure Point Total						4E-04
	Exposure Medium Total							4E-04
Medium Total								4E-04
Sediment	Sediment	Wissahickon Creek	Benzo(a)pyrene	--		--		--
			Carbazole	--		--		--
			Arsenic	--		--		--
			Chromium	--		--		--
			Manganese	--		--		--
			Chemical Total					--
		Exposure Point Total						--
	Exposure Medium Total							--
Medium Total								--
Receptor Total							Receptor Risk Total	4E-04

Notes:
Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion
ROD = Record of Decision

Table 23
Risk Summary
Reasonable Maximum Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future Receptor Population: Recreational User Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Surface Water	Surface Water	Wissahickon Creek	Dibenz(a,h)anthracene	3E-06		5E-04		5E-04
			Indeno(1,2,3-cd)pyrene	3E-07		3E-05		3E-05
			Chromium	--		--		--
			Manganese	--		--		--
			Chemical Total	4E-06		5E-04		5E-04
		Exposure Point Total						5E-04
	Exposure Medium Total							5E-04
Medium Total								5E-04
Sediment	Sediment	Wissahickon Creek	Benzo(a)pyrene	--		--		--
			Carbazole	--		--		--
			Arsenic	--		--		--
			Chromium	--		--		--
			Manganese	--		--		--
			Chemical Total	--		--		--
		Exposure Point Total						--
	Exposure Medium Total							--
Medium Total								--
Receptor Total							Receptor Risk Total	5E-04

Notes:
Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion
ROD = Record of Decision

Table 24
Risk Summary
Reasonable Maximum Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future Receptor Population: Recreational User Receptor Age: Lifetime

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Surface Water	Surface Water	Wissahickon Creek	Dibenz(a,h)anthracene	4E-06		9E-04		9E-04
			Indeno(1,2,3-cd)pyrene	4E-07		5E-05		5E-05
			Chromium	--		--		--
			Manganese	--		--		--
			Chemical Total	5E-06		9E-04		9E-04
		Exposure Point Total						9E-04
	Exposure Medium Total							9E-04
Medium Total								9E-04
Sediment	Sediment	Wissahickon Creek	Benzo(a)pyrene	1E-06		4E-06		5E-06
			Carbazole	--		--		--
			Arsenic	--		--		--
			Chromium	--		--		--
			Manganese	--		--		--
			Chemical Total	--		--		5E-06
		Exposure Point Total						5E-06
	Exposure Medium Total							5E-06
Medium Total								5E-06
Receptor Total							Receptor Risk Total	1E-03

Notes:
Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion
ROD = Record of Decision

Table 25
Risk Summary
Central Tendency Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future Receptor Population: Recreational User Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Surface Water	Surface Water	Wissahickon Creek	Dibenz(a,h)anthracene	1E-08		1E-04		1E-04
			Indeno(1,2,3-cd)pyrene	3E-08		8E-06		8E-06
			Chromium	--		--		--
			Manganese	--		--		--
			Chemical Total	5E-08		1E-04		1E-04
		Exposure Point Total						1E-04
	Exposure Medium Total							1E-04
Medium Total								1E-04
Sediment	Sediment	Wissahickon Creek	Benzo(a)pyrene	--		--		--
			Carbazole	--		--		--
			Arsenic	--		--		--
			Chromium	--		--		--
			Manganese	--		--		--
			Chemical Total					--
		Exposure Point Total						--
	Exposure Medium Total							--
Medium Total								--
Receptor Total							Receptor Risk Total	1E-04

Notes:
Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion
ROD = Record of Decision

Table 26
Risk Summary
Central Tendency Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Surface Water	Surface Water	Wissahickon Creek	Dibenz(a,h)anthracene	3E-06		4E-04		4E-04
			Indeno(1,2,3-cd)pyrene	3E-07		3E-05		3E-05
			Chromium	--		--		--
			Manganese	--		--		--
			Chemical Total	3E-06		4E-04		4E-04
		Exposure Point Total						4E-04
	Exposure Medium Total							4E-04
Medium Total								4E-04
Sediment	Sediment	Wissahickon Creek	Benzo(a)pyrene	--		--		--
			Carbazole	--		--		--
			Arsenic	--		--		--
			Chromium	--		--		--
			Manganese	--		--		--
			Chemical Total	--		--		--
		Exposure Point Total						--
	Exposure Medium Total							--
Medium Total								--
Receptor Total							Receptor Risk Total	4E-04

Notes:
Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion
ROD = Record of Decision

Table 27
Risk Summary
Central Tendency Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Lifetime

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Surface Water	Surface Water	Wissahickon Creek	Dibenz(a,h)anthracene	3E-06		6E-04		6E-04
			Indeno(1,2,3-cd)pyrene	3E-07		3E-05		3E-05
			Chromium	--		--		--
			Manganese	--		--		--
			Chemical Total	3E-06		6E-04		6E-04
		Exposure Point Total						6E-04
	Exposure Medium Total							6E-04
Medium Total								6E-04
Sediment	Sediment	Wissahickon Creek	Benzo(a)pyrene	--		--		--
			Carbazole	--		--		--
			Arsenic	--		--		--
			Chromium	--		--		--
			Manganese	--		--		--
			Chemical Total	--		--		--
		Exposure Point Total						--
	Exposure Medium Total							--
Medium Total								--
Receptor Total							Receptor Risk Total	6E-04

Notes:
Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion
ROD = Record of Decision

Table 28
Risk Summary
Reasonable Maximum Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future Receptor Population: Fisher Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Fish Tissue	Wissahickon Creek	Benzo(a)anthracene	--				--	NA	--			--
			Benzo(a)pyrene	2E-06				2E-06	NA	--			--
			Benzo(b)fluoranthene	--				--	NA	--			--
			4,4'-DDD	--				--	NA	--			
			4,4'-DDE	--				--	NA	--			--
			4,4'-DDT	6E-06				6E-06	Liver	--			--
			Aldrin	4E-06				4E-06	Liver	--			--
			alpha-Chlordane	--				--	Liver	--			--
			Aroclor-1254	2E-05				2E-05	Eyes	--			--
			Aroclor-1260	2E-06				2E-06	NA	--			--
			Dieldrin	2E-03				2E-03	Liver	6E+00			6E+00
			Heptachlor	--				--	Liver	--			--
			Heptachlor Epoxide	--				--	Liver	--			--
			Arsenic	9E-05				9E-05	Skin/Cardiovascular System	--			--
			Cadmium	--				--	Kidney	--			--
			Chromium	4E-05				4E-05	No-Observed-Adverse Effect Level	--			--
			Copper	--				--	Gastrointestinal Tract	--			--
			Lead	--				--	NA	--			--
			Mercury	--				--	Autoimmune System	--			--
			Nickel	--				--	Body Weight	--			--
			Zinc	--				--	Blood	--			--
			Chemical Total	2E-03				2E-03		6E+00			6E+00
		Exposure Point Total						2E-03					6E+00
	Exposure Medium Total							2E-03					6E+00
Medium Total								2E-03					6E+00
Receptor Total							Receptor Risk Total	2E-03				Receptor HI Total	6E+00
												Total Liver HI =	6E+00

Notes:

Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion

ROD = Record of Decision

HI = hazard index

NA = not applicable

Table 29
Risk Summary
Reasonable Maximum Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Fish Tissue	Wissahickon Creek	Benzo(a)anthracene	--				--	NA	--			--
			Benzo(a)pyrene	2E-06				2E-06	NA	--			--
			Benzo(b)fluoranthene	--				--	NA	--			--
			4,4'-DDD	--				--	NA	--			--
			4,4'-DDE	--				--	NA	--			--
			4,4'-DDT	4E-06				4E-06	Liver	3E-01			3E-01
			Aldrin	2E-06				2E-06	Liver	--			--
			alpha-Chlordane	--				--	Liver	--			--
			Aroclor-1254	1E-05				1E-05	Eyes	3E+00			3E+00
			Aroclor-1260	1E-06				1E-06	NA	--			--
			Dieldrin	1E-03				1E-03	Liver	2E+01			2E+01
			Heptachlor	--				--	Liver	--			--
			Heptachlor Epoxide	--				--	Liver	--			--
			Arsenic	6E-05				6E-05	Skin/Cardiovascular System	--			--
			Cadmium	--				--	Kidney	--			--
			Chromium	2E-05				2E-05	No-Observed-Adverse Effect Level	--			--
			Copper	--				--	Gastrointestinal Tract	--			--
			Lead	--				--	NA	--			--
			Mercury	--				--	Autoimmune System	--			--
			Nickel	--				--	Body Weight	--			--
			Zinc	--				--	Blood	--			--
			Chemical Total	1E-03				1E-03		2E+01			2E+01
		Exposure Point Total						1E-03					2E+01
	Exposure Medium Total							1E-03					2E+01
Medium Total								1E-03					2E+01
Receptor Total							Receptor Risk Total	1E-03				Receptor HI Total	2E+01
												Total Liver HI =	2E+01
												Total Eyes HI =	3E+00

Notes:
Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion
ROD = Record of Decision
HI = hazard index
NA = not applicable

Table 30
Risk Summary
Central Tendency Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Fish Tissue	Wissahickon Creek	Benzo(a)anthracene	--				--	NA	--			--
			Benzo(a)pyrene	--				--	NA	--			--
			Benzo(b)fluoranthene	--				--	NA	--			--
			4,4'-DDD	--				--	NA	--			--
			4,4'-DDE	--				--	NA	--			--
			4,4'-DDT	--				--	Liver	--			--
			Aldrin	--				--	Liver	--			--
			alpha-Chlordane	--				--	Liver	--			--
			Aroclor-1254	2E-06				2E-06	Eyes	--			--
			Aroclor-1260	--				--	NA	--			--
			Dieldrin	2E-04				2E-04	Liver	2E+00			2E+00
			Heptachlor	--				--	Liver	--			--
			Heptachlor Epoxide	--				--	Liver	--			--
			Arsenic	1E-05				1E-05	Skin/Cardiovascular System	--			--
			Cadmium	--				--	Kidney	--			--
			Chromium	5E-06				5E-06	No-Observed-Adverse Effect Level	--			--
			Copper	--				--	Gastrointestinal Tract	--			--
			Lead	--				--	NA	--			--
			Mercury	--				--	Autoimmune System	--			--
			Nickel	--				--	Body Weight	--			--
			Zinc	--				--	Blood	--			--
			Chemical Total	3E-04				3E-04		2E+00			2E+00
		Exposure Point Total						3E-04					2E+00
	Exposure Medium Total							3E-04					2E+00
Medium Total								3E-04					2E+00
Receptor Total							Receptor Risk Total	3E-04				Receptor HI Total	2E+00
												Total Liver HI =	2E+00

Notes:

Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion

ROD = Record of Decision

HI = hazard index

NA = not applicable

Table 31
Risk Summary
Central Tendency Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Current/Future
Receptor Population: Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Fish Tissue	Wissahickon Creek	Benzo(a)anthracene	--				--	NA	--			--
			Benzo(a)pyrene	--				--	NA	--			--
			Benzo(b)fluoranthene	--				--	NA	--			--
			4,4'-DDD	--				--	NA	--			--
			4,4'-DDE	--				--	NA	--			--
			4,4'-DDT	--				--	Liver	--			--
			Aldrin	--				--	Liver	--			--
			alpha-Chlordane	--				--	Liver	--			--
			Aroclor-1254	--				--	Eyes	--			--
			Aroclor-1260	--				--	NA	--			--
			Dieldrin	2E-04				2E-04	Liver	3E+00			3E+00
			Heptachlor	--				--	Liver	--			--
			Heptachlor Epoxide	--				--	Liver	--			--
			Arsenic	8E-06				8E-06	Skin/Cardiovascular System	--			--
			Cadmium	--				--	Kidney	--			--
			Chromium	3E-06				3E-06	No-Observed-Adverse Effect Level	--			--
			Copper	--				--	Gastrointestinal Tract	--			--
			Lead	--				--	NA	--			--
			Mercury	--				--	Autoimmune System	--			--
			Nickel	--				--	Body Weight	--			--
			Zinc	--				--	Blood	--			--
			Chemical Total	2E-04				2E-04		3E+00			3E+00
		Exposure Point Total						2E-04					3E+00
	Exposure Medium Total							2E-04					3E+00
Medium Total								2E-04					3E+00
Receptor Total							Receptor Risk Total	2E-04				Receptor HI Total	3E+00
												Total Liver HI =	3E+00

Notes:

Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion

ROD = Record of Decision

HI = hazard index

NA = not applicable

Table 32
Risk Summary
Reasonable Maximum Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap Water Drawn from Shallow Bedrock Aquifer	1,2,3-Trichlorobenzene	--		--		--	Body Weight/Thyroid/Liver	--		--	--
			Carbon Tetrachloride	4E-06		1E-06		6E-06	Liver	--		--	--
			Chloroform	2E-06		1E-07		2E-06	Liver	--		--	--
			Tetrachloroethene	--		--		--	Central Nervous System	1E-01		7E-02	2E-01
			Trichloroethene	9E-07		2E-07		1E-06	Immune System/Cardiovascular System	--		--	--
			Bis(2-ethylhexyl)phthalate	6E-06		9E-06		1E-05	Liver	--		--	--
			Dimethyl Phthalate	--		--		--	NA	--		--	--
			Aluminum	--		--		--	Central Nervous System	--		--	--
			Arsenic	8E-05		4E-07		8E-05	Kidney	--		--	--
			Barium	--		--		--	Kidney	--		--	--
			Cadmium	--		--		--	Kidney	--		--	--
			Chromium	9E-05		9E-07		9E-05	No-Observed-Adverse Effect Level	--		--	--
			Cobalt	--		--		--	Thyroid	--		--	--
			Cyanide	--		--		--	Reproductive System	--		--	--
			Iron	--		--		--	Gastrointestinal Tract	--		--	--
			Manganese	--		--		--	Central Nervous System	1E+01		1E+00	1E+01
			Thallium	--		--		--	Hair	2E+01		1E-01	2E+01
			Vanadium	--		--		--	Hair	--		--	--
			Chemical Total	2E-04		1E-05		2E-04		3E+01		1E+00	3E+01
		Exposure Point Total						2E-04					3E+01
	Exposure Medium Total							2E-04					3E+01
	Air	Tap Water Drawn from Shallow Bedrock Aquifer	1,2,3-Trichlorobenzene		--			--	NA		--		--
			Carbon Tetrachloride		--			--	Liver		--		--
			Chloroform		3E-06			3E-06	Liver		--		--
			Tetrachloroethene		--			--	Central Nervous System		--		--
			Trichloroethene		--			--	Immune System/Cardiovascular System		--		--
			Bis(2-ethylhexyl)phthalate		--			--	NA		--		--
			Dimethyl Phthalate		--			--	NA		--		--
			Chemical Total		3E-06			3E-06			--		--
		Exposure Point Total						3E-06					--
	Exposure Medium Total							3E-06					--
Medium Total								2E-04					3E+01
Receptor Total							Receptor Risk Total	2E-04				Receptor HI Total	3E+01
												Total Central Nervous System HI =	1E+01
												Total Hair HI =	2E+01

Notes:
Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion
ROD = Record of Decision
HI = hazard index
NA = not applicable

Table 33
Risk Summary
Reasonable Maximum Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap Water Drawn from Shallow Bedrock Aquifer	1,2,3-Trichlorobenzene	--		--		--	Body Weight/Thyroid/Liver	--		--	--
			Carbon Tetrachloride	3E-06		7E-07		4E-06	Liver	--		--	--
			Chloroform	--		--		--	Liver	--		--	--
			Tetrachloroethene	--		--		--	Central Nervous System	4E-01		2E-01	5E-01
			Trichloroethene	--		--		--	Immune System/Cardiovascular System	--		--	--
			Bis(2-ethylhexyl)phthalate	4E-06		5E-06		9E-06	Liver	--		--	--
			Dimethyl Phthalate	--		--		--	NA	--		--	--
			Aluminum	--		--		--	Central Nervous System	4E-01		2E-03	4E-01
			Arsenic	6E-05		3E-07		6E-05	Kidney	2E+00		8E-03	2E+00
			Barium	--		--		--	Kidney	--		--	--
			Cadmium	--		--		--	Kidney	--		--	--
			Chromium	6E-05		7E-07		6E-05	No-Observed-Adverse Effect Level	--		--	--
			Cobalt	--		--		--	Thyroid	--		--	--
			Cyanide	--		--		--	Reproductive System	--		--	--
			Iron	--		--		--	Gastrointestinal Tract	--		--	--
			Manganese	--		--		--	Central Nervous System	3E+01		4E+00	3E+01
			Thallium	--		--		--	Hair	7E+01		3E-01	7E+01
			Vanadium	--		--		--	Hair	2E-01		1E-03	2E-01
			Chemical Total	1E-04		7E-06		1E-04		1E+02		4E+00	1E+02
		Exposure Point Total						1E-04					1E+02
	Exposure Medium Total							1E-04					1E+02
Medium Total								1E-04					1E+02
Receptor Total							Receptor Risk Total	1E-04				Receptor HI Total	1E+02
												Total Central Nervous System HI =	3E+01
												Total Kidney HI =	2E+00
												Total Hair HI =	7E+01

Notes:

Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion

ROD = Record of Decision

HI = hazard index

NA = not applicable

Table 34
Risk Summary
Reasonable Maximum Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Lifetime

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Groundwater	Groundwater	Tap Water Drawn from Shallow Bedrock Aquifer	1,2,3-Trichlorobenzene	--		--		--
			Carbon Tetrachloride	8E-06		2E-06		9E-06
			Chloroform	3E-06		2E-07		3E-06
			Tetrachloroethene	1E-06		5E-07		1E-06
			Trichloroethene	2E-06		3E-07		2E-06
			Bis(2-ethylhexyl)phthalate	1E-05		1E-05		2E-05
			Dimethyl Phthalate	--		--		--
			Aluminum	--		--		--
			Arsenic	1E-04		7E-07		1E-04
			Barium	--		--		--
			Cadmium	--		--		--
			Chromium	1E-04		2E-06		2E-04
			Cobalt	--		--		--
			Cyanide	--		--		--
			Iron	--		--		--
			Manganese	--		--		--
			Thallium	--		--		--
			Vanadium	--		--		--
			Chemical Total	3E-04		2E-05		3E-04
		Exposure Point Total						3E-04
	Exposure Medium Total							3E-04
	Air	Tap Water Drawn from Shallow Bedrock Aquifer	1,2,3-Trichlorobenzene		--			--
			Carbon Tetrachloride		--			--
			Chloroform		3E-06			3E-06
			Tetrachloroethene		--			--
			Trichloroethene		--			--
			Bis(2-ethylhexyl)phthalate		--			--
			Dimethyl Phthalate		--			--
			Chemical Total		3E-06			3E-06
		Exposure Point Total						3E-06
	Exposure Medium Total							3E-06
Medium Total								3E-04
Receptor Total							Receptor Risk Total	3E-04

Notes:
Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion
ROD = Record of Decision

Table 35
Risk Summary - CTE Receptor Risks and Hazards for COPCs
Central Tendency Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Non-Carcinogenic Hazard Quotient				
				Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap Water Drawn from Shallow Bedrock Aquifer	1,2,3-Trichlorobenzene	Body Weight/Thyroid/Liver	--		--	--
			Carbon Tetrachloride	Liver	--		--	--
			Chloroform	Liver	--		--	--
			Tetrachloroethene	Central Nervous System	--		--	--
			Trichloroethene	Immune System/Cardiovascular System	--		--	--
			Bis(2-ethylhexyl)phthalate	Liver	--		--	--
			Dimethyl Phthalate	NA	--		--	--
			Aluminum	Central Nervous System	--		--	--
			Arsenic	Kidney	--		--	--
			Barium	Kidney	--		--	--
			Cadmium	Kidney	--		--	--
			Chromium	No-Observed-Adverse Effect Level	--		--	--
			Cobalt	Thyroid	--		--	--
			Cyanide	Reproductive System	--		--	--
			Iron	Gastrointestinal Tract	--		--	--
			Manganese	Central Nervous System	5E+00		4E-01	5E+00
			Thallium	Hair	1E+01		3E-02	1E+01
			Vanadium	Hair	--		--	--
			Chemical Total		1E+01		4E-01	2E+01
		Exposure Point Total						2E+01

Table 35
Risk Summary - CTE Receptor Risks and Hazards for COPCs
Central Tendency Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Non-Carcinogenic Hazard Quotient				
				Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Exposure Medium Total							2E+01
	Air	Tap Water Drawn from Shallow Bedrock Aquifer	1,2,3-Trichlorobenzene	NA		--		--
			Carbon Tetrachloride	Liver		--		--
			Chloroform	Liver		--		--
			Tetrachloroethene	Central Nervous System		--		--
			Trichloroethene	Immune System/Cardiovascular System		--		--
			Bis(2-ethylhexyl)phthalate	NA		--		--
			Dimethyl Phthalate	NA		--		--
			Chemical Total			--		--
		Exposure Point Total						--
	Exposure Medium Total							--
Medium Total								2E+01
Receptor Total							Receptor HI Total	2E+01
							Total Central Nervous System HI =	5E+00
							Total Hair HI =	1E+01

Notes:

Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion

COPC = contaminant of potential concern

CTE = central Tendency Exposure

ROD = Record of Decision

HI = hazard index

NA = not applicable

Table 36
Risk Summary
Central Tendency Exposure
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Non-Carcinogenic Hazard Quotient				
				Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap Water Drawn from Shallow Bedrock Aquifer	1,2,3-Trichlorobenzene	Body Weight/Thyroid/Liver	--		--	--
			Carbon Tetrachloride	Liver	--		--	--
			Chloroform	Liver	--		--	--
			Tetrachloroethene	Central Nervous System	1E-01		6E-02	2E-01
			Trichloroethene	Immune System/Cardiovascular System	--		--	--
			Bis(2-ethylhexyl)phthalate	Liver	--		--	--
			Dimethyl Phthalate	NA	--		--	--
			Aluminum	Central Nervous System	--		--	--
			Arsenic	Kidney	--		--	--
			Barium	Kidney	--		--	--
			Cadmium	Kidney	--		--	--
			Chromium	No-Observed-Adverse Effect Level	--		--	--
			Cobalt	Thyroid	--		--	--
			Cyanide	Reproductive System	--		--	--
			Iron	Gastrointestinal Tract	--		--	--
			Manganese	Central Nervous System	1E+01		8E-01	1E+01
			Thallium	Hair	3E+01		7E-02	3E+01
			Vanadium	Hair	--		--	--
			Chemical Total		4E+01		1E+00	4E+01
		Exposure Point Total						4E+01
	Exposure Medium Total							4E+01
Medium Total								4E+01
Receptor Total							Receptor HI Total	4E+01
							Total Central Nervous System HI =	1E+01
							Total Hair HI =	3E+01

Notes:
Shading = chemicals associated with unacceptable potential risk and the focus of the ROD discussion
ROD = Record of Decision
NA = not applicable
HI = hazard index

Table 37
Ecological Exposure Pathways Evaluated in the SLERA
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Assessment Endpoint	Exposure Medium	Sensitive Environment Flag (Y or N)	Receptor	Endangered/ Threatened Species Flag (Y or N)	Exposure Route	Measurement Endpoint	Notes
1: Survival, growth, and reproduction of terrestrial ecological receptors	On-site Soil On-site Seep	N	Terrestrial Plants, Terrestrial Invertebrates, Birds, Mammals	N	Direct contact	Chemical toxicity evaluated by comparing maximum-detected concentrations in soil and seep to soil-and surface water-specific ESLs.	[a]
2: Survival, growth, and reproduction of aquatic ecological receptors/ communities utilizing Wissahickon Creek, Tannery Run, and Rose Valley Creek	Off-site Surface Water	N	Fish	N	Direct contact with surface water	Chemical and asbestos toxicity evaluated by comparing maximum-detected concentrations in sediment and surface water to sediment- and surface water-specific ESLs.	
	Off-site Sediment	N	Aquatic Invertebrates	N	Direct contact with sediment		
3: Survival, growth, and reproduction of aquatic ecological receptors/ communities utilizing the reservoir	Reservoir Surface Water	N	Fish	N	Direct contact with surface water	Chemical and asbestos toxicity evaluated by comparing maximum-detected concentrations in sediment and surface water to sediment- and surface water-specific ESLs.	
	Reservoir Sediment	N	Aquatic Invertebrates	N	Direct contact with sediment		
4: Survival, growth, and reproduction of insectivorous birds	On-site Soil	N	American robin (*Turdus migratorius*)	N	Incidental ingestion of soil, ingestion of terrestrial invertebrates (uptake from soil into dietary items)	Estimate daily chemical dietary doses from soil using food chain exposure model. Toxicity evaluated by comparing estimated daily doses to literature-based dietary doses that are associated with adverse effects in birds.	[b]
5: Survival, growth, and reproduction of insectivorous mammals	On-site Soil	N	Short-tailed shrew (*Blarina brevicauda*)	N	Incidental ingestion of soil, ingestion of terrestrial invertebrates (uptake from soil into dietary items)	Estimate daily chemical and asbestos dietary doses from soil using food chain exposure model. Toxicity evaluated by comparing estimated daily doses to literature-based dietary doses that are associated with adverse effects in mammals.	
					Inhalation of asbestos during burrowing activities	Estimate inhalation exposures for asbestos fibers released from soils. Toxicity evaluated by comparing literature-based inhalation exposure doses that are associated with adverse effects in mammals.	

Table 37
Ecological Exposure Pathways Evaluated in the SLERA
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Assessment Endpoint	Exposure Medium	Sensitive Environment Flag (Y or N)	Receptor	Endangered/ Threatened Species Flag (Y or N)	Exposure Route	Measurement Endpoint	Notes
6: Survival, growth, and reproduction of piscivorous birds utilizing Wissahickon Creek, Tannery Run, and Rose Valley Creek	Off-site Sediment	N	Green heron (*Butorides virescens*)	N	Incidental ingestion of sediment, ingestion of fish (uptake from sediment into dietary items)	Estimate daily chemical dietary doses from sediment using food chain exposure model. Toxicity evaluated by comparing estimated daily doses to literature-based dietary doses that are associated with adverse effects in birds.	[b]
7: Survival, growth, and reproduction of piscivorous mammals utilizing Wissahickon Creek, Tannery Run, and Rose Valley Creek	Off-site Sediment	N	Mink (*Mustela vison*)	N	Incidental ingestion of sediment, ingestion of fish (uptake from sediment into dietary items)	Estimate daily chemical and asbestos dietary doses from sediment using food chain exposure model. Toxicity evaluated by comparing estimated daily doses to literature-based dietary doses that are associated with adverse effects in mammals.	
8: Survival, growth, and reproduction of piscivorous birds utilizing the Reservoir parcel	Reservoir Sediment	N	Green heron (*Butorides virescens*)	N	Incidental ingestion of sediment, ingestion of fish (uptake from sediment into dietary items)	A food chain exposure model was used to estimate daily dietary doses from chemicals detected in reservoir sediment. The estimated daily doses were then compared with literature-based dietary doses that are associated with adverse effects in birds.	[b]
9: Survival, growth, and reproduction of piscivorous mammals utilizing the Reservoir parcel	Reservoir Sediment	N	Mink (*Mustela vison*)	N	Incidental ingestion of sediment, ingestion of fish (uptake from sediment into dietary items)	A food chain exposure model was used to estimate daily dietary doses from chemicals and asbestos detected in reservoir sediment. The estimated daily doses were then compared with literature-based dietary doses that are associated with adverse effects in mammals.	

Notes:

[a] Because there are no asbestos ESLs for terrestrial receptors, asbestos could not be evaluated in this measurement endpoint for soil.

[b] Because avian toxicity data are not available for asbestos, risk via ingestion for the American robin and green heron was not evaluated for asbestos.

ESL = Ecological Screening Level

SLERA = Screening Level Ecological Risk Assessment

Y = Yes

N = No

Table 38
Occurrence and Selection of Chemicals of Concern for Direct Contact Exposure Scenarios
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Panel A: On-site Soil

Chemical	CAS	Minimum Concentration Detected		Maximum Concentration Detected		Screening Level [1,2,3]	Hazard Quotient	COC flag (Y or N)
Semi-Volatile Organic Compounds (µg/kg)								
1,2-Benzphenanthracene [4]	218-01-9	42	J	2900		1100	3E+00	N
Benzo(a)anthracene [4]	56-55-3	37	J	3100		1100	3E+00	N
Benzo(a)pyrene [4]	50-32-8	48	J	3000		1100	3E+00	N
Benzo(b)fluoranthene [4]	205-99-2	25	J	3800		1100	3E+00	N
Benzo(g,h,i)perylene [4]	191-24-2	55	J	1900		1100	2E+00	N
Benzo(k)fluoranthene [4]	207-08-9	26	J	2600		1100	2E+00	N
Benzyl butyl phthalate	85-68-7	22	J	420	J	239	2E+00	N
Bis(2-ethylhexyl)phthalate	117-81-7	23	J	280000		925	3E+02	Y
Fluoranthene [4]	206-44-0	35	J	7200		1100	7E+00	N
Indeno(1,2,3-c,d)pyrene [4]	193-39-5	31	J	2000		1100	2E+00	N
Pyrene [4]	129-00-0	29	J	5100		1100	5E+00	N
Pesticides (µg/kg)								
4,4'-DDT	50-29-3	0.11	J	60		21	3E+00	N
Endrin ketone [5]	53494-70-5	0.034	J	12	J	10.1	1E+00	N
Dioxins/Furans (pg/g) [6]								
Total TEQ	NA	2.8		49.5		0.20	2E+02	Y
Inorganics (mg/kg)								
Aluminum	7429-90-5	3220		20900		50	4E+02	N
Antimony	7440-36-0	1.5	J	2.4	J	0.27	9E+00	N
Cadmium	7440-43-9	0.21	J	2.3		0.36	6E+00	N
Chromium [7]	7440-47-3	8.3		124		26	5E+00	Y
Cobalt	7440-48-4	5.1	J	22.9		13	2E+00	N
Copper	7440-50-8	9.6		80.5		28	3E+00	N
Lead	7439-92-1	14.9		178		11	2E+01	N
Manganese	7439-96-5	108		1370	J	220	6E+00	N
Mercury	7439-97-6	0.037	J	5		0.1	5E+01	N
Nickel	7440-02-0	8.6		345		38	9E+00	Y
Thallium	7440-28-0	2.4	B	3.1		1	3E+00	N
Vanadium	7440-62-2	13.2		38.6		7.8	5E+00	N
Zinc	7440-66-6	25.1		2440		46	5E+01	Y

Notes:

1. Primary Screening Value. EPA Ecological Soil Screening Levels (ECO SSLs). http://www.epa.gov/oswer/riskassessment/ecorisk/ecossl.htm
2. Secondary Screening Values. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision.
3. Tertiary Screening Values. EPA Region 5 RCRA Ecological Screening Levels. http://epa.gov/region05/waste/cars/pdfs/ecological-screening-levels-200308.pdf
4. High molecular weight PAH; screening value used is for high molecular weight PAHs.
5. Value for endrin
6. Values are the sum of total minimum and maximum Toxic Equivalent Values (TEQ) to 2,3,7,8 TCDD for all samples.
7. Value for chromium III

µg/kg = micrograms per kilogram
CAS = Chemical Abstract Services
COC = chemical of concern
J = estimated value
mg/kg = milligrams per kilogram
pg/g = picograms per gram
EPA = United States Environmental Protection Agency

Y = Yes
N = No
PAH = polycyclic aromatic hydrocarbon
TCDD = tetrachlorodibenzo-p-dioxin

Table 38
Occurrence and Selection of Chemicals of Concern for Direct Contact Exposure Scenarios
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Panel B: Off-site Creek Sediment

Chemical	CAS	Minimum Concentration Detected		Maximum Concentration Detected		Screening Level [1]	Hazard Quotient	COC flag (Y or N)
Semi-Volatile Organic Compounds (µg/kg)								
1,2-Benzphenanthracene	218-01-9	120	J	1300		166	8E+00	N
Acenaphthene	83-32-9	25	J	140	J	6.7	2E+01	N
Acenaphthylene	208-96-8	25	J	26	J	5.9	4E+00	N
Anthracene	120-12-7	44	J	330		57.2	6E+00	N
Benzo(a)anthracene	56-55-3	170	J	1200		108	1E+01	N
Benzo(a)pyrene	50-32-8	150	J	1000		150	7E+00	N
Benzo(b)fluoranthene [2]	205-99-2	170	J	1300		190	7E+00	N
Benzo(g,h,i)perylene	191-24-2	46	J	420		170	2E+00	N
Benzo(k)fluoranthene	207-08-9	64	J	540		240	2E+00	N
Bis(2-ethylhexyl)phthalate	117-81-7	26	B	180	B	180	1E+00	N
Fluoranthene	206-44-0	250		2700		423	6E+00	N
Fluorene	86-73-7	38	J	180	J	77.4	2E+00	N
Indeno(1,2,3-c,d)pyrene	193-39-5	69	J	570		17	3E+01	N
Phenanthrene	85-01-8	170	J	1900		204	9E+00	N
Pyrene	129-00-0	260		2200	J	195	1E+01	N
Pesticides/PCBs (µg/kg)								
Aroclor-1254 [3]	11097-69-1	5.2	J	71		59.8	1E+00	N
4,4'-DDT	50-29-3	0.08	J	7.5		4.16	2E+00	N
Dieldrin	60-57-1	0.64	J	8.3		1.9	4E+00	N
Endrin ketone [4]	53494-70-5	0.047	J	4.7	J	2.22	2E+00	N
Inorganics (mg/kg)								
Iron	7439-89-6	6250		22100		20000	1E+00	N
Lead	7439-92-1	13.1	K	53.2	K	35.8	1E+00	N
Manganese	7439-96-5	195		2010		460	4E+00	N
Zinc	7440-66-6	46.4		153		121	1E+00	N

Notes:

1. EPA Region III Freshwater Sediment Screening Benchmarks. http://www.epa.gov/reg3hscd/risk/eco/btag/sbv/fwsed/screenbench.htm
2. High molecular weight PAH; screening value used is for high molecular weight PAHs.
3. Value for total PCBs
4. Value for endrin

µg/kg = micrograms per kilogram
B = not detected substantially above the level reported in laboratory or field blank
CAS = Chemical Abstract Services
COC = chemical of concern
J = estimated value
K = chemical present, but reported value may be biased high; actual value expected to be lower
mg/kg = milligrams per kilogram
PCB = polychlorinated biphenyl
EPA = United States Environmental Protection Agency

Y = Yes
N = No
PAH = polycyclic aromatic hydrocarbon

Table 38
Occurrence and Selection of Chemicals of Concern for Direct Contact Exposure Scenarios
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Panel C: On-site Reservoir Sediment

Chemical	CAS	Minimum Concentration Detected		Maximum Concentration Detected		Screening Level [1]	Hazard Quotient	COC flag (Y or N)
Volatile Organic Compounds (µg/kg)								
Carbon disulfide [2]	75-15-0	4.1	J	46	J	4.1	1E+01	Y
Semi-Volatile Organic Compounds (µg/kg)								
1,2-Benzphenanthracene	218-01-9	32	J	410	J	166	2E+00	N
Anthracene	120-12-7	120	J	120	J	57.2	2E+00	N
Benzo(a)anthracene	56-55-3	35	J	410	J	108	4E+00	N
Benzo(a)pyrene	50-32-8	31	J	370	J	150	2E+00	N
Benzo(b)fluoranthene [3]	205-99-2	44	J	470		190	2E+00	N
Bis(2-ethylhexyl)phthalate	117-81-7	51	J	230	J	180	1E+00	N
Dibenzo(a,h)anthracene	53-70-3	65	J	65	J	33	2E+00	N
Fluoranthene	206-44-0	50	J	910		423	2E+00	N
Indeno(1,2,3-c,d)pyrene	193-39-5	92	J	190	J	17	1E+01	N
Phenanthrene	85-01-8	480		480		204	2E+00	N
Pyrene	129-00-0	43	J	720		195	4E+00	N
Pesticides/PCBs (µg/kg)								
Endrin ketone [4]	53494-70-5	0.057	J	3.5	J	2.22	2E+00	N
Inorganics (mg/kg)								
Cadmium	7440-43-9	0.3	J	2	J	0.99	2E+00	N
Chromium	7440-47-3	2.8		65.5		43.4	2E+00	N
Copper	7440-50-8	2.7	J	90.9		31.6	3E+00	N
Iron	7439-89-6	1590		25600		20000	1E+00	N
Lead	7439-92-1	2.8		96		35.8	3E+00	N
Manganese	7439-96-5	38.3		542		460	1E+00	N
Mercury	7439-97-6	0.12	J	0.36	J	0.18	2E+00	N
Nickel	7440-02-0	1.8	J	82.9		22.7	4E+00	N
Zinc	7440-66-6	11.3		354		121	3E+00	N

Notes:

1. EPA Region III Freshwater Sediment Screening Benchmarks. http://www.epa.gov/reg3hscd/risk/eco/btag/sbv/fwsed/screenbench.htm
2. Screening values adjusted for carbon content using the total organic carbon concentration from the location used in the screening excercise.
3. High molecular weight PAH; screening value used is for high molecular weight PAHs.
4. Value for endrin

µg/kg = micrograms per kilogram
CAS = Chemical Abstract Services
COC = chemical of concern
J = estimated value
mg/kg = milligrams per kilogram
PCB = polychlorinated biphenyl

EPA = United States Environmental Protection Agency
Y = Yes
N = No
PAH = polycyclic aromatic hydrocarbon

Table 38
Occurrence and Selection of Chemicals of Concern for Direct Contact Exposure Scenarios
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Panel D: Off-site Creek Surface Water

Chemical	CAS	Minimum Concentration Detected		Maximum Concentration Detected		Screening Level [1]	Hazard Quotient	COC flag (Y or N)
Pesticides (µg/L)								
Methoxyclor	72-43-5	0.025	B	0.051	B	0.019	3E+00	N
Inorganics (µg/L)								
Aluminum	7429-90-5	118	J	212		87	2E+00	N
Barium	7440-39-3	107	J	179	J	4	4E+01	N
Iron	7439-89-6	77.4	B	1050		300	4E+00	N
Lead	7439-92-1	2.8	J	6.3	J	2.5	3E+00	N
Manganese	7439-96-5	13.6	J	334		120	3E+00	N
Asbestos (MFL, based on fibers longer than 10 µm)								
Total asbestos [2]	1332-21-4	0.18		30		0.0001	3E+05	N

Panel E: On-site Reservoir Surface Water

Chemical	CAS	Minimum Concentration Detected		Maximum Concentration Detected		Screening Level [1]	Hazard Quotient	COC flag (Y or N)
Inorganics (µg/L)								
Aluminum	7429-90-5	107	B	3520		87	4E+01	N
Arsenic	7440-38-2	3.7	J	5.1	J	5	1E+00	N
Barium	7440-39-3	69.1	J	297		4	7E+01	N
Copper	7440-50-8	23.2	J	23.2	J	9	3E+00	N
Iron	7439-89-6	78.2	B	3930		300	1E+01	N
Lead	7439-92-1	3.6	J	54.4		2.5	2E+01	N
Manganese	7439-96-5	40.2		311		120	3E+00	N
Vanadium	7440-62-2	22.3	J	22.3	J	20	1E+00	N
Zinc	7440-66-6	176		176		120	1E+00	N
Asbestos (MFL, based on fibers longer than 10 µm)								
Total asbestos [2]	1332-21-4	1.8		640		0.0001	6E+06	Y

Panel F: On-site Seep

Chemical	CAS	Minimum Concentration Detected		Maximum Concentration Detected		Screening Level [1]	Hazard Quotient	COC flag (Y or N)
Inorganics (µg/L)								
Aluminum	7429-90-5	554		554		87	6E+00	N
Barium	7440-39-3	65.5	J	65.5	J	4	2E+01	N
Iron	7439-89-6	708		708		300	2E+00	N
Thallium	7440-28-0	6.3	B	6.3	B	0.8	8E+00	N
Asbestos (MFL, based on fibers longer than 10 µm)								
Total asbestos [2]	1332-21-4	5.1		5.1		0.0001	5E+04	N

Notes:

1. EPA Region III Freshwater Screening Benchmarks. http://www.epa.gov/reg3hscd/risk/eco/btag/sbv/fw/screenbench.htm
2. Screening value for asbestos is the lowest no observed effect concentration reported for effects to growth, reproduction, and survival of aquatic invertebrates or fish. Screening level is based on all fibers (i.e., it is not based on fibers longer than 10 µm, which is the reported concentration unit for Site collected samples).

µg/L = micrograms per liter
B = not detected substantially above the level reported in laboratory or field blank
CAS = Chemical Abstract Services
COC = chemical of concern
EPA = United States Environmental Protection Agency
Y = Yes
N = No
MFL = millions fibers per liter
J = estimated value
µm = micrometers

Table 39
Occurrence and Selection of Chemicals of Concern for Wildlife Exposure Scenarios
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Panel A: On-site Soil

Receptor	Chemical	Soil EPC (mg/kg)	Dose (mg/kg/d)	LOAEL TRV (mg/kg/d)	LOAEL HQ	NOAEL TRV (mg/kg/d)	NOAEL HQ	COC Flag (Y or N)
Robin	Lead	102	27	11.3	**2E+00**	1.13	2E+01	N
	Zinc	1754	2278	131	**2E+01**	14.5	2E+02	Y
	Benzo(a)anthracene	2.6	8.6	20	4E-01	2	4E+00	N
	Benzo(a)pyrene	2.5	7.1	20	4E-01	2	4E+00	N
	Benzo(b)fluoranthene	3.7	20	20	1E+00	2	1E+01	N
	Benzo(g,h,i)perylene	1.6	9.5	20	5E-01	2	5E+00	N
	Benzo(k)fluoranthene	2.1	11	20	5E-01	2	5E+00	N
	Dibenzo(a,h)anthracene	0.71	3.4	20	2E-01	2	2E+00	N
	Fluoranthene	6.0	37	20	**2E+00**	2	2E+01	N
	Indeno(1,2,3-c,d)pyrene	1.7	10	20	5E-01	2	5E+00	N
	Pyrene	4.3	16	20	8E-01	2	8E+00	N
	4,4'-DDT	0.039	0.10	0.028	**4E+00**	0.003	3E+01	N
	Aroclor-1260	0.15	0.37	1.8	2E-01	0.18	2E+00	N
	2,3,7,8-TCDD	0.000044	0.00014	0.00014	**1E+00**	0.000014	1E+01	Y
Shrew	Arsenic	2.3	0.23	1.5	2E-01	0.15	2E+00	N
	Zinc	1754	665	703.3	9E-01	351.7	2E+00	N
	Benzo(a)anthracene	2.6	2.7	6.15	4E-01	0.615	4E+00	N
	Benzo(a)pyrene	2.5	2.2	11.89	2E-01	1.19	2E+00	N
	Benzo(b)fluoranthene	3.7	6.1	6.15	1E+00	0.615	1E+01	N
	Benzo(g,h,i)perylene	1.6	3.0	6.15	5E-01	0.615	5E+00	N
	Benzo(k)fluoranthene	2.1	3.4	6.15	6E-01	0.615	6E+00	N
	Dibenzo(a,h)anthracene	0.71	1.0	6.15	2E-01	0.615	2E+00	N
	Fluoranthene	6.0	12	6.15	**2E+00**	0.615	2E+01	N
	Indeno(1,2,3-c,d)pyrene	1.7	3.0	6.15	5E-01	0.615	5E+00	N
	Pyrene	4.3	4.8	6.15	8E-01	0.615	8E+00	N
	Aroclor-1248	0.10	0.07	0.427	2E-01	0.043	2E+00	N
	Aroclor-1260	0.15	0.11	0.668	2E-01	0.067	2E+00	N
	Dioxins/Furans	0.000044	0.000044	0.000022	**2E+00**	0.0000022	2E+01	Y
	Asbestos	200000	130400	777	**2E+02**	656	2E+02	Y

Panel B: Off-site Creek Sediment

Receptor	Chemical	Sediment EPC (mg/kg)	Dose (mg/kg/d)	LOAEL TRV (mg/kg/d)	LOAEL HQ	NOAEL TRV (mg/kg/d)	NOAEL HQ	COC Flag (Y or N)
Heron	Zinc	112	4E+01	131	3E-01	14.5	3E+00	N
Mink	Arsenic	5	2E-01	0.524	4E-01	0.052	5E+00	N
	Asbestos	8,000	2E+03	777	**2E+00**	656	3E+00	N

Panel C: On-site Reservoir Sediment

No COCs identified for wildlife (heron, mink) exposures

Notes:

Bold indicates LOAEL HQ > 1

COC = chemical of concern

EPC = exposure point concentration

HQ = hazard quotient

LOAEL = lowest observed adverse effect level

mg/kg = milligrams per kilogram

mg/kg/day = milligram per kilogram body weight per day

NOAEL = no observed adverse effect level

TRV = toxicity reference value

Y = Yes

N = No

Table 40
COPCs from the Screening Level Ecological Risk Assessment
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

COPC	Units	Range of Detections	Hazard Quotient[1]	Screening Level[2,3,4]	Background Range	Chemical of Concern	Cleanup Level	Rationale
Soil/Waste								
1,2-benzphenanthracene	µg/kg	42 J - 2900	2.6	1100	160 J - 1300 J	N	NA	Detect range near background range; common constituent in urban soils
Benzo(a)anthracene	µg/kg	37 J - 3100	2.8	1100	140 J - 1100 J	N	NA	Detect range near background range; common constituent in urban soils
Benzo(a)pyrene	µg/kg	48 J - 3000	2.7	1100	130 J - 1100 J	N	NA	Detect range near background range; common constituent in urban soils
Benzo(b)fluoranthene	µg/kg	25 J - 3800	3.5	1100	180 J - 1500 J	N	NA	Detect range near background range; common constituent in urban soils
Benzo(g,h,i)perylene	µg/kg	55 J - 1900	1.7	1100	310 J - 670 J	N	NA	Detect range near background range; common constituent in urban soils
Benzo(k)fluoranthene	µg/kg	26 J - 2600	2.4	1100	280 J - 520 J	N	NA	Detect range near background range; common constituent in urban soils
Benzyl butyl phthalate	µg/kg	22 J - 420 J	1.8	239	ND	N	NA	Maximum detection near screening level
Bis(2-ethylhexyl)phthalate	**µg/kg**	**23 J - 280000**	**303**	**925**	**ND**	**Y**	**Yes**	**One location (former fire training area) of maximum detect three magnitudes higher than screening level**
Fluoranthene	µg/kg	35 J - 7200	6.5	1100	96 J - 2500 J	N	NA	Detect range near background range; common constituent in urban soils
Indeno(1,2,3-c,d)pyrene	µg/kg	31 J - 2000	1.8	1100	350 J - 710 J	N	NA	Detect range near background range; common constituent in urban soils
4,4-DDT	µg/kg	0.11 J - 60	2.9	21	NA	N	NA	Maximum detection near screening level
Endrin Ketone	µg/kg	0.034 J - 12 J	1.2	10.1	NA	N	NA	Maximum detection near screening level
Dioxin and Furans	**ng/kg**	**2.8 - 49.5**	**249**	**0.199**	**NA**	**Y**	**Yes**	**Elevated HQ**
Aluminum	mg/kg	3220 - 20900	418	50	8530 - 12400	N	NA	Detect range near background range
Antimony	mg/kg	1.5 J - 2.4 J	8.9	0.27	0.34 J - 0.81 J	N	NA	Detect range near background range
Cadmium	mg/kg	0.21 J - 2.3	6.4	0.36	0.03 J- - 0.4 J	N	NA	Detect range near background range
Chromium	**mg/kg**	**8.3 - 124**	**4.8**	**26**	**13 - 21.1**	**Y**	**Yes**	**Maximum detection one magnitude greater than background**
Cobalt	mg/kg	5.1 J - 22.9	1.8	13	5.3 J - 11.5 J	N	NA	Detect range near background range
Copper	mg/kg	9.6 J - 80.5	2.9	28	3.9 - 26.7	N	NA	Detect range near background range
Lead	mg/kg	14.9 - 178	16.2	11	15.6 J - 80.5 J	N	NA	Qualitative analysis completed for RI did not indicate disposed waste as potential source for lead
Manganese	mg/kg	108 - 1370 J	6.2	220	268 J - 1030 J	N	NA	Detect range near background range
Mercury	mg/kg	0.037 J - 5	50	0.1	0.025 J - 0.23 J	N	NA	Qualitative analysis completed for RI did not indicate disposed waste as potential source for mercury
Nickel	**mg/kg**	**8.6 - 345**	**9.1**	**38**	**8.8 J - 19.4 J**	**Y**	**Yes**	**Maximum detection one magnitude greater than background**
Thallium	mg/kg	2.4 B - 3.1	3.1	1	ND	N	NA	Detect range near background range
Vanadium	mg/kg	13.2 - 38.6	4.9	7.8	18.6 J - 29.5 J	N	NA	Detect range near background range
Zinc	**mg/kg**	**25.1 - 2440**	**53**	**46**	**20.6 - 104**	**Y**	**Yes**	**Maximum detection one magnitude greater than background**
Total asbestos	**%**	**0.1 - 20**	**NC**	**NSL**	**NA**	**Y**	**Yes**	**Known site contaminant that is not naturally occurring in the Site area**
Reservoir Sediment								
Carbon disulfide	**µg/kg**	**4.1 J - 46 J**	**11**	**4.1**	**ND**	**Y**	**Yes**	**Elevated HQ**
1,2-benzphenanthracene	µg/kg	32 J - 410 J	2.5	166	82 J - 850	N	NA	Detect range near background range; common constituent in urban sediment
Anthracene	µg/kg	120 J - 120 J	2.1	57.2	ND - 210	N	NA	Detect range near background range; common constituent in urban sediment
Benzo(a)anthracene	µg/kg	35 J - 410 J	3.8	108	79 J - 730	N	NA	Detect range near background range; common constituent in urban sediment
Benzo(a)pyrene	µg/kg	31 J - 370 J	2.5	150	84 J - 540	N	NA	Detect range near background range; common constituent in urban sediment
Benzo(b)fluoranthene	µg/kg	44 J - 470 J	2.5	190	96 J - 470	N	NA	Detect range near background range; common constituent in urban sediment
Bis(2-ethylhexyl)phthalate	µg/kg	51 J - 230 J	0.7	180	ND	N	NA	HQ less than 1
Dibenzo(a,h)anthracene	µg/kg	65 J - 65 J	1.3	33	ND	N	NA	Common constituent in urban sediment
Fluoranthene	µg/kg	50 J - 910	2.2	423	110 J - 810	N	NA	Detect range near background range; common constituent in urban sediment
Indeno(1,2,3-c,d)pyrene	µg/kg	92 J - 190 J	11	17	53 J - 150 J	N	NA	Detect range near background range; common constituent in urban sediment
Phenanthrene	µg/kg	480 - 480	2.4	204	61 J - 570	N	NA	Detect range near background range; common constituent in urban sediment
Pyrene	µg/kg	43 J - 720	3.7	195	130 J - 1900	N	NA	Detect range near background range; common constituent in urban sediment
Cadmium	mg/kg	0.3 J - 2 J	2.0	0.99	ND - 0.2 J	N	NA	Detect range near background range
Chromium	mg/kg	2.8 - 65.5	1.5	43.4	17.6 - 20.3	N	NA	Detect range near background range
Copper	mg/kg	2.7 J - 90.9	2.9	31.6	15 J - 15.3 J	N	NA	Detect range near background range
Lead	mg/kg	2.8 - 96	2.7	35.8	11.4 K - 27.5 K	N	NA	Detect range near background range
Manganese	mg/kg	38.3 - 542	1.2	460	341 - 447	N	NA	Detect range near background range
Mercury	mg/kg	0.12 J - 0.36 J	2.0	0.18	0.036 J - 0.043 J	N	NA	Detect range near background range
Nickel	mg/kg	1.8 J - 82.9	3.7	22.7	14.1 - 16	N	NA	Detect range near background range
Zinc	mg/kg	11.3 - 354	2.9	121	73.9 - 95.1	N	NA	Detect range near background range

Table 40
COPCs from the Screening Level Ecological Risk Assessment
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

COPC	Units	Range of Detections	Hazard Quotient[1]	Screening Level[2,3,4]	Background Range	Chemical of Concern	Cleanup Level	Rationale
Reservoir Surface Water								
Aluminum	**µg/L**	**107 B - 3520**	**40**	**87**	**ND**	**Y**	**Yes**	**Elevated HQ**
Arsenic	µg/L	3.7 J - 5.1 J	1.0	5	ND	N	NA	Low HQ
Barium	µg/L	69.1 J - 297	74	4	107 J	N	NA	Detections near background concentration
Copper	µg/L	23.2 J - 23.2 J	3	9	ND	N	NA	Low HQ
Iron	**µg/L**	**78.2 B - 3930**	**13**	**300**	**161 B**	**Y**	**Yes**	**Detection maximum one magnitude above background and elevated HQ**
Lead	**µg/L**	**3.6 J - 54.4**	**22**	**2.5**	**3 J**	**Y**	**Yes**	**Detection maximum one magnitude above background and elevated HQ**
Manganese	µg/L	40.2 - 311	3	120	34.4	N	NA	Low HQ
Vanadium	µg/L	22.3 J - 22.3 J	1.1	20	ND	N	NA	Low HQ
Zinc	µg/L	176 - 176	1.5	120	ND	N	NA	Low HQ
Total asbestos[5]	**MFL**	**1.8 - 640**	**6,400,000**	**0.0001**	**0**	**Y**	**Yes**	**Very high HQ**
Seep Water								
Aluminum	**µg/L**	**554 - 554**	**40**	**87**	**ND**	**Y**	**Yes**	**Elevated HQ**
Barium	µg/L	65.5 J - 65.5 J	1.0	5	107 J	N	NA	Low HQ
Iron	**µg/L**	**708 - 708**	**74**	**4**	**161 B**	**Y**	**Yes**	**High HQ**
Thallium	µg/L	6.3 B - 6.3 B	3	9	ND	N	NA	Low HQ
Total asbestos[5]	**MFL**	**5.1 - 5.1**	**51,000**	**0.0001**	**0**	**Y**	**Yes**	**Very high HQ**

Notes:
Bolded contaminants indicate the COPC is a proposed COC for the respective media and receptor type.
1. Hazard quotient based on maximum concentration and reported in the Screening Level Ecological Risk Assessment of the *Final Remedial Investigation Report, BoRit Asbestos Superfund Site, Operable Unit 1, Ambler, Pennsylvania* (CDM Smith 2013).
2. Soil Screening Levels
- Primary Screening Value. USEPA Ecological Soil Screening Levels (Eco-SSLs). 2005 https://www.epa.gov/risk/ecological-soil-screening-level-eco-ssl-guidance-and-documents.
- Secondary Screening Values. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision. U.S. DOE 1997b.
Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. U.S. DOE 1997a.
- Tertiary Screening Values. USEPA Region 5 RCRA Ecological Screening Levels. 2003. http://epa.gov/region05/waste/cars/pdfs/ecological-screening-levels-200308.pdf.
3. Reservoir Sediment Screening Levels
- USEPA Region III Freshwater Sediment Screening Benchmarks. 2006. https://www.epa.gov/sites/production/files/2015-09/documents/r3_btag_fw_sediment_benchmarks_8-06.pdf
4. Reservoir Surface Water and Seep Screening Levels
- USEPA Region III Freshwater Screening Benchmarks. 2006. https://www.epa.gov/sites/production/files/2015-09/documents/r3_btag_fw_benchmarks_07-06.pdf.
5. Screening value for asbestos is the lowest no observed adverse effect concentration reported for effects to growth, reproduction, and survival of aquatic invertebrates or fish (see Appendix C of the *Final Remedial Investigation Report* [CDM Smith 2013]).
Screening level is based on all fibers (i.e., it is not based on fibers longer than 10 µm, which is the reported concentration unit for site collected samples).

% = percent
µg/kg = micrograms per kilogram
µg/L = micrograms per liter
µm = micrometers
B = not detected substantially above the level reported in laboratory or field blank
COPC = chemical of potential concern
COC = chemical of concern
HHRA = Human Health Risk Assessment
HQ = hazard quotient
J = Analyte present. Reported value may not be accurate or precise
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower
N = No
MCL = Maximum Contaminant Level
MFL = million fibers per liter
mg/kg = milligrams per kilogram
NA = not applicable
NC = not calculated
ND = not detected
NSL = no screening value
RCRA = Resource Conservation and Recovery Act
SLERA = Screening Level Ecological Risk Assessment
Y = Yes

Table 41
Identification of Chemicals of Concern and Cleanup Levels for Remedial Alternative Development
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Site-Related Human Health COCs - Soil/Waste

COC	Range of Detections (PCME s/cc)	Cancer Risk Level *1E-06*	Cancer Risk Level *1E-05*	Cancer Risk Level *1E-04*	HI *HI = 1*	Background Range (f/cc)	Cleanup Levels (f/cc)	Rationale for Cleanup Levels
Asbestos (based on air sampling)								
Park parcel (ABS)	**0 - 0.46**	**NE**	**NE**	**0.04**	**NE**	**NA**	**0.04**	**Risk level set at 1E-04**
Asbestos Pile parcel (ABS)	**0 - 0.13**	**NE**	**NE**	**0.04**	**NE**		**0.04**	**Risk level set at 1E-04**
Reservoir parcel (ABS)	**0**	**NE**	**NE**	**0.04**	**NE**		**0.04**	**Risk level set at 1E-04; ABS did not result in an unacceptable risk; however, exposed ACM debris is located on the Reservoir berm.**
Ambient Air	0 - 0.0012	NE	NE	0.001	NE	0	0.001	One detect (CM01-AA-HD12) above 0.001 PCME s/cc

Site-Related Ecological COCs - Soil/Waste

COC	Units	Range of Detections	HQ[1]	HQ using 95% UCL	Screening Level[2,3,4]	Background Range	Rationale for cleanup level development	Cleanup Levels (f/cc)	Rationale for Cleanup Levels
Bis(2-ethylhexyl)phthalate	**µg/kg**	**23 J - 280000**	**303**	**82**	**925**	**ND**	**Maximum detections tied to former fire training area**	**925**	**ESL**
Dioxin and Furans	**ng/kg**	**2.8 - 49.5**	**249**	**105**	**0.199**	**NA**	**Maximum detections tied to former fire training area**	**0.199**	**ESL**
Chromium	**mg/kg**	**8.3 - 124**	**4.8**	**NC**	**26**	**13 - 21.1**	**Qualitative analysis completed for RI indicated that disposed waste may be source for chromium**	**26**	**ESL**
Nickel	**mg/kg**	**8.6 - 345**	**9.1**	**2.7**	**38**	**8.8 J - 19.4 J**	**Qualitative analysis completed for RI indicated that disposed waste may be source for nickel**	**38**	**ESL**
Zinc	**mg/kg**	**25.1 - 2440**	**53**	**11**	**46**	**20.6 - 104**	**Qualitative analysis completed for RI indicated that disposed waste may be source for zinc**	**104**	**Maximum Background Concentration**
Total asbestos	**%**	**0.1 - 20**	**NC**	**NC**	**NSL**	**NA**	**Site history**	**25 WHO f/cc in air**	**ESLs for asbestos are not available; however, the SLERA indicated a potential for risk from exposure to asbestos in air. The SLERA also indicated risk from exposure to asbestos to the short-tailed shrew using a food-chain model. (SLERA did not evaluate asbestos risk to avian communities as avian toxicity data are not available for asbestos.) A surrogate cleanup level is proposed for soil. The proposed cleanup level is the NOAEL TRV for inhalation.**

Site-Related Ecological COCs - Reservoir Sediment

COC	Units	Range of Detections	HQ[1]	HQ using 95% UCL	Screening Level[5]	Background Range	Rationale for cleanup level development	Cleanup Levels (f/cc)	Rationale for Cleanup Levels
Carbon disulfide	**µg/kg**	**4.1 J - 46 J**	**11**	**6**	**4.1**	**ND**	**Insufficient information to eliminate**	**4.1**	**ESL**
Total asbestos	**%**	**0.1 - 0.5**	**0.1**	**NC**	**5 (Endrin)**	**NA**	**Site history**	**0.0001 MFL in Reservoir surface water**	**Although there were no detections above the screening level, a surrogate cleanup level is proposed for Reservoir sediment based on the risk to ecological receptors that may occur from exposure to asbestos in surface water that may be released from Reservoir sediment. The surface water ESL is proposed as the cleanup level.**

Notes:
Bolded contaminants indicate the COPC is a proposed COC for the respective media and receptor type.
1. Hazard quotient based on maximum concentration and reported in the SLERA of the *Final Remedial Investigation Report, BoRit Asbestos Superfund Site, Operable Unit 1, Ambler, Pennsylvani* (CDM Smith 2013).
2. Primary Screening Value. EPA Ecological Soil Screening Levels (Eco-SSLs). 2005 https://www.epa.gov/risk/ecological-soil-screening-level-eco-ssl-guidance-and-documents.
3. Secondary Screening Values. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision. U.S. DOE 1997b.
Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. U.S. DOE 1997a.
4. Tertiary Screening Values. EPA Region 5 RCRA Ecological Screening Levels. 2003. http://epa.gov/region05/waste/cars/pdfs/ecological-screening-levels-200308.pdf.
5. EPA Region III Freshwater Sediment Screening Benchmarks. 2006. https://www.epa.gov/sites/production/files/2015-09/documents/r3_btag_fw_sediment_benchmarks_8-06.pdf.

% = percent
µg/kg = micrograms per kilogram
µm = micrometers
ABS = activity-based sampling
ACM = asbestos-containing material
COC = chemical of concern
COPC = chemical of potential concern
ESL = ecological screening level
f/cc = fibers per cubic centimeter
HI = hazard index
HQ = hazard quotient
J = Analyte present. Reported value may not be accurate or precise.
MCL = Maximum Contaminant Level
MFL = million fibers per liter
mg/kg = milligrams per kilogram
NA = not applicable
NC = not calculated
ND = not detected
NE = not evaluated
ng/kg = nanograms per kilogram
NOAEL = no observed adverse effect level
NSL = no screening value
PCME = phase contrast microscopy equivalent
RCRA = Resource Conservation and Recovery Act
RI = remedial investigation
s/cc = structures per cubic centimeter
SLERA = Screening Level Ecological Risk Assessment
TRV = toxicity reference value
UCL = upper confidence level
EPA = United States Environmental Protection Agency
WHO = World Health Organization

Table 42
Target Media, Chemicals of Concern, and Cleanup Levels
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Soil/Waste					
Chemical of Concern	**Cleanup Levels**				**Basis**
	Soil	**Air (ABS)**	**Air (Ambient)**	--	
Asbestos	--	0.04 f/cc (ABS)(PCME)	0.001 f/cc (PCME)	--	Human Health Protection
Asbestos	--	--	25 f/cc (WHO)	--	Ecological Protection; NOAEL TRV
Bis(2-ethylhexyl)phthalate	925 µg/kg	--	--	--	Ecological Protection; ESL
Dioxins and Furans	0.199 ng/kg	--	--	--	Ecological Protection; ESL
Chromium	26 mg/kg	--	--	--	Ecological Protection; ESL
Nickel	38 mg/kg	--	--	--	Ecological Protection; ESL
Zinc	104 mg/kg	--	--	--	Ecological Protection; Maximum background concentration
Reservoir Sediment					
Chemical of Concern	**Cleanup Levels**				**Basis**
	Reservoir Sediment	**Air (ABS)**	**Air (Ambient)**	**Reservoir Surface Water**	
Asbestos	--	--	--	0.0001 MFL	Ecological Protection; ESL
Carbon Disulfide	4.1 µg/kg	--	--	--	Ecological Protection; ESL

Notes:

1. Asbestos is the dominant environmental concern and primary COC at the BoRit Site. RAOs are focused on preventing release of asbestos from source material and preventing exposure to asbestos in both source material and primary exposure media. The remaining chemicals of concern in the table are likely attributed to source material or past activities at the Site and the remedial action proposed to address asbestos in source material will address these additional contaminants.
   Although the HHRA and SLERA proposed additional COPCs, including COPCs for groundwater, surface water, and seep water beyond those listed above, those remaining COPCs were not included because they are not considered to be related to past Site activities (i.e., they come from off the Site or occur naturally at elevated levels in the soil) or they no longer occur at concentrations of concern.
2. Groundwater, surface water, and seep water are not proposed as target media. The RI data suggest that the presence of ACM and other contaminants in soil has not resulted in a Site-related groundwater contaminant plume or location with levels above the MCL of 7 MFL. Additionally, although PAHs were found above soil RSLs in many samples, they were not detected in the upper bedrock aquifer, and only one SVOC, bis(2-ethylhexyl)phthalate, was detected in groundwater at concentrations above the RSL. The detections of bis(2-ethylhexyl)phthalate above the RSL were limited to samples collected from MW-02, MW-05, and MW-06 in the first round of sampling conducted in 2010. Bis(2-ethylhexyl)phthalate was not detected in any of the three subsequent rounds of sampling completed at these wells in 2013. Manganese, which occurred at high concentrations in two wells that are not hydraulically connected to each other and which do not constitute a plume, is not a Site-related COPC in contaminated soil or waste and does not appear to be related to historical Site activities
3. Even though asbestos was not detected at levels that potentially posed a risk in the SLERA, the Reservoir bench study (discussed in Section 1.6 of the FS and in detail in the RI Addendum) demonstrated that Reservoir surface water is directly affected by the Reservoir sediment. Therefore, EPA used a conservative approach and assumed that asbestos is also a potential ecological risk in Reservoir sediment.

µg/kg = micrograms per kilogram
ABS = activity-based sampling
ACM = asbestos-containing material
COPC = chemical of potential concern
ESL = ecological screening level
f/cc = fibers per cubic centimeter
FS = Feasibility Study
HHRA = Human Health Risk Assessment
MCL = maximum contaminant level
MFL = million fibers per liter
mg/kg = milligrams per kilogram
Mn = manganese
ng/kg = nanograms per kilogram
NOAEL = no observed adverse effect level
PCME = phase contrast microscopy equivalent
RAO = remedial action objective
RI = remedial investigation
SLERA = Screening Ecological Risk Assessment
TRV = toxicity reference value
WHO = World Health Organization

Table 43
Estimated Quantity of Contaminated Soil, Waste, Reservoir Sediment, and Reservoir Surface Water
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

	Remediation Zones					
	Park (Soil and Waste)	Asbestos Pile (Soil and Waste)	Reservoir Berm (Soil and Waste)	Reservoir Bottom (Waste and Sediment)[2]	Stream Banks	Total (Soil, Waste, Sediment)
Dimensions and Volume of Clean Topsoil/Fill						
Perimeter (ft):	3,700	2,300	3,300	2,500	9,300	11,800
Surface Area (ft^2):	486,500	244,600	183,500	455,100	80,400	1,450,100
Surface Area (yd^2):	54,056	27,178	20,389	50,567	8,933	161,122
Surface Area (ac):	11	6	4	10	2	33
Clean Topsoil/Fill[1] (cy):	45,000	22,600	17,000	NA	15,800	100,400
Volume of Waste						
Historical Fill[3] (cy):	25,100	27,300	11,600	NA	NA	64,000
Waste/Sediment[4,5] (cy):	214,200	129,700	18,100	126,900	(3,500) [8]	488,900
Residual Contamination (cy):	18,000 [6]	9,100 [6]	6,800 [6]	NA	3,500 [9]	37,400
Total[7] (cy):	257,300	166,100	36,500	126,900	3,500	590,300

Notes:

1. Topsoil/clean fill is defined as fill and topsoil placed by the EPA Removal Program during the Removal Action and assumed to be unimpacted by COCs. An average depth of 2 feet of clean fill and 6 inches of topsoil was assumed for estimation purposes. It is assumed that this layer will need to be removed and stockpiled for implementation of several alternatives. There is potential that topsoil and fill placed by the EPA Removal Program contacted waste material on-site. As a result, details for handling and treating topsoil and fill for certain alternatives will be accounted for during remedial design.
2. The sediment/waste volume for the Reservoir was calculated using bathymetric data collected during the RI, the highest Reservoir stream gauge elevation during the five rounds of groundwater synoptics, the bedrock elevations logged in the monitoring wells, and estimated bedrock elevations along the Wissahickon Creek. The total volume includes all sediment down to the estimated top of bedrock in the Reservoir.
3. Volumes of historical fill and waste were estimated using soil boring data collected during the RI.
4. Waste includes ACM and LPW.
5. Twelve borings across the three parcels did not penetrate the bottom of the waste layer. The estimated depth to the top of bedrock at these locations was used to estimate the waste volumes.
6. A 1 foot thick cut of native soil with residual contamination was assumed below the greatest encountered depth of historical fill or waste.
7. Unless noted, the total volume for the Site and each remediation zone includes estimated quantities from historical fill, waste/sediment, and residual contamination (1 foot thick cut of native soil with residual contamination).
8. Previously removed during EPA Removal Program bank stabilization work. This volume is not included in the total volume estimated for remediation.
9. For the purpose of developing and comparing remedial alternatives, a volume of native soil containing residual contamination equal to volume of waste removed during EPA Removal Program bank stabilization work was assumed.

ac = acre
ACM = asbestos-containing material
cy = cubic yard
COCs = contaminants of concern
ft = feet
ft^2 = square foot
LPW = light process waste
NA = not applicable
RI = remedial investigation
yd^2 = square yard
EPA = United States Environmental Protection Agency

Table 44
Summary of Detailed Analysis for Retained Alternatives
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Remedial Alternative	Description	*Threshold Criteria*		*Balancing Criteria*					
		Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Present Value Cost³ (Dollars)	
WSS1	No Action	N	N	⓿	⓿	⓿	❺	$	165,000
WSS2	Capping	Y	Y	❹	⓿	❹	❹	$$$	27,100,000
WSS3	Excavation and Off-Site Disposal	Y	Y	❺	⓿	❷	❷	$$$$$$	268,800,000
WSS4	In Situ Joule Heating	Y	Y*	❹	❹	❸	❶	$$$$$$	256,700,000
WSS5	Excavation, On-Site Ex Situ TCCT, and On-site Disposal	Y	Y*	❺	❺	❷	❶	$$$$$$	266,500,000

Notes:

1. The numerical designations for qualitative ratings used in this table are not used to quantitatively assess remedial alternatives (for instance, individual rankings for an alternative are not additive).
2. Threshold Criteria must be satisfied by the remedial alternative being considered as the preferred alternative (unless an ARAR waiver is granted). Alternatives are rated either "Yes" or "No" as to whether the threshold criterion is met.
3. Detailed analysis cost estimates shown for each alternative are provided in Table 4-4 of the Feasibility Study and are expected to achieve an accuracy range of -30 to +50 percent.

* With the qualifier that if pilot studies indicate that flood zone-related ARARs cannot be met, an ARAR waiver, if available, would need to be employed. ARAR = applicable or relevant and appropriate requirement

TCCT = thermo-chemical conversion technology

M = million

<u>Threshold Criteria:</u>

Y	Yes
N	No

<u>Balancing Criteria (Excluding Cost)</u>:

⓿	None
❶	Low
❷	Low to Moderate
❸	Moderate
❹	Moderate to High
❺	High

<u>Balancing Criteria (Present Value Cost in Dollars)</u>:

⓿	None ($0)
$	Low ($0 to $1M)
$$	Low to Moderate ($1M to $10M)
$$$	Moderate ($10M to $50M)
$$$$	Moderate to High ($50M to $100M)
$$$$$	High ($100M to $250M)
$$$$$$	Very High (Greater than $250M)

Table 45a
Action-Specific ARARs for the Selected Remedy
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Requirement/Standard	Legal Citation	ARAR/TBC Classification	Requirement Synopsis	Applicability to Remedy
FEDERAL				
CWA, § 404(b)(1) Restrictions on Discharge	40 C.F.R. § 230.10(b)(1-2)	Applicable	Establishes criteria for evaluating impacts to waters of the US (including wetlands) and sets forth restrictions for the discharge of dredged or fill material.	Site activities would be designed to control discharge of dredged or fill material into adjacent creeks and streams.
CWA; National Pollution Discharge Elimination System (NPDES)	40 C.F.R. §§ 129.4(c) and 129.102	Applicable	Establishes effluent standards or prohibitions for certain toxic pollutants.	Treatment of surface water pumped from Reservoir would be designed to meet standards for the listed toxic pollutants if present.
Clean Air Act (CAA) National Ambient Air Quality Standards (NAAQS)	40 C.F.R. § 50.6	Applicable	Requires that the remedial action include fugitive dust control measures.	Fugitive dust control measures would be implemented for any earth disturbance activities to meet substantive primary and secondary ambient air quality standards.
CAA National Emission Standards for Hazardous Air Pollutants (NESHAPs) - Standard for asbestos waste disposal sites	40 C.F.R. § 61.150(a)	Relevant and Appropriate	Standard for waste disposal for manufacturing, fabricating, demolition, renovation and spraying operations. This regulation provides detailed procedures for processing, handling, and transporting asbestos-containing waste material generated during building demolition and renovation (among other sources).	Remedy would meet all substantive requirements for soil disturbance activities and handling of material that do not meet the definition of RACM.

Table 45a
Action-Specific ARARs for the Selected Remedy
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Requirement/Standard	Legal Citation	ARAR/TBC Classification	Requirement Synopsis	Applicability to Remedy
CAA NESHAPs - Standard for inactive asbestos waste disposal sites	40 C.F.R. § 61.151(a)(b)	Relevant and Appropriate	Standard for inactive waste disposal sites, including emissions, waste coverage, and access restriction requirements. Provides requirements for covering, revegetation, and signage at facilities where regulated ACM (RACM) will be left in place.	Capping of waste, soil, and Reservoir Sediment, ICs, ECs, and LTM would meet substantive requirements for ACM left in place.
CAA NESHAPs - Air-Cleaning	40 C.F.R. § 61.152	Relevant and Appropriate	This requirement establishes detailed specifications for air cleaning (i.e., vacuuming) used as part of a system to control asbestos emissions.	Remedy would meet substantive requirements. Appropriate dust control measures would be implemented to control asbestos emissions.
Pennsylvania Hazardous Waste Management Regulations PA Code, Title 25, Article VII Pennsylvania has an EPA authorized hazardous waste program; therefore, the EPA authorized hazardous waste regulations are identified here as the applicable federal hazardous waste standard.	25 PA Code § 264a.1 (incorporating by reference 40 C.F.R. Part 264, but limited to the substantive portions of Section 264.18(b)(1))	Relevant and Appropriate	Provides substantive requirements for the generation, accumulation, on-site management, and transportation of hazardous waste via incorporation of 40 C.F.R. Part 264 by reference (except where noted).	While the Site is not expected to contain RCRA hazardous waste, as defined in 25 PA Code § 261a.1, capping and stream stabilization work would be designed, constructed, and maintained to prevent washout and/or accidental release of asbestos.
	25 PA Code § 264a.1 (incorporating by reference 40 C.F.R. Part 264, but limited to the substantive parts of Sections 264.19, .95, .96(a), .96(c), .97, .98, .99, .111, .114, .117, and .310)	Relevant and Appropriate	Provides substantive requirements for the generation, accumulation, on-site management, and transportation of hazardous waste via incorporation of 40 C.F.R. Part 264 by reference (except where noted).	Appropriate monitoring programs would be conducted (i.e., confirmation sampling and LTM) to monitor waste, soil, and Reservoir sediment capped in place.
	25 PA Code § 264a.1 (incorporating by reference 40 C.F.R. Part 264, but limited to the substantive parts of Section 264.301, .310)	Relevant and Appropriate	Provides substantive requirements for the generation, accumulation, on-site management, and transportation of hazardous waste via incorporation of 40 C.F.R. Part 264 by reference (except where noted).	Capping design and remedy implementation would be conducted to meet substantive design and operating requirements (40 CFR § 264.301) and closure/post-closure requirements (40 CFR § 264.310) for landfills.
	25 PA Code § 264a.1 (incorporating by reference 40 C.F.R. Part 264, but limited to the substantive parts of Sections 264.552 and .554)	Relevant and Appropriate	Provides substantive requirements for the generation, accumulation, on-site management, and transportation of hazardous waste via incorporation of 40 C.F.R. Part 264 by reference (except where noted).	If hazardous waste is present within the source material on the Site, use of corrective action management units and/or staging piles required to implement the remedy will follow substantive requirements specified in 40 C.F.R. §§ 261.552 and .554.

Table 45a
Action-Specific ARARs for the Selected Remedy
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Requirement/Standard	Legal Citation	ARAR/TBC Classification	Requirement Synopsis	Applicability to Remedy
STATE				
Air Quality Regulations	25 PA Code §§ 121.7, 123.1(a), 123.2, 124.3, 137.3, 139.32-.33	Applicable	Provides substantive requirements applicable to air pollution sources, including prohibition of air pollution, standards for contaminants, national emission standards for hazardous air pollutants, reporting of sources, air pollution episodes, and sample and testing.	Substantive requirements would be met through dust control measures.
Construction, Modification, Reactivation, and Operation of Sources	25 PA Code §§ 127.201(c)(f)(g), .203(a)(b), .204(a), .218(a)(4), .218(m-o)	Applicable	Substantive requirements applicable to air pollution sources.	Remedy would meet substantive requirements. Remedy would implement dust control measures.
Erosion and Sediment Control Regulations	25 PA Code §§ 102.4(b)(1), .11(a), .14, .22	Applicable	Substantive requirements for erosion and sediment controls for earth disturbance activities during construction and post- construction.	E&S measures for construction and post-construction would be implemented to meet substantive requirements.
Pennsylvania Water Quality Standards	25 PA Code §§ 93.4a(b)(1)(i), .7(a), .8a(d), .8b, .8c(a), .9f	Applicable	Establishes standards for protection of watershed quality, including antidegradation requirements and water quality criteria. Section 93.9f identifies protected water uses for Wissahickon Creek as cold water fishes and migratory fishes.	Remedy and activities on the Site would be designed to prevent contaminant migration that could impact water quality of Wissahickon Creek.

Notes:
ACM = asbestos-containing material
ARAR = Applicable or Relevant and Appropriate Requirement
CAA = Clean Air Act
C.F.R. = Code of Federal Regulations
COC = contaminant of concern
EC = engineering control
E&S = erosion and sediment
IC = institutional control
LTM = long-term monitoring
NAAQS = National Ambient Air Quality Standards
NESHAP = National Emission Standards for Hazardous Air Pollutants
NPDES = National Pollutant Discharge Elimination System
RACM = regulated asbestos-containing material
RCRA = Resource Conservation and Recovery Act

Table 45b
Location-Specific ARARs for the Selected Remedy
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Requirement/Standard	Legal Citation	ARAR/TBC Classification	Requirement Synopsis	Applicability to Remedy
FEDERAL				
CWA, § 404(b)(1) Restrictions on Discharge	40 C.F.R. § 230.10(b)(1-2)	Applicable	Establishes criteria for evaluating impacts to waters of the US (including wetlands) and sets forth restrictions for the discharge of dredged or fill material.	Site activities would be designed to control discharge of dredged or fill material into adjacent creeks and streams.
Endangered Species Act Endangered and threatened wildlife	50 C.F.R. §§ 17.11	Applicable	Requires that federal activities not jeopardize the continued existence of any threatened or endangered species.	Site activities and remedy would be designed and implemented to meet the substantive portions of these requirements in a manner that protects and conserves threatened or endangered species identified on the Site. Threatened species identified on the Site include Red-bellied turtles.
Migratory Bird Act List of Migratory Birds	50 C.F.R. § 10.13(c)	Applicable	Makes it unlawful to "hunt, take, capture, kill," or take other various actions adversely affecting a broad range of migratory birds, without the prior approval of the Department of the Interior.	Migratory bird species would be expected because the Reservoir is a water fowl preserve. Activities (i.e., FYRs) would be designed to avoid adverse impact to migratory bird species by meeting the substantive portions of these requirements. The remedy would be implemented to avoid adverse impact to migratory bird species and/or their nests.
Pennsylvania Hazardous Waste Management Regulations PA Code, Title 25, Article VII Pennsylvania has an EPA authorized hazardous waste program; therefore, the EPA authorized hazardous waste regulations are identified here as the applicable federal hazardous waste standard.	25 PA Code § 264a.1 (incorporating by reference 40 C.F.R. Part 264, but limited to the substantive portions of Section 264.18(b)(1))	Relevant and Appropriate	Provides substantive requirements for the generation, accumulation, on-site management, and transportation of hazardous waste via incorporation of 40 CFR Part 264 by reference (except where noted).	While the Site is not expected to contain RCRA hazardous waste, as defined in 25 PA Code § 261a.1, capping and stream stabilization work would be designed, constructed, and maintained to prevent washout and/or accidental release of asbestos.

Notes:
ARAR = Applicable or Relevant and Appropriate Requirement
C.F.R. = Code of Federal Regulations
FYR = five-year review
RCRA = Resource Conservation and Recovery Act

Table 45c
Chemical-Specific ARARs for the Selected Remedy
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Requirement/Standard	Legal Citation	ARAR/TBC Classification	Requirement Synopsis	Applicability to Remedy
FEDERAL				
CWA; NPDES	40 C.F.R. §§ 129.4(c) and 129.102	Applicable	Establishes effluent standards or prohibitions for certain toxic pollutants.	Treatment of surface water pumped from Reservoir would be designed to meet the substantive standards for the listed toxic pollutants if present.
CAA NAAQS	40 C.F.R. § 50.6	Applicable	Requires that the remedial action include fugitive dust control measures.	Fugitive dust control measures would be implemented for any earth disturbance activities to meet substantive primary and secondary ambient air quality standards.
CAA NESHAPs - Standard for asbestos waste disposal sites	40 C.F.R. § 61.150(a)	Relevant and Appropriate	Standard for waste disposal for manufacturing, fabricating, demolition, renovation and spraying operations. This regulation provides detailed procedures for processing, handling, and transporting asbestos-containing waste material generated during building demolition and renovation (among other sources).	Remedy would meet all substantive requirements for soil disturbance activities and handling of material that do not meet the definition of RACM.

Table 45c
Chemical-Specific ARARs for the Selected Remedy
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Requirement/Standard	Legal Citation	ARAR/TBC Classification	Requirement Synopsis	Applicability to Remedy
STATE				
Act 2 Site-specific Standards	25 PA Code §§ 250.402(b), .403(a),.407(d)(e)	Relevant and Appropriate	Allows development of site-specific risk-based standards for soil and groundwater including consideration of human health and environmental cleanup goals, use of groundwater, relationship to surface water quality requirements, and points of compliance.	Remedy would meet site-specific standards to protect human health and the environment if more stringent than federal standards.
Act 2 Statewide Health Standards for Soil	25 PA Code § 250.305(b)-(f)	Relevant and Appropriate	Medium-Specific Concentrations for contaminants in soil based on land use.	Remedy would meet substantive health standards if more stringent than federal standards. Waste, soil, and Reservoir sediment would be capped.
Act 2 Statewide Health Standards for Surface Water	25 PA Code § 250.309(c)	Relevant and Appropriate	Medium-Specific Concentrations for contaminants in surface water.	Substantive surface water standards would be met if more stringent than federal standards, through capping of the source material (waste, soil, and Reservoir sediment) and ICs.
Hazardous Substance List	34 PA Code Part 323, Appendix A	Applicable	List of substances considered hazardous by the Commonwealth of Pennsylvania.	Asbestos and other COCs are listed hazardous substances. Asbestos is further designated as an environmental hazard and a special hazardous substance. ACM would be capped and subject to regulatory study.
Pennsylvania Water Quality Standards	25 PA Code §§ 93.4a(b)(1)(i), .7(a), .8a(d), .8b, .8c(a), .9f	Applicable	Establishes standards for protection of watershed quality, including antidegradation requirements and water quality criteria. Section 93.9f identifies protected water uses for Wissahickon Creek as cold water fishes and migratory fishes.	Remedy and activities on the Site would be designed to prevent contaminant migration that could impact water quality of Wissahickon Creek.

Notes:
ACM = asbestos-containing material
ARAR = Applicable or Relevant and Appropriate Requirement
CAA = Clean Air Act
CFR = Code of Federal Regulations
COC = contaminant of concern
FYR = five-year review
IC = institutional control
MSC = Medium-Specific Concentrations
NAAQS = National Ambient Air Quality Standards
NESHAP = National Emission Standards for Hazardous Air Pollutants
NPDES = National Pollutant Discharge Elimination System
RACM = regulated asbestos-containing material

Table 46a
Detailed Analysis Cost Estimate for Selected Remedy - Park Parcel (Waste and Soil)
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Detailed analysis cost estimates have an expected accuracy range of -30 to +50 percent.

CONSTRUCTION	Quantity[1]	Units of Measure	Unit Cost ($)	Unit Cost Reference and/or Basis[2]	WSS2 Capping Costs ($)
Site Prep and Mobilization	1	Each	--	[1] [2]	78,326
H&S, E&S, grubbing and clearing	11	Acres	5,300	[3] [2]	91,328
Creek Bed and Bank Stabilization	1	Each	3,394,800	[4]	3,394,800
Backfill with imported clean fill (Park, Pile, Berm)	257,300	CY	42	[5] [2]	2,335,228
Backfill with imported topsoil and hydroseed (Park, Pile, Berm)	9,000	CY	42	[6] [2]	583,807
Regrading/Site Restoration (moderate to major)	11	Acres	1,000	[7] [2]	17,232
Placement of Geotextile Fabric	54,056	SY	1	[8] [2]	64,356
Re-fill/re-vegetate/re-populate	11	Acres	5,000	[9] [2]	86,158
Demobilization	1	Each	--	[10] [2]	61,512
Construction Completion - Confirmation Sampling	1	Events	20,000	[11]	*20,000*
Construction Completion - Remedial Action Report	1	Each	20,000	[12]	*20,000*
Institutional Controls	1	Each	40,000	[13]	*40,000*
Engineering Controls (Perimeter Fencing)	3,700	Feet	10	[14]	*37,000*
Construction Cost for Each Alternative ($)					**6,829,745**
Contingency (scope 10% and bid 15%)	25%			[15]	1,707,436
Estimated Total Construction Cost for Each Alternative ($)					**8,537,182**
Project Management	Refer to Percentages table below			[15]	427,000
Remedial Design				[15]	683,000
Construction Management				[15]	513,000
Technical Support	0%			[15]	0
ESTIMATED TOTAL CAPITAL COSTS ($)					**10,161,000**
O&M					
LTM (30 Years) - Including Annual Inspections and Maintenance					
Years 1 to 2 (Annual Sampling, 1 event per year)	2	Events	15,000	[16]	*30,000*
Present Value of LTM Costs (Years 1 to 2) ($)					***28,000***
Years 3 to 4 (Annual Sampling, 1 event per year)	2	Events	15,000	[16]	*30,000*
Years 6 to 30 (1 Sampling Event every 5 years, in years 10, 15, 20, 25, and 30)	5	Events	10,000	[16]	*50,000*
Present Value of LTM Costs (Years 3 to 32) ($)					***38,000***
Present Value of Total LTM Costs ($)					***66,000***
Annual Cap Maintenance (WSS2 Only)					
Annual O&M Years 1 to 2	2	Events	6,726	[17]	*13,452*
Present Value of Annual Cap Maintenance Costs (Years 1 to 2) ($)					***12,161***
Annual O&M Years 3 to 32	30	Events	6,726	[17]	*201,780*
Present Value of Annual Cap Maintenance Costs (Years 3 to 32) ($)					***72,903***
Contingency	20%			[15]	*30,213*
O&M Present Value Subtotal Costs ($)					***181,276***
O&M Project Management	6%			[15]	*10,877*
O&M Technical Support	15%			[15]	*27,191*
PRESENT VALUE OF ESTIMATED TOTAL O&M COSTS ($)					***220,000***
PERIODIC					
FYRs [6 x FYRs]	6	Each	12,500	[18]	*75,000*
FYRs [Only 1 x FYR]	1	Each	12,500	[18]	
Present Value of FYRs ($)					***26,973***
Contingency	20%			[15]	*5,395*
Periodic Present Value Subtotal Costs ($)					***32,367***
FYRs Project Management	6%			[15]	*2,000*
FYRs Technical Support	15%			[15]	*4,900*
PRESENT VALUE OF ESTIMATED TOTAL PERIODIC COSTS ($)					***40,000***
TOTAL ESTIMATED COSTS ($)					**10,421,000**

Assumptions:

All Capital Costs are Present Value (with no PV Discounting). The simplifying assumption of Year 0 for capital costs was assumed even though actual durations vary.

Percentages for Professional/Technical Services Capital Costs are as follows:

	<$100K	$100K-$500K	$500K-$2M	>$10M
Project Management	10%	8%	6%	5%
Remedial Design	20%	15%	12%	6%
Construction Management	15%	10%	8%	6%

Real Discount Rate for the Purpose of Calculating Present Value of Recurring Costs = 7%

Notes:

(1) Quantities used for developing the detailed analysis level cost estimates are provided in Table 43 of the report. Simplifying assumptions were made about expansion and contraction of volumes (unit costs and quantities reflect current states of volume whether bank, loose, or compacted CY).

(2) References and/or Basis for Unit Costs are listed in Table 46e.

- Estimates in italics under WSS2 indicate items to be completed by EPA Remedial Program

- EPA 540-R-00-002 was followed for the development of cost estimates.

CY = cubic yard
O&M = operations and maintenance
FYR = five-year review
LTM = long-term monitoring
MG = million gallons
RT = round trip

Costs shaded in yellow indicate line items to be completed by EPA Remedial Program during years 1 through 2.

Costs shaded in gray indicate estimated incurred costs for line items that have been completed by EPA Removal Program.

Shaded rows and/or cells are not applicable.

Table 46b
Detailed Analysis Cost Estimate for Selected Remedy - Asbestos Pile (Waste and Soil)
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Detailed analysis cost estimates have an expected accuracy range of -30 to +50 percent.

CONSTRUCTION	Quantity	Units of Measure	Unit Cost ($)	Unit Cost Reference and/or Basis[2]	WSS2 Capping Costs ($)
Site Prep and Mobilization	1	Each	--	[1]	50,000
H&S, E&S, grubbing and clearing	6	Acres	5,300	[3]	31,800
Creek Bed and Bank Stabilization	1	Each	1,269,300	[4]	1,269,300
Backfill with imported clean fill (Park, Pile, Berm)	166,100	CY	42	[5]	813,120
Backfill with imported topsoil and hydroseed (Park, Pile, Berm)	4,520	CY	42	[6]	203,280
Regrading/Site Restoration (moderate to major)	6	Acres	1,000	[7]	6,000
Placement of Geotextile Fabric	27,178	SY	1	[8]	20,655
Re-fill/re-vegetate/re-populate	6	Acres	5,000	[9]	30,000
Demobilization	1	Each	--	[10]	25,000
Construction Completion - Confirmation Sampling	1	Events	20,000	[11]	*20,000*
Construction Completion - Remedial Action Report	1	Each	20,000	[12]	*20,000*
Institutional Controls	1	Each	40,000	[13]	*40,000*
Engineering Controls (Perimeter Fencing)	2,300	Feet	10	[14]	*23,000*
Construction Cost for Each Alternative ($)					**2,553,000**
Contingency (scope 10% and bid 15%)	25%			[15]	638,250
Estimated Total Construction Cost for Each Alternative ($)					**3,191,250**
Project Management	Refer to Percentages table below			[15]	160,000
Remedial Design				[15]	256,000
Construction Management				[15]	192,000
Technical Support	0%			[15]	0
ESTIMATED TOTAL CAPITAL COSTS ($)					**3,800,000**

O&M					
LTM (30 Years) - Including Annual Inspections and Maintenance					
Years 1 to 2 (Annual Sampling, 1 event per year)	2	Events	15,000	[16]	*30,000*
Present Value of LTM Costs (Years 1 to 2) ($)					***28,000***
Years 3 to 4 (Annual Sampling, 1 event per year)	2	Events	15,000	[16]	*30,000*
Years 6 to 30 (1 Sampling Event every 5 years, in years 10, 15, 20, 25, and 30)	5	Events	10,000	[16]	*50,000*
Present Value of LTM Costs (Years 3 and 32) ($)					***38,000***
Present Value of Total LTM Costs ($)					***66,000***
Annual Cap Maintenance (WSS2 Only)					
Annual O&M Years 1 to 2	2	Events	3,669	[17]	*7,338*
Present Value of Annual Cap Maintenance Costs (Years 1 to 2) ($)					***6,634***
Annual O&M Years 3 to 32	30	Events	3,669	[17]	*110,070*
Present Value of Annual Cap Maintenance Costs (Years 3 to 32) ($)					***39,768***
Contingency	20%			[15]	*22,480*
O&M Present Value Subtotal Costs ($)					***134,882***
O&M Project Management	6%			[15]	*8,093*
O&M Technical Support	15%			[15]	*20,232*
PRESENT VALUE OF ESTIMATED TOTAL O&M COSTS ($)					***164,000***

PERIODIC					
FYRs [6 x FYRs]	6	Each	12,500	[18]	*75,000*
FYRs [Only 1 x FYR]	1	Each	12,500	[18]	
Present Value of FYRs ($)					***26,973***
Contingency	20%			[15]	*5,395*
Periodic Present Value Subtotal Costs ($)					***32,367***
FYRs Project Management	6%			[15]	*2,000*
FYRs Technical Support	15%			[15]	*4,900*
PRESENT VALUE OF ESTIMATED TOTAL PERIODIC COSTS ($)					***40,000***

TOTAL ESTIMATED COSTS ($)		**4,004,000**

Assumptions:
All Capital Costs are Present Value (with no PV Discounting). The simplifying assumption of Year 0 for capital costs was assumed even though actual durations vary.

Percentages for Professional/Technical Services Capital Costs are as follows:

	<$100K	$100K-$500K	$500K-$2M	>$10M
Project Management	10%	8%	6%	5%
Remedial Design	20%	15%	12%	6%
Construction Management	15%	10%	8%	6%

Real Discount Rate for the Purpose of Calculating Present Value of Recurring Costs = 7%

Notes:

(1) Quantities used for developing the detailed analysis level cost estimates are provided in Table 43 of the report. Simplifying assumptions were made about expansion and contraction of volumes (unit costs and quantities reflect current states of volume whether bank, loose, or compacted CY).
(2) References and/or Basis for Unit Costs are listed in Table 46e.
- Estimates in italics under WSS2 indicate items to be completed by EPA Remedial Program
- EPA 540-R-00-002 was followed for the development of cost estimates.

CY = cubic yard
O&M = operations and maintenance
FYR = five-year review
LTM = long-term monitoring
MG = million gallons
RT = round trip

Costs shaded in yellow indicate line items to be completed by EPA Remedial Program during years 1 through 2.
Costs shaded in gray indicate estimated incurred costs for line items that have been completed by EPA Removal Program.
Shaded rows and/or cells are not applicable.

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Table 46c
Detailed Analysis Cost Estimate for Selected Remedy - Reservoir Berm (Waste and Soil)
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Detailed analysis cost estimates have an expected accuracy range of -30 to +50 percent.

CONSTRUCTION	Quantity	Units of Measure	Unit Cost ($)	Unit Cost Reference and/or Basis(2)	WSS2 Capping Costs ($)
Site Prep and Mobilization	1	Each	--	[1]	50,000
H&S, E&S, grubbing and clearing	4	Acres	5,300	[3]	21,200
Creek Bed and Bank Stabilization	1	Each	916,000	[4]	916,000
Backfill with imported clean fill (Park, Pile, Berm)	36,500	CY	42	[5]	542,080
Backfill with imported topsoil and hydroseed (Park, Pile, Berm)	3,400	CY	42	[6]	135,520
Regrading/Site Restoration (moderate to major)	4	Acres	1,000	[7]	4,000
Placement of Geotextile Fabric	20,389	SY	1	[8]	15,496
Re-fill/re-vegetate/re-populate	4	Acres	5,000	[9]	20,000
Demobilization	1	Each	--	[10]	25,000
Construction Completion - Confirmation Sampling	1	Events	20,000	[11]	*20,000*
Construction Completion - Remedial Action Report	1	Each	20,000	[12]	*20,000*
Institutional Controls	1	Each	40,000	[13]	*40,000*
Engineering Controls (Perimeter Fencing)	3,300	Feet	10	[14]	*33,000*
Construction Cost for Each Alternative ($)					**1,842,296**
Contingency (scope 10% and bid 15%)	25%			[15]	460,574
Estimated Total Construction Cost for Each Alternative ($)					**2,302,870**
Project Management	Refer to			[15]	116,000
Remedial Design	Percentages			[15]	185,000
Construction Management	table below			[15]	139,000
Technical Support	0%			[15]	0
ESTIMATED TOTAL CAPITAL COSTS ($)					**2,743,000**
O&M					
LTM (30 Years) - Including Annual Inspections and Maintenance					
Years 1 to 2 (Annual Sampling, 1 event per year)	2	Events	15,000	[16]	*30,000*
Present Value of LTM Costs (Years 1 to 2) ($)					***28,000***
Years 3 to 4 (Annual Sampling, 1 event per year)	2	Events	15,000	[16]	*30,000*
Years 6 to 30 (1 Sampling Event every 5 years, in years 10, 15, 20, 25, and 30)	5	Events	10,000	[16]	*50,000*
Present Value of LTM Costs (Years 3 and 32) ($)					***38,000***
Present Value of Total LTM Costs ($)					***66,000***
Annual Cap Maintenance (WSS2 Only)					
Annual O&M Years 1 to 2	2	Events	2,446	[17]	*4,892*
Present Value of Annual Cap Maintenance Costs (Years 1 to 2) ($)					***4,422***
Annual O&M Years 3 to 32	30	Events	2,446	[17]	*73,380*
Present Value of Annual Cap Maintenance Costs (Years 3 to 32) ($)					***26,512***
Contingency	20%			[15]	19,387
O&M Present Value Subtotal Costs ($)					**116,321**
O&M Project Management	6%			[15]	*6,979*
O&M Technical Support	15%			[15]	*17,448*
PRESENT VALUE OF ESTIMATED TOTAL O&M COSTS ($)					***141,000***
PERIODIC					
FYRs [6 x FYRs]	6	Each	12,500	[18]	*75,000*
FYRs [Only 1 x FYR]	1	Each	12,500	[18]	
Present Value of FYRs ($)					***26,973***
Contingency	20%			[15]	*5,395*
Periodic Present Value Subtotal Costs ($)					***32,367***
FYRs Project Management	6%			[15]	*2,000*
FYRs Technical Support	15%			[15]	*4,900*
PRESENT VALUE OF ESTIMATED TOTAL PERIODIC COSTS ($)					***40,000***
TOTAL ESTIMATED COSTS ($)					**2,924,000**

Assumptions:
All Capital Costs are Present Value (with no PV Discounting). The simplifying assumption of Year 0 for capital costs was assumed even though actual durations vary.

Percentages for Professional/Technical Services Capital Costs are as follows:

	<$100K	$100K-$500K	$500K-$2M	>$10M
Project Management	10%	8%	6%	5%
Remedial Design	20%	15%	12%	6%
Construction Management	15%	10%	8%	6%

Real Discount Rate for the Purpose of Calculating Present Value of Recurring Costs = 7%

Notes:
(1) Quantities used for developing the detailed analysis level cost estimates are provided in Table 43 of the report. Simplyfing assumptions were made about expansion and contraction of volumes (unit costs and quantities reflect current states of volume whether bank, loose, or compacted).
(2) References and/or Basis for Unit Costs are listed in Table 46e.
- Estimates in italics under WSS2 indicate items to be completed by EPA Remedial Program
- EPA 540-R-00-002 was followed for the development of cost estimates.

CY = cubic yard — O&M = operations and maintenance
FYR = five-year review — LTM = long-term monitoring
MG = million gallons — RT = round trip

Costs shaded in yellow indicate line items to be completed by EPA Remedial Program during years 1 through 2.
Costs shaded in gray indicate estimated incurred costs for line items that have been completed by EPA Removal Program.
Shaded rows and/or cells are not applicable.

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Table 46d
Detailed Analysis Cost Estimate for Selected Remedy - Reservoir Bottom (Waste and Sediment)
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Detailed analysis cost estimates have an expected accuracy range of -30 to +50 percent.

CONSTRUCTION	Quantity	Units of Measure	Unit Cost ($)	Unit Cost Reference and/or Basis(2)	WSS2 Capping Costs ($)
Site Prep and Mobilization	1	Each	--	[1]	50,000
Creek Bed and Bank Stabilization	1	Each	3,119,900	[4]	3,119,900
Drain/treat/discharge Reservoir Surface Water	37.8	MG	2,280	[19]	86,184
Backfill with Imported Substrate (Reservoir)	126,900	CY	50	[20] [21]	2,721,764
Regrading/Site Restoration (moderate to major)	10	Acres	1,000	[7] [21]	16,870
Placement of Geotextile Fabric	48,400	SY	1	[8] [21]	70,037
Re-fill/re-vegetate/re-populate	29	MG	1,720	[9] [21]	84,150
Demobilization	1	Each	--	[10] [21]	42,176
Construction Completion - Confirmation Sampling	1	Events	20,000	[11]	*20,000*
Construction Completion - Remedial Action Report	1	Each	20,000	[12]	*20,000*
Institutional Controls	1	Each	40,000	[13]	*40,000*
Engineering Controls (Perimeter Fencing)	2,500	Feet	10	[14]	*25,000*
Construction Cost for Each Alternative ($)					**6,296,081**
Contingency (scope 10% and bid 15%)	25%			[15]	1,574,020
Estimated Total Construction Cost for Each Alternative ($)					**7,870,102**
Project Management	Refer to Percentages table below			[15]	394,000
Remedial Design				[15]	630,000
Construction Management				[15]	473,000
Technical Support	0%			[15]	0
ESTIMATED TOTAL CAPITAL COSTS ($)					**9,368,000**
O&M					
LTM (30 Years) - Including Annual Inspections & Maintenance					
Years 1 to 2 (Annual Sampling, 1 event per year)	2	Events	15,000	[16]	*30,000*
Present Value of LTM Costs (Years 1 and 2) ($)					***28,000***
Years 3 to 4 (Annual Sampling, 1 event per year)	2	Events	15,000	[16]	*30,000*
Years 6 to 30 (1 Sampling Event every 5 years, in years 10, 15, 20, 25, and 30)	5	Events	10,000	[16]	*50,000*
Present Value of LTM Costs (Years 3 and 32) ($)					***38,000***
Present Value of Total LTM Costs ($)					***66,000***
Annual Cap Maintenance (WSS2 Only)					
Annual O&M Years 1 to 2	2	Events	5,779	[17]	*11,558*
Present Value of Annual Cap Maintenance Costs (Years 1 to 2) ($)					***10,448***
Annual O&M Years 3 to 32	30	Events	5,779	[17]	*173,370*
Present Value of Annual Cap Maintenance Costs (Years 3 to 32) ($)					***62,639***
Contingency	20%			[15]	*27,817*
O&M Present Value Subtotal Costs ($)					***166,904***
O&M Project Management	6%			[15]	*10,014*
O&M Technical Support	15%			[15]	*25,036*
PRESENT VALUE OF ESTIMATED TOTAL O&M COSTS ($)					***202,000***
PERIODIC					
FYRs [6 x FYRs]	6	Each	12,500	[18]	*75,000*
FYRs [Only 1 x FYR]	1	Each	12,500	[18]	
Present Value of FYRs ($)					***26,973***
Contingency	20%			[15]	*5,395*
Periodic Present Value Subtotal Costs ($)					***32,367***
FYRs Project Management	6%			[15]	*2,000*
FYRs Technical Support	15%			[15]	*4,900*
PRESENT VALUE OF ESTIMATED TOTAL PERIODIC COSTS ($)					***40,000***
TOTAL ESTIMATED COSTS ($)					**9,610,000**

Assumptions:

All Capital Costs are Present Value (with no PV Discounting). The simplifying assumption of Year 0 for capital costs was assumed even though actual durations vary.

Percentages for Professional/Technical Services Capital Costs are as follows:

	<$100K	$100K-$500K	$500K-$2M	>$10M
Project Management	10%	8%	6%	5%
Remedial Design	20%	15%	12%	6%
Construction Management	15%	10%	8%	6%

Real Discount Rate for the Purpose of Calculating Present Value of Recurring Costs = 7%

Notes:

(1) Quantities used for developing the detailed analysis level cost estimates are provided in Table 43 of the Report.

(2) References and/or Basis for Unit Costs are listed in Table 46e.

- Estimates in italics under WSS2 indicate items to be completed by EPA Remedial Program

- EPA 540-R-00-002 was followed for the development of cost estimates.

CY = cubic yard O&M = operations and maintenance

FYR = five-year review LTM = long-term monitoring

MG = million gallons RT = round trip

Costs shaded in yellow indicate line items to be completed by EPA Remedial Program during years 1 through 2.

Costs shaded in gray indicate estimated incurred costs for line items that have been completed by EPA Removal Program.

Shaded rows and/or cells are not applicable.

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Table 46e
Detailed Analysis Unit Cost Reference and/or Basis
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Detailed cost estimates were developed in accordance with "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 540-R-00-002 & OSWER 9355.0-75).

Cost estimates developed during the detailed analysis phase are used to compare alternatives and support remedy selection. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) includes the following language in its description of the cost criterion for detailed analysis and remedy selection: "The types of costs that shall be assessed include the following: (1) Capital costs, including both direct and indirect costs (2) Annual operations and maintenance (O&M) costs; and (3) Net present value of capital and O&M costs." (40 CFR 300.430 (e)(9)(iii)(G))
Remedial action alternative cost estimates for the detailed analysis are intended to provide a measure of total resource costs over time (i.e., "life cycle costs") associated with any given alternative. As such, these estimates generally are based on more detailed information and should achieve a greater level of accuracy than screening-level estimates. The detailed analysis level of accuracy range of -30 to +50 percent means that, for an estimate of $100,000, the actual cost of an alternative is expected to be between $70,000 and $150,000.

All unit costs were developed using a base year of 2015. When applicable, productivity factors for health and safety (H&S) protection were applied to account for the complexity of handling asbestos-containing material (ACM), and costs were adjusted to account for the size and scale of the BoRit site. Unit costs obtained from RSMeans CostWorks are specific to the Ambler, PA area.

[1]	The Site Prep and Mobilization cost for the Selected Remedy is based on example mobilization costs for large Superfund Projects that used capping. The lump sum cost for the Selected Remedy is estimated to be $200,000 and is split evenly among all four parcels.
[2]	For the Selected Remedy, EPA Removal Program anticipates that approximately $1.8 million (M) will be incurred between September 2015 and September 2016 as capping work for the Park Parcel is completed. For this cost estimate, the $1.8M to be incurred by EPA Removal Program was distributed proportionately and added to previously estimated costs for yellow highlighted line items associated with work at the Park parcel (site prep and mobilization, H&S, erosion and sediment [E&S] control, grubbing and clearing, backfill with imported clean fill, backfill with imported topsoil and hydroseed [Park, Pile, Berm], regrading/Site Restoration [moderate to major], placement of geotextile fabric, re-fill/revegetate/re-populate, demobilization, and scope and bid contingency line items). Unit rates for the highlighted line items were adjusted to account for the appropriate portion of the $1.8M.
[3]	Unit cost of $5,300 per acre is based on vendor-provided estimate for a Superfund site in the Northeast region.
[4]	The cost for the stabilization of the creek beds and banks across the Site is estimated at $8,700,000. This estimated cost has been split up into four parts in proportion to the estimated cost fraction incurred by EPA Removal Branch across the four parcels: Park, Asbestos Pile, Reservoir Berm, and Reservoir Bottom.
[5]	Unit cost of $42 per cubic yard (CY) is based on a vendor-provided estimate for a job in the Northeast Region, plus it is similar to what is suggested for the Ambler, PA area by the RSMeans CostWorks - a construction industry cost estimating tool. This estimate includes the cost of the clean backfill material (at $30 per CY, including delivery) that is imported from within the region and compacted to specification of the fill following backfilling.
[6]	Unit cost of $42 per CY is based on a vendor-provided estimate for a job in the Northeast region, plus it is similar to what is suggested for the Ambler, PA area by the RSMeans CostWorks - a construction industry cost estimating tool. This estimate includes the cost of the top soil material (at $30 per CY, including delivery) that is imported from within the region and hydroseeding following backfilling.
[7]	Unit cost of $1,000 per acre for regrading is based on vendor-provided estimate.
[8]	Unit cost of $0.76/square yard (SY) is based on what is suggested for Ambler, PA area by the RSMeans CostWorks 2015 - a construction industry cost estimating tool. Unit cost assumed a crew of two common laborers and an 0.8" thick geotextile fabric.
[9]	Unit cost of $5,000 per acre for re-vegetating the Park/Pile/Berm is based on vendor-provided estimate. Unit cost of $1.72/1,000 gallons or $1,720/1M gallons was used to estimate the pumping expenses to refill the Reservoir using surface water from Wissahickon Creek. It is assumed that costs to refill the Reservoir would be approximately 25% less than costs to dewater the Reservoir since filtration would not be required.
[10]	It was assumed demobilization would cost one-half of the site prep and mobilization expense.
[11]	The confirmation sampling costs for the entire site are estimated at $80,000 and have been split evenly among the four parcels: Park, Asbestos pile, Reservoir Berm, and Reservoir Bottom. Confirmation sampling assumes activity-based sampling (ABS) would be conducted in previous areas of high detections (i.e., the Park and Pile parcels). Ambient air would be performed at the seven locations sampled in the remedial investigation (RI). Costs also include estimates for labor, mobilization, travel to the Site, supplies, and lab analysis.
[12]	The Construction Completion/Remedial Action Report costs for the entire site are estimated at $80,000 and have been split evenly between the four parcels: Park, Asbestos Pile, Reservoir Berm, and Reservoir Bottom.
[13]	Typical costs for the implementation of institutional controls for remediation projects for large Superfund Projects. The estimate of $160,000 has been split evenly among the four parcels: Park, Asbestos Pile, Reservoir Berm, and Reservoir Bottom.
[14]	Unit cost of $10 per linear foot of chain link fencing is based on vendor-provided estimate.
[15]	As per "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 540-R-00-002 OSWER 9355.0-75), percentages used to estimate professional/technical services capital costs were taken from Exhibit 5-8 on page 5-13.
[16]	Long-term Monitoring (LTM) (including periodic inspections, maintenance,surface water monitoring, and reporting) costs for the Selected Remedy are estimated at $60,000 per event (1 per year) for years 1 through 4 and have been split evenly among the four parcels: Park, Asbestos Pile, Reservoir Berm, and Reservoir Bottom. LTM costs for the Selected Remedy are estimated at $40,000 per event (in Years 10, 15, 20, 25, and 30) and have been split evenly among the four parcels: Park, Asbestos Pile, Reservoir Berm, and Reservoir Bottom.

Table 46e
Detailed Analysis Unit Cost Reference and/or Basis
BoRit Asbestos Superfund Site
Ambler, Pennsylvania

[17]	Annual cap maintenance costs were estimated using "Landfill Economics Part III: Closing Up Shop." Annual maintenance costs were estimated for each remediation zone based on area. Costs include mowing of cover vegetation, cover soil repairs, and reseeding. Stream bank stabilization structure repair is incorporated into cover soil. Streambank stabilization repair work was distributed evenly among the Park, Pile, Reservoir Berm, and Reservoir Bottom. Additional details and calculations are provided in Cost Reference Worksheet WSS2.A included in Appendix B of the Final FS Report.
[18]	Typical costs for Five-Year Reviews for remediation projects for large Superfund projects. The estimate of $50,000 per event has been split evenly among the four parcels: Park, Asbestos Pile, Reservoir Berm, and Reservoir Bottom.
[19]	As per Federal Remediation Technologies Roundtable (FRTR) Remediation Technologies Screening Matrix and Reference Guide, the typical unit cost for filtration ranges between $1.38 and $4.56 per 1,000 gallons treated. A unit price of $2.28/1,000 gallons or $2,280/1M gallons treated was used to estimate pump and treat expenses of contaminated Reservoir surface water using filtration. It is assumed any dewatering performed for the Pile parcel or Reservoir sediment would require filtration prior to discharge in Wissahickon Creek. As a result, this unit price was used for these line items.
[20]	Unit cost of $50 per CY is based on suggested costs for the Ambler, PA area by the RSMeans CostWorks - a construction industry cost estimating tool. This estimate includes the cost of the Reservoir bottom substrate material (at $40 per CY, including delivery) that is imported from within the region and placement/backfilling. Clean material quantities for the Selected Remedy assumes 2 feet of cover material would be placed on the Reservoir Bottom based on EPA Removal Program efforts at the Reservoir.
[21]	Based on incurred to date costs for the Selected Remedy, EPA Removal Program incurred approximately $1.8M from September 2014 through September 2015 as remaining capping work for the Reservoir Parcel was completed. The $1.8M incurred cost was distributed proportionately and added to the previously estimated costs for the line items completed from September 2014 through September 2015 (backfill with imported substrate [Reservoir], regrading/site restoration [moderate to major], placement of geotextile fabric, refilling of the Reservoir, demobilization and scope and bid contingency line items). Unit rates for the highlighted line items were adjusted to account for the appropriate portion of the $1.8M.

Table 46f

Remedial Action, Long-term Monitoring, and Operations and Maintenance Cost Summary

BoRit Asbestos Superfund Site

Ambler, Pennsylvania

Cost Item	Years 1 to 2		Years 3 to 32	
	Cost (2015 Dollars)	*Cost (2017 Dollars)*	*Cost (2015 Dollars)*	*Cost (2017 Dollars)*
RA ACTIVITIES				
ICs	$142,500	$151,178	NA	NA
ECs	$118,000	$125,186	NA	NA
Post-Construction Sampling	$80,000	$84,872	NA	NA
RA Report	$80,000	$84,872	NA	NA
Contingency (Scope and Bid 25%)		$111,527	NA	NA
Subtotal		$557,636	NA	NA
PM Support (6%)		$33,458	NA	NA
Technical Support (15%)		$83,645	NA	NA
Total RA Costs		**$675,000**		

Cost Item	Years 1 to 2 (2015 Dollars)	Years 1 to 2 (2017 Dollars)	Years 3 to 32 (2015 Dollars)	Years 3 to 32 (2017 Dollars)
O&M ACTIVITIES				
Present Value LTM	$112,000	--	$152,000	--
Contingency (20%)	$22,400	--	$30,400	--
Subtotal	$134,400	--	$182,400	--
PM Support (6%)	$8,064	--	$10,944	--
Technical Support (15%)	$20,160	--	$27,360	--
Total LTM Costs	$162,624	**$173,000**	$220,704	**$234,000**
Present Value Annual Cap Maintenance	$33,665	--	$201,822	--
Contingency (20%)	$6,733	--	$40,364	--
Subtotal	$40,398	--	$242,186	--
PM Support (6%)	$2,424	--	$14,531	--
Technical Support (15%)	$6,060	--	$36,328	--
Total Cap Maintenance Costs	$49,000	**$52,000**	$293,046	**$311,000**
Total O&M Costs		**$225,000**		**$545,000**

Notes:

1. Costs were developed using present value totals from Tables 46a through 46e presented in the Record of Decision.
2. The unit costs used to develop the detailed cost estimates in Feasibility Study were based on 2015 dollars. Present value totals for RA, LTM, and O&M costs were inflated to 2017 dollars.
3. A rounding rule to the nearest thousand was applied to estimated total costs.

PM = project management
O&M = operations and maintenance
ICs = institutional controls
ECs = engineering controls
RA = remedial action
LTM = long-term monitoring
NA = not applicable