REGION 5 RAC2

REMEDIAL ACTION CONTRACT FOR

Remedial, Enforcement Oversight, and
Non-Time Critical Removal Activities at Sites of Release or
Threatened Release of Hazardous Substances in Region 5

FINAL FEASIBILITY STUDY REPORT
Amcast Industrial Site Cedarburg, Wisconsin
WA No. 202-RICO-B5KW/Contract No. EP-S6-06-01

June 2020

PREPARED FOR

U.S. Environmental Protection Agency

PREPARED BY

ch2m

FOR OFFICIAL USE ONLY

FINAL FEASIBILITY STUDY REPORT

Amcast Industrial Site
Cedarburg, Wisconsin

WA No. 202-RICO-B5KW/Contract No. EP-S6-06-01

Prepared for

June 2020

Contents

Acronyms and Abbreviations vii

1 Introduction 1-1
- 1.1 Purpose 1-1
- 1.2 Site Description 1-2
- 1.3 Site History and Operations 1-3
  - 1.3.1 Amcast North 1-3
  - 1.3.2 Amcast South 1-3
  - 1.3.3 History of Polychlorinated Biphenyl Use and Detections 1-4
  - 1.3.4 Recent Site Status 1-4
- 1.4 Conceptual Site Model 1-5
  - 1.4.1 Land Surface Topography 1-5
  - 1.4.2 Geology 1-5
  - 1.4.3 Hydrogeology 1-6
  - 1.4.4 Site Surface Water Hydrology 1-6
  - 1.4.5 Nature and Extent of Contamination 1-7
  - 1.4.6 Contaminant Fate and Transport 1-10
- 1.5 Risk Assessment Summary 1-10
  - 1.5.1 Human Health Risk Assessment 1-10
  - 1.5.2 Ecological Risk Assessment 1-11

2 Development and Identification of ARARs, RAOs, and PRGs 2-1
- 2.1 Applicable or Relevant and Appropriate Requirements Summary 2-1
  - 2.1.1 Chemical-specific ARARs 2-2
  - 2.1.2 Location-specific ARARs 2-2
  - 2.1.3 Action-Specific ARARs 2-2
- 2.2 Remedial Action Objectives Summary 2-3
- 2.3 Preliminary Remediation Goals 2-4
  - 2.3.1 PRG Exceedances—Amcast North (Soil) 2-5
  - 2.3.2 PRG Exceedances—Residential Yards (Soil) 2-5
  - 2.3.3 PRG Exceedances—Wilshire Pond (Sediment/Bank Soil) 2-6
  - 2.3.4 PRG Exceedances—Amcast South (Soil) 2-6
  - 2.3.5 PRG Exceedances—Quarry Pond/Zeunert Park (Sediment) 2-6
  - 2.3.6 PRG Exceedances—Groundwater 2-7
  - 2.3.7 PRG Exceedances—Surface Water 2-7
  - 2.3.8 PRG Exceedances Summary 2-7

3 Identification and Screening of Technologies 3-1
- 3.1 General Response Actions 3-1
- 3.2 Technologies and Process Options Summary 3-1

4 Alternative Descriptions 4-1
- 4.1 Amcast North Alternatives (Soil) 4-1
  - 4.1.1 Alternative AMN-1—No Action 4-1
  - 4.1.2 Alternative AMN-2—Excavation, Offsite Disposal, Backfill, and Site Restoration 4-1
  - 4.1.3 Alternative AMN-3—Excavation, Backfill, Isolation Cover, and Site Restoration 4-4
- 4.2 Residential Yards Alternatives (Soil) 4-5

4.2.1 Alternative RY-1—No Action ... 4-5
4.2.2 Alternative RY-2—Soil Excavation, Offsite Disposal, Backfill, and Site Restoration ... 4-5
4.2.3 Alternative RY-3—Isolation Cover, Limited Excavation, and Site Restoration ... 4-8
4.3 Wilshire Pond Alternatives (Sediment/Bank Soil) ... 4-8
4.3.1 Alternative WP-1—No Action ... 4-8
4.3.2 Alternative WP-2—Sediment and Bank Soil Excavation, Offsite Disposal, Backfill, and Site Restoration ... 4-8
4.3.3 Alternative WP-3—Sediment and Bank Soil Excavation, Structural Excavation, Offsite Disposal, Backfill, and Site Restoration ... 4-10
4.4 Amcast South Alternatives (Soil) ... 4-11
4.4.1 Alternative AMS-1—No Action ... 4-11
4.4.2 Alternative AMS-2—Excavation, Offsite Disposal, Backfill, and Site Restoration ... 4-12
4.4.3 Alternative AMS-3—Isolation Cover and Site Restoration ... 4-14
4.5 Quarry Pond Alternatives (Sediment) ... 4-16
4.5.1 Alternative QP-1—No Action ... 4-16
4.5.2 Alternative QP-2—Sediment Dredging, Bank Soil Excavation, Offsite Disposal, and Site Restoration ... 4-16
4.5.3 Alternative QP-3—Construct Permeable Reactive Barrier to Isolate Contaminated Sediment, Excavate Bank Soil, Offsite Disposal, and Site Restoration ... 4-18
4.5.4 Alternative QP-4—Sediment Dredging to 1 mg/kg PCBs, Bank Soil Excavation, Offsite Disposal, and Site Restoration ... 4-20
4.6 Groundwater Alternatives ... 4-23
4.6.1 Alternative GW-1—No Action ... 4-23
4.6.2 Alternative GW-2—Groundwater Monitoring and Institutional Controls ... 4-23
4.6.3 Alternative GW-3—Groundwater Extraction, Treatment and Discharge of Groundwater Exceeding Enforcement Standards, Groundwater Monitoring, |and Institutional Controls ... 4-24
4.7 Storm Sewer Alternatives ... 4-24
4.7.1 Amcast North Storm Sewers Alternatives ... 4-24
4.7.2 Amcast South Storm Sewer Alternatives ... 4-28

5 Detailed and Comparative Analysis of Alternatives ... 5-1
5.1 Introduction ... 5-1
5.2 Evaluation Criteria ... 5-1
5.2.1 Threshold Criteria ... 5-2
5.2.2 Balancing Criteria ... 5-2
5.2.3 Modifying Criteria ... 5-5
5.3 Amcast North Alternatives (Soil) ... 5-5
5.3.1 Detailed Analysis ... 5-5
5.3.2 Comparative Analysis ... 5-5
5.4 Residential Yards Alternatives (Soil) ... 5-13
5.4.1 Detailed Analysis ... 5-13
5.4.2 Comparative Analysis ... 5-13
5.5 Wilshire Pond Alternatives (Sediment/Bank Soil) ... 5-20
5.5.1 Detailed Analysis ... 5-20
5.5.2 Comparative Analysis ... 5-21
5.6 Amcast South Alternatives (Soil) ... 5-29
5.6.1 Detailed Analysis ... 5-29

5.6.2 Comparative Analysis ... 5-29
5.7 Quarry Pond Alternatives (Sediment) ... 5-37
5.7.1 Detailed Analysis ... 5-37
5.7.2 Comparative Analysis ... 5-37
5.8 Groundwater Alternatives ... 5-46
5.8.1 Detailed Analysis ... 5-46
5.8.2 Comparative Analysis ... 5-46
5.9 Amcast North Storm Sewer Alternatives ... 5-53
5.9.1 Detailed Analysis ... 5-53
5.9.2 Comparative Analysis ... 5-53
5.10 Amcast South Storm Sewer Alternatives ... 5-61
5.10.1 Detailed Analysis ... 5-61
5.10.2 Comparative Analysis ... 5-61

6 References ... 6-1

Appendixes

A Human Health Risk-Based Preliminary Remediation Goals and Summary Tables
B Ecological Risk-Based Preliminary Remediation Goals and Summary Tables
C Alternative Cost Estimates
D Cap Modeling Output

Tables

1-1 HHRA Chemicals of Concern Based on Human Health Risk Assessment Estimates
1-2 ERA Chemicals of Potential Concern Based on Historical and Recent (2011) Analytical Data
2-1 Potential Applicable or Relevant and Appropriate Requirements and To-Be-Considered Criteria
2-2 Preliminary Remediation Goals for Soil Based on Human Health and Ecological Risk Assessment Estimates
2-3 Preliminary Remediation Goals for Sediment Based on Human Health and Ecological Risk Assessment Estimates
2-4 Preliminary Remediation Goals for Groundwater Based on Human Health Risk Assessment Estimates
3-1 General Response Actions Retained for the Amcast Industrial Site
3-2 Screening of Process Options—Soil
3-3 Screening of Process Options—Sediment (Quarry Pond and Wilshire Pond)
3-4 Screening of Process Options—Sewers
3-5 Screening of Process Options—Groundwater
5-1 Detailed Evaluation of Alternatives – Amcast North (Soil)
5-2 Detailed Evaluation of Alternatives – Residential Yards (Soil)
5-3 Detailed Evaluation of Alternatives – Wilshire Pond (Sediment/Bank Soil)
5-4 Detailed Evaluation of Alternatives – Amcast South (Soil)
5-5 Detailed Evaluation of Alternatives – Quarry Pond (Sediment)
5-6 Detailed Evaluation of Alternatives – Groundwater
5-7 Detailed Evaluation of Alternatives – Amcast North Storm Sewers
5-8 Detailed Evaluation of Alternatives – Amcast South Storm Sewers

Figures

1-1 Site Location Map
1-2 Storm Sewer Location Map
1-3 Site Cross-Section Location Map
1-4 Site Cross-Section D-D’
1-5 Groundwater Monitoring Well Locations
1-6 Conceptual Depiction - Release/Transport Mechanisms
2-1 Amcast North Property and Residential Yards - Surface Soil PRG Exceedances
2-2 Amcast North Property Subsurface Soil PRG Exceedances (2 – 10 ft bgs)
2-3 Wilshire Pond - Bank Soil and Basin Sediment PCB PRG Exceedances
2-4 Amcast South Property - Surface Soil PRG Exceedances
2-5 Amcast South Property - Subsurface Soil PRG Exceedances (2 – 21 ft bgs)
2-6 Quarry Pond and Zeunert Park Surface Soil and Sediment PCB PRG Exceedances
2-7 Groundwater PRG Exceedances – VOCs and SVOCs
2-8 Groundwater PRG Exceedances – Metals
2-9 Groundwater PRG Exceedances – PCBs
4-1 Amcast North and Residential Yards Alternatives
4-2 Wilshire Pond Alternatives
4-3 Amcast South Alternatives
4-4 Quarry Pond Alternatives
4-5 Groundwater Monitoring Alternatives
4-6 Amcast North Storm Sewer Alternatives
4-7 Amcast South Storm Sewer Alternatives

Acronyms and Abbreviations

µg/kg	microgram/kilogram
µg/L	microgram/liter
amsl	above mean sea level
ARAR	applicable or relevant and appropriate requirements
AST	aboveground storage tank
bgs	below ground surface
BMP	best management practice
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
CH2M	CH2M HILL, Inc.
COC	chemical of concern
COPC	chemical of potential concern
CSM	conceptual site model
ELCR	excess lifetime cancer risk
EPA	U.S. Environmental Protection Agency
ERA	ecological risk assessment
ES	enforcement standard
FS	feasibility study
GAC	granular activated carbon
GRA	general response action
HHRA	human health risk assessment
HI	hazard index
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
NAPL	nonaqueous phase liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ηg/L	nanograms per liter
NPL	National Priorities List
NR	Natural Resources
O&M	operation and maintenance
OSR	Offsite Rule
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyls

PCP	pentachlorophenol
PRB	permeable reactive barrier
PRG	preliminary remediation goal
RAO	remedial action objectives
RAS	remedial alternatives screening
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RSL	regional screening level
site	Amcast Industrial Site
SL	screening level
SVOC	semivolatile organic compound
TBC	to be considered
TCLP	Toxic Characteristic Leaching Procedure
TSCA	Toxic Substances Control Act
VOC	volatile organic compound
WAC	Wisconsin Administrative Code
WDNR	Wisconsin Department of Natural Resources
WGNHS	Wisconsin Geological and Natural History Survey
USGS	United States Geological Survey
yd^3	cubic yard
Zeunert	Herman A. Zeunert Park

SECTION 1

Introduction

CH2M HILL, Inc. (CH2M) has prepared this feasibility study (FS) report to present the results of the remedial action objectives (RAOs), technology screening, and alternatives development and evaluation completed for the Amcast Industrial Site (site) for the impacted media identified in the *Remedial Investigation Report, Amcast Industrial Site, Cedarburg, Wisconsin* (CH2M 2015). The remedial alternatives were developed and preliminarily screened in the remedial alternatives screening (RAS) report, which was used as the basis for Sections 1 through 3 of this report. This document was prepared in accordance with the Statement of Work Revision 3, dated March 6, 2017, for Work Assignment No. 202-RICO-B5KW/Contract No. EP-S6-06, for the U.S. Environmental Protection Agency (EPA) as part of the remedial investigation (RI)/FS.

1.1 Purpose

The purpose of the FS is to develop site-specific conceptual designs and detailed analysis of alternatives retained from the RAS. The alternatives were developed to address unacceptable risks to human health and the environment, as well as to meet applicable or relevant and appropriate requirements (ARARs). As specified in EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final* (EPA 1988) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the alternatives encompass a range of alternatives in which treatment is used to reduce the toxicity, mobility, or volume of wastes, but vary in the degree to which long-term management of residuals or untreated waste is required. As required, a no-action alternative was also investigated. The RAS was used as the basis for Sections 1 through 3 of this document. The FS report is organized as follows:

- **Background information**—The remainder of Section 1 summarizes the site description, history, and investigation activities for context purposes. Information is also summarized from the *Remedial Investigation Report, Amcast Industrial Site, Cedarburg, Wisconsin* (CH2M 2015), including site-specific characteristics, nature and extent of contamination, contaminant fate and transport, and risk assessments.
- **ARARs**—Remedial actions performed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; as amended in 1986 by the Superfund Amendments and Reauthorization Act) must meet ARARs for selected remedies unless a specific ARAR waiver is requested. ARARs are federal and state environmental or facility siting laws used to define the extent of site cleanup, identify sensitive land areas or land uses, develop remedial alternatives, and direct site remediation. CERCLA and the NCP require that remedial actions comply with federal ARARs and also with state ARARs that are more stringent than their federal counterparts, as long as they are legally enforceable and consistently enforced. ARARs are evaluated early in the RI/FS process so that fieldwork can be designed to collect data necessary to satisfy ARAR requirements and, if necessary, to identify and evaluate remedial alternatives relative to ARARs.
- **RAOs**—Based on existing information, site-specific RAOs that are protective of human health and the environment are identified. The RAOs specify the contaminants and media of concern, exposure routes, and receptors, and an acceptable contaminant level or range of levels for each exposure route (that is, preliminary remediation goals [PRGs]).
- **PRGs**—PRGs are risk-based or ARAR-based chemical-specific concentrations that help further define the RAOs. The PRGs are used to define the extent of contaminated media requiring remedial action.

- **General response actions (GRAs)**—GRAs are developed for each medium of interest by defining containment, treatment, excavation, pumping, or other actions, singly or in combination, to satisfy RAOs. The GRAs take into account requirements for protectiveness as identified in the RAOs and the site's chemical and physical characteristics.
- **Applicable remedial technologies identification and screening**—Applicable remedial technologies are identified and screened against the developed GRAs. Treatment technologies are identified and screened so that technologies are applicable to the contaminants present, their physical matrix, and other site characteristics. Screening is based primarily on a technology's ability to address impacted media and contaminants effectively, but also takes into account its implementability and cost.
- **Remedial alternatives development**—Representative remedial technologies and resulting process options are carried forward into the alternative development stage. The effort includes combining representative technologies and GRAs into alternatives, assessing the appropriateness of suggested alternatives, and developing alternatives in sufficient detail for identification of action-specific ARARs.
- **Preliminary screening of remedial alternatives**—Potential remedial alternatives are screened to reduce them to a manageable number for the detailed evaluation in the FS. Alternatives are screened with respect to three criteria: effectiveness, implementability, and cost. Section 3 presents the preliminary screening of remedial alternatives.
- **Alternatives Descriptions**—The screened technologies were developed and assembled into remedial action alternatives that achieve some or all of the RAOs and provide a range of levels of remediation and a corresponding range of costs. Section 4 presents the alternatives descriptions.
- **Detailed analysis of alternatives**—Section 5 presents a detailed analysis of the alternatives, including detailed descriptions, costs, alternative assessments, and comparative analysis. The detailed descriptions of alternatives include conceptual designs and assumptions made for costing purposes. The detailed analysis was performed using the nine evaluation criteria in accordance with EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final* (EPA 1988).
- **References**—Section 6 documents the references used to prepare this report.

1.2 Site Description

The Amcast Industrial Site is in Section 35, Township 10 North, Range 21 East, in the City of Cedarburg, Ozaukee County, Wisconsin. It is located on the south side of Cedarburg at N39 W5789 Hamilton Road, with portions of the property located on the north and south sides of Hamilton Road (Figure 1-1) and west of Cedar Creek. The Amcast Industrial Site includes the Amcast North and South properties, the residential properties adjacent to Amcast North, the stormwater retention basin (referred to as Wilshire Pond), Quarry Pond at Herman A. Zeunert (Zeunert) Park, and storm sewers. Amcast North is the site of the most recent aluminum die-casting operations. The property is fenced and consists of the former manufacturing plant building, paved asphalt area, and grassy corridors along the sides of the building. Amcast North is bounded on the northwest by the railroad, on the southwest by Hamilton Road, and on the northeast and southeast by residential properties. The residential yards adjacent to Amcast North extend northeast to Wilshire Drive, southeast to Park Lane, and southwest to Hamilton Road. Wilshire Pond is located southeast of Amcast North and the residential area.

Amcast South is the location of the original foundry (now demolished) and includes an office building, a Quonset storage building, an asphalt parking lot on the northern half of the property, and a former disposal area on the southern half of the property that contains buried waste. Amcast South is bounded on the north by Hamilton Road, on the east by the railroad, on the south by the City of Cedarburg Department of Public Works, and on the west by residential properties. Zeunert Park and the Quarry Pond are located across the railroad tracks and southeast of the former manufacturing operations at Amcast South.

Figure 1-2 shows the storm sewer system associated with the Amcast Industrial Site. Storm sewers from the Amcast North property are connected to the Wilshire Pond stormwater retention basin, which drains to Cedar Creek, located east of the site. Storm sewers from the Amcast South property connect to Quarry Pond at Zeunert Park.

1.3 Site History and Operations

1.3.1 Amcast North

Portions of the manufacturing building on Amcast North are first evident in 1963 aerial photography, but the building completion date and the first date of manufacturing operations are not known. The building was constructed in phases through the years. The northernmost building addition was completed in the 1970s and included a partial basement.

A detailed history of operations at the facility prior to 2001 is not available. The aluminum die-casting process occurring at Amcast North in 2001 included receipt of the aluminum ingot followed by temporary storage prior to its introduction into one of several heating furnaces. After melting, the aluminum was transferred into a holding furnace that metered aluminum into individual dies. Once the die was complete, the material was cooled by air and/or water and transferred into an oven to be tempered. The part was then heat-treated, inspected, and shipped offsite for distribution to customers. Dies were reused by entering a blast booth that used plastic media to remove old coating from the die. The die was then heated and re-coated.

Three aboveground storage tanks (ASTs) were reportedly present on the Amcast North property during a 2001 site visit conducted by Sigma Environmental. A propane AST was located adjacent to the railroad on the northwestern portion of Amcast North, and an AST containing liquid nitrogen was located near the partial basement. A 10,000-gallon AST was also reported at the southwestern portion of the northern facility that was used to collect contact, process, and other (oily) waters. The tank was emptied as needed and handled as a nonhazardous special waste. Wastewater was pumped from the facility and stored in the AST for disposal. Some of the drains and sumps in the manufacturing plant were also reportedly routed to this AST. No ASTs were present at Amcast North during 2011 field activities.

Two bermed areas were also noted in the basement for storage of drummed liquid products. Glycol and water tanks associated with the aluminum casting process were stored in one bermed area, while petroleum and other liquid products were stored in a separate bermed area. The following chemicals were reportedly stored in secondary containment on the property in 2001: glycol- and petroleum-based hydraulic fluids, petroleum-based die inspection fluid, oil- and vegetable-based cutting fluids, Stoddard Solvent, and mineral spirits and/or naphtha.

1.3.2 Amcast South

The Amcast South property is the location of the former Meta-Mold Aluminum Company, an aluminum die-cast facility that began operating as early as 1937. Dayton Malleable Iron, Inc., acquired shares of the Meta-Mold Aluminum Company in 1955, which, in turn, became a division of Dayton Malleable in 1973. In 1993, Dayton Malleable changed its name to Amcast Industrial Corporation. Amcast Industrial Corporation was a former manufacturer of aluminum castings, primarily for the automotive industry. The original foundry facility was located east of the present-day office building on Amcast South and was demolished sometime between 1975 and 1980. There were between three and five (depending on the year the aerial photograph was taken) ASTs located south-southeast of the Quonset building on Amcast South. The ASTs were reportedly used for the storage and distribution of fuel oil for heating the aluminum casting facilities on the Amcast South and North properties and were removed from the site between April 1980 and April 1985. A 14,000-gallon underground storage tank was also present on Amcast South, in an unspecified location, and reportedly abandoned in place by filling with an inert material (sand/gravel/slurry).

An area on the southern half of the property was depressed in elevation by at least 5 to 10 feet from the surrounding land based on a 1959 topographic map. The low-lying area, herein referred to as the former disposal area, received material from foundry casting operations and material from the City of Cedarburg during the 1970s. The fill materials encountered during previous investigations included silt and sand with variable amounts of gravel and other debris such as brick, metal, wood, concrete, slag, asphalt, a “white powdery substance,” and visible staining and odors. Interviews with former facility personnel report fill materials included debris from previous site structures, general office and/or factory refuse (such as, paper and wood), scrap metals, and possibly spent oils such as hydraulic fluids. Spent hydraulic fluids were also reportedly applied to the former gravel parking lot for dust control. The parking lot is now paved with asphalt, and the site is vacant. The City of Cedarburg maintains the grassy areas during the growing season.

1.3.3 History of Polychlorinated Biphenyl Use and Detections

Previous reports summarizing Wisconsin Department of Natural Resources (WDNR) records from 1990 indicated that specific products used onsite included Pydraul 312, Pydraul 312A, Pydraul 312C, and Amitron cutting fluid. A letter from Monsanto Company to Amcast Industrial Corporation’s former legal counsel dated July 13, 1990, indicates sales of 23,000 pounds of polychlorinated biphenyl (PCB)-containing Pydraul 312 to the facility between 1966 and 1971. Pydraul 312 contained PCB Aroclor 1242 in a concentration of 47 to 48 percent. No sale of the material was documented after 1971. PCB-based cutting fluids were historically used onsite, and some of the material was reportedly used to oil the roads on the property to reduce dust.

The summary of WDNR’s project files regarding the PCB detections and the elimination of PCBs from the facility reported that in 1974, WDNR notified Amcast (Dayton Malleable, Inc.) that Aroclor 1248 was found in a storm sewer manhole (location not specified) on the Amcast Industrial Site. WDNR requested that Amcast (Dayton Malleable) discontinue use of PCB-containing oils and determine the path of hydraulic fluid to the storm sewer. Correspondence files indicated that efforts to remove PCB-containing oils from the machine system were completed by 1976, installation of an oil/water separator and floor drain modifications were completed by 1978, discharges to the storm sewer were eliminated by 1980, cooling water from the oil/water separator had been rerouted to discharge to the sanitary sewer by 1986, and effluent was within permitted limits per a 1986 compliance report. A more detailed summary of the WDNR project files reviewed by Foth & Van Dyke is presented in the *Preliminary Site Characterization Summary* (Foth & Van Dyke 2004).

Despite efforts to eliminate the presence and use of PCBs onsite, sample results from previous investigations indicate significant levels of PCBs in storm sewers on the Amcast North and South properties. Two releases to surface waters and/or the storm sewer were reported to WDNR in 1998.

1.3.4 Recent Site Status

Some RI activities were completed in 2003 and 2004 by Amcast Industrial Corporation prior to its filing for bankruptcy under Chapter 11 (November 2004). Amcast Industrial Corporation operated until December 2005, when it filed for bankruptcy a second time under a Chapter 11 plan of liquidation. In April 2009, EPA proposed the Amcast Industrial Site for the National Priorities List (NPL), and it was finalized as an NPL site on September 23, 2009 (FDMS Docket ID: EPA-HQ-SFUND-2009-0073). The facility is now closed, and the site is vacant. The building remaining on Amcast North is locked and boarded up and is not being maintained as evidenced by the large hole in the roof. The RI sampling events did not include the building materials due to safety reasons. The building may need to be removed and characterized at the same time to accommodate safety procedures. This FS does not include the building removal and associated costs.

1.4 Conceptual Site Model

Physical site characteristics and physical and chemical characteristics of the site-related constituents combine to define a conceptual site model (CSM) for a site. In general, contaminants at the Amcast Industrial Site, primarily PCBs from oils used at the former die-casting facilities, were apparently transported to the environment via inlets to storm sewers and by overland flow during rain events. PCB contamination within the storm sewers has affected sediment that has accumulated in the sewers in Wilshire and Quarry Ponds, and surface water in the ponds (adjacent to the sediment). A former disposal area on Amcast South also received contaminated materials (PCBs, volatile organic compounds [VOCs], and polycyclic aromatic hydrocarbons [PAHs]) that have affected surrounding subsurface soil and groundwater).

Site physical characteristics, the nature and extent of site contamination, and the site-specific fate and transport mechanisms are summarized in the following subsections and combine to describe the overall CSM for the Amcast Industrial Site.

1.4.1 Land Surface Topography

The land surface elevations range from a high of approximately 770 feet above mean sea level (amsl) near the northwestern portion of Amcast South to a low at the edge of Quarry Pond (approximately 730 feet amsl) based on the 1994 United States Geological Survey (USGS) Cedarburg topographic quadrangle. The Amcast South property elevation decreases to approximately 760 feet amsl along its southern boundary. The elevation range across Amcast North is approximately 760 to 750 feet amsl, and the downward slope continues across the residential area to the south and east, to a general elevation of approximately 730 feet amsl. The ground surface elevation near Wilshire Pond is at the approximate elevation of 740 feet amsl. Farther south and east, the base elevation of Cedar Creek (not its water elevation) is approximately 700 to 710 feet amsl.

1.4.2 Geology

Regional geology in Ozaukee County consists of unconsolidated deposits ranging from 0 to 600 feet thick overlying eastward dipping, Silurian-aged dolomite bedrock that is approximately 500 feet thick in the Cedarburg area (Wisconsin Geological and Natural History Survey [WGNHS] 2005). The surface elevation of Silurian-aged “Niagara” dolomite in Ozaukee County ranges from approximately 600 to 900 feet, and outcrops locally at the ground surface. Underlying the dolomite in the Cedarburg area is approximately 150 feet of Maquoketa Group Shale that acts as a confining layer to deeper bedrock units. The unconsolidated deposits consist of glacial sediments, alluvium (east of the Amcast Industrial Site along Cedar Creek), and surface marsh deposits (WGNHS 1997; 2005). Glacial material deposited in Ozaukee County includes diamicton (nonsorted or poorly sorted sediment with a wide range of grain size and a fine-grained matrix deposited directly beneath glacial ice or on ice margins by mudflows and landslides that collapse off of glacial ice slopes), and landforms from interglacial and glacial periods, including end moraines, ground moraines, outwash plains, and ice-walled lake plains (WGNHS 1997). Gravel outwash or lake deposits are found between end moraine diamicton deposits.

The subsurface materials immediately beneath the site include a compact and uniform glacial clayey silt with some sand lenses and other discontinuities as shown in Figure 1-4. In addition, fill materials extending to depths of about 21 feet and containing soil material (silt, sand, and gravel), brick, metal filings, wood, concrete, and asphalt compose the uppermost materials at Amcast South in association with the former disposal area. A thin layer of organic-rich clayey silt up to 5 feet thick is also encountered beneath the fill or clay/silt layer(s) in some locations. Beneath the uppermost clayey silt or fill materials (and the organic layer, where present) is a fine-grained diamicton consisting of clayey silts and silty clays with some sand and/or gravel lenses. A sand unit reportedly composed of glacial outwash deposits is present beneath the diamicton and noted to be 15 feet thick at one location on Amcast North, where it is bounded below by a silt layer of unknown thickness. Below the unconsolidated units lies dolomite bedrock that outcrops on the northwestern shoreline of Quarry Pond (Figure 1-4). The RI report contains additional detail (CH2M 2015).

1.4.3 Hydrogeology

There are three major aquifer systems within Ozaukee County in descending elevation: the unconsolidated materials that are capable of yielding water under pumping stress, the Niagara dolomite aquifer, and the sandstone aquifer (WGNHS 1980). The Maquoketa shale aquifer serves as an aquitard beneath the unconfined Niagara aquifer and the confined, deeper sandstone aquifer (WGNHS 1980). The deeper confined aquifer historically has a horizontal flow towards Lake Michigan to the east but localized variations are possible due to pumping of high-capacity wells. Where the unconsolidated aquifer exists, it consists of the sand and gravel deposits such as outwash, alluvium, and glacial lake deposits and features within diamicton deposits that yields enough water to a residential or other relatively low-use well. Groundwater flow directions within unconsolidated deposits are expected to be toward local rivers and streams (e.g., Cedar Creek) that likely act as groundwater discharge areas.

Groundwater is encountered at the Amcast Industrial Site at depths ranging between 8 and 34 feet below ground, depending on the ground surface elevation. Monitoring wells that are screened in the shallow clay/silt are considered to be within a perched groundwater zone that is not able to yield sufficient water for residential or other use (logarithmic-average hydraulic conductivity of 4.31×10^{-4} centimeters per second). The potential direction of groundwater flow within the shallow clay/silt unit roughly coincides with the topography of the land surface, sloping toward the southeast and Quarry Pond at a relatively slow rate. Monitoring wells screened in the deeper, sandy outwash material (hydraulic conductivity of 2.08×10^{-2} centimeters per second) are considered to be part of a shallow unconsolidated groundwater aquifer with an apparent eastern flow direction at a relatively higher estimated flow rate.

1.4.4 Site Surface Water Hydrology

Surface water drains in the general direction that follows northwest to southeast topography. Quarry Pond (a former rock quarry) is situated south of Amcast North and South with a surface water elevation of approximately 730 feet. Principal water sources include precipitation, groundwater recharge, and runoff. In addition, the pond receives storm sewer discharge from adjacent commercial areas, including the City of Cedarburg Department of Public Works and the Amcast South property. Because it is a land-locked, flooded rock quarry that is not directly connected to Cedar Creek or other natural surface water features, the flow within the Quarry Pond is assumed to be limited. The water depth in Quarry Pond, as measured during a 2003 investigation (Foth & Van Dyke 2004), ranges from 0 feet at the shoreline with a sharp dropoff around the pond's edge to about 16 feet, with a maximum depth of 17.4 feet. Previous investigations reported depths up to 22 feet and that the pond elevation fluctuates and rises during storm events to the elevation where it drains into Cedar Creek by way of the city storm sewer along Hamilton Road (Strand 1992). However, this connection could not be verified during the RI or during the 2003/04 site characterization study (Foth & VanDyke 2004). Sediment thickness in the pond ranges from 1 to 5 feet thick. A 2011 biological survey noted green sunfish and black bullhead as the dominant fish species in Quarry Pond. The *Remedial Investigation Report* (CH2M 2015) contains additional details on the Quarry Pond.

Wilshire Pond is a shallow stormwater retention basin receiving stormwater from the neighborhood west of its location—emanating from Amcast North and surrounding areas. A stormwater discharge pipe extends in a northeast direction out of Wilshire Pond, continuing toward a confluence near Cedar Creek. Sediment thickness near Wilshire Pond ranges from between 0.5 and 2.9 feet. Based on the small size of the pond, its shallow water depth, and its irregular flooding regime, the pond does not appear to support much of a fish population, but snails, other invertebrates, and thick emergent vegetation are present. Small numbers of green sunfish and golden shiner were noted during a 2011 biological survey, along with frogs/tadpoles of unknown species.

Cedar Creek flows north to south approximately 1,000 feet east of the site, and apparently receives stormwater from Wilshire Pond in addition to the typical surface runoff from zones immediately adjacent to the Creek. Cedar Creek is at a lower elevation than the Quarry Pond.

1.4.5 Nature and Extent of Contamination

Screening-level concentrations were established and used for chemical data evaluation during the Amcast Industrial Site RI. The screening-level concentrations for the various media identified in the RI using a conservative approach are as follows:

- Soil—EPA Residential Soil Regional Screening Levels (RSLs).[1]
- Sediment—EPA Residential Soil RSLs (conservative risk-based values for sediment that assumes daily contact).
- Surface Water—Although the surface water in Quarry and Wilshire Ponds is not a drinking water source, the screening-level sources included the EPA Tapwater RSLs and Wisconsin Administrative Code (WAC) Natural Resources (NR) 140 groundwater quality Enforcement Standards (ESs).
- Groundwater—EPA Tapwater RSLs and WAC NR 140 groundwater quality ES.

PCBs (primarily Aroclor 1248) are the main contaminants in soil/sediment, storm sewer sediment, and/or surface water at the Amcast Industrial Site. There are also concentrations of PAHs and metals above RSLs in soil/sediment samples. Individual VOC and non-PAH semivolatile organic compounds (SVOC) were less frequently detected in soil/sediment, and typically at concentrations lower than their respective RSLs. Historical groundwater detections of PCBs are very limited as to frequency and concentration.

The findings of the field investigation relative to the nature and extent of contamination at the Amcast Industrial Site included the following:

- Amcast North
  - The highest PCB concentrations are generally limited to the top 5 feet of soil surrounding the existing building.
  - PCB concentrations in soil beneath the building are below 1,000 microgram/kilogram (µg/kg) based on data collected from 14 soil borings (ENSR 2007).
  - Arsenic exceeds its RSL in surface and subsurface soil with concentrations ranging from 0.61 to 5.3 milligram/kilogram (mg/kg); however, concentrations are lower than natural background concentrations according to the USGS and WDNR (Stensvold 2012).
  - The highest concentrations of total PAHs that exceed individual RSLs are generally limited to the top 6 feet of soil and predominantly occur on the northeast, southeast, and southwest corners of the site.
  - None of the individual VOC compounds were detected above their respective RSLs in surface or subsurface soil.
  - Building materials were not sampled in 2011 due to the deteriorated/unsafe condition of the building.
- Residential Yards
  - At least one surface soil sample from each of the 18 residential parcels contains total PCB concentrations exceeding 1,000 µg/kg.

---

[1] EPA RSL = Regional Screening Levels (RSLs) for chemical contaminants at Superfund Sites, May 2013

- Wilshire Pond
  - Total PCB concentrations in sediment range from 1,300 to 520,000 µg/kg in each of the 17 samples collected, and all samples exceed the individual congener RSL of 220 µg/kg.
  - PCBs were not detected in surface water samples above 1.0 microgram per liter (µg/L).
  - Only aluminum and manganese exceed WAC NR 140 ES values in the water samples.
  - Total PCB concentrations ranged from 3.83 to 30 mg/kg in 8 whole-body organism samples, including 1 fish sample (green sunfish), 1 composite fish sample (green sunfish and golden shiner), and 6 composite frog (tadpole) samples.
  - In 2014, the USGS placed swallow boxes near the Cedarburg Wastewater Treatment Plant, about 0.25 mile from the Wilshire Pond, to monitor bioaccumulation of chemicals, including PCBs, for the Area of Concern program. Among the 60 other Area of Concern sites that the USGS uses to relatively compare the results, Cedarburg was fifth highest (eighth percentile) for total PCBs with a geometric mean concentration of 2.7 micrograms per gram wet weight. PCBs in the swallows are interpreted by WDNR to be coming from the Wilshire and Quarry Ponds; however, these data were not available for evaluation during the RI.
- Amcast South
  - The highest concentrations of PCBs in soil generally occur within the limits of the former disposal area. Concentrations increase with depth to a maximum concentration reported for samples between 11 and 21 feet.
  - The distribution of PAHs in surface and subsurface soil roughly correlates with the PCB distribution, but the highest PAH concentrations are contained in surface soil versus at depth.
  - VOCs were not detected in soil samples.
  - Arsenic concentrations in soil and subsurface soil (1.2 to 8.2 mg/kg) exceed the RSL but are naturally occurring according to USGS and WDNR (Stensvold 2012).
  - Lead concentrations in soil at one location (FVSS-06; 1,200 mg/kg from 1 to 3 feet, 430 mg/kg from 5 to 7 feet) exceed the RSL of 400 mg/kg; FVSS-06 is located outside of the former disposal area boundary, on the eastern boundary of Amcast South and west of the railroad tracks.
- Zeunert Park/Quarry Pond
  - The distribution and concentrations of PCB-contaminated sediment in the pond suggest the source is the Amcast South property by storm sewer discharge.
  - Total PCB concentrations range from 1,300 to 11,000,000 µg/kg in 31 sediment samples, with the highest concentrations located in the northern portion of the pond where a storm sewer discharge pipe originating at Amcast South discharges.
  - The highest PCB concentration interval within the sediment is at an intermediate depth, with less contaminated sediment above and below.
  - PCB contamination on the banks of Quarry Pond and in the Zeunert Park soil is coincident with park areas that are more prone to flooding (the northern boundary of the pond, and one spot on the southeastern edge, both at relatively low ground surface elevations), suggesting that pond sediment is the likely source of the “onshore” PCB contamination via deposition of sediment particles during high water events.
  - The highest total PCB concentration in surface soil was detected in sample AMZ-SO02 in the northern portion of the park (2,000 µg/kg), also thought to be due to high water events/sediment deposition from the pond.
  - PCBs were not detected in Quarry Pond surface water samples above 1.0 µg/L.

- Pentachlorophenol (PCP) was detected in 5 of 8 surface water samples at concentrations above the WAC NR 140 ES, but PCP is not believed to be related to former Amcast operations. However, since it was detected above its tapwater RSL, it was addressed in the human health risk assessment (HHRA). In these five samples, PCP did not exceed chronic EPA national Ambient Water Quality Criteria values for aquatic life or Wisconsin chronic toxicity criteria for fish and aquatic life when adjusted using the mean water pH measured in Quarry Pond surface water samples.
- PCBs were detected in 13 of 24 organisms collected in the pond, ranging in concentration from 2.5 to 25 mg/kg.

- Storm Sewers
  - Storm sewers that connect Amcast North to Wilshire Pond eventually discharge to Cedar Creek. Total PCB sample concentrations in storm sewer sediment collected upslope from Wilshire Pond range in concentration from 65 to 19,000 µg/kg, with the highest concentration detected immediately adjacent to the Amcast North building.
  - Storm sewer sediment samples collected from sewers that connect Amcast South and Quarry Pond have total PCB concentrations ranging from 135 to 23,000,000 µg/kg. The highest concentrations were detected from sewer sediment samples on the north and south sides of the existing Quonset building on Amcast North, with concentrations decreasing in the downslope directions within the sewers.
  - Storm sewers located in Zeunert Park have total PCB sediment sample concentrations ranging from 2,000 to 250,000 µg/kg.
- Groundwater
  - AMS-MW01 was the only site well that had detections of PCBs at a concentration exceeding the WAC NR 140 ES of 0.03 µg/L (Aroclor 1260: 1.5 µg/L) during the most recent (2011) monitoring event. The well is located adjacent to and east of the former disposal area (Figure 1-5) on Amcast South and is screened from 30 to 40 feet below ground surface (bgs) in the sand and gravel unit.
  - Bromodichloromethane at GMMW-1 (1.1 µg/L) was the only VOC detected above its maximum contaminant level (MCL)/ES (0.6 µg/L) in 2011. GMMW-1 is located at the farthest northern corner of Amcast South, apparently upgradient former operations at Amcast South and crossgradient of former operations at Amcast North. The source of the contaminant is not known but is not thought to be related to former Amcast operations.
  - There were no SVOC compounds detected above their individual MCL/ESs in 2011.
  - The only metal compound concentrations that exceed an MCL/ES in 2011 were detected at the following locations:

    Amcast South

AMS-MW01	manganese: 1,120 µg/L versus MCL/ES of 300 µg/L
GMMW-3	arsenic: 16.6 µg/L versus MCL/ES of 10 µg/L
GMMW-4	arsenic: 13.3 µg/L, manganese 485 µg/L

    Zeunert Park

FVMW-23	manganese: 722 µg/L
FVMW-24	manganese: 754 µg/L

    The arsenic concentrations in groundwater are likely a result of naturally elevated (background) concentrations in soil.

1.4.6 Contaminant Fate and Transport

General fate and transport mechanisms were presented in the RI report and include, depending on contaminant and source characteristics, volatilization, wind dispersion, sorption to solid phases, degradation by numerous means, transformation of valence state, bioaccumulation, and water transport of solutes or particles.

Figure 1-6 depicts the fate and transport processes relevant to the Amcast Industrial Site. The primary contaminant release and transport mechanisms from the site, in decreasing order of importance based upon the current understanding of site conditions, are as follows:

- PCB-contaminated sediment and water within storm sewers originating at Amcast North and Amcast South and discharging to Wilshire Pond and Quarry Pond, respectively
- PCB-contaminated sediment and water within the storm sewer originating at Wilshire Pond and discharging into Cedar Creek
- Biological uptake of PCB-contaminated sediment by organisms in Wilshire and Quarry Ponds
- Surface runoff of suspended soil particles contaminated with PCBs and/or PAHs from surface soil at Amcast North, the residential properties adjacent to Amcast North, and Amcast South
- Surface runoff from PCB-contaminated sediment in ponds and subsequent deposition adjacent to the ponds during periods of high water elevation
- Surface runoff of dissolved metals from Wilshire Pond or PCP from Quarry Pond and subsequent dissolution or mineralization adjacent to the ponds during periods of high water elevation
- Infiltration/leaching through the former disposal area debris/contaminated soil at Amcast South with possible contaminant discharge into the groundwater
- Infiltration/leaching through PCB- and/or PAH-contaminated surface soil at residential properties, Amcast North, and Amcast South with possible discharge into the groundwater
- Dispersal of site contaminants from building materials (Amcast North) or contaminated surface soil into the atmosphere by volatilization or on particulates
- Movement of existing groundwater contaminants within the groundwater system with eventual discharge to Wilshire Pond, Quarry Pond, or Cedar Creek

1.5 Risk Assessment Summary

Potential risk posed by site-related constituents detected at the Amcast Industrial Site was evaluated in a HHRA and an ecological risk assessment (ERA) as part of the RI. The following subsections summarize the results of each assessment.

1.5.1 Human Health Risk Assessment

An HHRA was prepared using conservative assumptions and feasible exposure pathways that are based on both current and potential future site use conditions. Use of the conservative assumptions (consistent with a reasonable maximum exposure scenario) is intended to overstate rather than understate the potential risks. HHRA chemicals of potential concern (COPCs) were identified for the various site media/area groupings by comparing the maximum detected concentration of each chemical in a media/data grouping to its respective screening level (SL). Table 1-1 lists the identified COPCs by media/group. If the maximum detected concentration exceeded its SL, it was retained as an HHRA COPC. Chemicals not detected in an exposure medium/data grouping were not selected as HHRA COPCs. HHRA SLs for various media included the following:

- Soil = EPA RSLs for Chemical Contaminants at Superfund Sites (EPA 2013a)

- Fish ingestion = calculated using the default exposure assumptions in the EPA RSL Calculator for fish consumption (EPA 2013b)
- Surface water and groundwater = WAC NR 140 Preventive Action Limits and ESs, and federal MCLs
- Groundwater vapor pathway = calculated using the EPA VISL Calculator tool (EPA 2013c)

The HHRA was performed to evaluate potential exposure pathways and receptors, and to develop cumulative risk estimates for comparison with EPA target risk range and target hazard index. Chemicals of concern (COCs) were identified based on where the potential site-related excess lifetime cancer risk (ELCR) or hazard index (HI) for a receptor group exceeded EPA threshold values (a total ELCR greater than 1×10^{-4} or a target-organ-specific HI greater than 1.0). For each receptor group, when a potential site-related ELCR of 1×10^{-4} was exceeded for an environmental medium, the HHRA COPCs posing an individual ELCR greater than 1×10^{-6} in that environmental medium were identified as HHRA COCs. When a potential site-related target-organ HI exceeded 1 for an environmental medium, the COPCs posing a hazard quotient greater than 0.1 for the target organ in that environmental medium were identified as COCs.

ELCR and HI estimates exceed the acceptable threshold levels for the receptor groups evaluated in the HHRA. The HHRA COCs vary by site location and medium, as summarized in Table 1-1.

1.5.2 Ecological Risk Assessment

An ERA was conducted through Step 3A of the 8-step ERA process (EPA 1997). The objective of the ERA was to evaluate whether site-related contaminants represent a potential unacceptable risk to exposed ecological receptors.

Conservative assumptions were generally used in the exposure and effects assessments, so uncertainties related to the limitations of the available data (requiring that certain assumptions and extrapolations be made), along with uptake and food web exposure model assumptions, are more likely to result in an overestimation rather than an underestimation of the likelihood and magnitude of risks to ecological receptors. ERA COPCs were identified for each of the terrestrial and aquatic areas evaluated in the ERA (Amcast North, Amcast South, Residential Area, Zeunert Park, Quarry Pond, and Wilshire Pond). Table 1-2 summarizes ERA COPCs for the various areas. PCBs (total PCBs and Aroclor-1248) were the ERA COPCs identified in aquatic habitats associated with the site (Quarry Pond basin sediment, fish tissue, and aquatic food webs; Wilshire Pond basin and bank sediment, fish tissue, and aquatic food webs). The fish tissue and aquatic food web exposures in Wilshire Pond constituted the highest potential ecological risks of those evaluated in the ERA. PCBs (total PCBs, Aroclor-1248, and/or Aroclor-1254) were also the primary ERA COPCs in terrestrial habitats on and adjacent to the site.

Development and Identification of ARARs, RAOs, and PRGs

2.1 Applicable or Relevant and Appropriate Requirements Summary

Remedial actions must protect public health and the environment and address risks identified in the human health and ecological risk assessments. Section 121 of CERCLA requires that primary consideration be given to remedial alternatives that attain or exceed ARARs. The purpose of this requirement is to make CERCLA response actions consistent with other pertinent federal and state environmental requirements and adequately protect public health and the environment.

Definitions of the ARARs and the "to be considered" (TBC) criteria are as follows:

- Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that directly and fully address a hazardous substance, pollutant, contaminant, environmental action, location, or other circumstance at a CERCLA site. In short, "Applicability" in regard to the status of an ARAR, is a legal and jurisdictional determination.
- Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law, which while not "applicable," address problems or situations sufficiently similar (relevant) to those encountered at a CERCLA site, that their use is well suited (appropriate) to the particular site. Determination of "relevant and appropriate" relies on professional judgment, considering environmental and technical factors at the site. Once a requirement is determined to be relevant and appropriate, it must be complied with as if it were applicable.
- TBC criteria are non-promulgated, non-enforceable guidelines or criteria issued by federal or state government that are not legally binding but may be useful for developing a remedial action or are necessary for evaluating or determining the level of cleanup that is protective to human health and/or the environment. TBC factors do not have the status of potential ARARs unless they are included in the Record of Decision. Examples of TBC criteria include EPA drinking water health advisories, reference doses, and cancer slope factors.

Another factor in determining which requirements must be addressed is whether the requirement is substantive or administrative. Substantive requirements are those pertaining directly to actions or conditions in the environment. Administrative requirements are mechanisms that facilitate the implementation of the substantive requirements of an environmental law or regulation. In general, administrative requirements prescribe methods and procedures (e.g., fees, permitting, inspection, and reporting requirements) by which substantive requirements are made effective for the purposes of a particular environmental or public health program. "Onsite" CERCLA response actions must comply with the substantive requirements but not with the administrative requirements of environmental laws and regulations as specified in the NCP, 40 *Code of Federal Regulations* (CFR) 300.5, definitions of ARARs and as discussed in 55 Federal Register 8756.

ARARs are grouped into three types: chemical-specific, location-specific, and action-specific. Table 2-1 lists the chemical-specific, action-specific, and location-specific ARARs, along with ARAR-specific status analysis relative to remediation at the Amcast Industrial Site. Selection of ARARs often evolve as the project progresses and additional information is obtained.

2.1.1 Chemical-specific ARARs

Chemical-specific ARARs include laws and requirements that establish health- or risk-based numerical values or methodologies for environmental contaminant concentrations or discharge. There are no contaminant-specific federal ARARs for soil, but the Toxic Substances Control Act (TSCA) (40 CFR 761.61[c]) is applicable as a method to establish cleanup levels for removing PCB-contaminated remediation waste and managing such waste. State of Wisconsin regulations include the WAC NR 720.02(1)(e) soil cleanup standards. Wisconsin's water quality standards [WAC NR 102.04(1)(a) and (d) and WAC NR 105.06], as well as federal 40 CFR 132, are applicable to Wilshire and Quarry Ponds, and WAC NR 140 is applicable to groundwater quality. WAC NR 207 Wisconsin Pollutant Discharge Elimination System regulations may be applicable or relevant and appropriate to groundwater treatment, sediment dewatering, or pond water removal. There are no chemical-specific ARARs for sediments. Section 2.3 discusses the establishment of PRGs.

2.1.2 Location-specific ARARs

Location-specific ARARs are requirements that relate to the geographical position of the site. Examples of location-specific ARARs include state and federal laws and regulations that apply to the protection of wetlands, construction in floodplains, and protection of endangered species in streams or rivers.
The location-specific ARAR relevant to future work at the Amcast Industrial Site is the Migratory Bird Treaty Act of 1972. Migratory birds are known to pass over the area, although no nesting habitats are believed to exist on the site. If migratory birds, their nests, or eggs are discovered, the design will specify measures to minimize disturbance.

2.1.3 Action-Specific ARARs

Action-specific ARARs regulate the specific type of action, technology under consideration, or the management of regulated materials. Action-specific ARARs generally set performance, design, or other similar action-specific controls or restrictions on particular kinds of activities related to management of hazardous substances or pollutants. These requirements are triggered by the remedial activities selected to accomplish a remedy. Since there are usually several alternative actions for any remedial site, very different requirements may apply. The action-specific requirements do not solely determine the remedial alternative, but indicate how wastes will be managed, or to what level treatment will be achieved.

The TSCA 40 CFR 761.61(c) risk-based disposal approval for PCB remediation waste and soil and 40 CFR 761.65(c) are the main federal action-specific regulations that are applicable to remedial actions at the Amcast Industrial Site. Although not an ARAR by definition, 40 CFR 300.440 (the CERCLA Offsite Rule) is a regulation that requires compliance if waste is disposed offsite.

Action-specific ARARs originating at the state level that may be/are applicable or relevant depending on alternatives chosen include WAC NR 415 (fugitive dust emission standards), WAC NR 216 Subchapter III (WAC NR 216.46 and 216.47) for stormwater management, WAC NR 662 (management requirements for hazardous waste, if encountered), WAC NR 718 (storage, transportation, treatment, and disposal standards for excavated soil and other solid wastes), and WAC NR 292.12 for maintenance of a sediment cap. WAC NR 350-353 (wetland compensatory mitigation projects) may be relevant and appropriate to the Wilshire and Quarry Ponds if such a project is required. The State guidance document related to soil performance standard requirements (WDNR 2013a) may be relevant or applicable to work performed at Amcast South, and the state guidance document related to historical landfill development (WDNR 2013b) may be relevant to the disposal area in Amcast South is TBC.

2.2 Remedial Action Objectives Summary

RAOs are goals specific to media or operable units for protecting human health and the environment. Risk can be associated with current or potential future exposures. RAOs should be as specific as possible but not so that the range of alternatives to be developed is unduly limited. Objectives aimed at protecting human health and the environment should specify the following: (1) COCs, (2) exposure routes and receptors, and (3) an acceptable contaminant level or range of levels for each exposure route (that is, a PRG) (EPA 1988).

RAOs were developed for the Amcast Industrial Site considering the contaminant levels and exposure pathways found to present potentially unacceptable risk to human health and the environment as determined during the RI. Residents, industrial workers, recreational users, and recreational anglers were the human receptors, and various lower-trophic-level organisms (primarily invertebrates, amphibians, and fish) and upper-trophic-level organisms (birds and mammals) were the ecological receptors, used to develop RAOs.

The human-health RAOs for surface soil,[2] total soil (0 to 10 feet), groundwater, sediment, and fish are as follows:

1. Soil—Minimize the potential for dermal contact, ingestion, and inhalation exposures to COCs in the following areas for the indicated receptors:
   - Amcast North surface soil for trespassers and total soil for residents, industrial workers, and construction workers
   - Amcast South total soil for residents, industrial workers, and construction workers
   - Residential area surface soil for residents (based on soil cleanup level of 1 part per million per EPA 40 CFR 761.61(c))
   - Wilshire Pond bank surface soil for recreational users
2. Groundwater
   - Minimize the potential for dermal contact, ingestion, and inhalation exposures to COCs in tapwater for residents and industrial workers.
   - Minimize the potential for vapor intrusion of COCs for residents and industrial workers.
   - Prevent future residential exposure to groundwater that exceeds federal MCLs or WAC NR 140 ES.
   - Restore groundwater exceeding federal MCLs and WAC NR 140 ES in a reasonable timeframe given the site-specific circumstances.
3. Quarry Pond Sediment
   - Minimize the potential for dermal contact and ingestion exposures to COCs for recreational users.
   - Minimize the potential for bioaccumulation into edible-size fish for recreational anglers.
4. Quarry Pond Fish—Minimize the potential for ingestion exposures to COCs for recreational anglers.

[2] Surface soil was defined as 0 to 2 feet bgs in the EPA-approved Work Plan (CH2M 2009) and HHRA (CH2M 2015). The 2-foot bgs is the typical maximum depth of soil contacted by residents during outdoor activities such as lawn maintenance and gardening; however, WDNR defines surface soil as 0 to 4 feet bgs.

The ecological RAOs for surface soil (0 to 2 feet), surface sediment, fish/frog tissue, and wildlife are as follows:

1. Surface soil—Minimize the potential for direct contact, direct ingestion, and/or food web exposures to COC concentrations above acceptable levels in the following areas for the indicated receptors:
   - Amcast North surface soil for lower-trophic-level terrestrial organisms (soil invertebrates and plants) and upper-trophic-level organisms (birds and mammals)
   - Amcast South surface soil for lower-trophic-level terrestrial organisms (soil invertebrates) and upper-trophic-level organisms (primarily small mammals)
   - Residential area surface soil for upper-trophic-level organisms (small mammals)
   - Zeunert Park surface soil for upper-trophic-level organisms (small mammals)
2. Basin or pond bank sediment—Minimize the potential for direct contact, direct ingestion, and/or food web exposures to PCB concentrations above acceptable levels in the following areas for the indicated receptors:
   - Quarry Pond basin sediment for lower-trophic-level aquatic organisms (primarily invertebrates and fish) and upper-trophic-level organisms (birds and mammals)
   - Wilshire Pond bank and basin sediment for lower-trophic-level aquatic organisms (invertebrates, fish, and amphibians) and upper-trophic-level organisms (birds and mammals)
3. Fish/frogs—Minimize the potential for bioaccumulation of PCBs into fish/frog tissues above acceptable levels in the following areas for the indicated receptors:
   - Quarry Pond fish tissue from exposure to basin sediments
   - Wilshire Pond fish and frog tissue from exposure to bank and basin sediments
4. Wildlife—Minimize the potential for adverse effects resulting from the ingestion of water and aquatic prey taken from surface waters containing PCBs by attaining the numeric water-quality criterion for the protection of wildlife for total PCBs at 0.12 nanograms per liter (ηg/L) in the Quarry Pond and Wilshire Pond.

2.3 Preliminary Remediation Goals

In general, PRGs establish media-specific concentrations of COCs that will pose no unacceptable risk to human health and the environment. COCs are the chemicals that result in current or potential future unacceptable risk. To meet the RAOs defined in Section 2.2, PRGs were developed to define the extent of contaminated media (soil, sediment, and groundwater) requiring remedial action or for prevention of future adverse effects. PRGs are considered “preliminary” remediation goals because the final remedial goals will be defined in the Record of Decision once a remedy is selected for the site.

This section presents the PRGs and defines the extent and volumes of affected media that will be addressed in the FS process. Tables 2-2 through 2-4 summarize the PRGs discussed in the following sections. Appendix A presents the methodology used to select the human health PRGs for the COCs established in the HHRA. Appendix B presents the methodology used to select the ecological PRGs for the COPCs established in the ERA.

Ecological PRGs were established for all site areas. A set of PRGs for residential land use was established for Amcast North due to the City of Cedarburg’s future plans for this parcel. However, a residential human health PRG was not established, nor deemed appropriate, for Amcast South due to the presence of the former disposal area on this portion of the site, so human health PRGs were only established for industrial land use. The Quarry Pond/Zeunert Park portion of the site is assumed to have human health recreational (and not residential or industrial) use. A human health recreational use was also assumed for Wilshire Pond.

A numerical PRG was not defined for contaminated media (sediment and stormwater) located inside the stormwater sewers because they were not specifically evaluated in the HHRA. Potential exposures to sediment and water in the stormwater sewers would be very infrequent and considered negligible; however, remedial process options for storm sewers will still be addressed in the FS because of the potential for PCB contamination associated with sewer sediment or backfill to continue to act as source material for water travelling toward Wilshire and/or Quarry Ponds, either within the pipes or along the backfill.

A PRG of 1 mg/kg was established for soil remediation in the residential yards based on 40 CFR 761.61[c]. This numeric value is also consistent with what has been approved by EPA and WDNR for remediation of PCB-contaminated soils in residential yards and parks at EPA Superfund alternative sites located in the City of Cedarburg.

2.3.1 PRG Exceedances—Amcast North (Soil)

Surface soil areas (depths from 0 to 2 feet bgs) with COC concentrations exceeding the PCB PRG of 1 mg/kg are located outside of the boundaries of the former manufacturing building at Amcast North (Figure 2-1). There is only one location in the surface soil, AMN-SO09, where a PAH residential or soil-to-groundwater human health PRG is exceeded. In the shallow soil, the estimated total area exceeding the PRGs is 26,184 square feet, with an estimated in situ volume of 1,940 cubic yards (yd^3). It is assumed that the full surface soil interval from 0 to 2 feet[3] must be managed in order to protect human health and the environment via inhibiting direct contact (covering/capping) or by performing soil excavation.

The subsurface soil (depths greater than 2 feet bgs) area with COC concentrations exceeding the PRG of 1 mg/kg for PCBs is also identified outside of the boundaries of the former manufacturing building at Amcast North (Figure 2-2). There are also two subsurface soil locations to the north and southeast of the building (AMN-SO05 and FVSS-31, respectively) where a PAH human health residential or soil-to-groundwater PRG is exceeded. In the subsurface soil, the estimated total area exceeding the PRGs is 26,725 square feet, with an estimated in situ volume of 4,865 yd^3. Of that total, an estimated area of 561 square feet and 62 yd^3 of in situ subsurface soil near FVMW-27 exceeds 50 mg/kg of PCBs and will be managed “as found” (pre-remediation concentrations) in accordance with the appropriate TSCA regulation paragraphs cited in Table 2-2 (EPA 40 CFR 761.61, 761.40, 761.65(c)). Figure 2-2 shows the proposed remediation depths of subsurface soil.

2.3.2 PRG Exceedances—Residential Yards (Soil)

Figure 2-1 shows the soil areas in the residential yards with COC concentrations exceeding the human health residential and ecological PRGs (1 mg/kg). The majority of samples were collected from a depth of 0 to 0.5 foot, except four samples that were collected from approximately 0 to 2 feet. Those latter locations were collected along the residential property boundaries that adjoin to the northern side of Amcast North.

The estimated total area of soil that exceeds the PRG in residential yards is 42,764 square feet, with an estimated in situ soil volume of 926 yd^3. Of that total, an estimated area of 3,625 square feet and 201 yd^3 of in situ surface soil near FVSS-23 exceeds 50 mg/kg and will be managed “as found” in accordance with the appropriate TSCA regulations (EPA 40 CFR 761.61(c),761.40, 761.65(c)). Figure 2-1 shows proposed remediation depths of residential soils.

[3] WDNR defines surface soil as 0 to 4 feet bgs; if post-remediation confirmatory samples at 2 feet bgs contain concentrations exceeding the remedial goal, a visual warning barrier (for example, orange plastic fencing) could be placed at a depth of 2 feet bgs.

2.3.3 PRG Exceedances—Wilshire Pond (Sediment/Bank Soil)

The PCB concentrations in the majority of bank soil and/or sediment samples collected in Wilshire Pond were above the PRG of 1 mg/kg. The estimated boundary assumed to require remedial action based on PRG exceedances and cost effectiveness comprises the entire Wilshire Pond (Figure 2-3), with an assumed management depth from 0 to 0.5 foot bgs. The sediment thickness within the basins was unable to be determined during the investigation due to accessibility constraints and will be refined during the remedial design. The estimated total area that exceeds the PRG is 27,031 square feet, with an in situ sediment volume of 1,001 yd^3. In addition, a total estimated area of 1,216 square feet and a volume of 45 yd^3 at the western portion of the pond associated with Basin A (Figure 2-3) exceeds 50 mg/kg and will be managed "as found" in accordance with the appropriate TSCA regulations.

2.3.4 PRG Exceedances—Amcast South (Soil)

Surface soil areas (depths from 0 to 2 feet bgs) with COC concentrations exceeding the PCB PRG of 1 mg/kg are located within or immediately adjacent to the boundaries of the former disposal area at Amcast South (Figure 2-4). The locations in the surface soil where a PAH or soil-to-groundwater human health PRG is exceeded are also within this same footprint. In the shallow soil, the estimated total area exceeding the PRGs is 86,541 square feet, with an estimated in situ volume of 6,410 yd^3. It is assumed that the full surface soil interval from 0 to 2 feet[4] must be managed in order to protect human health and the environment via inhibiting direct contact (covering/capping) or by performing soil excavation.

The subsurface soil (depths greater than 2 feet bgs) area with COC concentrations exceeding the PRGs for PCBs and/or PAHs are located within or immediately adjacent to the boundaries of the former disposal area at Amcast South (Figure 2-5). Due to the presence of the disposal area, excavation is not being considered. Consideration/evaluation of management choices for material greater than 2 feet bgs is limited to in situ remedies such as containment and monitoring. In the subsurface soil, the estimated total area exceeding the PRGs is 22,240 square feet. The estimated removal volume for Amcast South will be limited to the surface soil.

2.3.5 PRG Exceedances—Quarry Pond/Zeunert Park (Sediment)

Most of the sampled sediment locations within Quarry Pond that have PCB concentrations exceeding the applicable human health PRG (21 mg/kg) are adjacent to and/or just downstream of current or former storm sewer pipes that discharge into the northwestern side of the pond (Figure 2-6).
The ecological PRG for PCBs (1.9 mg/kg) is exceeded at the majority of the remaining sampled sediment locations. Sediment concentrations that exceed the TSCA-level value of 50 mg/kg are located in the northern/northwestern portion of Quarry Pond, clustered in the vicinity of a stormwater discharge pipe that originates at/is aligned just east of the former disposal area on Amcast South. The estimated in situ sediment volume above TSCA levels in the Quarry Pond is 2,300 yd^3. The estimated in situ sediment volume above the PRG, but below TSCA levels, is 13,200 yd^3.

Surface soil samples collected along the pond banks typically did not exceed the ecological PRG for PCBs (1.0 mg/kg), except at a north-south-trending pond transect (Transect 2, Figure 2-6) and at AMZ-SO02, located farther north into Zeunert Park. The bank surface soil samples collected along the eastern and southern edges of the pond did not contain detectable concentrations of PCBs or concentrations that exceed the ecological PRG of 1 mg/kg.

[4] WDNR defines surface soil as 0 to 4 feet bgs; if post-remediation confirmatory samples at 2 feet bgs indicate concentrations exceeding the remedial goal, a visual warning barrier (for example, orange plastic fencing) could be placed at a depth of 2 feet.

2.3.6 PRG Exceedances—Groundwater

The areas exceeding groundwater PRGs include monitoring wells located at Amcast North, Amcast South, and Zeunert Park (Figures 2-7 through 2-9). The monitoring wells with concentrations above the PRGs are screened primarily in the shallow unit, which is composed of clayey silts and clays (Figure 1-4). Monitoring wells screened in this unit are considered to be in a perched groundwater zone that is unable to yield sufficient water for residential or other use.

2.3.7 PRG Exceedances—Surface Water

Surface water sampling during the RI was conducted without considering Wisconsin's (and EPA's) water-quality criteria for the protection of wildlife, which includes a numeric standard for total PCBs at 0.12 ηg/L. PCBs in previously collected surface water samples were not detected above 1 µg/L. Additional sampling will be conducted after remediation is complete to monitor surface quality as it applies to these protective criteria.

2.3.8 PRG Exceedances Summary

Remedial technologies will be evaluated for the media that have PRG exceedances in at least one area of the Amcast Industrial Site. In addition, technologies specifically related to contaminated sediment in storm sewers will be evaluated, even though specific PRGs are not established for "sewer sediment". Based on the CSM, contaminated sediment in the sewers must be addressed so that source material does not continue to be available to Wilshire and Quarry Ponds. Remedial alternatives will be compiled for the site areas (Amcast North, Amcast South, Quarry Pond/Zeunert Park, Wilshire Pond) where human health PRGs and/or ecological PRGs are exceeded. Remedial alternatives will also be compiled for storm sewers at the site.

Identification and Screening of Technologies

3.1 General Response Actions

GRAs were identified for affected media to address the developed RAOs and PRGs for the Amcast Industrial Site. As defined in EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*, *Interim Final* (1988), GRAs are media-specific actions that might be undertaken to remediate the site. For each GRA, several possible remedial technologies may exist. They can be further broken down into a number of process options. These technologies and process options are then screened based on several criteria. Those technologies and process options remaining after screening are assembled into alternatives in Section 4.

Table 3-1 summarizes the development of GRAs for achieving RAOs for the media of surface/subsurface soil, sediments (in ponds), sewers (sewer pipe, sediment in sewer and sewer pipe backfill), and groundwater. Additionally, Table 3-1 includes a preliminary screening of media-specific GRAs.

3.2 Technologies and Process Options Summary

Within each remaining media-specific GRA, remedial technologies were identified and screened based on effectiveness, implementability, and relative cost defined as follows:

- **Effectiveness** is the ability of the technology or process option to perform adequately to achieve the RAOs alone or as part of an overall system. Additionally, the NCP defines effectiveness as the "degree to which an alternative reduces toxicity, mobility, and volume through treatment, minimizes residual risk, affords long-term protection, complies with ARARs, minimizes short-term impacts, and how quickly it achieves protection." This is a relative measure for comparison of process options that perform the same or similar functions.
- **Implementability** refers to degree of difficulty anticipated in implementing a particular measure under practical technical, regulatory, and schedule constraints.
- **Relative cost** is comparative only and is judged similarly to the effectiveness criterion. It is used to preclude further evaluation of process options that are very costly where there are other choices that perform similar functions with comparable effectiveness. It includes construction and long-term operation and maintenance (O&M) costs.

The NCP preference is for solutions that use treatment technologies to permanently reduce the toxicity, mobility, and volume of hazardous substances. Available treatment processes are typically divided into three technology types: physical/chemical, biological, and thermal, which are applied in one or more GRA with varying results.

Tables 3-2 through 3-5 summarize media-specific (soil, sediments, sewers, and groundwater) technology process options, and present the second screening phase in terms of effectiveness, implementability, and cost. The technologies and process options considered infeasible based on effectiveness, implementability, and relative cost are shown in shaded background. Screening was based on professional experience, published sources, and other relevant documentation. Technologies that are retained for further consideration are indicated on the tables in rows of information that has not been shaded (i.e., that remain "white").

Representative process options for each technology type were retained for incorporation into the range of potential remedial alternatives based on the two-step evaluation and technology screening process. Consistent with state and federal guidance, the No Further Action GRA was retained as a baseline against which other remedial alternatives will be evaluated.

Process options were eliminated during this screening step if the option met any of the following criteria:

1. It did not effectively meet the RAOs established in Section 2.2.
2. It was not applicable to PCBs, conditions at each specific area, or the media of concern.
3. It was not sufficiently demonstrated at pilot-scale or full-scale.
4. It was similar to other retained options but had a much higher relative implementation cost.

Alternative Descriptions

The remedial technologies and process options remaining after screening were assembled into a range of conceptual remedial alternatives. The specific details of the remedial components discussed for each conceptual alternative serve as a basis for the alternative evaluations. These descriptions incorporate sufficient detail and assumptions, as necessary, to develop a cost estimate that will be within a +50 percent to -30 percent range of uncertainty for the FS. The specific details of the remedial components discussed for each alternative are intended to serve as representative examples. The site remedial design may evaluate other viable options within the same remedial technology category that achieve the same objectives.

The alternative descriptions are structured per area and media as follows: Amcast North (soil), residential yards (soil), Wilshire Pond (sediment/bank soil), Amcast South (soil), Quarry Pond (sediment), and sitewide groundwater and storm sewers (Amcast North and Amcast South).

4.1 Amcast North Alternatives (Soil)

The alternatives developed for Amcast North, which are depicted in Figure 4-1, address soil contamination. The following subsections provide detailed descriptions of conceptual designs that form the basis of cost development.

4.1.1 Alternative AMN-1—No Action

Alternative AMN-1 consists of taking no action. The NCP requires that a no-action alternative be retained throughout the FS process as a baseline for comparison to the other approaches. The no-action alternative would leave affected soil in place at the site. There are no capital or O&M costs associated with Alternative AMN-1. However, the NCP requires 5-year site reviews as long as hazardous substances remain at the site at concentrations that do not allow unlimited use and unrestricted exposure.

4.1.2 Alternative AMN-2—Excavation, Offsite Disposal, Backfill, and Site Restoration

Alternative AMN-2 consists of excavating the soil with COCs exceeding human health and ecological PRGs (Table 2-2), followed by offsite disposal at a Resource Conservation and Recovery Act (RCRA) or TSCA-permitted and Offsite Rule (OSR)-approved facility. Soil verification samples will be required to document that soil with concentrations exceeding the PRGs has been removed. The excavation will then be filled with clean soil and restored to existing conditions. The alternative assumes the Amcast North building remains intact and the storm sewer remedial activities are conducted prior to or during the soil remedial activities. Alternatives for the storm sewer remedial activities have been developed and are discussed separately. Figure 4-1 depicts the major components of the alternatives for Amcast North and the residential yards, including Alternative AMN-2. The following are the main components of Alternative AMN-2 and conceptual design details for the basis of the cost estimate:

- Conducting predesign investigations of areas within Amcast North that were not previously sampled to determine the extent of remedial actions at the property, including the following:
  - Locating utilities.
  - Using direct-push technology to collect soil samples.
  - Collecting 15 soil samples and analyzing the samples for PCBs.

- Mobilizing to the site and preparing the site for construction, including the following:
  - Performing preconstruction activities, including preparing submittals.
  - Clearing and grubbing vegetation and removing debris in areas depicted in Figure 4-1.
  - Performing pre- and post-construction surveys.
  - Establishing site controls, including installing a decontamination pad, traffic signage, dust control, and perimeter fencing.
  - Establishing utilities and site trailers, which will be required for a period of 4 months.
  - Installing erosion controls to minimize transport of soil or cover materials. Erosion controls include the installation of silt fence around laydown areas, snow fence around the excavations, and other best management practices (BMPs) such as hay bales.
- Excavating soils with concentrations exceeding human health PRGs and/or the ecological PRGs (Table 2-2) to various depths up to 10 feet below grade, as shown in Figure 4-1. Approximately 4,981 yd^3 of non-TSCA and 56 yd^3 of TSCA soil will be removed. Activities include the following:
  - Demolishing and removing 3-inch-thick bituminous pavement.
  - Installing sheet pile for excavations greater than 2 feet deep adjacent to railroad embankment. Sheet pile will be installed to a depth of twice the excavation depth.
  - Operating an air monitoring station for 4 months to document that dust/particulate action levels are not exceeded.
  - Collecting confirmation soil samples to verify that remaining soil concentrations are below the PRGs. It is assumed that 30 confirmation samples would be collected and analyzed for PCBs, metals, and PAHs.
- Transporting soil and pavement offsite for disposal, including the following:
  - Collecting and analyzing samples for waste characterization, as required by the disposal facility. It is assumed that one sample would be collected per 500 tons of material for disposal and a minimum of one sample per waste stream. The samples would be analyzed for RCRA waste characteristics, including Toxic Characteristic Leaching Procedure (TCLP) analysis.
  - Loading excavated soil and pavement into trucks for offsite disposal.
  - Transporting and disposing of soil containing PCBs at a concentration less than 50 mg/kg at an OSR-approved RCRA-permitted facility. The quantity of soil disposed assumes a unit weight of 1.7 tons per yd^3.
  - Transporting and disposing of soil containing PCBs at a concentration greater than 50 mg/kg at an OSR-approved TSCA-permitted facility. The quantity of soil disposed assumes a unit weight of 1.7 tons per yd^3.
  - Transporting and disposing of pavement and other debris at an OSR-approved RCRA-permitted facility.
- Importing clean backfill material (general fill soil) from an offsite source to fill excavations, including the following:
  - Placing backfill into excavations in 6- to 8-inch lifts using a small bulldozer and compacting the lifts using a vibratory roller. In some areas, hand-tamping may be required.
  - Performing compaction testing to ensure that the soil is properly compacted and meets specified compaction requirements.

- Restoring the site to existing conditions, including the following:
  - Removing the decontamination pad and other temporary facilities.
  - Adding 8 inches of compacted gravel to replace disturbed areas where gravel or pavement previously existed.
  - Placing 6 inches of topsoil and seed in all other disturbed areas.
  - Implementing erosion controls until final vegetation is established.
- Demobilizing from the site and conducting project closeout, including the following:
  - Demobilizing heavy equipment from the site.
  - Developing final record documents and drawings.
  - Completing subcontract closeout and other project closeout procedures.

If soil concentrations in the verification samples at the design depth (up to 10 feet below grade) exceed the human health PRGs (Table 2-2), institutional controls could be employed in the form of deed restrictions to define areas of remaining concern and the associated restrictions that would limit exposure. For purposes of the cost estimate, the following assumptions were made in developing Alternative AMN-2:

- The Amcast North building will remain intact, and no work will be conducted inside the building footprint.
- Costs for negotiating and coordinating with railroad for work adjacent to their property has not been included.
- Costs for railroad training (if required) has not been included.
- The disposal facility will allow direct loading of trucks. Most of the excavated soil will be direct-loaded, and 10 percent of the soil will require double handing.
- The majority of excavated soil will not be characteristic hazardous or TSCA-regulated waste.
- Soil that has PCB concentrations exceeding 50 mg/kg will be managed “as found” in accordance with the appropriate TSCA regulations.
- Overburden will be disposed of with excavated soil when sample exceedances occur at depth; overburden will not be stockpiled and reused as backfill.
- RAOs will be met upon excavating of soil areas and depths shown in Figure 4-1.
- Contact water, if generated during excavation, will be treated onsite using filters and discharged to the city sanitary sewer at de minimis cost.
- No soil having concentrations exceeding the PRGs will remain onsite, and institutional controls will not be required.
- O&M components will not be required.
- Five-year reviews will not be required.

4.1.3 Alternative AMN-3—Excavation, Backfill, Isolation Cover, and Site Restoration

Alternative AMN-3 consists of excavating PCB soils greater than 50 mg/kg and constructing an isolation cover over the soil with COCs exceeding human health-related and ecological-related PRGs (Table 2-2). The alternative assumes that the Amcast North building remains intact, and the storm sewer remedial activities are conducted prior to or during the soil remedial activities. Alternatives for the storm sewer remedial activities have been developed and are discussed separately. Figure 4-1 depicts the major components of the alternatives for Amcast North and the residential yards, including for Alternative AMN-3.

The following components of Alternative AMN-3 are identical or very similar to those described for Alternative AMN-2, with the exception of quantities and construction time required:

- Conducting predesign investigations of areas within Amcast North that were not previously sampled to determine the extent of remedial actions at the property.
- Mobilizing to the site and preparing the site for construction. Site trailers, utilities, and controls would be required for 3 months as part of Alternative AMN-3.
- Transporting soil and pavement offsite for disposal.
- Importing clean backfill material (general fill soil) from an offsite source to fill excavations.
- Restoring the site to existing conditions.
- Demobilizing from the site and conducting project closeout.

The unique components of Alternative AMN-3 are as follows:

- Excavating contaminated soils with PCB concentrations greater than 50 mg/kg within 1 area (Area E) to a depth of 3 feet below grade (approximately 56 yd^3), as depicted in Figure 4-1. No shoring will be required for this alternative. Other subcomponents were described for Alternative AMN-2.
- Constructing a low-permeability isolation cover over the soil with COCs exceeding human health and ecological PRGs (Table 2-2), including the following:
  - Proof-rolling the existing subgrade.
  - Importing and placing 2 feet of clay over the isolation cover area shown in Figure 4-1 in 6-inch lifts.
  - Compacting the clay lifts using a vibrating sheeps-foot roller.
  - Performing geotechnical testing and compaction testing of the clay.
- Performing annual inspections and maintenance of the isolation cover for a period of 30 years, including the following:
  - Performing annual inspections, including visual onsite inspection, travel, and documentation of the findings.
  - Repairing and replacing portions of the isolation cover on a cost basis of 5 percent of the original isolation cover cost.
- Implementing institutional controls in the form of deed restrictions to define areas of remaining concern and the associated restrictions that would limit exposure.
- Preparing 5-year review reports and updating the institutional control plan for 30 years.

For purposes of the cost estimate, the following assumptions were made in developing Alternative AMN-3:

- The Amcast North building will remain intact, and no work is conducted inside the building footprint.
- Costs for negotiating and coordinating with railroad for work adjacent to their property has not been included.
- Costs for railroad training (if required) has not been included.
- The disposal facility will allow direct loading of trucks. Most of the excavated soil will be direct-loaded, and 10 percent of the soil will require double handing.
- Soil that has PCB concentrations exceeding 50 mg/kg will be managed “as found” in accordance with the appropriate TSCA regulations.
- Contact water, if generated during excavation, will be treated onsite using a filter and discharged to the city sanitary sewer at de minimis cost.
- Clay cover will raise existing grades; no excavation will be performed specifically to return the site to existing grades after the clay cover is installed.
- Replacement of asphalt or placement of gravel will not be required.

4.2 Residential Yards Alternatives (Soil)

The alternatives developed for the residential yards, which are depicted in Figure 4-1, address soil contamination. Detailed descriptions of conceptual design that form the basis of cost development are presented in the subsequent subsections.

4.2.1 Alternative RY-1—No Action

Alternative RY-1 consists of taking no action. The NCP requires that a no-action alternative be retained throughout the FS process as a baseline for comparison to the other approaches. The no-action alternative leaves affected soil in place at the site. There are no capital or O&M costs associated with Alternative RY-1. However, the NCP requires 5-year site reviews as long as hazardous substances remain at the site at concentrations that do not allow unlimited use and unrestricted exposure.

4.2.2 Alternative RY-2—Soil Excavation, Offsite Disposal, Backfill, and Site Restoration

Alternative RY-2, the presumptive remedy, consists of excavating the soil with COC concentrations exceeding human health and ecological PRGs (Table 2-2), followed by offsite disposal at RCRA or TSCA-permitted and OSR-approved facility. Soil verification samples will be required to verify that soil with concentrations exceeding the PRGs has been removed. The excavation will then be filled with clean soil and restored to its existing condition. Figure 4-1 depicts the major components of the alternatives for Amcast North and the residential yards, including for Alternative RY-2. The following are the main components of Alternative RY-2 and conceptual design details for the basis of the cost estimate:

- Conducting preconstruction activities, including the following:
  - Sampling individual residential yards to refine the extent of PCBs present in soil at depths from 0 to 2 feet bgs. Collecting an estimated 56 soil samples (one sample collected per 6-inch depth interval at 14 locations) by hand auger and analyzing the samples for PCBs.
  - Obtaining access agreements for 14 residential properties.
  - Completing property sketches for 14 residential properties.

- Mobilizing to the site and preparing the site for construction, including the following:
  - Performing preconstruction activities, including preparing submittals.
  - Clearing and grubbing vegetation, as depicted in Figure 4-1; assumes removing one tree per property.
  - Performing pre- and post-construction surveys.
  - Establishing site controls, including installation of a decontamination pad, traffic signage, dust control, and perimeter fencing. The decontamination pad would be established within a centralized laydown and staging area.
  - Establishing utilities and site trailers, which will be required for a period of 4 months. The site trailers and utilities would be established within a centralized laydown and staging area.
  - Installing erosion controls to minimize transport of soil or cover materials. Erosion controls include the installation of silt fence around laydown areas, snow fence around the excavations, and other BMPs, such as hay bales.
- Excavating contaminated soils exceeding human health PRGs and/or the ecological PRGs (Table 2-2) as shown in Figure 4-1, including the following:
  - Excavating soil in most yards to a depth of 2 feet below grade (approximately 3,015 yd^3 of non-TSCA soil). The excavation depth is assumed based on lack of sampling data available below 6 inches in most areas.
  - Excavating soil in one yard adjacent to Amcast North to a depth of 4 feet below grade (approximately 267 yd^3 of TSCA soil).
  - Placing visual warning barrier within the bottom of excavations over 30 percent of the excavated surface area. All TSCA material will be excavated and removed and will not be left in place under visual barrier.
  - Operating an air monitoring station for a period of 3 months to document that dust/particulate action levels are not exceeded.
  - Collecting confirmation soil samples to verify that remaining soil concentrations are below the PRGs. It is assumed that 56 confirmation samples would be collected and analyzed for PCBs.
- Transporting soil offsite for disposal, including the following:
  - Collecting and analyzing samples for waste characterization, as required by the disposal facility. It is assumed that one sample would be collected per 500 tons of material for disposal and a minimum of one sample per waste stream. The samples would be analyzed for RCRA waste characteristics, including TCLP analysis.
  - Loading excavated soil into trucks for offsite disposal.
  - Transporting and disposing of soil containing PCBs at a concentration less than 50 mg/kg at an OSR-approved RCRA-permitted facility.
  - Transporting and disposing of soil containing PCBs at a concentration greater than 50 mg/kg at an OSR-approved TSCA-permitted facility.
- Importing clean backfill material (general fill soil) from an offsite source to fill excavations, including the following:
  - Placing backfill into excavations in 6- to 8-inch lifts using a small bulldozer and compacting the lifts using a vibratory roller. In some areas, hand-tamping may be required.

  - Performing compaction testing to ensure that the soil is properly compacted and meets specified compaction requirements.
- Restoring the site to existing conditions, including the following:
  - Removing the decontamination pad and other temporary facilities.
  - Reestablishing yards, including fine grading, spreading topsoil or loam, and performing soil preparation.
  - Replacing sod in disturbed areas.
  - Replacing removed trees assuming one per property.
  - Replacing removed shrubs and plants.
  - Watering trees, sod, and vegetation for 30 days prior to restoration acceptance.
  - Completing miscellaneous repairs to properties as a result of the work, including repairs to streets, sidewalks, driveways, garages, and other personal property.
  - Implementing erosion controls until final vegetation is established. For cost purposes, it is assumed that staked hay bales and snow fence will be used.
- Demobilizing from the site and conducting project closeout, including the following:
  - Demobilizing heavy equipment from the site.
  - Developing final record documents and drawings.
  - Completing subcontract closeout and other project closeout procedures.

If soil concentrations in the excavation floor samples at the design depth exceed the human health PRGs (Table 2-2), visual warning barrier may be placed at the bottom of the excavation to indicate the interface of where soil exceeding PRGs remains. However, if excavation floor samples indicate that TSCA material exists, this material will be removed. No TSCA material will remain in place in this alternative. If the property cannot be sampled or remediated due to access restrictions, institutional controls could be employed in the form of deed restrictions to define areas of remaining concern and the associated restrictions that would limit exposure. For purposes of the cost estimate, the following assumptions were made in developing Alternative RY-2:

- Costs for negotiating and coordinating with railroad for work adjacent to their property has not been included.
- Costs for railroad training (if required) has not been included.
- The disposal facility will allow direct-loading trucks; approximately 50 percent of the soil will be direct-loaded, and the other 50 percent will be double-handled due to access constraints.
- The majority of excavated soil will not be characteristic hazardous or TSCA-regulated waste.
- The limited amount of soil (Area H) that exceeds 50 mg/kg will be managed “as found” in accordance with the appropriate TSCA regulations.
- No contact water will be generated during excavation.
- Sidewalks, driveways, streets, or other hardscape will not be removed to excavate soil, and minor damage caused by construction will be repaired.
- Institutional controls will be required.
- O&M components will not be required.
- Five-year reviews will be required.

4.2.3 Alternative RY-3—Isolation Cover, Limited Excavation, and Site Restoration

Upon further evaluation, Alternative RY-3 was not deemed to be reasonable or practical to implement and was removed from consideration from the evaluation. The cover in Alternative RY-3 would require an excavation deeper than what is needed in Alternative RY-2 to implement and was eliminated because there is no need to install a cover if all of the contamination is being removed.

4.3 Wilshire Pond Alternatives (Sediment/Bank Soil)

The alternatives developed for the Wilshire Pond, which are depicted in Figure 4-2, address sediment and bank soil contamination. Detailed descriptions of conceptual design that form the basis of cost development are presented in the subsequent subsections. Currently, it is unknown if the engineered structures (e.g., berms) separating the basins are contaminated or not. If testing before remedial activities indicates that the berms are clean, then Alternative 2 will be selected for the remedy. If the testing indicates that the berms are contaminated, Alternative 3 will be selected for the remedy.

4.3.1 Alternative WP-1—No Action

Alternative WP-1 consists of taking no action. The NCP requires that a no-action alternative be retained throughout the FS process as a baseline for comparison to the other approaches. The no-action alternative would leave affected soil in place at the site. There are no capital or O&M costs associated with Alternative WP-1. However, the NCP requires 5-year site reviews as long as hazardous substances remain at the site at concentrations that do not allow unlimited use and unrestricted exposure.

4.3.2 Alternative WP-2—Sediment and Bank Soil Excavation, Offsite Disposal, Backfill, and Site Restoration

Alternative WP-2 consists of excavating the sediment and/or bank soil with PCB concentrations exceeding human health and ecological PRGs (1.9 mg/kg, as shown in Tables 2-2 and 2-3) from each sub-basin composing Wilshire Pond, followed by offsite disposal at a RCRA and/or TSCA-permitted and OSR-approved facility. The alternative assumes that the berms are not contaminated, and therefore, does not include removal and replacement of the berms separating each basin. Verification samples will be required to document that soil with concentrations exceeding the PRGs has been removed.
The slopes of the basins will then be restored to stable conditions. Figure 4-2 depicts the major components of the alternatives for Wilshire Pond, including for Alternative WP-2.

The following are the main components of Alternative WP-2:

- Conducting predesign investigations of basin areas that were not previously sampled to determine the extent of PCBs present at depth and the extent of remedial actions required at Wilshire Pond, including the following:
  - Collecting 30 sediment samples and analyzing the samples for PCBs.
- Mobilizing to the site and preparing the site for construction, including the following:
  - Performing preconstruction activities, including preparing submittals.
  - Clearing and grubbing vegetation and removing debris from the Wilshire Pond banks and berms, as depicted in Figure 4-2.
  - Performing pre- and post-construction surveys.
  - Establishing site controls, including installing a decontamination pad, traffic signage, dust control, and perimeter fencing.

  - Establishing utilities and site trailers, which will be required for a period of 2 months.
  - Installing erosion controls to minimize transport of soil or sediment. Erosion controls include the installation of silt fence around laydown areas, snow fence around the excavations, and other BMPs such as hay bales.
- Performing dewatering of the pond basins and sediment, including the following:
  - Initially pumping approximately 241,000 gallons of water out of the Wilshire Pond basins assuming a maximum water elevation at the top of the basins.
  - Pumping approximately 241,000 additional gallons of water out of the Wilshire Pond basins to account for stormwater inflow and ongoing dewatering.
  - Treating the water using an onsite mobile treatment system consisting of bag filters, granular activated carbon, effluent tank, and pumps.
  - Conducting discharge monitoring and reporting.
  - Dewatering excavated sediments on the pond banks using constructed sumps and sump pumps.
- Excavating approximately 2 feet of contaminated sediment with concentrations exceeding human health and/or ecological PRGs (1.9 mg/kg, as shown in Tables 2-2 and 2-3) within the Wilshire Pond basins, as shown in Figure 4-2, including the following:
  - Mechanically dredging about 1,348 yd^3 of non-TSCA sediment from Area C.
  - Mechanically dredging about 89 yd^3 of TSCA sediment from Area D.
  - Mixing in drying reagents to stabilize TSCA and non-TSCA sediments after dewatering and prior to offsite disposal.
  - Operating an air monitoring station for a period of 2 months to document that dust/particulate action levels are not exceeded.
  - Collecting confirmation sediment samples to verify that remaining sediment and soil concentrations are below the PRGs. It is assumed that 20 confirmation samples would be collected and analyzed for PCBs.
- Transporting sediment and soil offsite for disposal, including the following:
  - Collecting and analyzing samples for waste characterization, as required by the disposal facility. It is assumed that one sample would be collected per 500 tons of material for disposal and a minimum of one sample per waste stream. The samples would be analyzed for RCRA waste characteristics, including TCLP analysis.
  - Loading excavated soil and sediment into trucks for offsite disposal.
  - Disposing of soil and sediment containing PCBs at a concentration less than 50 mg/kg at an OSR-approved RCRA-permitted facility.
  - Disposing of soil and sediment containing PCBs at a concentration greater than 50 mg/kg at an OSR-approved TSCA-permitted facility.
- Restoring the site, including the following:
  - Removing the decontamination pad and other temporary facilities.
  - Seeding disturbed areas (assumed to be the pond banks and berms) and placing erosion control blanket.
  - Maintaining erosion controls until final vegetation is established.

   - Restoring habitat by installing wetland plants on the pond banks and berms.
- Demobilizing from the site and conducting project closeout, including the following:
   - Demobilizing heavy equipment from the site.
   - Developing final record documents and drawings.
   - Completing subcontract closeout and other project closeout procedures.

If soil and/or sediment concentrations in verification samples at the desired depth (2 feet below grade) exceed the human health and ecological PRGs (1.9 mg/kg), additional excavation may be performed.

For purposes of the cost estimate, the following assumptions were made in developing Alternative WP-2:

   - The engineered structures (e.g., berms) separating the basins are in good condition and not contaminated, and therefore can be retained.
   - The PCB concentrations in excavated sediment and/or soil in basins B, C, D, E, and F are less than 50 mg/kg.
   - The disposal facility will allow direct-loading trucks; sediment will be mixed with stabilization agents within the pond and direct-loaded into trucks from the bank of the pond.
   - Fill material will not be added back into the basins once contaminated sediment was excavated.
   - The majority of excavated soil will not be characteristic hazardous or TSCA-regulated waste.
   - Soil that has PCB concentrations exceeding 50 mg/kg will be managed “as found” in accordance with the appropriate TSCA regulations.
   - RAOs will be met upon excavating the sediment/soil areas and depths shown in Figure 4-2.
   - No soil having concentrations exceeding the PRGs (1.9 mg/kg) will remain onsite, and institutional controls will not be required.
   - O&M components will not be required.
   - Five-year reviews will not be required.

4.3.3 Alternative WP-3—Sediment and Bank Soil Excavation, Structural Excavation, Offsite Disposal, Backfill, and Site Restoration

Alternative WP-3 consists of the same components as Alternative WP-2, except that the berms separating the basins are assumed to be contaminated and would not be retained during remedy implementation. Instead, the berms would be removed and replaced upon remedy completion. The stormwater retention basin would also be replaced in consultation with the City of Cedarburg. It is assumed that some of the structural components of the basin (e.g., gravel or riprap) can be recycled. Figure 4-2 depicts the major components of the alternatives for Wilshire Pond, including for Alternative WP-3.

The components of Alternative WP-3 were described as part of Alternative WP-2, although the following quantities would increase:

- Mechanically dredging or excavating non-TSCA sediments and soil, for a total of about 1,859 yd^3 of non-TSCA sediment and soil and 89 yd^3 of TSCA sediment.
- Adding stabilization reagents.
- Transporting and disposing of non-TSCA and TSCA sediments and soil.
- Collecting and analyzing waste characterization samples.

The components that are unique to Alternative WP-3 consist of removing the engineered structures between the basins and reconstructing them as follows:

- Excavating the existing berms to the level of the top of the basins.
- Importing clean backfill material (general fill soil) from an offsite source.
- Placing and compacting fill into Wilshire Pond to reconstruct the berms between the basins.
- Performing compaction testing to verify that the soil is properly compacted and meets specified compaction requirements.
- Erosion control and restoration of berms.

For purposes of the cost estimate, the following assumptions were made in developing Alternative WP-3:

- Based on as-built construction drawings, Wilshire Pond was constructed by excavating the basins to below the original pond bottom and then using the excavated material to construct the berms above the original pond bottom.
- The original pond bottom is now the base of the berms, which is an elevation of approximately 715 to 717 feet, depending on the basin.
- Limited information on the depth of contamination is known, and for the purposes of the cost estimate, 2 to 4 feet of impacted sediment has been assumed, depending on the berm.
- The PCB concentrations in excavated sediment and/or soil in basins B, C, D, E, and F are less than 50 mg/kg.
- The disposal facility will allow direct-loading trucks; sediment will be mixed with stabilization agents within the pond and direct-loaded into trucks from the bank of the pond.
- The majority of excavated soil will not be characteristic hazardous or TSCA-regulated waste.
- Soil that has PCB concentrations exceeding 50 mg/kg will be managed “as found” in accordance with the appropriate TSCA regulations.
- RAOs will be met upon excavating the soil areas shown in Figure 4-2.
- No soil having concentrations exceeding the PRGs (1.9 mg/kg) will remain onsite, and institutional controls will not be required.
- O&M components will not be required.
- Five-year reviews will not be required.

4.4 Amcast South Alternatives (Soil)

The alternatives developed for the Amcast South, which are depicted in Figure 4-3, address soil contamination. Detailed descriptions of conceptual design that form the basis of cost development are presented in the subsequent subsections.

4.4.1 Alternative AMS-1—No Action

Alternative AMS-1 consists of taking no action. The NCP requires that a no-action alternative be retained throughout the FS process as a baseline for comparison to the other approaches. The no-action alternative would leave affected soil in place at the site. There are no capital or O&M costs associated with Alternative AMS-1. However, the NCP requires 5-year site reviews as long as hazardous substances remain at the site at concentrations that do not allow unlimited use and unrestricted exposure.

4.4.2 Alternative AMS-2—Excavation, Offsite Disposal, Backfill, and Site Restoration

Alternative AMS-2 consists of excavating the soil with COCs exceeding human health and ecological PRGs (Table 2-2), followed by offsite disposal at a RCRA- and/or TSCA-permitted and OSR-approved facility. Verification samples will be required to document that soil concentrations exceeding the PRGs has been removed. The excavation will then be filled with clean soil and restored to its existing condition. The alternative assumes that the Amcast South building remains intact, and the storm sewer remedial activities are conducted prior to or during the soil remedial activities. Alternatives for the storm sewer remedial activities have been developed and are discussed separately. Figure 4-3 depicts the major components of the alternatives for Amcast South, including Alternative AMS-2.

The following are the main components of Alternative AMS-2:

- Conducting predesign investigations of areas within Amcast South that were not previously sampled to determine the extent of remedial actions at the property, including the following:
  - Locating utilities.
  - Using direct-push technology to collect soil samples.
  - Collecting 20 soil samples and analyzing the samples for PCBs.
- Mobilizing to the site and preparing the site for construction, including the following:
  - Performing preconstruction activities, including preparing submittals.
  - Clearing and grubbing vegetation and removing debris in areas depicted in Figure 4-3.
  - Performing pre- and post-construction surveys.
  - Establishing site controls, including installing a decontamination pad, traffic signage, dust control, and perimeter fencing.
  - Establishing utilities and site trailers, which will be required for 4 months.
  - Installing erosion controls to minimize transport of soil or cover materials. Erosion controls include the installation of silt fence around laydown areas, snow fence around the excavations, and other BMPs.
  - Maintaining two railroad flaggers onsite for the duration of the work.
- Excavating soils with concentrations exceeding human health PRGs and/or the ecological PRGs (Table 2-2) to various depths up to 21 feet below grade, as shown in Figure 4-3. Approximately 11,979 yd^3 of non-TSCA and 1,385 yd^3 of TSCA soil will be removed. Activities include the following:
  - Demolishing and removing 3-inch-thick bituminous pavement.
  - Installing sheet pile for excavations greater than 2 feet deep located adjacent to railroad embankment. Sheet pile will be installed to a depth of twice the excavation depth.
  - Operating an air monitoring station for a period of 4 months to ensure that dust/particulate action levels are not exceeded.
  - Collecting confirmation soil samples to verify that remaining soil concentrations are below the PRGs. It is assumed that 35 confirmation samples would be collected and analyzed for PCBs, metals, and PAHs.

- Transporting soil and pavement offsite for disposal, including the following:
  - Collecting and analyzing samples for waste characterization, as required by the disposal facility. It is assumed that 1 sample would be collected per 500 tons of material for disposal and a minimum of one sample per waste stream. The samples would be analyzed for RCRA waste characteristics, including TCLP analysis.
  - Loading excavated soil and pavement into trucks for offsite disposal.
  - Transporting and disposing of soil containing PCBs at a concentration less than 50 mg/kg at an OSR-approved TSCA-permitted facility. The quantity of soil disposed assumes a unit weight of 1.7 tons per yd^3.
  - Transporting and disposing of soil containing PCBs at a concentration greater than 50 mg/kg at an OSR-approved TSCA-permitted facility. The quantity of soil disposed assumes a unit weight of 1.7 tons per yd^3.
  - Transporting and disposing of pavement and other debris at an OSR-approved TSCA-permitted facility.
- Importing clean backfill material (general fill soil) from an offsite source to fill excavations, including the following:
  - Placing backfill into excavations in 6- to 8-inch lifts using a small bulldozer and compacting the lifts using a vibratory roller.
  - Performing compaction testing to ensure that the soil is properly compacted and meets specified compaction requirements.
- Restoring the site to existing conditions, including the following:
  - Removing the decontamination pad and other temporary facilities.
  - Adding gravel to replace disturbed areas where gravel or pavement previously existed.
  - Placing 6 inches of topsoil and seed in all other disturbed areas.
  - Implementing erosion controls until final vegetation is established.
- Demobilizing from the site and conducting project closeout, including the following:
  - Demobilizing heavy equipment from the site.
  - Developing final record documents and drawings.
  - Completing subcontract closeout and other project closeout procedures.

If soil concentration in the verification samples at the design depth exceed the human health PRGs (Table 2-2), institutional controls could be employed in the form of deed restrictions to define areas of remaining concern and the associated restrictions that would limit exposure. The alternative assumes that the Amcast storm sewer remedial activities are conducted prior to or during the soil remedial activities.

For purposes of the cost estimate, the following assumptions were made in developing Alternative AMS-2:

- Costs for negotiating and coordinating with railroad for work on and adjacent to their property has not been included.
- The railroad will remain intact and active throughout the work.
- Costs for railroad training (if required) has not been included.
- Work will be allowed to be performed on railroad property, including excavation and shoring.

- The Amcast South building will remain intact, and no work is conducted inside the building footprint.
- The disposal facility will allow direct loading of trucks. Most of the excavated soil will be direct-loaded, and 10 percent of the soil will require double handing.
- The majority of excavated soil will not be characteristic hazardous or TSCA-regulated waste.
- Soil that has PCB concentrations exceeding 50 mg/kg will be managed “as found” in accordance with the appropriate TSCA regulations.
- RAOs will be met upon excavating the soil areas and depths shown in Figure 4-3.
- Contact water, if generated during excavation, will be treated onsite using filters and discharged to the city sanitary sewer at a de minimis cost.
- No soil having concentrations exceeding the PRGs (Table 2-2) will remain onsite, and institutional controls will not be required.
- O&M components will not be required.
- Five-year reviews will not be required.

4.4.3 Alternative AMS-3—Isolation Cover and Site Restoration

Alternative AMS-3 consists of excavating PCB soils greater than 50 mg/kg and constructing an isolation cover over the remaining soil with COC concentrations exceeding the human health and ecological PRGs (Table 2-2), and stabilization of offsite contamination. The alternative assumes that the Amcast South building remains intact and the storm sewer remedial activities are conducted prior to or during the soil remedial activities. Alternatives for the storm sewer remedial activities have been developed and are discussed separately. Figure 4-3 depicts the major components of the alternatives for Amcast South, including for Alternative AMS-3.

The following main components of Alternative AMS-3 are identical or very similar to those described for Alternative AMS-2, with the exception of quantities and construction time required:

- Conducting predesign investigations of areas within Amcast South that were not previously sampled to determine the extent of remedial actions at the property.
- Mobilizing to the site and preparing the site for construction. Site trailers, utilities, and controls would be required for 3 months as part of Alternative AMS-3.
- Transporting soil and pavement offsite for disposal.
- Importing clean backfill material (general fill soil) from an offsite source to fill excavations.
- Restoring the site to existing conditions.
- Demobilizing from the site and conducting project closeout.

The unique components of Alternative AMS-3 are as follows:

- Excavating contaminated soils with PCB concentrations greater than 50 mg/kg (approximately 1,385 yd^3) within one area (Area D) to a depth of 22 feet below grade, as depicted in Figure 4-3. Shoring will be required for this alternative. Other subcomponents were described for Alternative AMS-2.
- Constructing a low-permeability isolation cover over the soil with COC concentrations exceeding human health and ecological PRGs (Table 2-2), including the following:
  - Proof-rolling the existing subgrade.
  - Importing and placing 2 feet of clay over the isolation cover area shown in Figure 4-3 in 6-inch lifts.

  - Compacting the clay lifts using a vibrating sheeps-foot roller.
  - Performing geotechnical testing and compaction testing of the clay.
  - Placing 6 inches of topsoil, seeding, and installing erosion control protection over the isolation cover.
- Performing annual inspections and maintenance of the isolation cover for a period of 30 years, including the following:
  - Performing annual inspections, including visual onsite inspection, travel, and documentation of the findings.
  - Repairing and replacing portions of the isolation cover on a cost basis of 5 percent of the original isolation cover cost.
- Implementing institutional controls in the form of deed restrictions to define areas of remaining concern and the associated restrictions that would limit exposure.
- Preparing 5-year review reports and updating institutional control plan for 30 years.

The alternative assumes that the Amcast storm sewer remedial activities are conducted prior to or during the soil remedial activities. For purposes of the cost estimate, the following assumptions were made in developing Alternative AMS-3:

- Costs for negotiating and coordinating with railroad for work on and adjacent to their property has not been included.
- Costs for railroad training (if required) have not been included.
- Work will be allowed to be performed on railroad property, including shoring, excavation, and capping.
- The Amcast South building will remain intact, and no work is conducted inside the building footprint.
- The disposal facility will allow direct loading of trucks. Most of the excavated soil will be direct-loaded, and 10 percent of the soil will require double handing.
- The majority of excavated soil will be characteristic hazardous or TSCA-regulated waste.
- Soil that has PCB concentrations exceeding 50 mg/kg will be managed “as found” in accordance with the appropriate TSCA regulations.
- Soils with PCB concentrations greater than 50 mg/kg will be removed upon excavation of the area and depth shown in Figure 4-3.
- Contact water, if generated during excavation, will be treated onsite using filters and discharged to the city sanitary sewer at a de minimis cost.
- Clay cover will raise existing grades; no excavation will be performed specifically to return the site to existing grades after the clay cover is installed.
- Replacement of asphalt or placement of gravel will not be required.
- O&M components will be required.
- Five-year reviews will be required.

4.5 Quarry Pond Alternatives (Sediment)

The alternatives developed for the Quarry Pond, which are depicted in Figure 4-4, address sediment contamination. The following subsections provide detailed descriptions of conceptual design that form the basis of cost development.

4.5.1 Alternative QP-1—No Action

Alternative QP-1 consists of taking no action. The NCP requires that a no-action alternative be retained throughout the FS process as a baseline for comparison to the other approaches. The no-action alternative would leave affected sediment in place at the site. There are no capital or O&M costs associated with Alternative QP-1. However, the NCP requires 5-year site reviews as long as hazardous substances remain at the site at concentrations that do not allow unlimited use and unrestricted exposure. Currently, there is a fish advisory in place.

4.5.2 Alternative QP-2—Sediment Dredging, Bank Soil Excavation, Offsite Disposal, and Site Restoration

Alternative QP-2 consists of dredging the sediment and excavating bank soil with COC concentrations exceeding human health and ecological PRGs (Tables 2-2 and 2-3), followed by offsite disposal of materials at RCRA- and/or TSCA-permitted and OSR-approved facility. Verification samples will be required to document that sediment concentrations exceeding the PRGs have been removed. The pond bank soil will then be backfilled with clean soil and restored. Figure 4-4 depicts the major components of the alternatives for the Quarry Pond, including for Alternative QP-2.

The following are the main components of Alternative QP-2:

- Conducting predesign investigations of pond sediment and bank area soil that were not previously sampled to determine the extent of PCBs present at depth and the extent of remedial actions required at Quarry Pond, including the following:
  - Collecting 30 sediment samples and analyzing the samples for PCBs.
- Mobilizing to the site and preparing the site for construction, including the following:
  - Performing preconstruction activities, including preparing submittals.
  - Clearing and grubbing vegetation from the soil bank area (Area D) along the Quarry Pond.
  - Performing pre- and post-construction surveys.
  - Establishing site controls, including installing a decontamination pad, traffic signage, dust control, and perimeter fencing.
  - Establishing utilities and site trailers, which will be required for a period of 4 months.
  - Installing erosion controls to minimize transport of soil or sediment. Erosion controls include the installation of silt fence around laydown areas and other BMPs.
- Excavating bank soils with concentrations exceeding ecological PRGs (approximately 656 yd^3 of non-TSCA soil) (Table 2-2) to an assumed depth of 3 feet below grade. Activities include the following:
  - Loading contaminated bank soils into trucks.
  - Importing and placing clean fill material from an offsite source in the bank area.
  - Compacting fill material and performing compaction testing.

- Dredging contaminated sediments at Quarry Pond, including the following:
  - Dredging non-TSCA sediments with concentrations exceeding ecological PRGs (1.9 mg/kg, as shown in Table 2-3) to an assumed depth of 3 feet (approximately 15,000 yd^3).
  - Dredging non-TSCA sediments with concentrations exceeding human health PRGs (21 mg/kg, as shown in Table 2-3) to an assumed depth of 2 feet (approximately 2,281 yd^3).
  - Dredging TSCA sediment to assumed depths between 3 to 5 feet, depending on area (approximately 2,292 yd^3).
  - Removing debris from the dredging areas.
  - Mixing in drying reagents (10 percent by weight) to stabilize the sediments prior to offsite disposal.
  - Operating an air monitoring station for a period of 3 months to verify that dust/particulate action levels are not exceeded.
  - Collecting confirmation samples to verify that remaining sediment and soil concentrations are below the PRGs. It is assumed that 20 confirmation samples would be collected and analyzed for PCBs.
- Transporting sediment, soil, and debris offsite for disposal, including the following:
  - Collecting and analyzing samples for waste characterization, as required by the disposal facility. It is assumed that one sample would be collected per 500 tons of material for disposal and a minimum of one sample per waste stream. The samples would be analyzed for RCRA waste characteristics, including TCLP analysis.
  - Loading excavated soil, sediment, and debris into trucks for offsite disposal.
  - Disposing of soil and sediment containing PCBs at a concentration less than 50 mg/kg at an OSR-approved RCRA-permitted facility.
  - Disposing of soil and sediment containing PCBs at a concentration greater than 50 mg/kg at an OSR-approved TSCA-permitted facility.
- Restoring the site to existing conditions, including the following:
  - Removing the decontamination pad and other temporary facilities.
  - Placing topsoil, seeding, and placing an erosion control blanket over disturbed areas (assumed to be bank soil area).
  - Maintaining erosion controls until final vegetation is established.
- Demobilizing from the site and conducting project closeout, including the following:
  - Demobilizing heavy equipment from the site.
  - Developing final record documents and drawings.
  - Completing subcontract closeout and other project closeout procedures.

If soil concentrations in verification samples at the design depth exceed the PRGs (Tables 2-2 and 2-3), additional materials may be removed. If the area cannot be accessed, institutional controls could be employed in the form of deed restrictions to define areas of remaining concern and the associated restrictions that would limit exposure. If sediment concentrations in verification samples at the design depth exceed the PRGs (Tables 2-2 and 2-3), additional materials may be removed. O&M components may be required if contaminated sediments are left in place due to structural impediments.

For purposes of the cost estimate, the following assumptions were made in developing Alternative QP-2:

- The water depth of Quarry Pond can be up to 20 feet.
- Sediments will be mechanically dredged using a barge-mounted long-reach excavator equipped with clam-shell bucket.
- Dewatering will be performed on the barge; most of the water will be allowed to run off the sediment as it is dredged. Additional water may be pumped off the top of the barge, treated by filter, and discharged back into the Quarry Pond.
- The disposal facility will allow direct-loading trucks; sediment will be mixed with stabilization agents on the barge and direct-loaded into trucks on the bank of the pond. No upland sediment-drying area will be required.
- Dredged sediment in the north end of Quarry Pond will be TSCA-regulated waste, and the remaining dredged sediment will not.
- Water generated during dredging associated with TSCA sediments will be managed in accordance with TSCA ARARs.
- Water generated from other locations will be managed in accordance with water-related WAC NR ARARs.
- PRGs will be obtained after soil and sediments are removed. No soil having concentrations exceeding the PRGs (Tables 2-2 and 2-3) will remain onsite, and institutional controls will not be required.
- O&M components will be required if contaminated sediments are left in place due to structural impediments.
- Five-year reviews will be required if contaminated sediments are left in place due to structural impediments.

4.5.3 Alternative QP-3—Construct Permeable Reactive Barrier to Isolate Contaminated Sediment, Excavate Bank Soil, Offsite Disposal, and Site Restoration

Alternative QP-3 consists of constructing a permeable reactive barrier (PRB) to isolate sediment with PCB concentrations exceeding human health and ecological PRGs (Table 2-3), excavating bank soils, and offsite disposal at a TSCA-permitted and OSR-approved facility. Soil verification samples will be required to document that soil concentrations exceeding the PRGs (Table 2-2) has been removed from the bank. The pond bank areas will then be filled with clean soil and restored. Figure 4-4 depicts the major components of the alternatives for the Quarry Pond, including for Alternative QP-3.

The following main components of Alternative QP-3 are identical or very similar to those described for Alternative QP-2, with the exception of quantities and construction time required:

- Conducting predesign investigations of pond sediment and bank area soil that were not previously sampled to determine the extent of PCBs present at depth and the extent of remedial actions required at Quarry Pond.
- Mobilizing to the site and preparing the site for construction.
- Excavating contaminated bank soils with concentrations exceeding ecological PRGs (1 mg/kg, as shown in Table 2-2) to an assumed depth of 3 foot below grade (approximately 656 yd^3 of non-TSCA soil).

- Collecting confirmation soil samples to verify that remaining soil concentrations are below the PRGs. It is assumed that four confirmation samples would be collected and analyzed for PCBs.
- Transporting soil and debris offsite for disposal.
- Restoring the site to existing conditions.
- Demobilizing from the site and conducting project closeout.

The unique components of Alternative QP-3 are as follows:

- Constructing a PRB to isolate the contaminated sediments with concentrations exceeding human health PRGs and ecological PRGs (Table 2-3), including the following:
  - Removing debris from the PRB area.
  - Placing 4 inches of sand (99 percent) mixed with bulk granular activated carbon (GAC; 1 percent) over non-TSCA sediment areas of Quarry Pond.
  - Placing 6 inches of sand (99 percent) mixed with bulk GAC (1 percent) over TSCA sediment areas of Quarry Pond.
  - Placing a 1-centimeter organophilic clay layer over the TSCA sediment areas of Quarry Pond for nonaqueous phase liquid (NAPL) management.
  - Placing 6 inches of 0.5-inch well-graded coarse aggregate over the entire PRB to conservatively serve as a protective armor layer.
  - Transporting PRB materials to a barge for placement.
  - Quality control sampling of the placed PRB material to confirm thickness and GAC percentage of the PRB.
- Performing monitoring and maintenance of the PRB every 5 years for a period of 30 years, including the following:
  - Performing monitoring, including visual inspection of cores for mixing, travel, and documentation of the findings.
  - Collecting samples from the PRB area of the newly deposited sediment and the PRB materials for physical and chemical analysis.
  - Porewater sampling of the PRB cap.
  - Performing bathymetric surveys.
  - Estimating cap overall and differential settlement.
  - Performing event-based monitoring, when the 100-year event is exceeded.
  - Repairing and replacing portions of the PRB on a cost basis of 2 percent of the original PRB cost.
- Implementing institutional controls to define areas of remaining concern and the associated restrictions that would limit exposure.
- Preparing 5-year review reports and updating the institutional control plan for 30 years.

The conceptual design for the PRB was determined by modeling pore water concentrations. Concentration modeling was performed for each sediment area (TSCA and non-TSCA) using different PRB thicknesses and different percentages of GAC amendment. One type of PRB that was modeled was AquaGate plus powdered activated carbon. This PRB was comprised of 10 percent AquaGate + powdered activated carbon and 90 percent sand. However, the PRB that was selected for the purpose of cost estimation consists of 99 percent sand and 1 percent bulk GAC due to lower material costs. Both conceptual PRB designs were modeled to be adequate. Appendix D contains the model inputs and outputs. The actual PRB design would be determined during the design phase if Alternative QP-3 was selected.

If sediment concentrations exceed human health PRGs or pond areas could not be sampled or remediated due to access restrictions, institutional controls will be employed in the form of deed restrictions to define areas of remaining concern and the associated restrictions that would limit exposure.

For purposes of the cost estimate, the following assumptions were made in developing Alternative QP-3:

- The disposal facility will allow direct-loading trucks; soil will be direct-loaded into trucks from the bank of the pond.
- Based on PCB concentrations within the TSCA areas, NAPL is likely present in these areas; an organophilic clay layer will be required between the reactive sand layer and sediment bed in areas where NAPL is present.
- Geotechnical properties of the sediments (such as sediment strength and bulk density) will sustain the weight of the PRB.
- The water depth of Quarry Pond can be up to 20 feet and the outfalls area near the pond surface; an erosion control layer (rock armor) will not be required over the PRB.
- Current model and design parameters, such as pore water concentration, upwelling Darcy velocity, and geotechnical properties, are estimated or assumed based on typical values. Site-specific data will be required to further refine the design if Alternative QP-3 is selected.
- The upwelling flux, which determines the amount of material required for PRB construction, was assumed to be 100 centimeters per year.
- The maximum PCB concentration for the non-TSCA sediment areas was assumed to be 50 mg/kg. The maximum PCB concentration for the TSCA sediment areas was assumed to be 11,000 mg/kg. Corresponding sediment pore water concentrations of 4 and 938 µg/L were calculated and used for the model.
- The model assumed an allowable PCB concentration of 1.9 mg/kg based on the ecological risk PRG.

4.5.4 Alternative QP-4—Sediment Dredging to 1 mg/kg PCBs, Bank Soil Excavation, Offsite Disposal, and Site Restoration

Alternative QP-4 consists of dredging the sediment and excavating bank soil with PCB concentrations above 1 mg/kg, followed by offsite disposal of materials at RCRA- and/or TSCA-permitted and OSR-approved facility. Verification samples will be required to document that sediment concentrations exceeding the PRGs have been removed. The pond bank soil will then be backfilled with clean soil and restored. Figure 4-4 depicts the major components of the alternatives for the Quarry Pond, including for Alternative QP-4.

The following are the main components of Alternative QP-4:

- Conducting predesign investigations of pond sediment and bank area soil that were not previously sampled to determine the extent of PCBs present at depth and the extent of remedial actions required at Quarry Pond, including the following:
  - Collecting 30 sediment samples and analyzing the samples for PCBs.

- Mobilizing to the site and preparing the site for construction, including the following:
  - Performing preconstruction activities, including preparing submittals.
  - Clearing and grubbing vegetation from the soil bank area (Area D) along the Quarry Pond.
  - Performing pre- and post-construction surveys.
  - Establishing site controls, including installing a decontamination pad, traffic signage, dust control, and perimeter fencing.
  - Establishing utilities and site trailers, which will be required for a period of 4 months.
  - Installing erosion controls around the facility to minimize transport of soil or sediment. Erosion controls include the installation of silt fence around laydown areas and other BMPs.
- Excavating bank soils with concentrations exceeding 1 mg/kg to an assumed depth of 3 feet below grade (approximately 656 yd^3 of non-TSCA soil). Activities include the following:
  - Loading contaminated bank soils into trucks.
  - Performing verification sampling to document that sediment concentrations exceeding the PRGs have been removed.
  - Importing and placing clean fill material from an offsite source in the bank area.
  - Compacting fill material and performing compaction testing.
- Dredging contaminated sediments at Quarry Pond, including the following:
  - Removing debris from the dredging areas and staging prior to offsite disposal.
  - Dredging non-TSCA sediments with concentrations exceeding 1 mg/kg to an assumed depth between 1 to 3 feet (approximately 17,281 yd^3) (see Figure 4-4).
  - Dredging TSCA sediment to an assumed depth between 3 to 5 feet (approximately 2,292 yd^3).
  - Mixing in drying reagents (10 percent by weight) to stabilize the sediments prior to offsite disposal.
  - Operating an air monitoring station for the estimated duration of the construction period of 3 months to verify that dust/particulate action levels are not exceeded.
  - Collecting confirmation samples to verify that remaining sediment and soil concentrations are below the PRGs. It is assumed that 20 confirmation samples would be collected and analyzed for PCBs.
- Transporting sediment, soil, and debris offsite for disposal, including the following:
  - Collecting and analyzing samples for waste characterization, as required by the disposal facility. It is assumed that one sample would be collected per 500 tons of material for disposal and a minimum of one sample per waste stream. The samples would be analyzed for RCRA waste characteristics, including TCLP analysis.
  - Loading excavated soil, sediment, and debris into trucks for offsite disposal.
  - Disposing of soil and sediment containing PCBs at a concentration less than 50 mg/kg at an OSR-approved RCRA-permitted facility.
  - Disposing of soil and sediment containing PCBs at a concentration greater than 50 mg/kg at an OSR-approved TSCA-permitted facility.

- Restoring the site to existing conditions, including the following:
  - Removing the decontamination pad and other temporary facilities.
  - Placing topsoil, seeding, and placing an erosion control blanket over disturbed areas (assumed to be bank soil area).
  - Maintaining erosion controls until final vegetation is established.
- Demobilizing from the site and conducting project closeout, including the following:
  - Demobilizing heavy equipment from the site.
  - Developing final record documents and drawings.
  - Completing subcontract closeout and other project closeout procedures.

If soil concentrations in verification samples at the design depth exceed 1 mg/kg, additional materials may be removed. If the area cannot be accessed, institutional controls could be employed in the form of deed restrictions to define areas of remaining concern and the associated restrictions that would limit exposure. If sediment concentrations in verification samples exceed 1 mg/kg, additional materials may be removed. Contaminants may be left in place if structural impediments prevent removal.

For purposes of the cost estimate, the following assumptions were made in developing Alternative QP-4:

- The water depth of Quarry Pond can be up to 20 feet.
- Sediments will be mechanically dredged using a barge-mounted long-reach excavator equipped with a clam-shell bucket.
- Dewatering will be performed on the barge; most of the water will be allowed to run off the sediment as it is dredged. Additional water may be pumped off the top of the barge, treated by filter, and discharged back into the Quarry Pond.
- The disposal facility will allow direct-loading trucks; sediment will be mixed with stabilization agents on the barge and direct-loaded into trucks on the bank of the pond. No upland sediment-drying area will be required.
- Dredged sediment in the north end of Quarry Pond will be TSCA-regulated waste, and the remaining dredged sediment will not.
- Water generated during dredging associated with TSCA sediments will be managed in accordance with TSCA ARARs.
- Water generated from other locations will be managed in accordance with water-related WAC NR ARARs.
- PRGs will be obtained after soil and sediments are removed. No soil having concentrations exceeding 1 mg/kg will remain onsite, and institutional controls will not be required.
- O&M components will be required if contaminated sediments are left in place due to structural impediments.
- Five-year reviews will be required if contaminated sediments are left in place due to structural impediments.

4.6 Groundwater Alternatives

Figure 4-5 shows the alternatives developed for groundwater. The following subsections provide detailed descriptions of conceptual design that form the basis of cost development.

4.6.1 Alternative GW-1—No Action

Alternative GW-1 consists of taking no action. The NCP requires that a no-action alternative be retained throughout the FS process as a baseline for comparison to the other approaches. The no-action alternative would leave impacted groundwater in place at the site. There are no capital or O&M costs associated with Alternative GW-1. However, the NCP requires 5-year site reviews as long as hazardous substances remain at the site at concentrations that do not allow unlimited use and unrestricted exposure.

4.6.2 Alternative GW-2—Groundwater Monitoring and Institutional Controls

Alternative GW-2, the presumptive remedy, consists of monitoring groundwater COCs with concentrations exceeding ES, and implementing groundwater use restrictions. This alternative primarily relies on source control and removal of contaminated soil to reduce groundwater concentrations over time. There are no potable water wells in the area. Figure 4-5 depicts the major components of the alternatives for groundwater.

The following are the main components of Alternative GW-2:

- Developing a site-specific groundwater monitoring program, including evaluating the existing site data.
- Supplementing the monitoring well network, including the following:
  - Locating utilities using a private firm.
  - Installing an estimated 5 new deep monitoring wells to a total depth of 50 feet bgs to better delineate the lower aquifer, as shown in Figure 4-5.
  - Developing and surveying wells.
  - Disposing of soil cuttings as nonhazardous waste.
- Abandoning two existing monitoring wells; FVMW-21 is damaged, and FVM-28 is consistently dry during sampling.
- Implementing groundwater use restrictions.
- Sampling groundwater, including the following:
  - Sampling an estimated 20 monitoring wells quarterly for 2 years.
  - Sampling an estimated 20 monitoring wells once per year for 30 years.
  - Managing water generated during sampling in accordance with ARARs.
  - Analyzing 22 groundwater samples (including quality assurance/quality control samples) for PCBs, VOCs, SVOCs, and metals during each sampling event.
- Monitoring contaminant concentrations and trends from each sampling event, including data evaluation and preparation of a technical memorandum.
- Performing periodic well maintenance and repairs every 5 years for 30 years.
- Conducting 5-year reviews and updating the institutional control plan for 30 years.

For purposes of the cost estimate, the following assumptions were made in developing Alternative GW-2:

- The number and locations of the proposed monitoring wells are approximate. Proposed deep wells will be nested with existing shallow wells where possible.
- Long-term groundwater monitoring will continue until eight consecutive sampling events demonstrate compliance with EPA MCLs and/or WDNR ES. For purposes of the cost estimate, 30 years of sampling was included.
- Groundwater samples will be analyzed by the EPA Contract Laboratory Program; costs for sample analysis are not included in the cost estimate.
- Parameters specific to natural attenuation were not included in the costs.

4.6.3 Alternative GW-3—Groundwater Extraction, Treatment and Discharge of Groundwater Exceeding Enforcement Standards, Groundwater Monitoring, and Institutional Controls

Upon further evaluation, Alternative GW-3 was not deemed to be reasonable or practical to implement and has removed from consideration from the evaluation. The low PCB concentrations in the groundwater make the treatment system required for Alternative GW-3 cost prohibitive. The cost required to achieve a slight improvement in water quality is very high; therefore, the alternative was removed.

4.7 Storm Sewer Alternatives

4.7.1 Amcast North Storm Sewers Alternatives

The Amcast North sewers are composed of the subsurface pipes and associated components (e.g., catch basins) that originate inside the building and extend to Wilshire Pond. Therefore, storm sewer remedial actions should be completed prior to implementing the remedy for Wilshire Pond. Figure 4-6 depicts the major components of the alternatives for the Amcast North storm sewers. The following subsections present detailed descriptions of conceptual design that form the basis of cost development.

Alternative SSN-1—No Action

Alternative SSN-1 consists of taking no action. The NCP requires that a no-action alternative be retained throughout the FS process as a baseline for comparison to the other approaches. The no-action alternative would leave affected soil and sediment in place at the site. There are no capital or O&M costs associated with Alternative SSN-1. However, the NCP requires 5-year site reviews as long as hazardous substances remain at the site at concentrations that do not allow unlimited use and unrestricted exposure.

Alternative SSN-2—Abandon Amcast North Building Storm Sewers, Pressure Wash Non-Building and Downgradient Storm Sewers, Sewer Backfill Excavation and Offsite Disposal, and Site Restoration

Alternative SSN-2 consists of abandoning the Amcast North building storm sewers at the building perimeter by plugging the pipe ends with concrete, removing sediment and associated water in storm sewers outside of the building footprint on the Amcast North property and downgradient storm sewers by pressure washing, excavating the sewer trench fill with COC concentrations exceeding human health PRGs and/or ecological PRGs for soil (Table 2-2), followed by offsite disposal at TSCA-permitted and OSR-approved facility. After pressure washing the pipes, the interior of the pipes will be sealed with epoxy to prevent potential recontamination of the pipes from outside material. Verification samples will be required to determine if soils with concentrations exceeding the PRGs have been removed. The excavation will then be filled with clean soil and restored to its existing condition.

The following are the main components of Alternative SSN-2:

- Conducting predesign investigations of the sewers within Amcast North that were not previously sampled to determine the extent of remedial actions at the property, including the following:
  - Locating utilities.
  - Collecting 12 sediment samples from existing catch basins and analyzing the samples for PCBs.
- Mobilizing to the site and preparing the site for construction, including the following:
  - Performing preconstruction activities, including preparing submittals.
  - Performing pre- and post-construction surveys.
  - Establishing site controls, including installing a decontamination pad, traffic signage, dust control, and perimeter fencing.
  - Establishing utilities and site trailers, which will be required for a period of 2 months.
  - Installing erosion controls to minimize transport of soil or fill materials. Erosion controls include the installation of silt fence around laydown areas, snow fence around excavations, and other BMPs such as hay bales.
- Excavating to expose the storm sewers immediately outside the building footprint and cutting them open for remedial action, including the following:
  - Excavating contaminated backfill surrounding the sewer piping with concentrations that exceed human health PRGs (Table 2-2) to a depth of up to 8 feet below grade where applicable. A 4-foot by 8-foot trench box will be used in all excavations exceeding 3 feet depth for worker safety.
  - Perform an in-line video inspection of sewer pipes prior to performing pressure washing to identify obstructions.
  - Abandoning the sewer pipes within the building footprint by plugging the cut end of the pipe at the building edge with a minimum of 3 feet of concrete.
  - Pressure washing storm sewer piping on Amcast North property outside the building footprint and the downgradient of the property and collecting and containing the sediment and wash water for offsite disposal.
  - Epoxy coating the inside of all pressure-washed pipes with an internal pipe coater to seal the pipe and prevent recontamination from outside sources.
  - Operating an air monitoring station for a period of 1 month to document that dust/particulate action levels are not exceeded.
  - Collecting confirmation soil samples to verify that remaining soil concentrations are below the PRGs. It is assumed that 20 confirmation samples would be collected and analyzed for PCBs, metals, and PAHs.
- Handling excavated soil and pavement, including the following:
  - Segregating soils with concentrations exceeding the PRGs (Table 2-2) in separate stockpiles by area that would be sampled for disposal characteristics. The stockpiles would be managed appropriately until approval for disposal was received.
  - Loading excavated soil and pavement into trucks for offsite disposal.

- Transporting soil and pavement offsite for disposal, including the following:
  - Collecting and analyzing samples for waste characterization, as required by the disposal facility. It is assumed that 1 sample would be collected per 500 tons of material for disposal and a minimum of 1 sample per waste stream. The samples would be analyzed for RCRA waste characteristics, including TCLP analysis.
  - Transporting and disposing of soil and sediment containing PCBs at a concentration less than 50 mg/kg at an OSR-approved RCRA-permitted facility. The quantity of soil disposed assumes a unit weight of 1.7 tons per yd^3. The quantity of sediment disposed assumes a unit weight of 1.4 tons per yd^3.
  - Transporting and disposing of soil and sediment containing PCBs at a concentration greater than 50 mg/kg at an OSR-approved TSCA-permitted facility. The quantity of soil disposed assumes a unit weight of 1.7 tons per yd^3. The quantity of sediment disposed assumes a unit weight of 1.4 tons per yd^3.
  - Transporting and disposing of pavement and other debris at an OSR-approved RCRA-permitted facility.
- Backfilling excavations, including the following:
  - Reusing excavated material above pipes that is not contaminated to fill excavations.
  - Importing clean backfill material (general fill soil) from an offsite source as needed to fill excavations, when quantities of clean excavated material is not sufficient.
  - Placing backfill into excavations in 6- to 8-inch lifts using a small excavator and compacting the lifts using a trench compactor. In some areas, hand-tamping may be required.
  - Performing compaction testing to ensure that the soil is properly compacted and meets specified compaction requirements.
- Restoring the site to existing conditions, including the following:
  - Removing the decontamination pad and other temporary facilities.
  - Adding gravel to replace disturbed areas where gravel or pavement previously existed.
  - Implementing erosion controls as needed.
- Demobilizing from the site and conducting project closeout, including the following:
  - Demobilizing heavy equipment from the site.
  - Developing final record documents and drawings.
  - Completing subcontract closeout and other project closeout procedures.

If soil concentrations in verification samples at the desired depth (8 feet below grade) exceed human health PRGs (Table 2-2), then institutional controls could be employed in the form of deed restrictions to define areas of remaining concern and the associated restrictions that would limit exposure.

For purposes of the cost estimate, the following assumptions were made in developing Alternative SSN-2:

- The Amcast North building will remain intact, and no work is conducted inside the building footprint.
- The disposal facility will allow direct-loading trucks.
- A trench box will be used for excavations exceeding 3 feet in depth. The trench box will be 8 feet tall and 4 feet in width.

- Pressure washing and epoxy coating will be performed by self-propelling, mechanical methods in the pipe itself. Existing access points (manholes and catch basins) will be used to the extent possible, and new access points will be created as necessary to facilitate pressure washing.
- The majority of the removed sediment and excavated fill surrounding the storm sewers at the building perimeter, and associated water, will not be characteristically hazardous or TSCA-regulated waste.
- Sediment and soil that has PCB concentrations exceeding 50 mg/kg will be managed “as found” in accordance with the appropriate TSCA regulations.
- RAOs will be met upon excavating the soil areas and depths shown in Figure 4-6.
- No soil having concentrations exceeding the PRGs will remain onsite, and institutional controls will not be required.
- O&M components will not be required.
- Five-year reviews will not be required.

Alternative SSN-3—Abandon Amcast North Building Storm Sewers, Remove Non-Building Storm Sewer Piping, Pressure Wash Downgradient Storm Sewers, Excavation of Pipes and Backfill, Offsite Disposal, Backfill, and Site Restoration

Alternative SSN-3 consists of abandoning the Amcast North building storm sewers at the building perimeter, removing the estimated 20 feet of non-building storm sewer piping emanating from the Amcast North building, removing sediment and associated water in storm sewers downgradient of the Amcast North property by pressure washing, excavating the soil and pipe backfill with COC concentrations exceeding human health PRGs and/or ecological PRGs for soil (Table 2-2), followed by offsite disposal at a RCRA Subtitle D-permitted and OSR-approved facility. The alternative assumes the Amcast North building remains intact, and no work is conducted inside the building. The alternative assumes that the contaminant concentrations in the excavated soil and sewer backfill at the building perimeter will not be characteristically hazardous waste or exceed the TSCA level of 50 mg/kg. Verification samples will be required to determine if concentrations exceeding the soil PRGs have been removed. The excavation will then be filled with clean material and restored to its existing condition.

The following main components of Alternative SSN-3 are identical or very similar to those described for Alternative SSN-2, with the exception of quantities and construction time required:

- Conducting predesign investigations of sewers within Amcast North that were not previously sampled to determine the extent of remedial actions at the property.
- Mobilizing to the site and preparing the site for construction. Site trailers, utilities, and controls would be required for 2 months as part of Alternative SSN-3.
- Pressure washing and epoxy coating the storm sewer piping downgradient of the property.
- Handling excavated soil and pavement.
- Transporting soil and pavement offsite for disposal.
- Importing clean backfill material (general fill soil) from an offsite source to fill excavations.
- Restoring the site to existing conditions.
- Demobilizing from the site and conducting project closeout.

The unique components of Alternative SSN-3 are as follows:

- Excavating to expose the storm sewers immediately outside building footprint and removing them, including the following:
  - Abandoning the sewer pipes within the building footprint by plugging the cut end of the pipe at the building edge with a minimum of 3 feet of concrete.
  - Excavating and removing about 20 feet of storm sewer piping on Amcast North property outside the building footprint and disposing of offsite.
  - Excavating contaminated backfill surrounding the sewer piping with concentrations that exceed human health PRGs (Table 2-2) to a depth of up to 8 feet below grade where applicable.
  - Operating an air monitoring station for a period of 1 month to document that dust/particulate action levels are not exceeded.
  - Collecting confirmation soil samples to verify that concentrations in the remaining soils are below the PRGs (Table 2-2). It is assumed that 20 confirmation samples would be collected and analyzed for PCBs, metals, and PAHs.

If soil concentrations in verification samples at the desired depth (8 feet below grade) exceed the human health PRGs (Table 2-2), institutional controls could be employed in the form of deed restrictions to define areas of remaining concern and the associated restrictions that would limit exposure.

For purposes of the cost estimate, the following assumptions were made in developing Alternative SSN-3:

- The Amcast North building will remain intact, and no work is conducted inside the building footprint.
- The disposal facility will allow direct-loading trucks.
- Excavation of pipes and bedding material will extend 1 foot below the pipe invert, resulting in a maximum excavation depth of 8 feet.
- The majority of excavated soil will not be characteristic hazardous or TSCA-regulated waste.
- Soil that has PCB concentrations exceeding 50 mg/kg, if encountered, will be managed “as found” in accordance with the appropriate TSCA regulations.
- RAOs will be met upon excavating soil areas and depths in Figure 4-6.
- No soil having concentrations exceeding the PRGs will remain onsite, and institutional controls will not be required.
- O&M components will not be required.
- Five-year reviews will not be required.

4.7.2 Amcast South Storm Sewer Alternatives

Figure 4-7 depicts the major components of the alternatives for the Amcast South storm sewers. Detailed descriptions of conceptual design that form the basis of cost development are presented in the following subsections.

Alternative SSS-1—No Action

Alternative SSS-1 consists of taking no action. The NCP requires that a no-action alternative be retained throughout the FS process as a baseline for comparison to the other approaches. The no-action alternative would leave affected soil and sediment in place at the site. There are no capital or O&M costs associated with Alternative SSS-1. However, the NCP requires 5-year site reviews as long as hazardous substances remain at the site at concentrations that do not allow unlimited use and unrestricted exposure.

Alternative SSS-2—Pressure Wash Non-Building and Downgradient Storm Sewers, Excavation, Offsite Disposal, Backfill, and Site Restoration

Alternative SSS-2 consists of pressure washing non-building and downgradient storm sewers, removing sediment and associated water, excavating the soil with COC concentrations exceeding human health PRGs and/or ecological PRGs (Table 2-2), followed by offsite disposal at a RCRA and/or TSCA-permitted and OSR-approved facility. After pressure washing the pipes, the interior of the pipes will be sealed with epoxy to prevent potential recontamination of the pipes from outside material. The alternative assumes the Amcast South building remains intact, and no work is conducted inside the building. The alternative assumes that the excavated soil surrounding the storm sewers will not be characteristic hazardous or TSCA waste. Soil verification samples will be required to determine if soil concentrations exceeding the PRGs has been removed. The excavation will then be filled with clean soil and restored to its existing condition.

The following are the main components of Alternative SSS-2:

- Conducting predesign investigation of sewers within Amcast South that were not previously sampled to determine the extent of remedial actions at the property, including the following:
  - Locating utilities.
  - Collecting 12 sediment samples from existing catch basins and analyzing the samples for PCBs.
- Mobilizing to the site and preparing the site for construction, including the following:
  - Performing preconstruction activities, including preparing submittals.
  - Establishing site controls, including installing a decontamination pad, traffic signage, dust control, and perimeter fencing.
  - Establishing utilities and site trailers, which will be required for a period of 2 months.
  - Installing erosion controls to minimize transport of soil or fill materials. Erosion controls include the installation of silt fence around laydown areas, snow fence around excavations, and other BMPs such as hay bales.
- Pressure wash the storm sewers immediately outside building footprint and downgradient of the property, including the following:
  - Performing an in-line video inspection of sewer pipes prior to performing pressure washing to identify obstructions.
  - Pressure washing storm sewer piping on Amcast South property outside the building footprint and downgradient of the property boundary and collecting and containing the sediment and wash water for offsite disposal.
  - Epoxy coating the inside of pressure-washed pipes with an internal pipe coater to seal the pipe and prevent recontamination from outside sources.
  - Operating an air monitoring station for a period of 1 month to ensure that dust/particulate action levels are not exceeded.
  - Collecting confirmation sediment samples to verify that remaining sediment concentrations are below the PRGs (Table 2-3). It is assumed that 20 confirmation samples would be collected and analyzed for PCBs, metals, and PAHs.

- Transporting sediment offsite for disposal, including the following:
  - Collecting and analyzing samples for waste characterization, as required by the disposal facility. It is assumed that one sample would be collected per 500 tons of material for disposal and a minimum of one sample per waste stream. The samples would be analyzed for RCRA waste characteristics, including TCLP analysis.
  - Transporting and disposing of sediment containing PCBs at a concentration less than 50 mg/kg at an OSR-approved RCRA-permitted facility. The quantity of sediment disposed assumes a unit weight of 1.4 tons per yd^3.
  - Transporting and disposing of sediment containing PCBs at a concentration greater than 50 mg/kg at an OSR-approved TSCA-permitted facility. The quantity of sediment disposed assumes a unit weight of 1.4 tons per yd^3.
- Restoring the site to existing conditions, including the following:
  - Removing the decontamination pad and other temporary facilities.
- Demobilizing from the site and conducting project closeout, including the following:
  - Demobilizing heavy equipment from the site.
  - Developing final record documents and drawings.
  - Completing subcontract closeout and other project closeout procedures.

If soil concentrations in verification samples at the desired depth (10 feet below grade) exceed human health PRGs (Table 2-2), institutional controls could be employed in the form of deed restrictions to define areas of remaining concern and the associated restrictions that would limit exposure.

For purposes of the cost estimate, the following assumptions were made in developing Alternative SSS-2:

- The Amcast South building will remain intact, and no work is conducted inside the building footprint.
- Existing manholes and catch basins are sufficient for access of the equipment used to visually inspect, pressure wash, and epoxy coat the insides of all sewer piping.
- O&M components will not be required.
- Five-year reviews will not be required.

Alternative SSS-3—Abandon Amcast South Storm Sewers, Pressure Wash Downgradient Storm Sewers, Excavation, Offsite Disposal, Backfill, and Site Restoration

Alternative SSS-3 consists of abandoning the Amcast South storm sewer system outside of the building footprint, removing sediment and associated water in storm sewers downgradient of the Amcast North property by pressure washing, excavating the soil with COC concentrations exceeding human health PRGs and ecological PRGs (Table 2-2), followed by offsite disposal at RCRA and/or TSCA-permitted and OSR-approved facility. The alternative assumes the Amcast South building remains intact, and no work is conducted inside the building. The alternative assumes that the excavated soil surrounding the storm sewers will not be characteristic hazardous or TSCA waste. Soil verification samples will be required to determine if soil concentrations exceeding the PRGs has been removed. The excavation will then be filled with clean soil and restored to its existing condition.

The following main components of Alternative SSS-3 are identical or very similar to those described for Alternative SSS-2, with the exception of quantities and construction time required:

- Conducting predesign investigations of sewers within Amcast South that were not previously sampled to determine the extent of remedial actions at the property.

- Mobilizing to the site and preparing the site for construction. Site trailers, utilities, and controls would be required for 2 months as part of Alternative SSS-3.
- Pressure washing and epoxy coating the storm sewer piping downgradient of the property.
- Restoring the site to existing conditions.
- Demobilizing from the site and conducting project closeout.

The unique components of Alternative SSS-3 are as follows:

- Abandoning the storm sewers immediately outside the building footprint, including the following:
  - Performing an in-line video inspection of sewer pipes prior to abandonment to identify obstructions.
  - Installing plugs at the final extents of pipe abandonment.
  - Installing monitoring points within the sewer system to observe abandonment in real time.
  - Abandoning the sewer pipes by pumping a flowable concrete grout into the storm sewers.
  - Operating an air monitoring station for a period of 1 month to document that dust/particulate action levels are not exceeded.

If soil concentrations from verification samples at the desired depth (11 feet below grade) exceed human health PRGs (Table 2-2), institutional controls could be employed in the form of deed restrictions to define areas of remaining concern and the associated restrictions that would limit exposure.

For purposes of the cost estimate, the following assumptions were made in developing Alternative SSS-3:

- The Amcast South building will remain intact, and no work is conducted inside the building footprint.
- Existing manholes and catch basins are sufficient for access of the equipment used to visually inspect the insides of all sewer piping, and to install monitoring points and plugs, and to perform abandonment of all sewer piping.
- Soil that has PCB concentrations exceeding 50 mg/kg will be managed “as found” in accordance with the appropriate TSCA regulations.
- O&M components will not be required.
- Five-year reviews will not be required.

Alternative SSS-4—Remove Non-Building Storm Sewers, Pressure Wash Downgradient Storm Sewers, Excavation, Offsite Disposal, Backfill, and Site Restoration

Alternative SSS-4 consists of removing the onsite storm sewer piping outside of the building footprint, removing sediment and associated water in storm sewers downgradient of the Amcast North property by pressure washing, excavating the soil with COC concentrations exceeding human health PRGs and ecological PRGs (Table 2-2), followed by offsite disposal at RCRA and/or TSCA-permitted and OSR-approved facility. The alternative assumes the Amcast South building remains intact. The alternative assumes that the excavated soil surrounding the storm sewers will not be characteristic hazardous or TSCA-regulated waste. Soil verification samples will be required to determine if soil concentrations exceeding the PRGs has been removed. The excavation will then be filled with clean soil and restored to its existing condition.

The following main components of Alternative SSS-4 are identical or very similar to those described for Alternative SSS-2, with the exception of quantities and construction time required:

- Conducting predesign investigations of sewers within Amcast South that were not previously sampled to determine the extent of remedial actions at the property.
- Mobilizing to the site and preparing the site for construction. Site trailers, utilities, and controls would be required for 2 months as part of Alternative SSS-4.
- Pressure washing and epoxy coating the storm sewer piping downgradient of the property.
- Demobilizing from the site and conducting project closeout.

The unique components of Alternative SSS-4 are as follows:

- Excavating to expose the storm sewers outside of the building footprint and removing them from the site, including the following:
  - Excavating and removing storm sewer piping on Amcast South property outside of the building footprint and disposing of offsite.
  - Excavating contaminated backfill surrounding the sewer piping that exceeds human health PRGs (Table 2-2) to a depth of up to 11 feet below grade where applicable. A 4-foot by 8-foot trench box will be used in all excavations exceeding 3 feet depth for worker safety.
  - Operating an air monitoring station for a period of 1 month to document that dust/particulate action levels are not exceeded.
  - Collecting confirmation soil samples to verify that remaining soil concentrations are below the PRGs (Table 2-2). It is assumed that 20 confirmation samples would be collected and analyzed for PCBs, metals, and PAHs.
- Handling excavated soil and pavement, including the following:
  - Segregating soils exceeding the PRGs (Table 2-2) in separate stockpiles by area that would be sampled for disposal characteristics. The stockpiles would be managed appropriately until approval for disposal was received.
  - Loading excavated soil and pavement into trucks for offsite disposal.
- Transporting soil and pavement offsite for disposal, including the following:
  - Collecting and analyzing samples for waste characterization, as required by the disposal facility. It is assumed that 50 samples would be collected and analyzed for RCRA waste characteristics, including TCLP analysis.
  - Transporting and disposing of soil and sediment containing PCBs at a concentration less than 50 mg/kg at an OSR-approved TSCA-permitted facility. The quantity of soil disposed assumes a unit weight of 1.7 tons per yd^3. The quantity of sediment disposed assumes a unit weight of 1.4 tons per yd^3.
  - Transporting and disposing of soil and sediment containing PCBs at a concentration greater than 50 mg/kg at an OSR-approved TSCA-permitted facility. The quantity of soil disposed assumes a unit weight of 1.7 tons per yd^3. The quantity of sediment disposed assumes a unit weight of 1.4 tons per yd^3.
  - Transporting and disposing of pavement and other debris at an OSR-approved TSCA-permitted facility.

- Backfilling excavations, including the following:
  - Reusing excavated material from above pipes that is not contaminated to fill excavations.
  - Importing clean backfill material (general fill soil) from an offsite source as needed to fill excavations, when quantities of clean excavated material is not sufficient.
  - Placing backfill into excavations in 6- to 8-inch lifts using a small excavator and compacting the lifts using a trench compactor. In some areas, hand-tamping may be required.
  - Performing compaction testing to ensure that the soil is properly compacted and meets specified compaction requirements.
- Restoring the site to existing conditions, including the following:
  - Removing the decontamination pad and other temporary facilities.
  - Adding gravel to replace disturbed areas where gravel or pavement previously existed.
  - Implementing erosion controls until final vegetation is established.

If soil concentrations in verification samples at the desired depth (11 feet below grade) exceed human health PRGs (Table 2-2), institutional controls could be employed in the form of deed restrictions to define areas of remaining concern and the associated restrictions that would limit exposure.

For purposes of the cost estimate, the following assumptions were made in developing Alternative SSS-4:

- The Amcast South building will remain intact, and no work is conducted inside the building footprint.
- The disposal facility will allow direct-loading trucks.
- Excavation of pipes and bedding material will extend 1 foot below the pipe invert, resulting in a maximum excavation depth of 11 feet.
- The majority of excavated soil will not be characteristic hazardous or TSCA-regulated waste.
- Soil that has PCB concentrations exceeding 50 mg/kg will be managed “as found” in accordance with the appropriate TSCA regulations.
- Overburden will be disposed of with excavated soil when sample exceedances occur at depth; overburden will not be stockpiled and reused as backfill.
- RAOs will be met upon excavating the soil areas shown in Figure 4-7.
- No soil having concentrations exceeding the PRGs (Table 2-2) will remain onsite, and institutional controls will not be required.
- O&M components will not be required.
- Five-year reviews will not be required.

Detailed and Comparative Analysis of Alternatives

5.1 Introduction

The detailed analysis provides the relevant information required for comparing the remedial alternatives for the Amcast Site. The detailed analysis of alternatives follows the development of alternatives and precedes the selection of a remedy. The selection of the remedy is conducted following the FS in the EPA's Record of Decision.

Detailed analysis of alternatives consists of the following components:

- A detailed evaluation of each individual alternative against seven evaluation criteria
- A comparative evaluation of alternatives with respect to the seven evaluation criteria

The detailed evaluation is presented in table format and follows the alternatives as structured in Tables 5-1 through 5-8. The comparative evaluation is presented in the text and highlights the most important factors that distinguish alternatives from each other.

5.2 Evaluation Criteria

Each alternative was evaluated using the first seven of the nine criteria established by EPA as part of the *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988). These criteria were established to provide grounds for comparison of the relative performance of the alternatives and to identify their advantages and disadvantages. This approach is intended to provide sufficient information for adequately comparing the alternatives and selecting the most appropriate alternative for implementation at the site as a remedial action. The EPA evaluation criteria include the following:

1. Overall protection of human health and the environment
2. Compliance with ARARs
3. Long-term effectiveness and permanence
4. Reduction of toxicity, mobility, and volume
5. Short-term effectiveness
6. Implementability
7. Cost
8. State acceptance
9. Community acceptance

The criteria are divided into three groups: threshold, balancing, and modifying criteria. Threshold criteria must be met by a particular alternative for it to be eligible for selection as a remedial action. There is little flexibility in meeting the threshold criteria—either they are met by a particular alternative, or that alternative is not considered acceptable. The threshold criteria consist of the following:

- Overall protection of human health and the environment
- Compliance with ARARs

Unlike the threshold criteria, the balancing criteria weigh the trade-offs between alternatives. A low rating on one balancing criterion can be compensated by a high rating on another criterion.
The balancing criteria consist of the following:

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, and volume

- Short-term effectiveness
- Implementability
- Cost

The modifying criteria are state acceptance and community acceptance. These criteria are evaluated following public comment on the FS and proposed plan and used to modify the selection of the recommended alternative. The criteria are described in the following subsections.

5.2.1 Threshold Criteria

To be eligible for selection, an alternative must meet the threshold criteria described in the following subsections, or in the case of ARARs, must justify that a waiver is appropriate.

Overall Protection of Human Health and the Environment

This evaluation criterion provides a final check to assess whether each alternative provides adequate protection of human health and the environment. The overall assessment of protection draws on the assessments conducted under other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

Compliance with ARARs

Compliance with ARARs is one of the statutory requirements of remedy selection. ARARs are cleanup standards, standards of control, and other substantive environmental statutes or regulations that are either “applicable” or “relevant and appropriate” to the cleanup action. Applicable requirements address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a site. Relevant and appropriate requirements are those that, while not applicable, address problems or situations sufficiently similar to those encountered at the site. The assessment with respect to this criterion describes how the alternative complies with ARARs or presents the rationale for waiving an ARAR. ARARs can be grouped into the following three categories:

- **Chemical-specific:** ARARs are health- or risk-based numerical values or methodologies, which, when applied to site-specific conditions, establish the amount or concentration of a chemical that may remain in or be discharged to the environment.
- **Location-specific:** ARARs restrict the concentration of hazardous substances or the conduct of activities solely because they are in specific locations, such as floodplains, wetlands, historic places, and sensitive ecosystems or habitats.
- **Action-specific:** ARARs include technology- or activity-based requirements that set controls, limits, or restrictions on design performance of remedial actions or management of hazardous constituents.

5.2.2 Balancing Criteria

The five criteria listed in the following subsections are used to weigh the trade-offs between alternatives.

Long-Term Effectiveness and Permanence

This criterion emphasizes implementing remedies that will ensure protection of human health and the environment in the long term after response objectives have been met, and mainly focus on the risk remaining at the site. A remedy is protective if it adequately eliminates, reduces, or controls current and potential risks posed by the site through each exposure pathway. The primary focus of this evaluation is the extent and effectiveness of the controls that may be required to manage the risk posed by treatment residuals and/or untreated wastes. The assessment of alternatives with respect to this criterion includes evaluation of the following components:

- **Magnitude of residual risks**—This component assesses the residual risk remaining from untreated waste or treatment residuals at the conclusion of remedial activities, including the quantity and characteristics of remaining residuals.
- **Adequacy and reliability of controls**—This component assesses the adequacy and suitability of controls, if any, that are used to manage treatment residuals or untreated wastes that remain at the site, such as containment systems and institutional controls. The long-term reliability of management controls for providing continued protection from residuals is also assessed.

Reduction of Toxicity, Mobility, and Volume

This criterion considers the statutory preference for selecting remedial actions that permanently and significantly reduce toxicity, mobility, or volume of the hazardous substances through treatment as a principal element. This preference is met when treatment is used to reduce the principal threats at a site through destruction of toxic contaminants, reduction of the total mass of toxic contaminants, irreversible reduction in contaminant mobility, or reduction of total volume of contaminated media (EPA 1988). The assessment of alternatives with respect to this criterion includes evaluation of the following components:

- **The treatment processes used and the materials treated**—This component considers if treatment addresses principal threats and if the treatment process has any special requirements.
- **The amount of hazardous materials destroyed or treated**—This component estimates the portion of contaminated material (either by mass or volume) is treated or destroyed.
- **The degree of expected reduction in toxicity, mobility, or volume**—This component considers the extent to which the total mass, mobility, and volume of contaminants are reduced.
- **The degree to which the treatment will be irreversible**—This component assesses to what extent the effects of treatment are irreversible.
- **The type and quantity of treatment residuals that will remain following treatment**—This component assesses the residuals that will remain after treatment, including their type, quantity, characteristics, and risks that they pose.
- **Statutory preference for treatment as a principal element**—This component considers whether principal threats are addressed as part of the scope of action and whether treatment is used to address the risk posed by principal threats at the site.

Short-Term Effectiveness

This criterion reflects the emphasis on implementing remedies that will ensure protection of human health and the environment in the short term. The assessment of alternatives with respect to this criterion includes the evaluation of the risks at a site during the construction and implementation of a remedy until the cleanup objectives are met. The assessment of alternatives with respect to this criterion includes evaluation of the following components:

- **Protection of community during remedial action**—This component addresses risks that may result during remedy implementation, such as dust from excavation, transportation of hazardous materials, and emissions from treatment.
- **Protection of workers during remedial action**—This component considers risks that workers may be exposed to during implementation and reliability of controls to protect workers.
- **Environmental impacts of remedial action**—This component considers if any adverse environmental impacts will result from implementation of the remedy and available mitigation measures.

- **Time until RAOs are achieved**—This component assesses the estimated time required to achieve protection.

Implementability

This criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of services and materials needed for its implementation. The assessment of alternatives with respect to this criterion includes evaluation of the following components:

- **Ability to construct and operate the technology**—This component considers the technical difficulties and unknowns that may be encountered during implementation of an alternative.
- **Reliability of the technology**—This component assesses the likelihood that technical problems will be encountered during implementation of an alternative and the degree to which delays will result.
- **Ease of undertaking additional remedial actions, if necessary**—This component considers how easy it is to implement additional remedial actions at the site and what additional actions may be necessary.
- **Ability to monitor the effectiveness of remedy**—This component assesses how easy it is to monitor the effectiveness of an alternative in whether it continues to be protective of human health and the environment and the risks of exposure if monitoring was not effective in detecting a remedy failure.
- **Coordination with other agencies**—This component considers the steps that are required to coordinate with other offices and agencies, including if permits can be obtained for offsite activities.
- **Availability of offsite treatment, storage, and disposal services and capacity**—This component considers whether offsite treatment, storage, and disposal services have adequate capacity and if not, how much additional capacity is required.
- **Availability of necessary equipment and specialists**—This component considers whether the equipment and specialists needed to implement the remedy are available and if not, what additional equipment/specialists are needed.
- **Availability of prospective technologies**—This component assesses whether the technologies required to implement the remedy are generally available, have been implemented on a full-scale basis, and if more than one vendor will be able to provide a bid.

Cost

Cost encompasses all engineering, construction, and O&M costs incurred over the life of the project. The assessment, with respect to this criterion, is based on the estimated present worth of the costs for each alternative. Present worth is a method of evaluating expenditures such as for construction and O&M that occur over different lengths of time. This allows costs for remedial alternatives to be compared by discounting all costs to the year that the alternative is implemented. The present worth of a project represents the amount of money, which if invested in the initial year of the remedy and disbursed as needed, would be sufficient to cover all costs associated with the remedial action. These estimated costs are expected to provide an accuracy of plus 50 percent to minus 30 percent. Appendix C provides a breakdown of the cost estimate for each alternative.

The level of detail required to analyze each alternative with respect to the cost criteria depends on the nature and complexity of the site, the types of technologies and alternatives being considered, and other project-specific considerations. The analysis is conducted in sufficient detail to understand the significant aspects of each alternative and to identify the uncertainties associated with the evaluation.

The cost estimates presented for each alternative have been developed strictly for comparing the alternatives. The final costs of the project and the resulting feasibility will depend on actual labor and material costs, competitive market conditions, actual site conditions, final project scope, the implementation schedule, and other variables; therefore, final project costs will vary from the cost estimates. Because of these factors, project feasibility and funding needs must be reviewed carefully before specific financial decisions are made or project budgets are established to help ensure proper project evaluation and adequate funding.

The cost estimates are order-of-magnitude estimates with an intended accuracy range of plus 50 to minus 30 percent. The range applies only to the alternatives as they are described and does not account for changes in the scope of the alternatives. Selection of specific technologies or processes to configure remedial alternatives is intended not to limit flexibility during remedial design, but to provide a basis for preparing cost estimates. The specific details of remedial actions and cost estimates would be refined during the final design.

5.2.3 Modifying Criteria

The modifying criteria, consisting of state acceptance and community acceptance, are used to modify the selection of the recommended alternative. State acceptance evaluates the technical and administrative issues and concerns the state (or support agency in the case of State-led sites) may have regarding each of the alternatives. Community acceptance evaluates the issues and concerns the public may have regarding each of the alternatives. The modifying criteria are addressed in the Record of Decision once comments on the FS report and proposed plan have been received.

5.3 Amcast North Alternatives (Soil)

5.3.1 Detailed Analysis

The following alternatives for project subsites involving soil were developed and described in Section 4:

- Alternative AMN-1 – No Action
- Alternative AMN-2 – Excavation, Offsite Disposal, Backfill, and Site Restoration
- Alternative AMN-3 – Excavation, Backfill, Isolation Cover, and Site Restoration

These alternatives were evaluated in detail using the evaluation criteria described above. Table 5-1 summarizes the detailed evaluations for these alternatives.

5.3.2 Comparative Analysis

This section presents the comparative analysis of the Amcast North alternatives and discussion of the criteria evaluated.

Overall Protection of Human Health and the Environment

The pertinent RAOs to Amcast North include the following:

- Minimize the potential for dermal contact, ingestion, and inhalation exposures to COCs in surface soil for trespassers and total soil for residents, industrial workers, and construction workers.
- Minimize the potential for direct contact, direct ingestion, and/or food web exposures to COC concentrations above acceptable levels in surface soil for lower-trophic-level terrestrial organisms (soil invertebrates and plants) and upper-trophic-level organisms (birds and mammals).

Alternative AMN-1 is not protective because it does not minimize contact or exposure to PCB contamination in soil. Alternative AMN-1 will also allow continued potential for dermal contact or ingestion of PCB-contaminated soil.

Alternatives AMN-2 and AMN-3 are considered protective of human health and the environment. Alternative AMN-2 removes and disposes of contaminated media; therefore, it is more protective than

Alternative AMN-3, which leaves contaminated material in place but beneath an isolation cover. The isolation cover only reduces the risk rather than removing it.

Overall Protection of Human Health and the Environment
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Amcast North Alternatives	1		3		2

Compliance with ARARs

The most important ARARs to be met relate to TSCA requirements and air pollution emission requirements. All alternatives, other than Alternative AMN-1, are expected to comply with ARARs.

Compliance with ARARs

	Does Not Meet Criteria	Meets Criteria
Amcast North Alternatives	1	2, 3

Long-Term Effectiveness and Permanence

There are two components that compose evaluation of the long-term effectiveness and permanence, which are evaluated in the following subsections for the Amcast North alternatives.

Magnitude of Residual Risks

For Alternative AMN-1, the magnitude of residual risk would remain unchanged from the existing conditions. The least amount of residual risk would occur as a result of the excavation and offsite disposal in Alternative AMN-2. Contaminated soil with PCB concentrations greater than 1 mg/kg would be removed from the site, resulting in a very low residual risk. The installation of an isolation cover in Alternative AMN-3 will reduce exposure to residual contamination in surface soil but will not reduce residual risk at depth.

Magnitude of Residual Risks
Relative Ranking from Greatest to Least

	Greatest 0	1	2	3	Least 4
Amcast North Alternatives	1		3		2

Adequacy and Reliability of Controls

Alternative AMN-1 requires advisories and warnings regarding dermal contact and ingestion of PCB-contaminated soil. These controls are based on public adherence to the warnings for measuring adequacy and reliability. Alternative AMN-2 would not require controls. Alternative AMN-3 requires long-term maintenance and inspection to monitor the installation and thickness of the isolation cover. There is the potential for the cover to be removed or disturbed depending on future site usage and activities. Thus, the adequacy and reliability of controls to prevent disturbance of the cover depend on maintenance and inspection.

Adequacy and Reliability of Controls
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Amcast North Alternatives	1		3		2

Reduction of Toxicity, Mobility, and Volume

There are six components that compose evaluation of the reduction of toxicity, mobility, and volume. These components are evaluated in the following subsections for the Amcast North alternatives.

Treatment Process Used and Materials Treated

There are no treatment processes associated with the implementation of Alternative AMN-1 because no remedial action would be taken. Additionally, there are no treatment processes with Alternatives AMN-2 and AMN-3 as no material is actually being treated. In Alternative AMN-2, contaminated material is being excavated and disposed of offsite. In Alternative AMN-3, some contaminated material will be disposed of offsite, with the remainder being capped under an isolation cover.

Treatment Process Used and Materials Treated
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Amcast North Alternatives	1, 2, 3				

Amount of Hazardous Materials Destroyed or Treated

No hazardous materials are destroyed or treated with the implementation of any alternative for Amcast North. For Alternative AMN-1, no remedial action would be taken. For Alternative AMN-2, hazardous material is excavated and disposed of offsite, but not destroyed or treated. Similarly, for Alternative AMN-3, some contaminated material is removed from the site, with the remainder remaining untreated under an isolation cover.

Amount of Hazardous Materials Destroyed or Treated
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Amcast North Alternatives	1, 2, 3				

Degree of Expected Reductions in Toxicity, Mobility, and Volume

There are no reductions in toxicity, mobility, or volume through treatment for each of the three alternatives. However, Alternatives AMN-2 and AMN-3 will both reduce mobility of contaminated material, AMN-2, by removing it from the site and containing at a disposal facility and AMN-3 by isolating it below a cover.

Degree of Expected Reductions in Toxicity, Mobility, and Volume
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Amcast North Alternatives	1	2, 3			

Degree to Which Treatment is Irreversible

No remedial action would be taken in Alternative AMN-1. Alternative AMN-2 is irreversible as contaminated material is being removed from the site and would not be allowed to be brought back as fill. Likewise, for Alternative AMN-3, contaminated material will be removed from the site and will not be allowed back onsite. However, Alternative AMN-3 is slightly more reversible than Alternative AMN-2 as the cover is removable.

Degree to Which Treatment is Irreversible
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Amcast North Alternatives	1			3	2

Type and Quantity of Residuals Remaining After Treatment

Treatment is not performed in any of the alternatives for the site; therefore, no treatment residuals will remain. Contaminated material will remain onsite after the implementation of Alternatives AMN-1 and AMN-3, because no remedial action would be taken in AMN-1, and an isolation cover is used in AMN-3. However, the quantity of material remaining for Alternative AMN-3 is less than AMN-1. The amount of contaminated material after implementation of Alternative AMN-2 will be minimal as all contaminated material will be excavated and disposed of offsite.

Type and Quantity of Residuals Remaining After Treatment
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Amcast North Alternatives	1, 2, 3				

Statutory Preference for Treatment as a Principal Element

Treatment is not performed in any of the alternatives for the site; therefore, there is no statutory preference based on treatment.

Statutory Preference for Treatment as a Principle Element
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Amcast North Alternatives	1, 2, 3				

Short-Term Effectiveness

There are four components that compose evaluation criteria of short-term effectiveness, which are evaluated in the following subsections for the Amcast North alternatives.

Protection of Community During Remedial Action

There are no risks to the community associated with the implementation of Alternative AMN-1 because no remedial action would be taken. Alternative AMN-2 may result in a greater potential for exposure to the community by air or direct contact than Alternative AMN-3 as more material is being removed and disposed of. For Alternative AMN-3, exposure to the community from dust during installation of a cover depends on whether the underlying material is dry or wet at the time of installation. However, dust emissions can be controlled using standard engineering controls, and trucks can be covered and decontaminated before leaving the site.

Protection of Community During Remedial Action
Relative Ranking from Least to Greatest

	Least **0**	**1**	**2**	**3**	**Greatest** **4**
Amcast North Alternatives			2	3	1

Protection of Workers During Remedial Action

There are no additional risks associated with the implementation of Alternative AMN-1 because no remedial action would be taken. Alternative AMN-3, which includes installation of an isolation cover, has a potential exposure to workers as some excavation is required for installation. Alternative AMN-2, which includes excavation and offsite disposal, would have a similar effect with respect to the protection of workers—soil will be disturbed, removed, and handled, mostly using properly designed equipment that may not require direct contact, but direct contact to workers is possible during operations. The higher volume of material removed and managed, the greater the chance for worker risk and the lower the amount of protection provided to the worker.

Protection of Workers During Remedial Action
Relative Ranking from Least to Greatest

	Least **0**	**1**	**2**	**3**	**Greatest** **4**
Amcast North Alternatives	2	3			1

Environmental Impacts of Remedial Action

There are no risks to the environment associated with the implementation of Alternative AMN-1 because no remedial action would be taken. Short-term environmental impacts are present in Alternatives AMN-2 and AMN-3 as damage will occur during excavation. Since more excavation is occurring in Alternative AMN-2, the potential impacts are greater.

Environmental Impacts of Remedial Action
Relative Ranking from Greatest to Least

	Greatest **0**	**1**	**2**	**3**	**Least** **4**
Amcast North Alternatives		2	3		1

Time until RAOs are Achieved

Alternative AMN-1 would rely on natural degradation of PCBs to achieve RAOs. In comparison to the other alternatives, a significant period of time is required for Alternative AMN-1 to achieve RAOs to reduce the potential for dermal contact or ingestion of PCB-contaminated soil. Alternatives AMN-2 and AMN-3 would generally achieve RAOs after implementation of the remedial action and restoration of the habitat.

Time until RAOs are Achieved
Relative Ranking from Longest to Shortest

	Longest **0**	**1**	**2**	**3**	**Shortest** **4**
Amcast North Alternatives	1				2, 3

Implementability

There are nine components that compose implementability, which are evaluated in the following subsections for the Amcast North alternatives.

Ability to Construct and Operate the Technology

There are no construction impediments associated with the implementation of Alternative AMN-1 because no remedial action would be taken. Likewise, there are no impediments with Alternatives AMN-2 or AMN-3 as they involve common construction operations.

Constructability
Relative Ranking from Least to Greatest

	Least **0**	**1**	**2**	**3**	**Greatest** **4**
Amcast North Alternatives					1, 2, 3

Reliability of the Technology

Reliability of the alternatives is based in part on the proven capability of the technology to operate as intended. Every alternative under consideration generally has a proven record of performance. Long-term monitoring and inspection would be required for Alternative AMN-3 to document reliability. Alternative AMN-1 was not considered because it does not include a technology.

Reliability
Relative Ranking from Least to Greatest

	Least **0**	**1**	**2**	**3**	**Greatest** **4**
Amcast North Alternatives			3		2

Ease of Undertaking Additional Remedial Actions, If Necessary

Every alternative under consideration has a fairly easy undertaking of additional remedial actions, should they be necessary. However, additional remedial actions following Alternative AMN-3 would need to take into consideration the isolation cover.

Ease of Undertaking Additional Remedial Actions, If Necessary
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Amcast North Alternatives			3		1, 2

Ability to Monitor the Effectiveness of Remedy

There is no remedial action under the implementation of Alternative AMN-1, so there is no effectiveness to monitor. There are no impediments for monitoring effectiveness for Alternative AMN-2. The isolation cover in Alternative AMN-3 will be covered by fill, which will reduce the ease of monitoring the cover.

Ability to Monitor the Effectiveness of Remedy
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Amcast North Alternatives	1		3		2

Ability to Obtain Approvals from Other Agencies

There is no remedial action under the implementation of Alternative AMN-1, so no approval is needed from agencies. Alternative AMN-2 uses known technologies with proven effectiveness so approvals would be obtained fairly easily. Alternative AMN-3 has the added intricacy of the isolation cover, which may make obtaining approvals more difficult.

Ability to Obtain Approvals from Other Agencies
Relative Ranking from Hardest to Easiest

	Hardest 0	1	2	3	Easiest 4
Amcast North Alternatives			3	2	1

Coordination with Other Agencies

There is no remedial action under the implementation of Alternative AMN-1, so no coordination with other agencies is needed. There are no impediments for coordination with other agencies for Alternatives AMN-2 and AMN-3.

Coordination with Other Agencies
Relative Ranking from Hardest to Easiest

	Hardest 0	1	2	3	Easiest 4
Amcast North Alternatives				2, 3	1

Availability of Offsite Treatment, Storage, and Disposal Services and Capacity

There is no remedial action under the implementation of Alternative AMN-1, so no offsite facilities are required. There are no impediments for offsite treatment, storage, and disposal services and capacity for Alternatives AMN-2 and AMN-3 because it is anticipated that local disposal facilities will have enough capacity for soil volumes being removed.

Available of Offsite Treatment, Storage, and Disposal Services and Capacity
Relative Ranking from Least to Greatest

	Least				Greatest
	0	**1**	**2**	**3**	**4**
Amcast North Alternatives	1			2	3

Availability of Necessary Equipment and Specialists

There are no impediments associated with the implementation of Alternative AMN-1 because no remedial action would be taken. Standard construction equipment can be used for Alternatives AMN-2 and AMN-3, and materials required are readily available. Excavated material may be requested for daily cover at the landfill, which may limit the amount of material the landfill can accept per day. This limitation can be resolved with prior planning, coordinating, and arranging for multiple disposal locations.

Availability of Services and Materials
Relative Ranking from Least to Greatest

	Least				Greatest
	0	**1**	**2**	**3**	**4**
Amcast North Alternatives					1, 2, 3

Availability of Prospective Technologies

Availability of prospective technologies refers in part to new technologies that have yet to reach mainstream use in the construction field. Every alternative under consideration generally has no impediments.

Availability of Prospective Technologies
Relative Ranking from Least to Greatest

	Least				Greatest
	0	**1**	**2**	**3**	**4**
Amcast North Alternatives					1, 2, 3

Cost

Appendix C contains an overview of the cost analysis and the detailed breakdowns for each of the alternatives. The alternative with the lowest total estimated cost is Alternative AMN-1, No Action; however, this alternative does not satisfy the requirements set forth by the RAOs. The alternative with the lowest capital cost is containment (Alternative AMN-3). The cost for this alternative is primarily composed of the cost for purchase and installation of the cap materials, but also includes long-term maintenance costs.

- AMN-2—$2,297,000 (present-worth cost)
- AMN-3—$1,523,000 ($937,000 capital, $486,000 O&M, and $100,000 periodic costs)

State Acceptance

The state acceptance criterion will be evaluated for the Amcast North alternatives after receipt of comments on the FS and proposed plan from the state agency.

Community Acceptance

The community acceptance criterion will be evaluated for the Amcast North alternatives after the public comment period on the FS and proposed plan.

5.4 Residential Yards Alternatives (Soil)

5.4.1 Detailed Analysis

The following alternatives for project subsites involving soil were developed and described in Section 4:

Alternative RY-1—No Action
Alternative RY-2—Soil Excavation, Offsite Disposal, Backfill, and Site Restoration

The alternatives were evaluated in detail using the evaluation criteria described above. Table 5-2 presents a detailed evaluation for these alternatives.

5.4.2 Comparative Analysis

This section presents the comparative analysis of the residential yard alternatives and discussion of the criteria evaluated.

Overall Protection of Human Health and the Environment

The pertinent RAOs include the following:

- Minimize the potential for dermal contact, ingestion, and inhalation exposures to COCs in surface soil in yard areas by residents (based on soil cleanup level of 1 part per million for PCBs per EPA 40 CFR 761.61(c))
- Minimize the potential for direct contact, direct ingestion, and/or food web exposures to COC concentrations above acceptable levels in surface soil in residential areas by upper-trophic-level organisms (small mammals)

Alternative RY-1 is not protective because it does not minimize contact or exposure to PCB contamination in soil. Alternative RY-1 will also allow continued potential for dermal contact or ingestion of PCB-contaminated soil. Alternative RY-2 is considered protective of human health and the environment as Alternative RY-2 removes and disposes of contaminated media.

Overall Protection of Human Health and the Environment
Relative Ranking from Least to Greatest

	Least				Greatest
	0	**1**	**2**	**3**	**4**
Residential Yard Alternatives	1				2

Compliance with ARARs

The most important ARARs to be met relate to TSCA requirements and air pollution emission requirements. Alternative RY-2 is expected to comply with ARARs.

Compliance with ARARs		
	Does Not Meet Criteria	**Meets Criteria**
Residential Yard Alternatives	1	2

Long-Term Effectiveness and Permanence

There are two components that compose evaluation of the long-term effectiveness and permanence, which are evaluated in the following subsections for the residential yard alternatives.

Magnitude of Residual Risks

For Alternative RY-1, the magnitude of residual risk would remain unchanged from the existing conditions. The least amount of residual risk would occur as a result of the excavation and offsite disposal in Alternative RY-2. Contaminated soil with PCB concentrations greater than 1 mg/kg would be removed from the site, resulting in a very low residual risk.

Magnitude of Residual Risks
Relative Ranking from Greatest to Least

	Greatest				**Least**
	0	**1**	**2**	**3**	**4**
Residential Yard Alternatives	1				2

Adequacy and Reliability of Controls

Alternative RY-1 requires advisories and warnings regarding dermal contact and ingestion of PCB-contaminated soil. These controls are based on public adherence to the warnings for measuring adequacy and reliability. Alternative RY-2 would not require controls.

Adequacy and Reliability of Controls
Relative Ranking from Lowest to Highest

	Lowest				**Highest**
	0	**1**	**2**	**3**	**4**
Residential Yard Alternatives	1				2

Reduction of Toxicity, Mobility, and Volume

There are six components that compose evaluation of the reduction of toxicity, mobility, and volume. These components are evaluated in the following subsections for the residential yard alternatives.

Treatment Process Used and Materials Treated

There are no treatment processes associated with the implementation of Alternative RY-1 because no remedial action would be taken. Additionally, there is no treatment process with Alternative RY-2 as no material is actually being treated. In Alternative RY-2, contaminated material is being excavated and disposed of offsite.

Treatment Process Used and Materials Treated
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Residential Yard Alternatives	1, 2				

Amount of Hazardous Materials Destroyed or Treated

No hazardous materials are destroyed or treated with the implementation of any alternative for the Residential Yards. For Alternative RY-1, no remedial action would be taken. For Alternative RY-2, hazardous material is excavated and disposed of offsite, but not destroyed or treated.

Amount of Hazardous Materials Destroyed or Treated
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Residential Yard Alternatives	1, 2				

Degree of Expected Reductions in Toxicity, Mobility, and Volume

There are no reductions in toxicity, mobility, or volume through treatment for each of the two alternatives. However, Alternative RY-2 will reduce mobility of contaminated material by removing it from the site and containing at a disposal facility.

Degree of Expected Reductions in Toxicity, Mobility, and Volume
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Residential Yard Alternatives	1	2			

Degree to Which Treatment is Irreversible

No remedial action would be taken in Alternative RY-1. Alternative RY-2 is irreversible as contaminated material is being removed from the site and would not be allowed to be brought back as fill.

Degree to Which Treatment is Irreversible
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Residential Yard Alternatives	1				2

Type and Quantity of Residuals Remaining After Treatment

Treatment is not performed in any of the alternatives for the site; therefore, no treatment residuals will remain. Contaminated material will remain onsite after the implementation of Alternatives RY-1 because no remedial action would be taken in RY-1. The amount of contaminated material after implementation of Alternative RY-2 will be minimal as all contaminated material will be excavated and disposed of offsite.

Type and Quantity of Residuals Remaining After Treatment
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Residential Yard Alternatives	1, 2				

Statutory Preference for Treatment as a Principal Element

Treatment is not performed in any of the alternatives for the site; therefore, there is no statutory preference based on treatment.

Statutory Preference for Treatment as a Principle Element
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Residential Yard Alternatives	1, 2				

Short-Term Effectiveness

There are four components that compose evaluation of the short-term effectiveness, which are evaluated in the following subsections for the residential yard alternatives.

Protection of Community During Remedial Action

There are no risks to the community associated with the implementation of Alternative RY-1 because no remedial action would be taken. Alternative RY-2 may result in a potential for exposure to the community by air or direct contact as material is being removed and disposed of. However, dust emissions can be controlled using standard engineering controls, and trucks can be covered and decontaminated before leaving the site.

Protection of Community During Remedial Action
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Residential Yard Alternatives		2			1

Protection of Workers During Remedial Action

There are no additional risks associated with the implementation of Alternative RY-1 because no remedial action would be taken. Alternative RY-2, which includes excavation and offsite disposal, has a potential exposure to workers as soil will be disturbed, removed, and handled, mostly using properly designed equipment that may not require direct contact, but direct contact to workers is possible during operations. The higher volume of material removed and managed, the greater the chance for worker risk and the lower the amount of protection provided to the worker.

Protection of Workers During Remedial Action
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Residential Yard Alternatives	2				1

Environmental Impacts of Remedial Action

There are no risks to the environment associated with the implementation of Alternative RY-1 because no remedial action would be taken. Short-term environmental impacts are present in Alternative RY-2 as damage will occur during excavation.

Environmental Impacts of Remedial Action
Relative Ranking from Greatest to Least

	Greatest 0	1	2	3	Least 4
Residential Yard Alternatives		2			1

Time until RAOs are Achieved

Alternative RY-1 would rely on natural degradation of PCBs to achieve RAOs. In comparison to the other alternative, a significant period of time is required for Alternative RY-1 to achieve RAOs to reduce the potential for dermal contact or ingestion of PCB-contaminated soil. Alternative RY-2 would generally achieve RAOs after implementation of the remedial action and restoration of the habitat.

Time until RAOs are Achieved
Relative Ranking from Longest to Shortest

	Longest 0	1	2	3	Shortest 4
Residential Yard Alternatives	1				2

Implementability

There are nine components that compose implementability, which are evaluated in the following subsections for the residential yard alternatives.

Ability to Construct and Operate the Technology

There are no construction impediments associated with the implementation of Alternative RY-1 because no remedial action would be taken. Likewise, there are no impediments with Alternative RY-2 as it involves common construction operations.

Constructability
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Residential Yard Alternatives					1, 2

Reliability of the Technology

Reliability of the alternatives is based in part on the proven capability of the technology to operate as intended. Alternative RY-2 generally has a proven record of performance. Alternative RY-1 was not considered because it does not include a technology.

Reliability
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Residential Yard Alternatives					2

Ease of Undertaking Additional Remedial Actions, If Necessary

Each alternative under consideration has a fairly easy undertaking of additional remedial actions, should they be necessary.

Ease of Undertaking Additional Remedial Actions, If Necessary
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Residential Yard Alternatives					1, 2

Ability to Monitor the Effectiveness of Remedy

There is no remedial action under the implementation of Alternative RY-1, so there is no effectiveness to monitor. There are no impediments for monitoring effectiveness for Alternative RY-2.

Ability to Monitor the Effectiveness of Remedy
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Residential Yard Alternatives	1				2

Ability to Obtain Approvals from Other Agencies

There is no remedial action under the implementation of Alternative RY-1, so no approval is needed from agencies. Alternative RY-2 uses known technologies with proven effectiveness so approvals would be obtained fairly easily.

Ability to Obtain Approvals from Other Agencies
Relative Ranking from Hardest to Easiest

	Hardest 0	1	2	3	Easiest 4
Residential Yard Alternatives				2	1

Coordination with Other Agencies

There is no remedial action under the implementation of Alternative RY-1, so no coordination with other agencies is needed. There are no impediments for coordination with other agencies for Alternative RY-2.

Coordination with Other Agencies
Relative Ranking from Hardest to Easiest

	Hardest 0	1	2	3	Easiest 4
Residential Yard Alternatives				2	1

Availability of Offsite Treatment, Storage, and Disposal Services and Capacity

There is no remedial action under the implementation of Alternative RY-1, so no offsite facilities are required. There are no impediments for offsite treatment, storage, and disposal services and capacity for Alternative RY-2 because it is anticipated that local disposal facilities will have enough capacity for soil volumes being removed.

Available of Offsite Treatment, Storage, and Disposal Services and Capacity
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Residential Yard Alternatives	1			2	

Availability of Necessary Equipment and Specialists

There are no impediments associated with the implementation of Alternative RY-1 because no remedial action would be taken. Standard construction equipment can be used for Alternative RY-2, and materials required are readily available. Excavated material may be requested for daily cover at the landfill, which may limit the amount of material the landfill can accept per day. This limitation can be resolved with prior planning, coordinating, and arranging for multiple disposal locations.

Availability of Services and Materials
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Residential Yard Alternatives					1, 2

Availability of Prospective Technologies

Availability of prospective technologies refers in part to new technologies that have yet to reach mainstream use in the construction field. Every alternative under consideration generally has no impediments.

Availability of Prospective Technologies
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Residential Yard Alternatives					1, 2

Cost

An overview of the cost analysis and the detailed breakdowns for each of the alternatives are presented in Appendix C. The alternative with the lowest total estimated cost is Alternative RY-1, No Action; however, this alternative does not satisfy the requirements set forth by the RAOs. The alternative with the lowest capital cost is excavation and removal (Alternative RY-2). The cost for Alternative RY-2 is entirely composed of the cost for excavation and removal of the contaminated soil.

- RY-2—$2,375,000 (present-worth cost)

State Acceptance

The state acceptance criterion will be evaluated for the residential yard alternatives after receipt of comments on the FS and proposed plan from the state agency.

Community Acceptance

The community acceptance criterion will be evaluated for the residential yard alternatives after the public comment period on the FS and proposed plan.

5.5 Wilshire Pond Alternatives (Sediment/Bank Soil)

5.5.1 Detailed Analysis

The following alternatives for subsites involving basin sediment and bank soil were developed and described in Section 4:

- Alternative WP-1—No Action
- Alternative WP-2—Sediment and Bank Soil Excavation, Offsite Disposal, Backfill, and Site Restoration
- Alternative WP-3—Sediment, Bank Soil and Structural Excavation, Offsite Disposal, Backfill, and Site Restoration

These alternatives were evaluated in detail using the evaluation criteria described above. Table 5-3 summarizes a detailed evaluation for these alternatives.

5.5.2 Comparative Analysis

This section presents the comparative analysis of the alternatives and discussion of the criteria evaluated.

Overall Protection of Human Health and the Environment

The pertinent RAOs include the following:

- Minimize the potential for dermal contact, ingestion, and inhalation exposures to COCs in bank surface soil by recreational users.
- Minimize the potential for direct contact, direct ingestion, and/or food web exposures to PCB concentrations above acceptable levels in bank and basin sediment by lower-trophic-level aquatic organisms (invertebrates, fish, and amphibians) and upper-trophic-level organisms (birds and mammals).
- Minimize the potential for bioaccumulation of PCBs above acceptable levels in fish and frog tissue from exposure to bank and basin sediments.

Alternative WP-1 is not protective because it does not minimize contact or exposure to PCB contamination in soil, water, or sediment. Alternative WP-1 would allow continued exposure by fish/frogs to the PCB-contaminated sediment, and the PCBs will not be prevented from bioaccumulating in the organisms. Alternative WP-1 will also allow continued potential for dermal contact or ingestion of PCB-contaminated sediment and soil. Alternatives WP-2 and WP-3 for Wilshire Ponds are considered protective of human health and the environment. Alternative WP-3 removes and disposes more contaminated media than Alternative WP-2 and is therefore more protective than Alternative WP-3.

Overall Protection of Human Health and the Environment
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Wilshire Ponds Alternatives	1			2	3

Compliance with ARARs

The most important ARARs to be met relate to TSCA requirements, protection of ponds during construction, disposal of treated water from the dewatering process, air pollution emission requirements, and post-remediation water quality. All alternatives, other than Alternative WP-1, are expected to comply with ARARs for each subsite.

Compliance with ARARs

	Does Not Meet Criteria	Meets Criteria
Wilshire Ponds Alternatives	1	2, 3

Long-Term Effectiveness and Permanence

There are two components that compose evaluation of the long-term effectiveness and permanence, which are evaluated in the following subsections for the Wilshire Pond alternatives.

Magnitude of Residual Risks

The magnitude of residual risk is based on a long-term evaluation of each alternative and the degree of risk remaining in the future after the remedial action is completed. For Alternative WP-1, the magnitude of residual risk would remain unchanged from the existing conditions. The remedial actions completed as part of these alternatives would not change the concentration of PCB contamination in the sediment or bank soil, except through natural degradation of PCBs that would occur gradually over an extended period of time. The least amount of residual risk would occur as a result of the excavation and offsite disposal in Alternatives WP-2 and WP-3. Contaminated sediment and soil with PCB concentrations greater than 1 mg/kg would be removed from the site, resulting in a very low residual risk.

Magnitude of Residual Risks
Relative Ranking from Greatest to Least

	Greatest **0**	**1**	**2**	**3**	**Least** **4**
Wilshire Pond Alternatives	1			2	3

Adequacy and Reliability of Controls

Long-term effectiveness of the remedial action also depends on the adequacy and reliability of controls to protect human health and the environment. Alternative WP-1 requires advisories and warnings regarding fish consumption, dermal contact, and ingestion of PCB-contaminated soil and sediment. These controls are based on public adherence to the warnings for measuring adequacy and reliability. Alternatives WP-2 and WP-3 would not require controls, except possibly maintenance of short-term fish consumption advisories, which would be required during the implementation of each alternative under consideration.

Adequacy and Reliability of Controls
Relative Ranking from Lowest to Highest

	Lowest **0**	**1**	**2**	**3**	**Highest** **4**
Wilshire Pond Alternatives	1			2	3

Reduction of Toxicity, Mobility, and Volume

There are six components that compose evaluation of the reduction of toxicity, mobility, and volume. These components are evaluated in the following subsections for the Wilshire Pond alternatives.

Treatment Process Used and Materials Treated

There are no treatment processes associated with the implementation of Alternative WP-1 because no remedial action would be taken. Additionally, there are no treatment processes with Alternatives WP-2 and WP-3 as no material is actually being treated; instead, it is being excavated and disposed of offsite.

Treatment Process Used and Materials Treated
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Wilshire Pond Alternatives	1, 2, 3				

Amount of Hazardous Materials Destroyed or Treated

No hazardous materials are destroyed or treated with the implementation of any alternative for Wilshire Pond. For Alternative WP-1, no remedial action would be taken. For Alternatives WP-2 and WP-3, hazardous material is excavated and disposed of offsite, but not destroyed or treated.

Amount of Hazardous Materials Destroyed or Treated
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Wilshire Pond Alternatives	1, 2, 3				

Degree of Expected Reductions in Toxicity, Mobility, and Volume

There are no reductions in toxicity, mobility, or volume through treatment for each of the three alternatives. However, Alternatives WP-2 and WP-3 will both reduce mobility and volume of contaminated material by removing it from the site and containing at a disposal facility, but WP-3 would do so to a greater degree because more volume is being removed (assumes contaminated berms).

Degree of Expected Reductions in Toxicity, Mobility, and Volume
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Wilshire Pond Alternatives	1	2	3		

Degree to Which Treatment is Irreversible

No remedial action would be taken in Alternative WP-1. Alternatives WP-2 and WP-3 are irreversible as contaminated material is being removed from the site and would not be allowed to be brought back as fill.

Degree to Which Treatment is Irreversible
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Wilshire Pond Alternatives	1				2, 3

Type and Quantity of Residuals Remaining After Treatment

Treatment is not performed in any of the alternatives for the site; therefore, no treatment residuals will remain. Contaminated material will remain onsite after the implementation of Alternative WP-1 because no remedial action is taken. The amount of contaminated material after implementation of Alternatives WP-2 and WP-3 will be minimal as contaminated material will be excavated and disposed of offsite.

Type and Quantity of Residuals Remaining After Treatment
Relative Ranking from Lowest to Highest

	Lowest **0**	**1**	**2**	**3**	**Highest** **4**
Wilshire Pond Alternatives	1, 2, 3				

Statutory Preference for Treatment as a Principal Element

Treatment is not performed in any of the alternatives for the site; therefore, there is no statutory preference based on treatment.

Statutory Preference for Treatment as a Principle Element
Relative Ranking from Lowest to Highest

	Lowest **0**	**1**	**2**	**3**	**Highest** **4**
Wilshire Pond Alternatives	1, 2, 3				

Short-Term Effectiveness

There are four components that compose evaluation of the short-term effectiveness, which are evaluated in the following subsections for the Wilshire Pond alternatives.

Protection of Community During Remedial Action

There are no risks to the community associated with the implementation of Alternative WP-1 because no remedial action would be taken. Alternative WP-3 may result in a greater potential for exposure to the community by air or direct contact than Alternative WP-2 as more material is being removed and disposed of. However, dust emissions can be controlled using standard engineering controls, and trucks can be covered and decontaminated before leaving the site.

Protection of Community During Remedial Action
Relative Ranking from Least to Greatest

	Least **0**	**1**	**2**	**3**	**Greatest** **4**
Wilshire Pond Alternatives			3	2	1

Protection of Workers During Remedial Action

There are no additional risks associated with the implementation of Alternative WP-1 because no remedial action would be taken. Alternatives WP-2 and WP-3 have a potential exposure to workers. Sediment and soil will be disturbed, removed, and handled, mostly using properly designed equipment that may not require direct contact, but direct contact to workers is possible during operations. Since Alternative WP-3 has a higher volume of material removed and managed, the chance for worker risk is greater, and the amount of protection provided to the worker is lower than Alternative WP-2.

Protection of Workers During Remedial Action
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Wilshire Pond Alternatives	3	2			1

Environmental Impacts of Remedial Action

There are no risks to the environment associated with the implementation of Alternative WP-1 because no remedial action would be taken. Short-term environmental impacts are present in Alternatives WP-2 and WP-3 as damage will occur during excavation. Since more excavation is occurring in Alternative WP-3, the potential impacts are greater.

Environmental Impacts of Remedial Action
Relative Ranking from Greatest to Least

	Greatest 0	1	2	3	Least 4
Wilshire Pond Alternatives		3	2		1

Time until RAOs are Achieved

Alternative WP-1 would rely on natural degradation of PCBs to achieve RAOs. In comparison to the other alternatives, a significant period of time is required for Alternative WP-1 to achieve RAOs to reduce the potential for ingestion of PCBs through fish tissue and reduce the potential for dermal contact or ingestion of PCB-contaminated sediment and soil. Alternatives WP-2 and WP-3 would generally achieve RAOs after implementation of the remedial action and restoration of the habitat.

Time until RAOs are Achieved
Relative Ranking from Longest to Shortest

	Longest 0	1	2	3	Shortest 4
Wilshire Ponds Alternatives	1				2,3

Implementability

There are nine components that compose implementability, which are evaluated in the following subsections for the Wilshire Pond alternatives.

Ability to Construct and Operate the Technology

There are no construction impediments associated with the implementation of Alternative WP-1 because no remedial action would be taken. Likewise, there are no impediments with Alternatives WP-2 or WP-3 as they involve common construction operations. These alternatives will require a storage area for dewatering/staging, bulk dewatering amendments, and/or soil stockpiles.

Ability to Construct and Operate the Technology
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Wilshire Pond Alternatives					1, 2, 3

Reliability of the Technology

Reliability of the alternatives is based in part on the proven capability of the technology to operate as intended. Every alternative under consideration generally has a proven record of performance. Excavation of dry sediment is generally more reliable when compared to excavation of wet sediment because it is easier to verify removal of the material through visual inspection. However, both methods are proven technologies. Alternative WP-1 was not considered because it does not include a technology.

Reliability of the Technology
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Wilshire Pond Alternatives					2, 3

Ease of Undertaking Additional Remedial Actions, If Necessary

Every alternative under consideration has a fairly easy undertaking of additional remedial actions, should they be necessary.

Ease of Undertaking Additional Remedial Actions, If Necessary
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Wilshire Pond Alternatives					1, 2, 3

Ability to Monitor the Effectiveness of Remedy

There is no remedial action under the implementation of Alternative WP-1, so there is no effectiveness to monitor. The only impediments for monitoring effectiveness for Alternatives WP-2 and WP-3 will be the presence of water within the ponds post completion.

Ability to Monitor the Effectiveness of Remedy
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Wilshire Pond Alternatives	1			2, 3	

Ability to Obtain Approvals from Other Agencies

There is no remedial action under the implementation of Alternative WP-1, so no approval is needed from agencies. Alternatives WP-2 and WP-3 use known technologies with proven effectiveness, so approvals would be obtained fairly easily.

Ability to Obtain Approvals from Other Agencies
Relative Ranking from Hardest to Easiest

	Hardest 0	1	2	3	Easiest 4
Wilshire Pond Alternatives				2, 3	1

Coordination with Other Agencies

There is no remedial action under the implementation of Alternative WP-1, so no coordination with other agencies is needed. There are no impediments for coordination with other agencies for Alternatives WP-2 and WP-3.

Coordination with Other Agencies
Relative Ranking from Hardest to Easiest

	Hardest 0	1	2	3	Easiest 4
Wilshire Pond Alternatives				2, 3	1

Availability of Offsite Treatment, Storage, and Disposal Services and Capacity

There is no remedial action under the implementation of Alternative WP-1, so no offsite facilities are required. There are no impediments for offsite treatment, storage, and disposal services and capacity for Alternatives WP-2 and WP-3 because it is anticipated that local disposal facilities will have enough capacity for soil volumes being removed.

Available of Offsite Treatment, Storage, and Disposal Services and Capacity
Relative Ranking from Least to Greatest

	Least				**Greatest**
	0	**1**	**2**	**3**	**4**
Wilshire Pond Alternatives	1			3	2

Availability of Necessary Equipment and Specialists

There are no impediments associated with the implementation of Alternative WP-1 because no remedial action would be taken. Standard construction equipment can be used for Alternatives WP-2 and WP-3, and materials required are readily available. Dewatered sediment may be requested for daily cover at the landfill, which may limit the amount of material the landfill can accept per day. This limitation can be resolved with prior planning, coordinating, and arranging for multiple disposal locations.

Availability of Necessary Equipment and Specialists
Relative Ranking from Least to Greatest

	Least				**Greatest**
	0	**1**	**2**	**3**	**4**
Wilshire Pond Alternatives					1, 2, 3

Availability of Prospective Technologies

Availability of prospective technologies refers in part to new technologies that have yet to reach mainstream use in the construction field. Every alternative under consideration generally has no impediments.

Availability of Prospective Technologies
Relative Ranking from Least to Greatest

	Least				**Greatest**
	0	**1**	**2**	**3**	**4**
Wilshire Pond Alternatives					1, 2, 3

Cost

Appendix C contains an overview of the cost analysis and the detailed breakdowns for each of the alternatives. The alternative with the lowest total estimated cost is Alternative WP-1, No Action; however, this alternative does not satisfy the requirements set forth by the RAOs. The alternative with the lowest capital cost is sediment and bank soil excavation (Alternative WP-2). The cost for this alternative is entirely composed of the cost for excavation and removal of the sediment and bank soil materials.

- WP-2—$1,327,000 (present-worth cost)
- WP-3—$1,536,000 (present-worth cost)

State Acceptance

The state acceptance criterion will be evaluated for the Wilshire Pond alternatives after receipt of comments on the FS and proposed plan from the state agency.

Community Acceptance

The community acceptance criterion will be evaluated for the Wilshire Pond alternatives after the public comment period on the FS and proposed plan.

5.6 Amcast South Alternatives (Soil)

5.6.1 Detailed Analysis

The following alternatives for project subsites involving soil were developed and described in Section 4:

- Alternative AMS-1—No Action
- Alternative AMS-2—Excavation, Offsite Disposal, Backfill, and Site Restoration
- Alternative AMS-3—Isolation Cover and Site Restoration

These alternatives were evaluated in detail using the evaluation criteria described above. Table 5-4 summarizes detailed evaluations for these alternatives.

5.6.2 Comparative Analysis

This section presents the comparative analysis of the Amcast South alternatives and discussion of the criteria evaluated.

Overall Protection of Human Health and the Environment

The pertinent RAOs include the following:

- Minimize the potential for dermal contact, ingestion, and inhalation exposures to COCs in total soil by residents, industrial workers, and construction workers.
- Minimize the potential for direct contact, direct ingestion, and/or food web exposures to COC concentrations above acceptable levels in surface soil by lower-trophic-level terrestrial organisms (soil invertebrates) and upper-trophic-level organisms (primarily small mammals).

Alternative AMS-1 is not protective because it does not minimize contact or exposure to PCB contamination in soil. Alternative AMS-1 will also allow continued potential for dermal contact or ingestion of PCB-contaminated soil. Alternatives AMS-2 and AMS-3 are considered protective of human health and the environment. Alternatives AMS-2 removes and disposes of contaminated media and is therefore more protective than Alternative AMS-3, which leaves contaminated material in place but below an isolation cover. The isolation cover only reduces the risk rather than removing it.

Overall Protection of Human Health and the Environment
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Amcast South Alternatives	1		3		2

Compliance with ARARs

The most important ARARs to be met relate to TSCA requirements and air pollution emission requirements. All alternatives, other than Alternative AMS-1, are expected to comply with ARARs.

Compliance with ARARs

	Does Not Meet Criteria	Meets Criteria
Amcast South Alternatives	1	2, 3

Long-Term Effectiveness and Permanence

There are two components that compose evaluation of the long-term effectiveness and permanence, which are evaluated in the following subsections for the Amcast South alternatives.

Magnitude of Residual Risks

For Alternative AMS-1, the magnitude of residual risk would remain unchanged from the existing conditions. The least amount of residual risk would occur as a result of the excavation and offsite disposal in Alternative AMS-2. Contaminated soil with PCB concentrations exceeding human health PRGs and/or the ecological PRGs (Table 2-2) would be removed from the site, resulting in a very low residual risk. The installation of an isolation cover in Alternative AMS-3 will reduce exposure to residual contamination in surface soil but will not reduce residual risk at depth.

Magnitude of Residual Risks
Relative Ranking from Greatest to Least

	Greatest 0	1	2	3	Least 4
Amcast South Alternatives	1		3		2

Adequacy and Reliability of Controls

Alternative AMS-1 requires advisories and warnings regarding dermal contact and ingestion of PCB-contaminated soil. These controls are based on public adherence to the warnings for measuring adequacy and reliability. Alternative AMS-2 would not require controls. Alternative AMS-3 requires long-term maintenance and inspection to verify the installation and thickness of the isolation cover. There is the potential for the cover to be removed or disturbed depending on future site usage and activities. Thus, the adequacy and reliability of controls to prevent disturbance of the cover depends on maintenance and inspection.

Adequacy and Reliability of Controls
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Amcast South Alternatives	1		3		2

Reduction of Toxicity, Mobility, and Volume

There are six components that compose evaluation of the reduction of toxicity, mobility, and volume. These components are evaluated in the following subsections for the Amcast South alternatives.

Treatment Process Used and Materials Treated

There are no treatment processes associated with the implementation of Alternative AMS-1 because no remedial action would be taken. Additionally, there are no treatment processes with Alternatives AMS-2 and AMS-3 as no material is actually being treated. In Alternative AMS-2, contaminated material is being excavated and disposed of offsite. In Alternative AMS-3, some contaminated material will be disposed of offsite, with the remainder being capped under an isolation cover.

Treatment Process Used and Materials Treated
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Amcast South Alternatives	1, 2, 3				

Amount of Hazardous Materials Destroyed or Treated

No hazardous materials are destroyed or treated with the implementation of any alternative for Amcast South. For Alternative AMS-1, no remedial action would be taken. For Alternative AMS-2, hazardous material is excavated and disposed of offsite, but not destroyed or treated. Similarly, for Alternative AMS-3, some contaminated material is removed from the site, with the remainder remaining untreated under an isolation cover.

Amount of Hazardous Materials Destroyed or Treated
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Amcast South Alternatives	1, 2, 3				

Degree of Expected Reductions in Toxicity, Mobility, and Volume

There are no reductions in toxicity, mobility, or volume through treatment for each of the three alternatives. However, Alternatives AMS-2 and AMS-3 will both reduce mobility of contaminated material, AMS-2 by removing it from the site and containing at a disposal facility and AMS-3 by isolating it below a cover.

Degree of Expected Reductions in Toxicity, Mobility, and Volume
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Amcast South Alternatives	1	2, 3			

Degree to Which Treatment is Irreversible

No remedial action would be taken in Alternative AMS-1. Alternative AMS-2 is irreversible as contaminated material is being removed from the site and would not be allowed to be brought back as fill. Likewise, for Alternative AMS-3, contaminated material will be removed from the site and will not be allowed back onsite. However, Alternative AMS-3 is slightly more reversible than Alternative AMS-2 as the cover is removable.

Degree to Which Treatment is Irreversible
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Amcast South Alternatives	1			3	2

Type and Quantity of Residuals Remaining After Treatment

Treatment is not performed in any of the alternatives for the site; therefore, no treatment residuals will remain. Contaminated material will remain onsite after the implementation of Alternatives AMS-1 and AMS-3, because no remedial action would be taken in AMS-1, and an isolation cover is used in AMS-3. However, the quantity of material remaining for Alternative AMS-3 is less than AMS-1. The amount of contaminated material after implementation of Alternative AMS-2 will be minimal as all contaminated material will be excavated and disposed of offsite.

Type and Quantity of Residuals Remaining After Treatment
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Amcast South Alternatives	1, 2, 3				

Statutory Preference for Treatment as a Principal Element

Treatment is not performed in any of the alternatives for the site; therefore, there is no statutory preference based on treatment.

Statutory Preference for Treatment as a Principle Element
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Amcast South Alternatives	1, 2, 3				

Short-Term Effectiveness

There are four components that compose evaluation of the short-term effectiveness, which are evaluated in the following subsections for the Amcast South alternatives.

Protection of Community During Remedial Action

There are no risks to the community associated with the implementation of Alternative AMS-1 because no remedial action would be taken. Alternative AMS-2 may result in a greater potential for exposure to the community by air or direct contact than Alternative AMS-3 as more material is being removed and disposed of. For Alternative AMS-3, exposure to the community from dust during installation of a cover depends on whether the underlying material is dry or wet at the time of installation. However, dust emissions can be controlled using standard engineering controls, and trucks can be covered and decontaminated before leaving the site.

Protection of Community During Remedial Action
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Amcast South Alternatives			2	3	1

Protection of Workers During Remedial Action

There are no additional risks associated with the implementation of Alternative AMS-1 because no remedial action would be taken. Alternative AMS-3, which includes installation of an isolation cover, has a potential exposure to workers as some excavation is required for installation. Alternative AMS-2, which includes excavation and offsite disposal, would have a similar effect with respect to the protection of workers—soil will be disturbed, removed, and handled, mostly using properly designed equipment that may not require direct contact, but direct contact to workers is possible during operations. The higher volume of material removed and managed, the greater the chance for worker risk and the lower the amount of protection provided to the worker.

Protection of Workers During Remedial Action
Relative Ranking from Least to Greatest

	Least **0**	**1**	**2**	**3**	**Greatest** **4**
Amcast South Alternatives	2	3			1

Environmental Impacts of Remedial Action

There are no risks to the environment associated with the implementation of Alternative AMS-1 because no remedial action would be taken. Short-term environmental impacts are present in Alternatives AMS-2 and AMS-3 as damage will occur during excavation. Since more excavation is occurring in Alternative AMS-2, the potential impacts are greater

Environmental Impacts of Remedial Action
Relative Ranking from Greatest to Least

	Greatest **0**	**1**	**2**	**3**	**Least** **4**
Amcast South Alternatives		2	3		1

Time until RAOs are Achieved

Alternative AMS-1 would rely on natural degradation of PCBs to achieve RAOs. In comparison to the other alternatives, a significant period of time is required for Alternative AMS-1 to achieve RAOs to reduce the potential for dermal contact or ingestion of PCB-contaminated soil. Alternatives AMS-2 and AMS-3 would generally achieve RAOs after implementation of the remedial action and restoration of the habitat.

Time until RAOs are Achieved
Relative Ranking from Longest to Shortest

	Longest **0**	**1**	**2**	**3**	**Shortest** **4**
Amcast South Alternatives	1				2, 3

Implementability

There are nine components that compose implementability, which are evaluated in the following subsections for the Amcast South alternatives.

Ability to Construct and Operate the Technology

There are no construction impediments associated with the implementation of Alternative AMS-1 because no remedial action would be taken. Likewise, there are no impediments with Alternatives AMS-2 or AMS-3 as they involve common construction operations.

Ability to Construct and Operate the Technology
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Amcast South Alternatives					1, 2, 3

Reliability of the Technology

Reliability of the alternatives is based in part on the proven capability of the technology to operate as intended. Every alternative under consideration generally has a proven record of performance. Alternative AMS-1 was not considered because it does not include a technology. Long-term monitoring and inspection would be required for Alternative AMS-3 to document reliability.

Reliability of the Technology
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Amcast South Alternatives			3		2

Ease of Undertaking Additional Remedial Actions, If Necessary

Every alternative under consideration has a fairly easy undertaking of additional remedial actions, should they be necessary. However, additional remedial actions following Alternative AMS-3 would need to take into consideration the isolation cover.

Ease of Undertaking Additional Remedial Actions, If Necessary
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Amcast South Alternatives			3		1, 2

Ability to Monitor the Effectiveness of Remedy

There is no remedial action under the implementation of Alternative AMS-1, so there is no effectiveness to monitor. There are no impediments for monitoring effectiveness for Alternative AMS-2. The isolation cover in Alternative AMS-3 will be covered by fill, which will reduce the ease of monitoring the cover.

Ability to Monitor the Effectiveness of Remedy
Relative Ranking from Least to Greatest

	Least **0**	**1**	**2**	**3**	**Greatest** **4**
Amcast South Alternatives	1		3		2

Ability to Obtain Approvals from Other Agencies

There is no remedial action under the implementation of Alternative AMS-1, so no approval is needed from agencies. Alternative AMS-2 uses known technologies with proven effectiveness so approvals would be obtained fairly easily. Alternative AMS-3 has the added intricacy of the isolation cover, which may make obtaining approvals more difficult.

Ability to Obtain Approvals from Other Agencies
Relative Ranking from Hardest to Easiest

	Hardest **0**	**1**	**2**	**3**	**Easiest** **4**
Amcast South Alternatives			3	2	1

Coordination with Other Agencies

There is no remedial action under the implementation of Alternative AMS-1, so no coordination with other agencies is needed. There are no impediments for coordination with other agencies for Alternatives AMS-2 and AMS-3.

Coordination with Other Agencies
Relative Ranking from Hardest to Easiest

	Hardest **0**	**1**	**2**	**3**	**Easiest** **4**
Amcast South Alternatives				2, 3	1

Availability of Offsite Treatment, Storage, and Disposal Services and Capacity

There is no remedial action under the implementation of Alternative AMS-1, so no offsite facilities are required. There are no impediments for offsite treatment, storage, and disposal services and capacity for Alternatives AMS-2 and AMS-3 because it is anticipated that local disposal facilities will have enough capacity for soil volumes being removed.

Available of Offsite Treatment, Storage, and Disposal Services and Capacity
Relative Ranking from Least to Greatest

	Least				**Greatest**
	0	**1**	**2**	**3**	**4**
Amcast South Alternatives	1			2	3

Availability of Necessary Equipment and Specialists

There are no impediments associated with the implementation of Alternative AMS-1 because no remedial action would be taken. Standard construction equipment can be used for Alternatives AMS-2 and AMS-3, and materials required are readily available. Excavated material may be requested for daily cover at the landfill, which may limit the amount of material the landfill can accept per day. This limitation can be resolved with prior planning, coordinating, and arranging for multiple disposal locations.

Availability of Necessary Equipment and Specialists
Relative Ranking from Least to Greatest

	Least				**Greatest**
	0	**1**	**2**	**3**	**4**
Amcast South Alternatives					1, 2, 3

Availability of Prospective Technologies

Availability of prospective technologies refers in part to new technologies that have yet to reach mainstream use in the construction field. Every alternative under consideration generally has no impediments.

Availability of Prospective Technologies
Relative Ranking from Least to Greatest

	Least				**Greatest**
	0	**1**	**2**	**3**	**4**
Amcast South Alternatives					1, 2, 3

Cost

Appendix C presents an overview of the cost analysis and the detailed breakdowns for each of the alternatives. The alternative with the lowest total estimated cost is Alternative AMS-1, No Action; however, this alternative does not satisfy the requirements set forth by the RAOs. The alternative with the lowest capital cost is containment (Alternative AMS-3). The cost for this alternative is primarily composed of the cost for purchase and installation of the cap materials, but also contains costs for long-term maintenance.

- AMS-2—$6,768,000 (present-worth costs)
- AMS-3—$4,292,000 ($3,475,000 capital, $716,000 O&M, and $100,000 periodic costs)

State Acceptance

The state acceptance criterion will be evaluated for the Amcast South alternatives after receipt of comments on the FS and proposed plan from the state agency.

Community Acceptance

The community acceptance criterion will be evaluated for the Amcast South alternatives after the public comment period on the FS and proposed plan.

5.7 Quarry Pond Alternatives (Sediment)

5.7.1 Detailed Analysis

The following alternatives for subsites involving sediment were developed and described in Section 4:

- Alternative QP-1—No Action
- Alternative QP-2—Sediment Dredging, Bank Soil Excavation, Offsite Disposal, and Site Restoration
- Alternative QP-3—Construct PRB to Isolate Contaminated Sediment, Excavate Bank Soil, Offsite Disposal, and Site Restoration
- Alternative QP-4—Sediment Dredging, Bank Soil Excavation, Offsite Disposal, and Site Restoration

These alternatives were evaluated in detail using the evaluation criteria described above. Table 5-5 summarizes the detailed evaluations for these alternatives.

5.7.2 Comparative Analysis

This section presents the comparative analysis of the alternatives and discussion of the criteria evaluated.

Overall Protection of Human Health and the Environment

The pertinent RAOs include the following:

- Minimize the potential for dermal contact and ingestion exposures to COCs in Quarry Pond sediment by recreational users.
- Minimize the potential for bioaccumulation into edible-size fish from exposure to COCs in Quarry Pond sediment.
- Minimize the potential for ingestion exposures to COCs in Quarry Pond fish by recreational anglers.
- Minimize the potential for direct contact, direct ingestion, and/or food web exposures to COC concentrations above acceptable levels in Zeunert Park surface soil by upper-trophic-level organisms (small mammals).
- Minimize the potential for direct contact, direct ingestion, and/or food web exposures to PCB concentrations above acceptable levels in Quarry Pond basin sediment by lower-trophic-level aquatic organisms (primarily invertebrates and fish) and upper-trophic-level organisms (birds and mammals).
- Minimize the potential for bioaccumulation of PCBs above acceptable levels in Quarry Pond fish tissue from exposure to basin sediments.

Alternative QP-1 is not protective because it does not minimize contact or exposure to PCB contamination in soil, water, or sediment. Alternative QP-1 would allow continued exposure by fish/frogs to the PCB-contaminated sediment, and the PCBs will not be prevented from bioaccumulating in the organisms. Alternative QP-1 will also allow continued potential for dermal contact or ingestion of PCB-contaminated sediment and soil. Alternatives QP-2, QP-3, and QP-4 are considered protective of human health and the environment. Alternatives QP-2 and QP-4 removes and disposes of contaminated media; therefore, they are more protective than Alternative QP-3, which leaves contaminated material in place but covered with a reactive barrier. The reactive barrier will reduce the risk in surface sediments but may leave contamination in place at depth.

Overall Protection of Human Health and the Environment
Relative Ranking from Least to Greatest

	Least **0**	**1**	**2**	**3**	**Greatest** **4**
Quarry Pond Alternatives	1			3	2,4

Compliance with ARARs

The most important ARARs to be met relate to TSCA requirements, protection of ponds during construction, disposal of treated water from the dewatering process, air pollution emission requirements, and post-remediation water quality. All alternatives, other than Alternative QP-1, are expected to comply with ARARs for each subsite.

Compliance with ARARs

	Does Not Meet Criteria	**Meets Criteria**
Quarry Pond Alternatives	1	2, 3,4

Long-Term Effectiveness and Permanence

There are two components that compose evaluation of the long-term effectiveness and permanence, which are evaluated in the following subsections for the Quarry Pond alternatives.

Magnitude of Residual Risks

For Alternative QP-1, the magnitude of residual risk would remain unchanged from the existing conditions. The remedial actions completed as part of these alternatives would not change the concentration of PCB contamination in the sediment or bank soil, except through natural degradation of PCBs that would occur gradually over an extended period of time. The least amount of residual risk would occur as a result of the excavation and offsite in Alternative QP-4 for Quarry Pond. Contaminated sediment and soil with PCB concentrations greater than 1 mg/kg, the most conservative PRG among the alternatives, would be removed from the site, resulting in a very low residual risk. The installation of a reactive barrier in Quarry Pond's Alternative QP-3 will reduce exposure to residual contamination in surface sediment by absorbing the contaminants but will not reduce residual risk at depth.

Magnitude of Residual Risks
Relative Ranking from Greatest to Least

	Greatest **0**	**1**	**2**	**3**	**Least** **4**
Quarry Pond Alternatives	1		3	2	4

Adequacy and Reliability of Controls

Alternative QP-1 requires advisories and warnings regarding fish consumption, dermal contact, and ingestion of PCB-contaminated soil and sediment. These controls are based on public adherence to the warnings for measuring adequacy and reliability. Alternatives QP-2 and QP-4 would not require controls, except possibly maintenance of short-term fish consumption advisories, which would be required during the implementation of each alternative under consideration. There is limited potential for the reactive barrier in Alternative QP-3 to be removed or disturbed by humans or the environment because the depth of water is up to 20 feet, the banks are steep over much of the pond, the stormwater outfall areas are at the water's surface, the cap is placed at depth, and other potential disturbances from tributary inlets/outlets or large wave action that could produce scouring velocities at depth are not present. In addition, placement of a 6-inch protective layer of 0.5-inch aggregate further minimizes the potential for disturbances. However, based on the nature of a seepage pond, water levels are linked to groundwater levels and precipitation. Thus, there may be an increased risk during low water cap disturbance from erosion (low pool), scour resulting from high-flow stormwater discharge events, or people. The adequacy and reliability of controls to prevent disturbance of the cover depends on long-term maintenance and monitoring to verify performance and thickness and, as such, is required.

Adequacy and Reliability of Controls
Relative Ranking from Lowest to Highest

	Lowest **0**	**1**	**2**	**3**	**Highest** **4**
Quarry Pond Alternatives	1		3		2,4

Reduction of Toxicity, Mobility, and Volume

There are six components that compose evaluation of the reduction of toxicity, mobility, and volume. These components are evaluated in the following subsections for the Quarry Pond alternatives.

Treatment Process Used and Materials Treated

There are no treatment processes associated with the implementation of Alternative QP-1 because no remedial action would be taken. Additionally, there is no treatment processes with Alternatives QP-2 and QP-4. In Alternative QP-3, PCB-contaminated sediment is covered and treated with a PRB composed of 1 percent GAC mixed with 99 percent sand, and an organophilic clay layer (over TSCA areas).

Treatment Process Used and Materials Treated
Relative Ranking from Lowest to Highest

	Lowest **0**	**1**	**2**	**3**	**Highest** **4**
Quarry Pond Alternatives	1, 2,4				3

Amount of Hazardous Materials Destroyed or Treated

No hazardous materials are destroyed or treated with the implementation of Alternatives QP-1, QP-2, or QP-4. For Alternative QP-3, contaminated sediment is treated by covering with a PRB composed of 1 percent GAC and 99 percent sand.

Amount of Hazardous Materials Destroyed or Treated
Relative Ranking from Lowest to Highest

	Lowest **0**	**1**	**2**	**3**	**Highest** **4**
Quarry Pond Alternatives	1, 2,4				3

Degree of Expected Reductions in Toxicity, Mobility, and Volume

There are no reductions in toxicity, mobility, or volume through treatment for Alternative QP-1. Alternatives QP-2 and QP-4 will reduce mobility of contaminated material by removing it from the site and containing at a disposal facility and to a greater degree with QP-4 due to the more conservative PRG. Alternative QP-3 will use a PRB and is expected to reduce toxicity and mobility by absorbing PCBs into the GAC.

Degree of Expected Reductions in Toxicity, Mobility, and Volume
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Quarry Pond Alternatives	1		3	2	4

Degree to Which Treatment is Irreversible

No remedial action would be taken in Alternative QP-1. Alternatives QP-2 and QP-4 are irreversible as contaminated material is being removed from the site and would not be allowed to be brought back as fill. Alternative QP-3 is slightly reversible as the PRB can be removed. However, due to the nature of the PRB, PCBs will be absorbed into the GAC and would be removed along with the barrier.

Degree to Which Treatment is Irreversible
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Quarry Pond Alternatives	1		3		2,4

Type and Quantity of Residuals Remaining After Treatment

Treatment is not performed in Alternatives QP-1, QP-2, and QP-4 for the site; therefore, no treatment residuals will remain. It is anticipated that some residuals will remain after treatment by the PRB in Alternative QP-3.

Type and Quantity of Residuals Remaining After Treatment
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Quarry Pond Alternatives	1, 2, 4				3

Statutory Preference for Treatment as a Principal Element

Treatment is not performed in Alternatives QP-1, QP-2, and QP-4 for the site. Therefore, statutory preference based on treatment is for Alternative QP-3 as it does treat the contaminated sediment.

Statutory Preference for Treatment as a Principle Element
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Quarry Pond Alternatives	1, 2,4				3

Short-Term Effectiveness

There are four components that compose evaluation of the short-term effectiveness, which are evaluated in the following subsections for the Quarry Pond alternatives.

Protection of Community During Remedial Action

There are no risks to the community associated with the implementation of Alternative QP-1 because no remedial action would be taken. Alternatives QP-2 and QP-4 may result in a potential for exposure to the community by air or direct contact as material is being removed and disposed of. For Alternative QP-3, exposure to the community from dust during the installation of the reactive barrier should be considerably less, as the cover will be placed under water. However, dust emissions can be controlled using standard engineering controls, and trucks can be covered and decontaminated before leaving the site.

Protection of Community During Remedial Action
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Quarry Pond Alternatives			2,4	3	1

Protection of Workers During Remedial Action

There are no additional risks associated with the implementation of Alternative QP-1 because no remedial action would be taken. Alternatives QP-2 and QP-4 for Quarry Pond would have a similar effect as Alternatives QP-2 and QP-3 at Wilshire Ponds. Alternative QP-3, which includes installation of a reactive barrier, has a potential exposure to workers as some bank soil excavation is required, but a greater degree of protection because installation of the barrier occurs in water, which prevents dust and direct contact with the sediment during construction.

Protection of Workers During Remedial Action
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Quarry Pond Alternatives	2,4		3		1

Environmental Impacts of Remedial Action

There are no risks to the environment associated with the implementation of Alternative QP-1 because no remedial action would be taken. Short-term environmental impacts include the disturbance and resuspension of sediment contamination into the water column during removal or submerged capping operations in Alternative QP-3. The resuspension of sediments during these activities may result in a short-term release of PCBs into the water column. Excavation, as well as some materials used for the reactive cover, can damage habitats during construction. These impacts, plus habitat destruction, are also present in Alternatives QP-2 and QP-4 for the dredging of sediment.

Environmental Impacts of Remedial Action
Relative Ranking from Greatest to Least

	Greatest				**Least**
	0	**1**	**2**	**3**	**4**
Quarry Pond Alternatives		2,4	3		1

Time until RAOs are Achieved

Alternative QP-1 would rely on natural degradation of PCBs to achieve RAOs. In comparison to the other alternatives, a significant period of time is required for Alternative QP-1 to achieve RAOs to reduce the potential for ingestion of PCBs through fish tissue and reduce the potential for dermal contact or ingestion of PCB-contaminated sediment and soil. Alternative QP-2 would generally achieve RAOs after implementation of the remedial action and restoration of the habitat, though a period of time is required to reduce the PCB concentrations in fish tissue. Alternative QP-3 will require additional time in comparison to Alternatives QP-2 and QP-4 as the reactive barrier needs time to react with and lower the PCB concentrations in sediment. Additionally, a period of time is required to reduce the PCB concentrations in fish tissue similar to the other alternatives.

Time until RAOs are Achieved
Relative Ranking from Longest to Shortest

	Longest				**Shortest**
	0	**1**	**2**	**3**	**4**
Quarry Pond Alternatives	1		3		2,4

Implementability

There are nine components that compose implementability, which are evaluated in the following subsections for the Quarry Pond alternatives.

Ability to Construct and Operate the Technology

There are no construction impediments associated with the implementation of Alternative QP-1 because no remedial action would be taken. Likewise, there are no impediments with Alternatives QP-2 or QP-4 for Quarry Pond as it involves common construction operations. This alternative will require a storage area for dewatering/staging, bulk dewatering amendments, and/or soil stockpiles. Consistent thickness of a reactive cover in Alternative QP-3 can be difficult to achieve in some site conditions, depending on the velocity and depth of the water during installation. As a result, an average thickness greater than the minimum required would be needed for a cover to ensure the minimum is placed for Alternative QP-3.

Ability to Construct and Operate the Technology
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Quarry Pond Alternatives			3		1, 2,4

Reliability of the Technology

Reliability of the alternatives is based in part on the proven capability of the technology to operate as intended. Every alternative under consideration generally has a proven record of performance. Alternative QP-1 was not considered because it does not include a technology. Excavation of dry sediment is generally more reliable when compared to excavation of wet sediment because it is easier to verify removal of the material through visual inspection. However, both methods are proven technologies. Long-term monitoring and inspection would be required for Alternative QP-3 to document reliability. Reactive covers may require replacement as material is exhausted and may require replacement if material is shifted out of place because of erosion or differential settlement.

Reliability of the Technology
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Quarry Pond Alternatives			3		2,4

Ease of Undertaking Additional Remedial Actions, If Necessary

Every alternative under consideration has a fairly easy undertaking of additional remedial actions, should they be necessary. However, additional remedial activities will need to take into account the PRB in Alternative QP-3.

Ease of Undertaking Additional Remedial Actions, If Necessary
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Quarry Pond Alternatives		3			1, 2,4

Ability to Monitor the Effectiveness of Remedy

There is no remedial action under the implementation of Alternative QP-1, so there is no effectiveness to monitor. The only impediments for monitoring effectiveness for Alternatives QP-2 and QP-4 will be the depth of water within the pond post completion. For Alternative QP-3, not only will the depth of water need to be considered, but it may be difficult to measure consistent thicknesses of the PRB, especially in deeper water.

Ability to Monitor the Effectiveness of Remedy
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Quarry Pond Alternatives	1		3	2,4	

Ability to Obtain Approvals from Other Agencies

There is no remedial action under the implementation of Alternative QP-1, so no approval is needed from agencies. Alternatives QP-2 and QP-4 use known technologies with proven effectiveness so approvals would be obtained fairly easily. Because QP-3 is less favored by WDNR due to concerns with long-term O&M costs associated with the PRB, likely resulting in the State's opposition to this option, ability to obtain approvals from other agencies was ranked as a 0. Therefore, QP-3 was ranked with a 0.

Ability to Obtain Approvals from Other Agencies
Relative Ranking from Hardest to Easiest

	Hardest 0	1	2	3	Easiest 4
Quarry Pond Alternatives	3			2,4	1

Coordination with Other Agencies

There is no remedial action under the implementation of Alternative QP-1, so no coordination with other agencies is needed. There are no impediments for coordination with other agencies for Alternatives QP-2 and QP-4, although WDNR may favor QP-4 because of the more conservative PRG. Because QP-3 is less favored by the WDNR due to concerns with long-term O&M costs associated with the PRB, likely resulting in the State's opposition to this option, coordination with other agencies for QP-3 was ranked as a 0.

Coordination with Other Agencies
Relative Ranking from Hardest to Easiest

	Hardest 0	1	2	3	Easiest 4
Quarry Pond Alternatives	3			2	1,4

Availability of Offsite Treatment, Storage, and Disposal Services and Capacity

There is no remedial action under the implementation of Alternative QP-1, so no offsite facilities are required. There are no impediments for offsite treatment, storage, and disposal services and capacity for Alternatives QP-2, QP-3, and QP-4 because it is anticipated that local disposal facilities will have enough capacity for soil volumes being removed.

Available of Offsite Treatment, Storage, and Disposal Services and Capacity
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Quarry Pond Alternatives	1			2,4	3

Availability of Necessary Equipment and Specialists

There are no impediments associated with the implementation of Alternative QP-1 because no remedial action would be taken. Standard construction equipment can be used for Alternatives QP-2, QP-3, and QP-4 and materials required are readily available, although selection of equipment for dredging and cover installation may require special consideration of existing conditions. Dewatered sediment may be requested for daily cover at the landfill, which may limit the amount of material the landfill can accept per day. This limitation can be resolved with prior planning, coordinating, and arranging for multiple disposal locations.

Availability of Necessary Equipment and Specialists
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Quarry Pond Alternatives			3		1, 2,4

Availability of Prospective Technologies

Availability of prospective technologies refers in part to new technologies that have yet to reach mainstream use in the construction field. Every alternative under consideration generally has no impediments.

Availability of Prospective Technologies
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Quarry Pond Alternatives					1, 2, 3,4

Cost

Appendix C presents an overview of the cost analysis and the detailed breakdowns for each of the alternatives. The alternative with the lowest total estimated cost is Alternative QP-1, No Action; however, this alternative does not satisfy the requirements set forth by the RAOs. The alternatives with the lowest capital costs are QP-2 (mechanically dredging sediment to PRGs) and QP-3 (constructing the PRB). The cost for QP-3 is primarily composed of the cost for purchase and installation of the cover materials, although it does include costs for long-term maintenance.

- QP-2—$6,184,000 (present-worth costs)
- QP-3—$6,194,000 ($4,400,000 capital and $1,795,000 O&M costs)
- QP-4—$7,462,000 (present-worth costs)

State Acceptance

The state acceptance criterion will be evaluated for the Quarry Pond alternatives after receipt of comments on the FS and proposed plan from the state agency. The State will not accept QP-3.

Community Acceptance

The community acceptance criterion will be evaluated for the Quarry Pond alternatives after the public comment period on the FS and proposed plan.

5.8 Groundwater Alternatives

5.8.1 Detailed Analysis

The following alternatives for groundwater were developed and described in Section 4:

- Alternative GW-1—No Action
- Alternative GW-2—Groundwater Monitoring and Institutional Controls

These alternatives were evaluated in detail using the evaluation criteria described above. Table 5-6 summarizes detailed evaluations for these alternatives.

5.8.2 Comparative Analysis

This section presents the comparative analysis of the alternatives and discussion of the criteria evaluated.

Overall Protection of Human Health and the Environment

The pertinent RAOs include the following:

- Minimize the potential for dermal contact, ingestion, and inhalation exposures to COCs in tapwater by residents and industrial workers.
- Minimize the potential for vapor intrusion of COCs by residents and industrial workers.
- Prevent future residential exposure to groundwater that exceeds federal MCLs or WAC NR 140 ES.
- Restore groundwater exceeding federal MCLs and WAC NR 140 ES in a reasonable timeframe given the site-specific circumstances.

Alternative GW-1 is not protective because it does not minimize contact or exposure to contamination in groundwater. Alternative GW-1 will also allow continued potential for dermal contact, ingestion, or inhalation of contaminated tap water. Alternative GW-2 is more protective as institutional controls will restrict water use, but it still does not remove the source of the contamination.

Overall Protection of Human Health and the Environment
Relative Ranking from Least to Greatest

	Least 0	**1**	**2**	**3**	**Greatest** 4
Groundwater Alternatives	1	2			

Compliance with ARARs

The most important ARARs to be met relate to groundwater quality criteria. Alternative GW-2 is expected to comply with ARARs by implementing institutional controls for groundwater use.

Compliance with ARARs

	Does Not Meet Criteria	**Meets Criteria**
Groundwater Alternatives	1	2

Long-Term Effectiveness and Permanence

There are two components that compose evaluation of the long-term effectiveness and permanence, which are evaluated in the following subsections for the groundwater alternatives.

Magnitude of Residual Risks

The magnitude of residual risk is based on a long-term evaluation of each alternative and the degree of risk remaining in the future after the remedial action is completed. For Alternatives GW-1 and GW-2, the magnitude of residual risk would remain unchanged from the existing conditions. The remedial actions completed as part of these alternatives would not change the concentration of PCB contamination in the groundwater, except through natural degradation of PCBs that would occur gradually over an extended period of time.

Magnitude of Residual Risks
Relative Ranking from Greatest to Least

	Greatest 0	1	2	3	Least 4
Groundwater Alternatives	1, 2				

Adequacy and Reliability of Controls

Long-term effectiveness of the remedial action also depends on the adequacy and reliability of controls to protect human health and the environment. Alternatives GW-1 and GW-2 require advisories and warnings regarding groundwater use and dermal contact. These controls are based on public adherence to the warnings for measuring adequacy and reliability.

Adequacy and Reliability of Controls
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Groundwater Alternatives	1, 2				

Reduction of Toxicity, Mobility, and Volume

There are six components that compose evaluation of the reduction of toxicity, mobility, and volume. These components are evaluated in the following subsections for the groundwater alternatives.

Treatment Process Used and Materials Treated

There are no treatment processes associated with the implementation of Alternatives GW-1 and GW-2 other than the natural degradation of PCBs.

Treatment Process Used and Materials Treated
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Groundwater Alternatives	1, 2				

Amount of Hazardous Materials Destroyed or Treated

No hazardous materials are destroyed or treated with the implementation of any alternative for groundwater, except by natural degradation of PCBs.

Amount of Hazardous Materials Destroyed or Treated
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Groundwater Alternatives	1, 2				

Degree of Expected Reductions in Toxicity, Mobility, and Volume

There are no reductions in toxicity, mobility, or volume through treatment for the two alternatives, other than by natural degradation.

Degree of Expected Reductions in Toxicity, Mobility, and Volume
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Groundwater Alternatives	1, 2				

Degree to Which Treatment is Irreversible

No remedial action would be taken in either alternative. Alternative GW-2 is slightly more irreversible as monitoring can be stopped and institutional controls can be removed.

Degree to Which Treatment is Irreversible
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Groundwater Alternatives	1	2			

Type and Quantity of Residuals Remaining After Treatment

Treatment is not performed in either of the alternatives for the site; therefore, no treatment residuals will remain, other than those present after natural degradation of PCBs.

Type and Quantity of Residuals Remaining After Treatment
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Groundwater Alternatives	1, 2				

Statutory Preference for Treatment as a Principal Element

Treatment is not performed in any of the alternatives for the site; therefore, there is no statutory preference based on treatment.

Statutory Preference for Treatment as a Principle Element
Relative Ranking from Lowest to Highest

	Lowest **0**	**1**	**2**	**3**	**Highest** **4**
Groundwater Alternatives	1, 2				

Short-Term Effectiveness

There are four components that compose evaluation of the short-term effectiveness, which are evaluated in the following subsections for the groundwater alternatives.

Protection of Community During Remedial Action

There are no risks to the community associated with the implementation of Alternative GW-1 because no remedial action would be taken. Likewise, there is no risk to the community from Alternative GW-2 because only existing wells will be monitored.

Protection of Community During Remedial Action
Relative Ranking from Least to Greatest

	Least **0**	**1**	**2**	**3**	**Greatest** **4**
Groundwater Alternatives					1, 2

Protection of Workers During Remedial Action

There are no additional risks associated with the implementation of Alternative GW-1 because no remedial action would be taken. Alternative GW-2 would have limited potential exposure to workers during the long-term monitoring of existing wells due to the potential for dermal contact with contaminated water.

Protection of Workers During Remedial Action
Relative Ranking from Least to Greatest

	Least **0**	**1**	**2**	**3**	**Greatest** **4**
Groundwater Alternatives				2	1

Environmental Impacts of Remedial Action

There are no risks to the environment associated with the implementation of Alternative GW-1 because no remedial action would be taken. Likewise, there are no risks associated with Alternative GW-2 as the monitoring will occur only in existing wells.

Environmental Impacts of Remedial Action
Relative Ranking from Greatest to Least

	Greatest 0	1	2	3	Least 4
Groundwater Alternatives				2	1

Time until RAOs are Achieved

Alternatives GW-1 and GW-2 would rely on natural degradation of PCBs to achieve RAOs. A significant period of time is required for Alternative GW-1 and GW-2 to achieve RAOs to reduce the potential for dermal contact or ingestion of PCB-contaminated water.

Time until RAOs are Achieved
Relative Ranking from Longest to Shortest

	Longest 0	1	2	3	Shortest 4
Groundwater Alternatives	1, 2				

Implementability

There are nine components that compose implementability, which are evaluated in the following subsections for the groundwater alternatives.

Ability to Construct and Operate the Technology

There are no construction impediments associated with the implementation of Alternative GW-1 because no remedial action would be taken. Likewise, there are no impediments with Alternative GW-2 as it involves common construction operations.

Ability to Construct and Operate the Technology
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Groundwater Alternatives					1, 2

Reliability of the Technology

Reliability of the alternatives is based in part on the proven capability of the technology to operate as intended. Alternative GW-1 generally has a proven record of performance. Long-term monitoring would be required for Alternative GW-2 to document the state of the groundwater. Alternative GW-1 was not considered because it does not include a technology.

Reliability of the Technology
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Groundwater Alternatives					2

Ease of Undertaking Additional Remedial Actions, If Necessary

Every alternative under consideration has a fairly easy undertaking of additional remedial actions, should they be necessary.

Ease of Undertaking Additional Remedial Actions, If Necessary
Relative Ranking from Least to Greatest

	Least **0**	**1**	**2**	**3**	**Greatest** **4**
Groundwater Alternatives					1, 2

Ability to Monitor the Effectiveness of Remedy

There is no remedial action under the implementation of Alternative GW-1, so there is no effectiveness to monitor. There are no impediments for monitoring effectiveness for Alternative GW-2.

Ability to Monitor the Effectiveness of Remedy
Relative Ranking from Least to Greatest

	Least **0**	**1**	**2**	**3**	**Greatest** **4**
Groundwater Alternatives	1				2

Ability to Obtain Approvals from Other Agencies

There is no remedial action under the implementation of Alternative GW-1, so no approval is needed from agencies. Alternative GW-2 uses known technologies with proven effectiveness so approvals would be obtained fairly easily.

Ability to Obtain Approvals from Other Agencies
Relative Ranking from Hardest to Easiest

	Hardest **0**	**1**	**2**	**3**	**Easiest** **4**
Groundwater Alternatives					1, 2

Coordination with Other Agencies

There is no remedial action under the implementation of Alternative GW-1, so no coordination with other agencies is needed. There are no impediments for coordination with other agencies for Alternative GW-2.

Coordination with Other Agencies
Relative Ranking from Hardest to Easiest

	Hardest **0**	**1**	**2**	**3**	**Easiest** **4**
Groundwater Alternatives					1, 2

Availability of Offsite Treatment, Storage, and Disposal Services and Capacity

There is no remedial action under the implementation of Alternative GW-1, so no offsite facilities are required. There are no impediments for offsite treatment, storage, and disposal services and capacity for Alternative GW-2 because it is anticipated that local disposal facilities will have enough capacity for water volumes being removed.

Available of Offsite Treatment, Storage, and Disposal Services and Capacity
Relative Ranking from Least to Greatest

	Least **0**	**1**	**2**	**3**	**Greatest** **4**
Groundwater Alternatives	1				2

Availability of Necessary Equipment and Specialists

There are no impediments associated with the implementation of Alternative GW-1 because no remedial action would be taken. Likewise, there are no impediments for Alternative GW-2 as no new construction will take place.

Availability of Necessary Equipment and Specialists
Relative Ranking from Least to Greatest

	Least **0**	**1**	**2**	**3**	**Greatest** **4**
Groundwater Alternatives					1, 2

Availability of Prospective Technologies

Availability of prospective technologies refers in part to new technologies that have yet to reach mainstream use in the construction field. Every alternative under consideration generally has no impediments.

Availability of Prospective Technologies
Relative Ranking from Least to Greatest

	Least **0**	**1**	**2**	**3**	**Greatest** **4**
Groundwater Alternatives					1, 2

Cost

Appendix C contains an overview of the cost analysis and the detailed breakdowns for each of the alternatives. The alternative with the lowest total estimated cost is Alternative GW-1, No Action; however, this alternative does not satisfy the requirements set forth by the RAOs. The alternative with the lowest capital cost is monitoring and institutional controls (Alternative GW-2). The cost for this alternative is primarily composed of the cost for long-term sampling of the groundwater.

- GW-2—$2,424,000 ($526,000 capital, $1,742,000 O&M, and $156,000 periodic costs)

State Acceptance

The state acceptance criterion will be evaluated for the groundwater alternatives after receipt of comments on the FS and proposed plan from the state agency.

Community Acceptance

The community acceptance criterion will be evaluated for the groundwater alternatives after the public comment period on the FS and proposed plan.

5.9 Amcast North Storm Sewer Alternatives

5.9.1 Detailed Analysis

The following alternatives for the Amcast North storm sewers were developed and described in Section 4:

- Alternative SSN-1—No Action
- Alternative SSN-2—Abandon Amcast North Building Storm Sewers, Pressure Wash Non-Building Storm Sewers, Sewer Backfill Excavation and Offsite Disposal, and Site Restoration
- Alternative SSN-3—Abandon Amcast North Building Storm Sewers, Remove Non-Building Storm Sewer Piping, Excavation of Pipes and Backfill, Offsite Disposal, Backfill, and Site Restoration

These alternatives were evaluated in detail using the evaluation criteria described above. Table 5-7 summarizes the detailed evaluations for these alternatives.

5.9.2 Comparative Analysis

This section presents the comparative analysis of the alternatives and discussion of the criteria evaluated.

Overall Protection of Human Health and the Environment

The pertinent RAOs include the following:

- Minimize the potential for dermal contact, ingestion, and inhalation exposures to COCs in surface soil by trespassers and total soil for residents, industrial workers, construction workers, and recreational users.
- Minimize the potential for direct contact, direct ingestion, and/or food web exposures to COC concentrations above acceptable levels in the following areas by lower-trophic-level terrestrial organisms (soil invertebrates and plants) and upper-trophic-level organisms (birds and mammals).
- Minimize the potential for direct contact, direct ingestion, and/or food web exposures to PCB concentrations above acceptable levels for bank and basin sediment by lower-trophic-level aquatic organisms (invertebrates, fish, and amphibians) and upper-trophic-level organisms (birds and mammals).
- Minimize the potential for bioaccumulation of PCBs into fish/frog tissues above acceptable levels and fish and frog tissue from exposure to bank and basin sediments.

Alternative SSN-1 is not protective because it does not minimize contact or exposure to PCB contamination in sediment. Alternative SSN-1 would allow contaminated sediment to remain in storm sewers and wash into Wilshire Ponds and Quarry Pond, which would allow continued exposure by fish/frogs to the PCB-contaminated sediment. Alternative SSN-1 will also allow continued potential for dermal contact or ingestion of PCB-contaminated sediment. Alternative SSN-2 is considered protective of human health and the environment in that it will remove contaminated sediment from storm sewers.

Alternative SSN-3 removes and disposes of the contaminated sediment and the pipes; therefore, it is the most protective alternative.

Overall Protection of Human Health and the Environment
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Amcast North Storm Sewer Alternatives	1		2		3

Compliance with ARARs

The most important ARARs to be met relate to TSCA requirements, protection of streams during construction, disposal of treated water from the dewatering process, and air pollution emission requirements. All alternatives, other than Alternative SSN-1, are expected to comply with ARARs for each subsite.

Compliance with ARARs

	Does Not Meet Criteria	Meets Criteria
Amcast North Storm Sewer Alternatives	1	2, 3

Long-Term Effectiveness and Permanence

There are two components that compose evaluation of the long-term effectiveness and permanence, which are evaluated in the following subsections for the Amcast North storm sewer alternatives.

Magnitude of Residual Risks

The magnitude of residual risk is based on a long-term evaluation of each alternative and the degree of risk remaining in the future after the remedial action is completed. For Alternative SSN-1, the magnitude of residual risk would remain unchanged from the existing conditions. The least amount of residual risk would occur as a result of excavation, removal, and offsite disposal of storm sewer pipes as opposed to abandoning or pressure washing these pipes and leaving in place. Contaminated sediment within pipes would be removed from the site, resulting in a very low residual risk.

Magnitude of Residual Risks
Relative Ranking from Greatest to Least

	Greatest 0	1	2	3	Least 4
Amcast North Storm Sewer Alternatives	1		2		3

Adequacy and Reliability of Controls

Long-term effectiveness of the remedial action also depends on the adequacy and reliability of controls to protect human health and the environment. Alternative SSN-1 requires advisories and warnings regarding dermal contact and ingestion of PCB-contaminated sediment. These controls are based on public adherence to the warnings for measuring adequacy and reliability. Alternative SSN-2 would require controls only during the short period of time when storm sewers are being pressure-washed. Advisories and warnings regarding dermal contact and ingestion of PCB-contaminated sediment should be posted for material that may be introduced due to pressure washing. Alternative SSN-3 would not require controls.

Adequacy and Reliability of Controls
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Amcast North Storm Sewer Alternatives	1			2	3

Reduction of Toxicity, Mobility, and Volume

There are six components that compose evaluation of the reduction of toxicity, mobility, and volume. These components are evaluated in the following subsections for the Amcast North storm sewer alternatives.

Treatment Process Used and Materials Treated

There are no treatment processes associated with the implementation of Alternative SSN-1 because no remedial action would be taken. Additionally, there are no treatment processes with Alternatives SSN-2 and SSN-3, as no material is actually being treated. In Alternative SSN-2, contaminated material is pressure-washed from the storm sewers and collected for disposal. In Alternative SSN-3, all contaminated material would be removed when the pipes are removed.

Treatment Process Used and Materials Treated
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Amcast North Storm Sewer Alternatives	1, 2, 3				

Amount of Hazardous Materials Destroyed or Treated

No hazardous materials are destroyed or treated with the implementation of any alternative for Amcast North storm sewers. For Alternative SSN-1, no remedial action would be taken. For Alternative SSN-2, hazardous material is pressure-washed, collected, and disposed of offsite, but not destroyed or treated. Similarly, for Alternative SSN-3, contaminated material is removed from the site, but not destroyed or treated.

Amount of Hazardous Materials Destroyed or Treated
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Amcast North Storm Sewer Alternatives	1, 2, 3				

Degree of Expected Reductions in Toxicity, Mobility, and Volume

There are no reductions in toxicity, mobility, or volume through treatment for each of the three alternatives. However, Alternatives SSN-2 and SSN-3 will both reduce mobility of contaminated material by removing it from the site and containing at a disposal facility.

Degree of Expected Reductions in Toxicity, Mobility, and Volume
Relative Ranking from Lowest to Highest

	Lowest **0**	**1**	**2**	**3**	**Highest** **4**
Amcast North Storm Sewer Alternatives	1	2, 3			

Degree to Which Treatment is Irreversible

No remedial action would be taken in Alternative SSN-1. Alternative SSN-2 is irreversible as contaminated material is being pressure-washed, collected, and removed from the site, and would not be allowed to be brought back as fill. Likewise, for Alternative SSN-3, contaminated material will be removed from the site and will not be allowed back onsite.

Degree to Which Treatment is Irreversible
Relative Ranking from Lowest to Highest

	Lowest **0**	**1**	**2**	**3**	**Highest** **4**
Amcast North Storm Sewer Alternatives	1				2, 3

Type and Quantity of Residuals Remaining After Treatment

Treatment is not performed in any of the alternatives for the site; therefore, no treatment residuals will remain.

Type and Quantity of Residuals Remaining After Treatment
Relative Ranking from Lowest to Highest

	Lowest **0**	**1**	**2**	**3**	**Highest** **4**
Amcast North Storm Sewer Alternatives	1, 2, 3				

Statutory Preference for Treatment as a Principal Element

Treatment is not performed in any of the alternatives for the site; therefore, there is no statutory preference based on treatment.

Statutory Preference for Treatment as a Principle Element
Relative Ranking from Lowest to Highest

	Lowest **0**	**1**	**2**	**3**	**Highest** **4**
Amcast North Storm Sewer Alternatives	1, 2, 3				

Short-Term Effectiveness

There are four components that compose evaluation of the short-term effectiveness, which are evaluated in the following subsections for the Amcast North storm sewer alternatives.

Protection of Community During Remedial Action

There are no risks to the community associated with the implementation of Alternative SSN-1 because no remedial action would be taken. Alternative SSN-2 may result in a greater potential for exposure to the community by air or direct contact during excavation of pipes. Additionally, pressure washing may increase the potential for contact to the community. Alternative SSN-3 may result in a potential for exposure to the community by air or direct contact as pipes are being removed and disposed of. However, dust emissions can be controlled using standard engineering controls, and trucks can be covered and decontaminated before leaving the site.

Protection of Community During Remedial Action
Relative Ranking from Least to Greatest

	Least **0**	**1**	**2**	**3**	**Greatest** **4**
Amcast North Storm Sewer Alternatives			2	3	1

Protection of Workers During Remedial Action

There are no additional risks associated with the implementation of Alternative SSN-1 because no remedial action would be taken. Alternative SSN-2 would have a higher potential exposure to workers than Alternative SSN-3 because pressure washing pipes carry more risk to worker than pipe removal and disposal with construction equipment.

Protection of Workers During Remedial Action
Relative Ranking from Least to Greatest

	Least **0**	**1**	**2**	**3**	**Greatest** **4**
Amcast North Storm Sewer Alternatives	2	3			1

Environmental Impacts of Remedial Action

There are no risks to the environment associated with the implementation of Alternative SSN-1 because no remedial action would be taken. Since storm sewers onsite drain directly to Quarry Pond and Wilshire Ponds, and pressure washing these storm sewers may wash contaminated sediment into these locations, the potential for environmental impacts is present in Alternative SSN-2. Short-term environmental impacts are present in the remaining alternatives because damage will occur during excavation.

Environmental Impacts of Remedial Action
Relative Ranking from Greatest to Least

	Greatest **0**	**1**	**2**	**3**	**Least** **4**
Amcast North Storm Sewer Alternatives		2	3		1

Time Until RAOs are Achieved

Alternative SSN-1 would rely on natural degradation of PCBs to achieve RAOs. In comparison to the other alternatives, a significant period of time is required for Alternative SSN-1 to achieve RAOs. Alternatives SSN-2 and SSN-3 would generally achieve RAOs after implementation of the remedial action and site restoration.

Time until RAOs are Achieved
Relative Ranking from Longest to Shortest

	Longest 0	1	2	3	Shortest 4
Amcast North Storm Sewer Alternatives	1				2, 3

Implementability

There are nine components that compose implementability, which are evaluated in the following subsections for the Amcast North storm sewer alternatives.

Ability to Construct and Operate the Technology

There are no construction impediments associated with the implementation of Alternative SSN-1 because no remedial action would be taken. Likewise, there are no impediments with Alternatives SSN-2 or SSN-3 because they involve common construction operations.

Ability to Construct and Operate the Technology
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Amcast North Storm Sewer Alternatives					1, 2, 3

Reliability of the Technology

Reliability of the alternatives is based in part on the proven capability of the technology to operate as intended. Every alternative under consideration generally has a proven record of performance. Alternative SSN-1 was not considered because it does not include a technology. Pressure washing is generally reliable but will require monitoring and inspections to verify that all contaminated sediment has been removed.

Reliability of the Technology
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Amcast North Storm Sewer Alternatives				2	3

Ease of Undertaking Additional Remedial Actions, If Necessary

Every alternative under consideration has a fairly easy undertaking of additional remedial actions, should they be necessary.

Ease of Undertaking Additional Remedial Actions, If Necessary
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Amcast North Storm Sewer Alternatives					1, 2, 3

Ability to Monitor the Effectiveness of Remedy

There is no remedial action under the implementation of Alternative SSN-1, so there is no effectiveness to monitor. There are no impediments for monitoring effectiveness for Alternative SSN-3. The only impediment for monitoring Alternative SSN-2 will be the effectiveness of in-pipe video equipment and the quality of the video feed they provide.

Ability to Monitor the Effectiveness of Remedy
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Amcast North Storm Sewer Alternatives	1		2		3

Ability to Obtain Approvals from Other Agencies

There is no remedial action under the implementation of Alternative SSN-1, so no approval is needed from agencies. Alternatives SSN-2 and SSN-3 use known technologies with proven effectiveness, so approvals would be obtained fairly easily.

Ability to Obtain Approvals from Other Agencies
Relative Ranking from Hardest to Easiest

	Hardest 0	1	2	3	Easiest 4
Amcast North Storm Sewer Alternatives					1, 2, 3

Coordination with Other Agencies

There is no remedial action under the implementation of Alternative SSN-1, so no coordination with other agencies is needed. There are no impediments for coordination with other agencies for Alternatives SSN-2 and SSN-3.

Coordination with Other Agencies
Relative Ranking from Hardest to Easiest

	Hardest 0	1	2	3	Easiest 4
Amcast North Storm Sewer Alternatives					1, 2, 3

Availability of Offsite Treatment, Storage, and Disposal Services and Capacity

There is no remedial action under the implementation of Alternative SSN-1, so no offsite facilities are required. There are no impediments for offsite treatment, storage, and disposal services, and capacity for Alternatives SSN-2 and SSN-3, because it is anticipated that local disposal facilities will have enough capacity for soil volumes being removed.

Available of Offsite Treatment, Storage, and Disposal Services and Capacity
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Amcast North Storm Sewer Alternatives	1			3	2

Availability of Necessary Equipment and Specialists

There are no impediments associated with the implementation of Alternative SSN-1 because no remedial action would be taken. Standard construction equipment can be used for Alternatives SSN-2 and SSN-3 and materials required are readily available. Excavated material may be requested for daily cover at the landfill, which may limit the amount of material the landfill can accept per day. This limitation can be resolved with prior planning, coordinating, and arranging for multiple disposal locations.

Availability of Necessary Equipment and Specialists
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Amcast North Storm Sewer Alternatives					1, 2, 3

Availability of Prospective Technologies

Availability of prospective technologies refers in part to new technologies that have yet to reach mainstream use in the construction field. Every alternative under consideration generally has no impediments.

Availability of Prospective Technologies
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Amcast North Storm Sewer Alternatives					1, 2, 3

Cost

Appendix C contains an overview of the cost analysis and the detailed breakdowns for each of the alternatives. The alternative with the lowest total estimated cost is Alternative SSN-1, No Action; however, this alternative does not satisfy the requirements set forth by the RAOs. The alternative with the lowest capital cost is pressure washing (Alternative SSN-2). The cost for this alternative is primarily composed of the cost for pressure washing and disposing of the sediment collected.

- SSN-2—$2,201,000 (present-worth costs)
- SSN-3—$2,287,000 (present-worth costs)

State Acceptance

The state acceptance criterion will be evaluated for the Amcast North storm sewers alternatives after receipt of comments on the FS and proposed plan from the state agency.

Community Acceptance

The community acceptance criterion will be evaluated for the Amcast North storm sewers alternatives after the public comment period on the FS and proposed plan.

5.10 Amcast South Storm Sewer Alternatives

5.10.1 Detailed Analysis

The following alternatives for Amcast South storm sewers were developed and described in Section 4:

- Alternative SSS-1—No Action
- Alternative SSS-2—Pressure Wash Storm Sewers, Excavation, Offsite Disposal, Backfill, and Site Restoration
- Alternative SSS-3—Abandon Amcast South Building Storm Sewers, Excavation, Offsite Disposal, Backfill, and Site Restoration
- Alternative SSS-4—Remove Storm Sewer Piping, Excavation, Offsite Disposal, Backfill, and Site Restoration

These alternatives were evaluated in detail using the evaluation criteria described above. Table 5-8 summarizes the detailed evaluations for these alternatives.

5.10.2 Comparative Analysis

This section presents the comparative analysis of the alternatives and discussion of the criteria evaluated.

Overall Protection of Human Health and the Environment

The pertinent RAOs include the following:

- Minimize the potential for dermal contact, ingestion, and inhalation exposures to COCs in surface soil by residents, industrial workers, and construction workers.
- Minimize the potential for dermal contact and ingestion exposures to COCs by recreational users.
- Minimize the potential for bioaccumulation into edible-sized fish, and ingestion exposures by recreational anglers.

- Minimize the potential for direct contact, direct ingestion, and/or food web exposures to COC concentrations above acceptable levels in surface soil by lower-trophic-level terrestrial organisms (soil invertebrates) and upper-trophic-level organisms (primarily small mammals).
- Minimize the potential for direct contact, direct ingestion, and/or food web exposures to PCB concentrations above acceptable levels in basin sediment by lower-trophic-level aquatic organisms (primarily invertebrates and fish) and upper-trophic-level organisms (birds and mammals).
- Minimize the potential for bioaccumulations of PCBs into fish/frog tissues above acceptable levels in basin sediments.

Alternative SSS-1 is not protective because it does not minimize contact or exposure to PCB contamination in sediment. Alternative SSS-1 would allow contaminated sediment to remain in storm sewers and wash into Quarry Pond, which would allow continued exposure by fish/frogs to the PCB-contaminated sediment. Alternative SSS-1 will also allow continued potential for dermal contact or ingestion of PCB-contaminated sediment. Alternative SSS-2 is considered protective of human health and the environment in that it will remove contaminated sediment from storm sewers. Alternative SSS-3 abandons the storm sewers preventing exposure or transport of contaminated sediment, so it more protective than Alternative SSS-2. Alternative SSS-4 removes and disposes of the contaminated sediment and the pipes; therefore, it is the most protective alternative.

Overall Protection of Human Health and the Environment
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Amcast South Storm Sewer Alternatives	1		2	3	4

Compliance with ARARs

The most important ARARs to be met relate to TSCA requirements, protection of streams during construction, disposal of treated water from the dewatering process, and air pollution emission requirements. All alternatives, other than Alternative SSS-1, are expected to comply with ARARs for each subsite.

Compliance with ARARs

	Does Not Meet Criteria	Meets Criteria
Amcast South Storm Sewer Alternatives	1	2, 3, 4

Long-Term Effectiveness and Permanence

There are two components that compose evaluation of the long-term effectiveness and permanence, which are evaluated in the following subsections for the Amcast South storm sewer alternatives.

Magnitude of Residual Risks

The magnitude of residual risk is based on a long-term evaluation of each alternative and the degree of risk remaining in the future after the remedial action is completed. For Alternative SSS-1, the magnitude of residual risk would remain unchanged from the existing conditions. The least amount of residual risk would occur as a result of excavation, removal, and offsite disposal of storm sewer pipes as opposed to abandoning or pressure washing these pipes and leaving in place. Contaminated sediment within pipes would be removed from the site, resulting in a very low residual risk.

Magnitude of Residual Risks
Relative Ranking from Greatest to Least

	Greatest 0	1	2	3	Least 4
Amcast South Storm Sewer Alternatives	1		2	3	4

Adequacy and Reliability of Controls

Long-term effectiveness of the remedial action also depends on the adequacy and reliability of controls to protect human health and the environment. Alternative SSS-1 requires advisories and warnings regarding dermal contact and ingestion of PCB-contaminated sediment. These controls are based on public adherence to the warnings for measuring adequacy and reliability. Alternative SSS-2 would require controls only during the short period of time when storm sewers are being pressure-washed. Advisories and warnings regarding dermal contact and ingestion of PCB-contaminated sediment should be posted for material that may be introduced due to pressure washing. Alternatives SSS-3 and SSS-4 would not require controls.

Adequacy and Reliability of Controls
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Amcast South Storm Sewer Alternatives	1			2	3, 4

Reduction of Toxicity, Mobility, and Volume

There are six components that compose evaluation of the reduction of toxicity, mobility, and volume. These components are evaluated below for the Amcast South storm sewer alternatives.

Treatment Process Used and Materials Treated

There are no treatment processes associated with the implementation of Alternative SSS-1 because no remedial action would be taken. Additionally, there are no treatment processes with Alternatives SSS-2, SSS-3, and SSS-4 because no material is actually being treated.

Treatment Process Used and Materials Treated
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Amcast South Storm Sewer Alternatives	1, 2, 3, 4				

Amount of Hazardous Materials Destroyed or Treated

No hazardous materials are destroyed or treated with the implementation of any alternative for Amcast South Storm Sewers. For Alternative SSS-1, no remedial action would be taken. For Alternative SSS-2, hazardous material is pressure-washed, collected, and disposed of offsite, but not destroyed or treated. Similarly, for Alternatives SSS-3 and SSS-4, contaminated material is removed from the site, but not destroyed or treated.

Amount of Hazardous Materials Destroyed or Treated
Relative Ranking from Lowest to Highest

	Lowest **0**	**1**	**2**	**3**	**Highest** **4**
Amcast South Storm Sewer Alternatives	1, 2, 3, 4				

Degree of Expected Reductions in Toxicity, Mobility, and Volume

There are no reductions in toxicity, mobility, or volume through treatment for each of the four alternatives. However, Alternatives SSS-2, SSS-3, and SSS-4 will all reduce mobility of contaminated material by removing it from the site and containing at a disposal facility.

Degree of Expected Reductions in Toxicity, Mobility, and Volume
Relative Ranking from Lowest to Highest

	Lowest **0**	**1**	**2**	**3**	**Highest** **4**
Amcast South Storm Sewer Alternatives	1	2, 3			

Degree to Which Treatment is Irreversible

No remedial action would be taken in Alternative SSS-1. Alternative SSS-2 is irreversible because contaminated material is being pressure-washed, collected, and removed from the site and would not be allowed to be brought back as fill. Likewise, for Alternatives SSS-3 and SSS-4, contaminated material will be removed from the site and will not be allowed back onsite.

Degree to Which Treatment is Irreversible
Relative Ranking from Lowest to Highest

	Lowest **0**	**1**	**2**	**3**	**Highest** **4**
Amcast South Storm Sewer Alternatives	1				2, 3, 4

Type and Quantity of Residuals Remaining After Treatment

Treatment is not performed in any of the alternatives for the site; therefore, no treatment residuals will remain.

Type and Quantity of Residuals Remaining After Treatment
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Amcast South Storm Sewer Alternatives	1, 2, 3, 4				

Statutory Preference for Treatment as a Principal Element

Treatment is not performed in any of the alternatives for the site; therefore, there is no statutory preference based on treatment.

Statutory Preference for Treatment as a Principle Element
Relative Ranking from Lowest to Highest

	Lowest 0	1	2	3	Highest 4
Amcast South Storm Sewer Alternatives	1, 2, 3, 4				

Short-Term Effectiveness

There are four components that compose evaluation of the short-term effectiveness, which are evaluated in the following subsections for the Amcast South storm sewer alternatives.

Protection of Community During Remedial Action

There are no risks to the community associated with the implementation of Alternative SSS-1 because no remedial action would be taken. Alternative SSS-2 may result in a greater potential for exposure to the community by air or direct contact during excavation of pipes. Additionally, pressure washing may increase the potential for contact to the community. Alternative SSS-3 may result in a potential for exposure to the community by air or direct contact as pipes are being abandoned. Alternative SSS-4 may result in a potential for exposure to the community by air or direct contact as pipes are being removed and disposed of. However, dust emissions can be controlled using standard engineering controls, and trucks can be covered and decontaminated before leaving the site.

Protection of Community During Remedial Action
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Amcast North Storm Sewer Alternatives			4	2, 3	1

Protection of Workers During Remedial Action

There are no additional risks associated with the implementation of Alternative SSS-1 because no remedial action would be taken. Alternative SSS-2 would have a higher potential exposure to workers than Alternatives SSS-3 and SSS-4 because pressure washing pipes carries more risk to workers than pipe removal and disposal with construction equipment.

Protection of Workers During Remedial Action
Relative Ranking from Least to Greatest

	Least 0	1	2	3	Greatest 4
Amcast South Storm Sewer Alternatives	2	3, 4			1

Environmental Impacts of Remedial Action

There are no risks to the environment associated with the implementation of Alternative SSS-1 because no remedial action would be taken. Since storm sewers onsite drain directly to Quarry Pond and Wilshire Pond, and pressure washing these storm sewers may wash contaminated sediment into these locations, the potential for environmental impacts is present in Alternative SSS-2. Short-term environmental impacts are present in the remaining alternatives because damage will occur during excavation.

Environmental Impacts of Remedial Action
Relative Ranking from Greatest to Least

	Greatest 0	1	2	3	Least 4
Amcast South Storm Sewer Alternatives		2	3, 4		1

Time Until RAOs are Achieved

Alternative SSS-1 would rely on natural degradation of PCBs to achieve RAOs. In comparison to the other alternatives, a significant period of time is required for Alternative SSS-1 to achieve RAOs. Alternatives SSS-2, SSS-3, and SSS-4 would generally achieve RAOs after implementation of the remedial action and site restoration.

Time until RAOs are Achieved
Relative Ranking from Longest to Shortest

	Longest 0	1	2	3	Shortest 4
Amcast South Storm Sewer Alternatives	1				2, 3, 4

Implementability

There are nine components that compose implementability, which are evaluated in the following subsections for the Amcast South storm sewer alternatives.

Ability to Construct and Operate the Technology

There are no construction impediments associated with the implementation of Alternative SSS-1 because no remedial action would be taken. Likewise, there are no impediments with Alternatives SSS-2, SSS-3, or SSS-4 because they involve common construction operations.

Ability to Construct and Operate the Technology
Relative Ranking from Least to Greatest

	Least				**Greatest**
	0	**1**	**2**	**3**	**4**
Amcast South Storm Sewer Alternatives					1, 2, 3, 4

Reliability of the Technology

Reliability of the alternatives is based in part on the proven capability of the technology to operate as intended. Every alternative under consideration generally has a proven record of performance. Alternative SSS-1 was not considered because it does not include a technology. Pressure washing is generally reliable but will require monitoring and inspections to verify that all contaminated sediment has been removed.

Reliability of the Technology
Relative Ranking from Least to Greatest

	Least				**Greatest**
	0	**1**	**2**	**3**	**4**
Amcast South Storm Sewer Alternatives				2	3, 4

Ease of Undertaking Additional Remedial Actions, If Necessary

Every alternative under consideration has a fairly easy undertaking of additional remedial actions, should they be necessary.

Ease of Undertaking Additional Remedial Actions, If Necessary
Relative Ranking from Least to Greatest

	Least				**Greatest**
	0	**1**	**2**	**3**	**4**
Amcast South Storm Sewer Alternatives					1, 2, 3, 4

Ability to Monitor the Effectiveness of Remedy

There is no remedial action under the implementation of Alternative SSS-1, so there is no effectiveness to monitor. There are no impediments for monitoring effectiveness for Alternatives SSS-3 and SSS-4. The only impediment for monitoring Alternative SSS-2 will be the effectiveness of in-pipe video equipment and the quality of the video feed they provide.

Ability to Monitor the Effectiveness of Remedy
Relative Ranking from Least to Greatest

	Least				**Greatest**
	0	**1**	**2**	**3**	**4**
Amcast South Storm Sewer Alternatives	1		2		3, 4

Ability to Obtain Approvals from Other Agencies

There is no remedial action under the implementation of Alternative SSS-1, so no approval is needed from agencies. Alternatives SSS-2, SSS-3, and SSS-4 use known technologies with proven effectiveness, so approvals would be obtained fairly easily.

Ability to Obtain Approvals from Other Agencies
Relative Ranking from Hardest to Easiest

	Hardest				**Easiest**
	0	**1**	**2**	**3**	**4**
Amcast South Storm Sewer Alternatives					1, 2, 3, 4

Coordination with Other Agencies

There is no remedial action under the implementation of Alternative SSS-1, so no coordination with other agencies is needed. There are no impediments for coordination with other agencies for Alternatives SSN-2, SSN-3, and SSS-4.

Coordination with Other Agencies
Relative Ranking from Hardest to Easiest

	Hardest				**Easiest**
	0	**1**	**2**	**3**	**4**
Amcast South Storm Sewer Alternatives					1, 2, 3, 4

Availability of Offsite Treatment, Storage, and Disposal Services and Capacity

There is no remedial action under the implementation of Alternative SSS-1, so no offsite facilities are required. There are no impediments for offsite treatment, storage, and disposal services and capacity for Alternatives SSS-2, SSS-3, and SSS-4 because it is anticipated that local disposal facilities will have enough capacity for soil volumes being removed.

Available of Offsite Treatment, Storage, and Disposal Services and Capacity
Relative Ranking from Least to Greatest

	Least **0**	**1**	**2**	**3**	**Greatest** **4**
Amcast South Storm Sewer Alternatives	1			3	2

Availability of Necessary Equipment and Specialists

There are no impediments associated with the implementation of Alternative SSS-1 because no remedial action would be taken. Standard construction equipment can be used for Alternatives SSS-2, SSS-3, and SSS-4, and materials required are readily available. Excavated material may be requested for daily cover at the landfill, which may limit the amount of material the landfill can accept per day. This limitation can be resolved with prior planning, coordinating, and arranging for multiple disposal locations.

Availability of Necessary Equipment and Specialists
Relative Ranking from Least to Greatest

	Least **0**	**1**	**2**	**3**	**Greatest** **4**
Amcast South Storm Sewer Alternatives					1, 2, 3, 4

Availability of Prospective Technologies

Availability of prospective technologies refers in part to new technologies that have yet to reach mainstream use in the construction field. Every alternative under consideration generally has no impediments.

Availability of Prospective Technologies
Relative Ranking from Least to Greatest

	Least **0**	**1**	**2**	**3**	**Greatest** **4**
Amcast South Storm Sewer Alternatives					1, 2, 3, 4

Cost

Appendix C contains overview of the cost analysis and the detailed breakdowns for each of the alternatives. The alternative with the lowest total estimated cost is Alternative SSS-1, No Action; however, this alternative does not satisfy the requirements set forth by the RAOs. The alternative with the lowest capital cost is abandoning site sewers (Alternative SSS-3). The cost for this alternative is primarily composed of the cost for pressure washing the downgradient sewers.

- SSS-2—$1,791,000 (present-worth costs)
- SSS-3—$1,658,000 (present-worth costs)
- SSS-4—$2,813,000 (present-worth costs)

State Acceptance

The state acceptance criterion will be evaluated for the Amcast South storm sewer alternatives after receipt of comments on the FS and proposed plan from the state agency.

Community Acceptance

The community acceptance criterion will be evaluated for the Amcast South storm sewer alternatives after the public comment period on the FS and proposed plan.

References

CH2M HILL, Inc. (CH2M). 2009. *Amcast Industrial Site Work Plan*. October.

CH2M HILL, Inc. (CH2M). 2015. *Human Health Risk Assessment, Amcast Industrial Site, Cedarburg, Wisconsin*. May.

CH2M HILL, Inc. (CH2M). 2015. *Remedial Investigation Report, Amcast Industrial Site, Cedarburg, Wisconsin*. May.

ENSR. 2007. *Results of Phase II Investigation Conducted at the Amcast Industrial Corporation Facility, located in Cedarburg, Wisconsin*. June 6.

Foth & Van Dyke. 2004. *Technical Memorandum – Amcast Industrial Corporation – Preliminary Site Characterization Summary*. March 22.

Stensvold, K.A. 2012. *Distribution and Variation of Arsenic in Wisconsin Surface Soils, With Data on Other Trace Elements.* USGS Scientific Investigations Report 2011–5202. Prepared in cooperation with the U.S. Department of Agriculture, Natural Resources Conservation Service, Wisconsin Department of Natural Resources, and Wisconsin Department of Health Services.

Strand Associates, Inc. 1992. *Cedar Creek PCB Investigation (Final Report)*. May.

U.S. Environmental Protection Agency (EPA). 2013a. *Pentachlorophenol and its Use as a Wood Preservative*. http://www.epa.gov/pesticides/factsheets/chemicals/pentachlorophenol_main.htm. Accessed on March 5, 2013.

U.S. Environmental Protection Agency (EPA). 2013b. *Regional Screening Levels for Chemical Contaminants at Superfund Sites*. May.

U.S. Environmental Protection Agency (EPA). 2013c. *Vapor Intrusion Screening Level (VISL) Calculator, Version 3.1*. Accessed at: http://www.epa.gov/oswer/vaporintrusion/guidance.html.

U.S. Environmental Protection Agency (EPA). 1997. *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. Interim Final.* EPA/540/R-97/006.

U.S. Environmental Protection Agency (EPA). 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final*.

Wisconsin Department of Natural Resources (WDNR). 2013a. *Guidance for Cover Systems as Soil Performance Standard Remedies*, WDNR PUB-RR-709. October.

Wisconsin Department of Natural Resources (WDNR). 2013b. *Development At Historic Fill Sites And Licensed Landfills: Guidance For Investigation*, WDNR PUB-RR-684. November.

University of Wisconsin-Extension Geological and Natural History Survey (WGNHS). 2005. Bedrock Geology of Wisconsin. Scale 1: 1,000,000.

University of Wisconsin-Extension Geological and Natural History Survey (WGNHS). 1997. Quaternary Geology of Ozaukee and Washington Counties, Wisconsin. David M. Mickelson and Kent M. Syverson. WGNHS Bulletin 91, 1997.

University of Wisconsin-Extension Geological and Natural History Survey (WGNHS). 1980. Groundwater Resources and Geology of Washington and Ozaukee Counties, Wisconsin.

Tables

Table 1-1. HHRA Chemicals of Concern Based on Human Health Risk Assessment Estimates

Feasibility Study Report

Amcast Industrial Site, Cedarburg, Wisconsin

		PCBs	Metals				PAHs							Non-PAH SVOCs			VOCs						
Exposure Location/Media:	**Potential Receptor Group**	**PCBs**	**Arsenic**	**Chromium**	**Manganese**	**Lead**	**Benzo(a)anthracene**	**Benzo(a)pyrene**	**Benzo(b)fluoranthene**	**Benzo(k)fluoranthene**	**Chrysene**	**Dibenzo(a,h)anthracene**	**Indeno(1,2,3-c,d)pyrene)**	**bis(2-ethylhexyl)phthalate**	**Hexachloroethane**	**Pentachlorophenol**	**1,1'-biphenyl**	**1,2,4-trimethylbenzene**	**Benzene**	**Bromodichloromethane**	**Chloroform**	**Ethylbenzene**	**Naphthalene**
AMN Total Soil (0-10 feet)	Residents (adults and children)	x					x	x	x	x		x	x										
	Industrial Workers	x						x															
	Construction Workers	x																					
AMS Surface Soil (0-2 feet)	NONE																						
AMS Total Soil (0-10 feet)	Residents (adults and children)	x					x	x	x	x	x	x	x										
	Industrial Workers	x					x	x	x	x		x	x										
	Construction Workers	x																					
Wilshire Pond Bank Surface Soil	Adults and Children	x																					
Wilshire Pond Surface Water	None	No COCs																					
Wilshire Pond Sediment	None	No COCs																					
Zeunert Park Surface soil	None	No COCs																					
Quarry Pond Sediment	Recreational Users (adults and Children)	x																					
Quarry Pond Surface Water	None	No COCs																					
Quarry Pond Fish Fillets	Recreational Anglers (adults and children)	x																					
Sitewide Groundwater (tapwater use)	Adults and Children	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Industrial Workers	x	x	x			x	x	x	x	x	x	x	x	x								

Notes:

AMN = Amcast North

AMS = Amcast South

PAH = polycyclic aromatic hydrocarbon

PCB = polychlorinated biphenyl

HHRA = Human Health Risk Assessment

SVOC = semivolatile organic carbon

VOC = volatile organic carbon

Total soil = 0 to 10 feet with ingestion, dermal contact, and inhalation assumed

Surface Soil = 0 to 2 feet with ingestion, dermal contact, and inhalation assumed

Surface Water = ingestion and dermal contact assumed

Sediment = ingestion and dermal contact assumed

Table 1-2. ERA Chemicals of Potential Concern Based on Historical and Recent (2011) Analytical Data
Feasibility Study Report
Amcast Industrial Site, Cedarburg, Wisconsin

Exposure Location/Media	Aroclor-1248	Aroclor-1254	Total PCBs	Copper	Manganese	HMW PAHs
Amcast North – Terrestrial – Surface Soil	X		X		X	
Amcast North – Terrestrial Food Web	X		X			
Amcast South – Terrestrial – Surface Soil	X	X	X	X	X	X
Amcast South – Terrestrial Food Web	X		X			
Residential Area – Terrestrial – Surface Soil	X	X	X			
Residential Area – Terrestrial Food Web	X	X	X			
Wilshire Pond – Aquatic Surface Water	No COPCs					
Wilshire Pond –Aquatic Sediment (Basin and Bank)	X		X			
Wilshire Pond – Aquatic Fish Tissue	X		X			
Wilshire Pond –Aquatic Food Web	X		X			
Zeunert Park – Terrestrial - Surface Soil	No COPCs					
Zeunert Park - Terrestrial Food Web	X		X			
Quarry Pond – Aquatic Surface Water	No COPCs					
Quarry Pond – Aquatic Basin Sediment	X		X			
Quarry Pond – Aquatic Bank Sediment	No COPCs					
Quarry Pond – Aquatic Fish Tissue	X		X			
Quarry Pond – Aquatic Food Web	X		X			

Notes:

Surface soil = 0 to 2 feet

HMW PAHs are the sum total of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene), and pyrene.

Table 2-1. Potential Applicable or Relevant and Appropriate Requirements and To-Be-Considered Criteria

Feasibility Study Report

Amcast Industrial Site, Cedarburg, Wisconsin

Requirement	Citation	Description	ARAR/TBC Determination by Area: Amcast North	Amcast South	Residential Yards	Wilshire & Quarry Ponds	Comment
Chemical-specific ARARs							
Toxic Substances Control Act (TSCA)	40 CFR 761.61(c)	Allows development of risk-based cleanup levels for removing PCB-contaminated remediation waste. Requires approval from the Regional Administrator of the EPA region in which the site is located.	A	A	A	A	EPA intended complex remediation situations such as those found at the Amcast site to be addressed as a risk-based cleanup. This provision allows for flexibility in developing remedial alternatives.
Soil Cleanup Standards	WAC NR 720.02(1)(e)	Applies to soil contamination at sites with PCB contamination.	A	A	A		Allows for the calculation of site-specific risk-based cleanup standards based on the intended reuse of the property. Generally applied to unsaturated material or soils.
Water Quality Standards for Wisconsin Surface Water	WAC NR 102.04(1)(a) and (d); WAC NR 105.06 and 105.07 40 CFR 132	Substances that will cause objectionable deposits on the shore or in the bed or a body of water, shall not be present in such amounts as to interfere with public rights in water of the state; and Substances in concentrations or combinations that are toxic or harmful to humans shall not be present in amounts found to be of public health significance, nor shall substances be present in amounts that are acutely harmful to animal, plant, or aquatic life. The wildlife criterion is the concentration of a substance which, if not exceeded, protects Wisconsin's wildlife from adverse effects resulting from ingestion of surface waters of the state and from ingestion of aquatic organisms taken from surface waters of the state. Federal guidance identifies minimum water quality standards, antidegradation policies, and implementation procedures for the Great Lakes System to protect human health, aquatic life, and wildlife.				R/A	WDNR placed the first 5 miles of Cedar Creek upstream of the confluence with the Milwaukee River on Wisconsin's 303(d) Impaired Waters List for Fish Consumption Advisories due to PCBs in contaminated sediments.
PCB Total Maximum Daily Load for Cedar Creek	WDNR 2008	PCBs Total Maximum Daily Load for Cedar Creek and Milwaukee River (Thiensville Segment) Ozaukee County, WI; proposes a long-term goal of sediment PCB concentration for Cedar Creek.				TBC	WDNR has established a TMDL for Cedar Creek. The Cedar Creek TMDL = 0.17 grams per day of PCBs. To meet the TMDL, a reduction in PCB loading is needed. Table 4 estimates that the PCB load from Wilshire Pond is 0.081 gram per day; therefore, a 100% load reduction from Wilshire Pond is needed to meet the TMDL and ultimately WDNR's goal of reducing fish tissue levels of PCBs in Cedar Creek to the target value of 0.21 milligram per kilogram. This will allow for the removal of the special fish consumption advisory for Cedar Creek and will meet narrative water quality standards that aim to protect the public health and recreational activities.
Sediment Sampling and Analysis and Review requirements	WAC NR 347.06	Establishes sediment sampling and analysis requirements for dredging projects regulated by the State of Wisconsin.				R/A	Relevant and appropriate because it applies to dredging projects regulated under certain WI statutes; whereas this is a CERCLA project. However, the sampling requirements are appropriate to be followed.
Groundwater Quality	WAC NR 140	Establishes groundwater quality standards for substances detected in or having a reasonable probability of entering the groundwater resources of the state; to specify scientifically valid procedures for determining if a numerical standard has been attained or exceeded; to specify procedures for establishing points of standards application, and for evaluating groundwater monitoring data.	A	A		A	Table 1 contains Public Health Groundwater Quality Standards, and Table 2 contains Public Welfare Groundwater Quality Standards.
Water Quality Antidegradation	WAC NR 207	WAC NR 207 Water Quality Antidegradation establishes procedures for evaluating degradation in certain waters.	A or R/A	A or R/A		A or R/A	Status is to dependent on Remediation Alternative Chosen; could apply to groundwater treatment, sediment dewatering, and/or pond water removal; applicable for establishing discharge limits for a temporary water treatment system used during implementation.
Wisconsin Pollutant Discharge Elimination System (WPDES)	WAC NR 205	This regulation outlines the general conditions to be included in all WPDES permits issued by the WDNR.				A or R/A	This regulation applies to remedial alternatives involving point discharges where a WPDES permit equivalency would be required. The City of Cedarburg has an MS4 permit that covers the storm sewers.
Procedures for Calculating Water Quality Based Effluent Limitations	WAC NR 106	Specifies the procedures to calculate effluent limits for toxic and organoleptic substances and if and how these limits will be included in WPDES permits.				X	
Safe Drinking Water	WAC NR 809	Establishes drinking water standards for water supplies, including federal MCLs. Also specifies sampling and analysis requirements.	A	A	A	A	
Action-specific ARARs							
Dust	WAC NR 415	Establishes standards for fugitive dust emissions and specifies that precautions should be taken to prevent particulate matter from becoming airborne.	A	A	A	A	
Stormwater	WAC NR 216.46 and NR 216.47	Prevents and controls water pollution and soil erosion by minimizing the amount of sediment and other pollutants carried by runoff or discharged from land-disturbing construction activity to waters of the state for construction activities that disturb more than 1 acre of land through identification and implementation of best management practices plan.	A	A	A	A	Obtaining a permit and an approved erosion and sediment control plan or stormwater pollution protection plan is an administrative requirement and is not required for onsite activities. However, the requirements and best management practices associated with this regulation are applicable to some of the proposed remedial alternatives.
Toxic Substances Control Act (TSCA)	40 CFR 761.61 (c)	Establishes cleanup options and storage options for PCB remediation waste, including PCB-contaminated soils. Options include risk-based approval by EPA. Risk-based approval option must demonstrate that cleanup or storage plan will not pose an unreasonable risk of injury to health or the environment.	A	A	A	A	Applicable to remedial actions that involve PCB remediation wastes.
	40 CFR 761.40	Requirements regarding the marking of PCB containers and PCB storage areas.	A	A	A	A	Applicable to remedial actions that involve PCB remediation wastes.
	40 CFR 761.65(b)(2)(v), 40 CFR 761.65(c)(3), and 40 CFR 761.65(c)(9)	Requirements regarding storage of PCB remediation waste.	A	A	A	A	Applicable to remedial actions that involve PCB remediation wastes.
Groundwater Quality	WAC NR 141	Establish minimum acceptable standards for the design, installation, construction, abandonment, and documentation of groundwater monitoring wells.	X	X	X	X	A few of the existing groundwater monitoring wells are no longer functional and will be abandoned and new wells will be installed.
Hazardous Waste	WAC NR 661	This part identifies those solid wastes that are subject to regulation as hazardous wastes under parts 262 through 265, and 268 when transported and disposed offsite. Sets TCLP concentrations above which generated wastes must be managed as hazardous waste. Waste is generated when it is removed from the ground and taken outside of the area of contamination.	X	X	X	X	Applicable if concentration in waste exceeds TCLP concentrations. Includes procedure for notification of hazardous waste activities.
Hazardous Waste Management Standards applicable to Generators	WAC NR 662.011 and NR 662.030 through .033	A generator needs to characterize all wastes (including media) that are generated and then appropriately manage any hazardous waste. Generator requirements include properly labeling waste containers, storing containers in containment areas, and protecting them from the elements.	R/A	R/A	R/A		Each site could potentially generate waste that exhibits hazardous characteristics.
Hazardous Waste Management Standards applicable to Use and Management of Containers	WAC NR 665.0171 through 0173	Containers must be in good condition; compatible with the type of waste place the container; always be closed during storage except when it is necessary to add or remove waste; and must not be opened, handled, or stored in a manner that could cause it to rupture or leak.					R/A if hazardous waste is generated.
Hazardous Waste Management Land Disposal Restriction Requirements	WAC NR 668.07 and NR 668.40 and .48	Provides testing, tracking, and recordkeeping requirements for generators, treatment, and disposal facilities. Provides treatment standards for hazardous wastes. Hazardous wastes must be treated to specific concentrations before they can be placed back on the ground.					R/A if hazardous waste is generated. If a hazardous waste is generated, the hazardous waste characteristic and all UHCs would need to be treated to the applicable land disposal restriction (LDR) concentration (for the characteristic) (NR 668.40) or the UTS (for the UHCs) (NR 668.48) before it can be placed on the ground.
Management of Contaminated Soils	WAC NR 718	Establishes minimum standards for the storage, transportation, treatment, and disposal of contaminated soil and certain other solid wastes excavated during response actions.	X	X	X	X	
Guidance for Cover Systems as Soil Performance Standard Remedies	WDNR 2013	Provide remedy selection, design, construction, and operation and maintenance (O&M) concepts, including specific examples, for cover systems for soil performance standard remedies.		TBC			
Notification for Closure	WAC NR 725	Specifies the minimum notification requirements that shall be met before it can be determined that a specific site or facility may be closed with a continuing obligation or residual contamination, or to approve a remedial action plan that includes a continuing obligation.	X	X	X		Substantive requirements would be met through the CERCLA process for areas of the site that require maintenance of an engineered system, action in the future, restricting development or activities at a site, or requiring additional environmental work be completed before land use at a site changes.
Sites with Residual Contamination	Wisconsin Statutes Section 292.12 292.12(2)(d); 29.12(5m)	This regulation provides notification about residual contamination or other continuing obligations on a property.				X	This potentially applies after completion of the CERCLA process, if residual PCBs in sediment are left in place at levels requiring notification, maintenance of an engineered system such as a sediment cap, action in the future, restricting development or activities at a site, or additional environmental work before land use at a site changes.
Historic Landfill	WDNR 2013	WDNR's Remediation and Redevelopment and Waste and Materials Management programs have jointly developed a process and guidance for development on historic fill sites and licensed landfills.		TBC			Guidance may be considered if disposal site was developed prior to 1970 and is intended for redevelopment.
Wetlands	WAC NR 350-353	Establish standards for development, monitoring, and long-term maintenance of wetland compensatory mitigation projects that are approved by the department, and to establish procedures and standards for the establishment and maintenance of mitigation banks.				R/A	Relevant and Appropriate if a wetland compensatory mitigation project is needed.
Oil Pollution Prevention	40 CFR 112	Governs management of oils or fuels in amounts greater than 1,320 gallons, if held in containers 55 gallons or larger. Requirements include secondary containment, routine inspections of containment before discharging accumulated stormwater, implementation of spill prevention procedures, and spill response procedures.					Applicable , if >1,320 gallons of oil are managed. If oil or oil-based compounds are managed during the remediation, then the design and management requirements of this rule would apply.
Location-specific ARARs							
US Fish and Wildlife Coordination Act	16 USC 661	The purpose is to protect fish and wildlife when federal actions result in the control or structural modification of a water body. Federal agencies may take action to prevent loss or damage to fish and wildlife resources.				A	Consultation is administrative and not required for onsite actions. However, expertise resides within the U.S. Fish and Wildlife Service, and consultation is encouraged to tap this expertise.
EPA Guidance - OSWER	OSWER Directive 9355.7-04, May 1995	Land Use in CERCLA Remedy Selection Process. Identifies considerations for incorporating anticipated future land use in the remedy selection process.	TBC	TBC			Provides guidance for consideration of future site land use in selection of a site remedy.

Requirement	Citation	Description	ARAR/TBC Determination by Area				Comment
			Amcast North	Amcast South	Residential Yards	Wilshire & Quarry Ponds	
Migratory Bird Treaty Act of 1972	16 USC 703-712	Prohibits the taking, possessing, buying, selling, or bartering of any migratory bird, including feathers, or other parts, nest eggs, or products, except as allowed by regulations. This includes disturbing nesting birds.	A	A	A	A	Applicable if migratory birds are identified during the action. Migratory birds are known to pass over the area, although no nesting habitats are believed to exist in the four area/sites. If migratory birds, their nests, or eggs are discovered, the design will specify measures to minimize disturbance.
Endangered Species Act of 1973 16 USC §1531 et seq.	50 CFR 200	Requires that federal agencies ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify critical habitat.					No endangered species are known to be present that would be affected by remedial activities. Applicable if listed species or critical habitat is identified.
Beneficial Reuse Solid Waste Exemption	WAC NR 500.08(6)	Establishes criteria for possible beneficial use of solid wastes after treatment. Applies for onsite reuse options only.					TBD if considered part of an alternative. Applicable for onsite beneficial reuse of treated soils meeting criteria.

Notes:
Occupational Safety and Health Administration requirements have not been identified as potential ARARs or TBC; these requirements are not ARARS because they are not an environmental or siting law.
The hazardous waste program (RCRA), CWA's NPDES program, and SDWA has been delegated to the State.
A = Applicable
R/A = Relevant and Appropriate
X = Likely Relevant and Appropriate but need more information before finalizing

ARAR = Applicable, or Relevant and Appropriate Requirements
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
CFR = *Code of Federal Regulations*
NR = Natural Resources
PCB = polychlorinated biphenyl
TBC = to be considered
TBD = to be determined
TCLP = Toxicity Characteristic Leaching Procedure
TMDL = total maximum daily load
USC = United States Code
WAC = Wisconsin Administrative Code
WDNR = Wisconsin Department of Natural Resources

Development At Historic Fill Sites AndLicensed Landfills : *Guidance For Investigation* , WDNR PUB-RR-684, November 2013
Guidance for Cover Systems as Soil Performance Standard Remedies , WDNR PUB-RR-709, October 2013
Guidance for Determining Soil Contaminant Background Levels at Remediation Sites , WDNR PUB-RR-721, October 2013
Land Use in CERCLA Remedy Selection Process, EPA OSWER Directive No. 9355.7-04, May 25, 1995.
PCB Remediation in Wisconsin under the One Cleanup Program MOA , WDNR PUB-RR-786, October 2013
PCBs Total Maximum Daily Load for Cedar Creek and Milwaukee River (Thiensville Segment) Ozaukee County, WI , WDNR, August 2008

Table 2-2. Preliminary Remediation Goals for Soil Based on Human Health and Ecological Risk Assessment Estimates

Feasibility Study Report

Amcast Industrial Site, Cedarburg, Wisconsin

	Amcast North (mg/kg)			Amcast South (mg/kg)			Wilshire Pond Bank Soil[1] (mg/kg)		Residential Areas (mg/kg)		Zeunert Park Soil (mg/kg)	
	Human Health[7]			Human Health[7]								
	Residential[9]	Industrial	Ecological[1]	Residential[9]	Industrial	Ecological[1]	Human Health Recreational[8, 10]	Ecological	Human Health[7, 9]	Ecological[1]	Ecological[1]	State of Wisconsin NR700 groundwater protection value[11] (mg/kg)
PCBs												
Aroclor 1248	--	--	1[3]	--	--	1[3]	--	1.9[6]	--	1[3]	1[3]	NA
Aroclor 1254	--	--	--	--	--	28.3[4]	--	--	--	1[3]	--	NA
Total PCBs	1	7.3	1[3]	1	7.3	1[3]	7.6	1.9[6]	1	1[3]	1[3]	0.0094
Metals												
copper	--	--	--	--	--	80[5]	--	--	--	--	--	91.6
manganese	--	--	--	--	--	450[5]	--	--	--	--	--	39.1
PAHs												
benzo(a)anthracene	1.5	--	--	1.5	21	--	--	--	--	--	--	NA
benzo(a)pyrene	0.15	2.1	--	0.15	2.1	--	--	--	--	--	--	0.47
benzo(b)fluoranthene	1.5	--	--	1.5	21	--	--	--	--	--	--	0.48
benzo(k)fluoranthene	1.5	--	--	1.5	21	--	--	--	--	--	--	NA
chrysene	--	--	--	5.2	--	--	--	--	--	--	--	0.15
dibenzo(a,h)anthracene	0.15	--	--	0.15	2.1	--	--	--	--	--	--	NA
indeno(1,2,3-c,d)pyrene)	1.5	--	--	1.5	21	--	--	--	--	--	--	NA
HMW PAHs[2]	--	--	--	--	--	18[5]	--	--	--	--	--	NA

Notes:

[1] Applies only to soil 0-2 foot interval

[2] High molecular weight PAHs are the sum total of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and pyrene

[3] Back-calculated food web value (shrew)

[4] Efroymson et. al (1997) for plants

[5] Eco Site Screening Level from USEPA 2007a for soil invertebrates

[6] Back-calculated food web value (tree swallow)

[7] Total Soil = any depth 0 to 10 feet with incidental ingestion, dermal contact, and inhalation assumed

[8] Bank Surface Soil = 0 to 2 feet with incidental ingestion, dermal contact, and inhalation assumed

[9] PCB values Based on a hazard quotient of 1, PAH values based on an individual chemical excess lifetime cancer risk of $1x10^{5}$

[10] PCB values Based on a hazard quotient of 1

[11] Per WDNR's RCL spreadsheet and a Wisconsin dilution factor (DF) default value of 2

-- = PRG not applicable for parameter and potential receptor

mg/kg = milligrams per kilogram

NA = not available

PAH = polycyclic aromatic hydrocarbon

PCB = polychlorinated biphenyl

Table 2-3. Preliminary Remediation Goals for Sediment Based on Human Health and Ecological Risk Assessment Estimates

Feasibility Study Report

Amcast Industrial Site, Cedarburg, Wisconsin

	Quarry Pond Sediment (mg/kg)		Wilshire Pond Sediment (mg/kg)
	Human Health Recreational[1]	**Ecological[2]**	**Ecological[2]**
PCBs			
Aroclor 1248	NA	1.9	1.9
Total PCBs	21	1.9	1.9

Notes:

[1] Ingestion and dermal contact assumed

[2] Back-calculated food web (tree swallow)

PCB = polychlorinated biphenyl

HHRA = Human Health Risk Assessment

NA = Not applicable

Table 2-4. Preliminary Remediation Goals for Groundwater Based on Human Health Risk Assessment Estimates

Feasibility Study Report

Amcast Industrial Site, Cedarburg, Wisconsin

	PRG Based on ELCR of $1x10^{-5}$ or HI of 1 for Target Organ (µg/L)	**WDNR Groundwater Quality Standards/Advisory Levels (Source) (µg/L)**	**Recommended PRG (µg/L)**	**Source**
Residential Use - Groundwater				
Total PCB (Calc)	1.5E-02	0.03 (1), 0.5 (2)	0.03	1
Arsenic	4.4E-01	10 (1, 2)	10	1
Chromium	2.4E-01	100 (1, 2)	100	1
Lead	NA	15 (1,2)	15	1
Manganese	3.2E+02	300 (1)	300	1
Benzo(a)anthracene	1.6E-02	NA	0.016	4
Benzo(a)pyrene	1.1E-03	0.2 (1, 2)	0.2	1
Benzo(b)fluoranthene	1.8E-02	0.2 (1)	0.2	1
Benzo(k)fluoranthene	1.1E-02	NA	0.011	4
Chrysene	1.6E-02	0.2 (1)	0.2	1
Dibenzo(a,h)anthracene	7.0E-04	NA	0.0007	4
Indeno(1,2,3-cd)pyrene	6.5E-03	0.03 (3)	0.0065	4
Bis(2-ethylhexyl)phthalate	5.6E-01	6 (1, 2)	6	1
Hexachloroethane	3.0E+00	1 (3)	3	4
Pentachlorophenol	3.2E-01	1 (1,2)	1	1
1,1'-Biphenyl	3.0E-01	NA	0.3	4
Benzene	5.4E+00	5 (1, 2)	5	1
Bromodichloromethane	1.9E+00	0.6 (1) 80 total * (2)	0.6	1
Chloroform	3.1E+00	6 (1), 80 total * (2)	6	1
Ethylbenzene	1.8E+01	700 (1, 2)	700	1
1,2,4-Trimethylbenzene	1.2E+01	480 (1)	480	1
Naphthalene	2.5E+00	100 (1)	100	1

Notes:

µg/L = micrograms per liter

ELCR = excess lifetime cancer risk

HQ = hazard quotient

NA = Not applicable

NOE = No Observed Effect

PCB = polychlorinated biphenyl

PRG = Preliminary Remediation Goal

Sources:

(1) Wisconsin Natural Resource (NR) 140 Public Health Enforcement Standard (ES) value (WDNR 2011)

(2) NR 809 Maximum Contaminant Level (MCL) value (WDNR 2011)

(3) Wisconsin Department of Health Services (DHS)/US EPA Lifetime Health Advisory/Cancer Risk (HAL/CR) value (WDNR 2011)

http://dnr.wi.gov/topic/drinkingwater/documents/haltable.pdf

(4) Risk-based PRG

(5) If there is a state groundwater standard (Public Health Enforcement Standard - ES), it is legally-enforceable and takes priority over a calculated risk-based concentration. An MCL is also legally-enforceable and takes precedence over a calculated risk-based concentration in those instances where an ES is not available.

* the MCL for total trihalomethanes (TTHM) = 80 ug/L

Table 3-1. General Response Actions Retained for the Amcast Industrial Site
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

General Response Actions	Approach to Achieving the RAO
No action	The NCP requires that the no-action alternative be retained through the FS process as a basis of comparison. However, the no-action alternative does not achieve the RAOs.
Institutional controls	Restricts access to a medium or area and notifies residents and workers of the contamination to render the human contact pathway incomplete. Process options may include deed restrictions, fences, signs, or permits. Signs warning against fishing are already present at Quarry Pond.
Monitoring	Monitoring of soil or sediment contaminant concentrations to evaluate achieving the RAOs. Monitoring soil and sediment does not preclude either direct contact by humans or ecological fauna nor does it prevent additional transport to the environment. Therefore, monitoring was not evaluated further. Groundwater monitoring is relevant because there is no current human use of groundwater for drinking water or other purposes, and it can be effective in combination with institutional controls.
Containment	Containment is used to minimize the risk of contaminant migration as well as prevent direct contact exposures. Containment technologies for soil or sediment consist of low-permeability caps (relevant to soil, subsurface soil, or pond sediment) or plugging of subsurface sewers to inhibit further downpipe transport. Caps over the soil render human and ecological contact pathways incomplete and in addition minimize the leaching and subsequent movement of contaminants to surface water, groundwater or downpipe. Containment technologies for groundwater consist of caps or vertical barriers to prevent active flow out of/away from a source area. A cap is not relevant for groundwater because direct contact with the groundwater is already inhibited by the presence of surface and subsurface soil. However, vertical subsurface barriers may be relevant to subsurface flow of groundwater at/away from some of the site areas.
Removal	Removes contaminants from affected areas of soil, sediment, groundwater, or sewers.
In situ treatment or stabilization	Involves in-place treatment of soil, sediment, or groundwater to reduce mobility, toxicity, or volume. In situ treatments are effective in treating VOCs in groundwater, but are only marginally effective when addressing PCBs, PAHs or inorganics. Because of the variety of groundwater constituents, respective PRGs (Table 2-4), and relative costs, in situ treatment was NOT evaluated further for groundwater with the exception of phytoremediation.
Ex situ treatment	Ex situ treatment involves removing the soil, sediment, or groundwater followed by reducing contaminant volume, mobility, and concentrations. For soil and sediment, examples of ex situ treatment include stabilization after soil material is excavated or sediment is dredged, soil washing, or chemical extraction. Groundwater extraction and treatment employs technologies to reduce the volume, mobility, and contaminant concentrations. Because of the variety of groundwater constituents, respective PRGs (Table 2-4), and relative cost, ex situ groundwater treatment was NOT retained for screening.
Disposal	Disposal involves transporting the soil, sediment, or groundwater media offsite per applicable regulations. Solid nonhazardous wastes will be disposed of in a Subtitle D landfill. Solid hazardous wastes will be disposed of in a Subtitle C landfill. Solid wastes with PCBs greater than 50 mg/kg will be permanently disposed of in a TSCA-permitted landfill. All disposal facilities will be Offsite Rule--approved. Groundwater would be treated and/or transported (discharged) to a locally owned treatment works or trucked to a treatment and disposal facility, depending on facility permit requirements.

Table 3-2. Screening of Process Options—Soil
Feasibility Study Report
Amcast Industrial Site, Cedarburg, Wisconsin

General Response Action/Remedial Technology	Process Option	Description	Effectiveness—Ability to Meet RAOs	Reliability	Implementability	Relative Cost	Screening Assessment
No Further Action							
	No Further Action; reliance on IRMs implemented to date	The "no action" technology does not include any engineering or institutional controls to mitigate exposure, or monitoring to assess ongoing contact with constituents of concern, and as such serves as a baseline for comparison to all other remedial technologies. Inclusion of this technology is required by the National Contingency Plan.	None. Will not achieve RAOs.	N/A.	N/A	N/A	Required by CERCLA for comparison
Institutional Controls							
	Deed Restrictions	Deed restrictions issued for property within potentially affected areas to restrict property use	Low to Moderately effective in reducing direct human exposure to PCB containing media by informing future property owners of potential risks associated with the property and limiting property uses. Low effectiveness in reducing ecological exposure. Ability to meet the soil RAO could be further enhanced in combination with other technologies (for example, capping).	Reliable with appropriate enforcement in place.	High—Negotiations with potentially affected landowner(s) would be necessary.	Low	Retained for further evaluation with other GRAs.
	Access Restrictions (for example, security fencing, warning signs)	Security fences installed around potentially affected areas to limit access.	Moderately effective in reducing direct human exposure to PCB containing media by physically restricting access and informing potential trespassers of potential risks associated with the property. Low effectiveness in reducing ecological exposure. Ability to meet this RAO could be further enhanced in combination with other technologies (for example, capping). Not effective for residential areas and ecological receptors.	Reliable with appropriate inspections and maintenance.	High—fencing and signage currently in place. Further restrictions readily implementable. Restrictions for other properties require landowner agreement.	Low	Retained for further evaluation with other GRAs.
	Permits	Regulations promulgated to require a permit for excavation/removal activities.	Moderate. Required only if soil COC concentrations in excess of the PRGs are left in-place. Would require action by the City government to implement. Would also require that the City has means and interest to enforce. Minimally effective for residential areas.	Reliability is dependent on effective communication and enforcement.	High—readily implementable.	Low	Retained for further evaluation with other GRAs.

General Response Action/Remedial Technology	Process Option	Description	Effectiveness—Ability to Meet RAOs	Reliability	Implementability	Relative Cost	Screening Assessment
Containment							
Engineered Barrier	Engineered Cap (Earthen Cover)	Soil exceeding PRGs covered with uncontaminated native soil and revegetated to prevent direct contact and erosion. Control of leaching is not essential because PCBs and PAHs onsite in soil have limited mobility.	Moderately effective in reducing potential for human and ecological exposure to PCB via direct contact and reducing the potential for PCB migration via erosion or surface water runoff. Ability to meet the RAO could be further enhanced in combination with other technologies. Not effective for residential areas and Wilshire Pond.	Moderate for Amcast North and Amcast South—capping technologies are well established, widely applied, and are proven to be reliable over long time scales at sites of similar size and characteristics. Low for residential areas and Wilshire Pond.	High—experienced contractors and suitable soil cover materials are readily available. Appropriate engineering controls are readily available to mitigate short-term risks. Negotiations with potentially affected landowner(s) would be necessary.	Moderate	Retained for further evaluation with other GRAs.
	Engineered Cap (Isolation Cover System)	Soil exceeding PRGs capped with any one of a variety of low permeability cap materials. In-place grading of existing soils and placement of a multi-layered cap (e.g., clean soil, sand, gravel, cobbles, geotextile), with an impermeable layer (e.g., geomembrane, compacted clay) over and around affected soil to prevent direct contact by isolating constituents and mitigate erosion.	High—reduces potential for human and ecological exposure to PCB via direct contact and reduces the potential for PCB migration via erosion or surface water runoff.	High for Amcast North and Amcast South—capping technologies are well established, widely applied, and are proven to be reliable over long time scales at sites of similar size and characteristics. Moderate for residential areas if used in conjunction with deed restrictions. Not effective for Wilshire Pond.	High—experienced contractors and suitable capping materials are readily available. Appropriate engineering controls are readily available to mitigate short-term risks. Negotiations with potentially affected landowner(s) would be necessary.	High	Retained for further evaluation with other GRAs for Amcast North and Amcast South.
	Land surface Grading	Surface controls used to reroute surface water around contamination or otherwise control soil erosion.	Low to moderate—would marginally reduce potential for human exposure and PCB migration in the long-term. Not effective for residential properties or Wilshire Pond.	Moderate	High—experienced contractors and materials are readily available.	Moderate	Retained for further evaluation with other GRAs.
Removal							
Source Excavation	Excavation	Excavation of soils exceeding PRGs using ordinary construction equipment (backhoes, bulldozers, front-end loaders).	High. In combination with offsite transportation and disposal, removal of PCB-containing soil would effectively reduce potential for human exposure and PCB migration in the long-term.	High—excavation is a commonly implemented remedial technology.	High—experienced contractors and materials are readily available. Handling, transportation, and disposal of larger volumes of material are a significant implementation challenge.	Low for Excavation Moderate to Very High for Transportation and Disposal (see disposal technologies below)	Retained for further evaluation with other GRAs.

General Response Action/Remedial Technology	Process Option	Description	Effectiveness—Ability to Meet RAOs	Reliability	Implementability	Relative Cost	Screening Assessment
In Situ Treatment							
Biological	Phytoremediation	Phytoremediation is a set of processes that uses plants to remove contaminants from the surface soil and transfer them to the biomass.	Low—does little to reduce potential for human and ecological exposure to PCB via direct contact or PCB migration via erosion or surface water runoff.	Moderate—Used in conjunction with monitoring. Would require treatability studies to determine whether site specific factors make it feasible.	Moderate	High	Not retained based on minimal effectiveness.
	Enhanced Aerobic Bioremediation	Injection of water containing inducers and electron acceptors (oxygen) to enhance aerobic biodegradation. In the presence of sufficient oxygen (aerobic conditions), and other nutrient elements, microorganisms will ultimately convert many organic contaminants to carbon dioxide, water, and microbial cell mass.	Poor. Not effective for PCBs.	Low.	Moderate to difficult.	Moderate. Pilot testing required. .	Not retained. Not well suited for site contaminants of concern and concentrations.
	Enhanced Anaerobic Bioremediation	Delivery of electron donors within the target zone to stimulate anaerobic biodegradation of chlorinated compounds by reductive dechlorination.	Not effective for PCBs.	None.	Moderate to difficult.	Moderate. Pilot testing required.	Not retained. Not effective.
	Bioventing	Oxygen is delivered to impacted unsaturated soils by forced air movement (either extraction or injection of air) to increase oxygen concentrations and stimulate biodegradation. Bioventing uses low airflow rates to provide only enough oxygen to sustain microbial activity.	Poor. Not effective for PCBs and clay soil precludes successful venting.	Low.	Moderate to difficult.	Moderate.	Not retained. Not well suited for site contaminants of concern and concentrations, or hydrogeologic conditions.
	Natural Attenuation	Natural subsurface processes such as dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials are allowed to reduce contaminant concentrations to acceptable levels.	Poor.	Low. PCBs are very slow to biodegrade and would be present for decades. Carcinogenic PAHs are also slow to degrade in shallow soil.	Readily Implementable.	Low.	Not retained. Not well suited for site contaminants of concern and related concentrations.
Chemical	In Situ Soil Mixing	Use of large-diameter augers to physically disturb the subsurface, with the introduction of hot air, steam, peroxide, or other fluids to promote contaminant removal or destruction. Soil mixing can be combined with many variations such as vapor extraction and ambient air injection, vapor extraction and hot air injection, hydrogen peroxide injection, ZVI injection and grout injection for solidification/stabilization.	Low for Amcast North and Amcast South. Not effective for the residential surface soils.	Low to Moderate.	Implementable for Amcast North and Amcast South.	High cost when combined with in-situ oxidation or other chemical processes. Bench testing required.	Not retained. Not well suited for site contaminants of concern and concentrations, or hydrogeologic conditions.

General Response Action/Remedial Technology	Process Option	Description	Effectiveness—Ability to Meet RAOs	Reliability	Implementability	Relative Cost	Screening Assessment
	Solidification/Stabilization	Applying or mixing of an amendment into soil through mechanical means (using augers, for instance) to immobilize contaminants by physically binding or enclosing the soil within a stabilized mass or chemically treating these to become immobile.	Fair. PCBs and PAHs are already relatively immobile in soil.	Moderate.	Readily implementable.	Moderate.	Not retained given effectiveness.
Thermal	Thermal Extraction	Variety of heating methods (Electrical Resistance Heating/Six Phase Soil Heating/Radio Frequency Heating/Steam Heating) to promote steam generation to vaporize target compounds.	Limited effectiveness on PCBs. Low permeability clay soils are difficult to effectively vent.	Low to moderate.	Moderate to Difficult.	High to very high.	Not retained given effectiveness.
	Vitrification	Vitrification is a process which uses an electric current to melt soil or other earthen materials at extremely high temperatures (1,600 to 2,000 °C or 2,900 to 3,650 °F) to form a glass and crystalline structure with very low leaching characteristics. The vitrification product is a chemically stable, leach-resistant, glass and crystalline material similar to obsidian or basalt rock.	Fair. PCBs and PAHs are already relatively immobile in soil.	Moderate.	Difficult.	Very high.	Not retained given effectiveness.
Ex Situ Treatment							
Biological	Enhanced Aerobic Bioremediation	Application of substrate containing inducers and electron acceptors (oxygen) to enhance aerobic biodegradation to excavated soils. In the presence of sufficient oxygen (aerobic conditions), and other nutrient elements, microorganisms will ultimately convert many organic contaminants to carbon dioxide, water, and microbial cell mass.	Poor. Not effective for PCBs.	Low.	Moderate to difficult.	Moderate. Pilot testing required.	Not retained. Not well suited for site contaminants of concern and concentrations.
	Enhanced Anaerobic Bioremediation	Delivery of electron donors to excavated soil to stimulate anaerobic biodegradation of chlorinated compounds by reductive dechlorination.	Not effective for PCBs.	None.	Moderate to difficult.	Moderate. Pilot testing required.	Not retained. Not effective.
	Bioventing	Oxygen is delivered to excavated soils by forced air movement (either extraction or injection of air) to increase oxygen concentrations and stimulate biodegradation. Bioventing uses low airflow rates to provide only enough oxygen to sustain microbial activity.	Poor. Not effective for PCBs and clay soil precludes successful venting.	Low.	Moderate to difficult.	Moderate	Not retained. Not well suited for site contaminants of concern and concentrations, or hydrogeologic conditions.

General Response Action/Remedial Technology	Process Option	Description	Effectiveness—Ability to Meet RAOs	Reliability	Implementability	Relative Cost	Screening Assessment
	Biopiles or Land Farming	Biopile treatment is a full-scale technology in which excavated soils are mixed with soil amendments and placed on a treatment area that includes leachate collection systems and some form of aeration.	Not effective. PCBs are very slow to biodegrade and would be present for decades. Carcinogenic PAHs are also slow to degrade in shallow soil.	Low.	Moderate.	Low to Moderate	Not retained. Not effective.
	Composting	Impacted soil is excavated and mixed with bulking agents and proper organic amendments such as wood chips, hay, manure, and vegetative (e.g., potato) wastes to ensure adequate porosity and provide a balance of carbon and nitrogen to promote thermophilic, microbial activity.	Not effective. PCBs are very slow to biodegrade and would be present for decades. Carcinogenic PAHs are also slow to degrade in shallow soil.	Low.	Moderate.	Low to Moderate	Not retained. Not effective.
Chemical	Basic Extractive Sludge Treatment	Using the BEST approach, solvent (having inverse miscibility [i.e., resistant to dissolving] in water) is used to remove PCBs from solids.	Low to Moderate—Would be used in conjunction with removal other actions.	Moderate—Would require treatability study to determine whether site-specific factors make it feasible.	Low—quantity of PCB-containing materials subject to treatment presents a significant limitation to application of treatment technologies.	High to Very High	Not retained based on dependence of other removal actions and related costs for transportation, treatment and ultimate disposal of residual waste.
	Low Energy Extraction Process (LEEP)	The LEEP option calls for the use of acetone and kerosene as solvents to extract PCB from solids.	Low. Technology has not been proven to be effective to reliably reduce PCBs.	Low.	Moderate to difficult.	High	Not retained.
	Soil Washing	Solids are separated into fractions based on particle size and density. Water with surfactants can then be used to "wash" PCBs from solid fraction(s).	Low	Low	Moderate	Moderate to high.	Not retained.
Thermal	Onsite incineration	Solids are thermally treated in a fluidized bed, rotary kiln, or infrared incinerator transported to the site.	High—Would be used in conjunction with removal actions to satisfy RAOs.	High—Process proven to be effective at destroying PCBs in soils. Can result in creation of dioxins.	Low—quantity of PCB-containing materials subject to treatment presents a significant limitation to application of treatment technologies. Issues associated with offsite transportation component are present as with removal response action.	High to Very High	Not retained.
	Offsite incineration	Solids are thermally treated in a fluidized bed, rotary kiln, or infrared incinerator located offsite.	High—Would be used in conjunction with removal actions to satisfy RAOs.	High—Process proven to be effective at destroying PCBs in soils. Can result in creation of dioxins.	Low—Issues associated with offsite transportation component are present as with removal response action.	High to Very High	Retained for a portion of the excavated soils with the highest PCB concentrations.
	Low Temperature Thermal Desorption	Thermal separation of PCBs from solids at temperatures that volatilize PCBs. PCBs are then condensed and treated/disposed separately.	Moderate to High—Would be used in conjunction with removal actions to satisfy RAOs. Treatment may not be as effective for soils with high PCB concentrations.	High—Process proven to be effective at destroying PCBs in soils. Can result in creation of dioxins.	Low—quantity of PCB-containing materials subject to treatment presents a significant limitation to application of treatment technologies. Issues associated with offsite transportation component are present as with removal response action.	High to Very High	Not retained given high cost, potential to not meet RAOs at lower temperatures and must be used with other GRAs.

Table 3-2. Screening of Process Options—Soil
Feasibility Study Report
Amcast Industrial Site, Cedarburg, Wisconsin

General Response Action/Remedial Technology	Process Option	Description	Effectiveness—Ability to Meet RAOs	Reliability	Implementability	Relative Cost	Screening Assessment
	Vitrification/Pyrolysis	Ex-situ treatment method where solids are melted inside a chamber via electrical current, pyrolyzing PCB and incorporating remaining PCB and other constituents into glass-like monolith.	Would be used in conjunction with removal actions and/or onsite consolidation to satisfy RAOs.	Process proven to be effective.	Moderate—technologies, equipment and materials are available; however, quantity of PCB-containing materials subject to treatment presents a significant limitation to application of treatment technologies.	High to Very High	Not retained given high cost and must be used with other GRAs.
Immobilization	Solidification/Stabilization	Removed soils and/or waste materials are mixed with an immobilization agent to bind material within a solid mass (monolith).	Would be used in conjunction with removal actions and/or onsite consolidation to satisfy RAOs.	High—Has been used ex situ full-scale at other Superfund sites. Utilized to reduce free moisture and stabilize materials for disposal purposes.	Moderate—technologies, equipment and materials are available; however, quantity of PCB-containing materials subject to treatment presents a significant limitation to application of treatment technologies.	High	Retained for a portion of the excavated soils with the highest PCB concentrations.
Disposal							
	Overland transport and offsite disposal of non-hazardous soil at RCRA Subtitle D Solid Waste Landfill.	Solid non-hazardous and non-TSCA wastes are permanently disposed of in a solid waste landfill.	High—in combination with removal, offsite transportation and disposal of PCB-containing materials would effectively reduce potential for human exposure and PCB migration in the long-term.	High—offsite transportation and disposal is commonly implemented practice.	Moderately High—experienced contractors and materials are readily available. Timing of implementation is dependent upon proper project planning and availability of offsite disposal locations. External factors (for example, community concerns, traffic routes, trucking resources, offsite landfill capacity) may limit rate of disposal and increase overall duration of remedy implementation.	Moderate—Depends on material volumes.	Retained for further evaluation with other GRAs.
	Overland transport and offsite disposal of hazardous soil at TSCA-Compliant Landfill or Resource Conservation and Recovery Act (RCRA) Subtitle C Landfill	Solid hazardous wastes are permanently disposed of in a TSCA- or RCRA-compliant landfill.	High—in combination with removal, offsite transportation and disposal of PCB-containing materials would effectively reduce potential for human exposure and PCB migration in the long-term.	High—offsite transportation and disposal is commonly implemented practice.	Moderately High—experienced contractors and materials are readily available. Timing of implementation is dependent upon proper project planning and availability of offsite disposal locations. External factors (for example, community concerns, traffic routes, trucking resources, offsite landfill capacity) may limit rate of disposal and increase overall duration of remedy implementation.	High to Very High—Depending on TSCA material volumes relative to total volume.	Retained for further evaluation with other GRAs.
	Onsite Consolidation/Disposal	Construct onsite containment cell for placement and consolidation of excavated soil.	In association with excavation, relocation to disposal cell would contribute to attainment of RAO.	Once cell completed, dependent on design and construction of cell components and cap.	Low to Moderate—limited implementability subject to space limitations for onsite relocation, temporary storage, cell construction and filling operations. There may be disposal capacity constraints, depending on the volume of material to be relocated.	Very High	Not retained given cost and implementability.

Notes:

Shading denotes process options not retained for further consideration.

N/A = not applicable

GRAs = general response actions

IRMs = interim remedial measures

PCBs = polychlorinated biphenyls

PRGs = preliminary remediation goals

RAOs = remedial action objectives

RCRA = Resource Conservation and Recovery Act

TSCA = Toxic Substances Control Act

Table 3-3. Screening of Process Options—Sediment (Quarry Pond and Wilshire Pond)
Feasibility Study Report
Amcast Industrial Site, Cedarburg, Wisconsin

General Response Action/Remedial Technology	Process Option	Description	Effectiveness—Ability to Meet RAOs	Reliability	Implementability	Relative Cost	Screening Assessment
No Further Action							
	No Further Action	The “no action” technology does not include any engineering or institutional controls to mitigate exposure, or monitoring to assess ongoing contact with constituents of concern, and as such serves as a baseline for comparison to all other remedial technologies. Inclusion of this technology is required by the National Contingency Plan.	None. Will not achieve RAOs.	N/A	N/A	N/A	Required by CERCLA for comparison
Institutional Controls							
	Deed Restrictions	Deed restrictions issued for property within potentially affected areas to restrict property use	Low to Moderately effective in reducing direct human exposure to PCB containing media by informing future property owners of potential risks associated with the property and limiting property uses. Low effectiveness in reducing ecological exposure. Ability to meet the sediment RAO could be further enhanced in combination with other technologies (for example, capping).	Reliable with appropriate enforcement in place.	High—Negotiations with potentially affected landowner(s) would be necessary.	Low	Retained for further evaluation with other GRAs.
	Access Restrictions (for example, security fencing, warning signs)	Security fences installed around potentially affected areas to limit access.	Moderately effective in reducing direct human exposure to PCB containing media by physically restricting access and informing potential trespassers of potential risks associated with the property. Low effectiveness in reducing ecological exposure. Ability to meet this RAO could be further enhanced in combination with other technologies (for example, capping). Not effective for ecological receptors.	Reliable with appropriate inspections and maintenance.	High—fencing and signage currently in place. Further restrictions readily implementable. Restrictions for other properties require landowner agreement.	Low	Retained for further evaluation with other GRAs.
	Fish Consumption Advisories	Advisories to indicate how consumption of some fish should be limited.	High for mitigating human exposure, and low for mitigating ecological exposure. Mitigates the potential for human exposure by reducing potential for consumption of fish in Quarry Pond containing PCBs. Ability to meet this RAO for humans could be further enhanced in combination with other technologies.	Reliability is dependent on effective communication of advisories.	High—advisories currently in place can be maintained and updated until appropriate to remove.	Low	Retained for further evaluation with other GRAs.

Table 3-3. Screening of Process Options—Sediment (Quarry Pond and Wilshire Pond)
Feasibility Study Report
Amcast Industrial Site, Cedarburg, Wisconsin

General Response Action/Remedial Technology	Process Option	Description	Effectiveness—Ability to Meet RAOs	Reliability	Implementability	Relative Cost	Screening Assessment
Monitoring							
	Periodic Visual Observations and/or Field Sampling to Monitor Site Conditions	Monitoring involves the collection and analysis of site sediment samples and/or performance of visual reconnaissance (inspections) to track site conditions.	None. Current potential for human exposure and future PCB migration persists; however, could be combined with other technologies to confirm stability of site exposure controls, source controls, and/or containment to more effectively meet the RAOs.	Monitoring techniques well established. Reliability subject to adequacy of supporting monitoring plans.	High—readily implementable. Experienced field personnel, sampling equipment, and supplies are readily available.	Moderately Low (depending on time period and intensity of monitoring activities)	Retained for further evaluation with other GRAs.
Containment							
Engineered Barrier	Engineered Cap (Earthen Cover)	Sediment exceeding PRGs covered with uncontaminated native material.	Minimally effective in reducing potential for human and ecological exposure to PCB via direct contact and reducing the potential for PCB migration via erosion or surface water runoff. Ability to meet the RAO could be further enhanced in combination with other technologies.	Low	High—experienced contractors and suitable sediment cover materials are readily available. Appropriate engineering controls are readily available to mitigate short-term risks.	Moderate	Not retained. Not effective.
	Engineered Cap (Isolation Cover System)	Sediment exceeding PRGs capped with any one of a variety of low permeability cap materials. Placement of a multi-layered cap (e.g., clean sand, gravel, cobbles, geotextile), with an impermeable layer (e.g., geomembrane, compacted clay) over and around affected sediment to prevent direct contact by isolating constituents and mitigate erosion.	Effectively reduces potential for human and ecological exposure to PCB via direct contact and reduces the potential for PCB migration via erosion or surface water runoff.	Not reliable for Quarry Pond or Wilshire Pond. At the Quarry Pond, the potential for groundwater upwelling under the isolation cap limits the effectiveness and the longer-term sustainability. The Wilshire Pond is a storm water basin subject to high flow rates during periods of heavy rain which has the potential to compromise the cap and reduce reliability.	High—experienced contractors and suitable sediment cover materials are readily available. Appropriate engineering controls are readily available to mitigate short-term risks. Not implementable Wilshire Pond due to the shallow nature of the inner basins.	High to Very High	Not retained. Not reliable.
	Engineered Cap (Reactive Cover System)	Placement of a layer of reactive material on top of contaminated sediment to isolate contaminated sediments, prevent contact with the water column or benthic organisms, and treat contaminant flux.	Effective—reduces potential for human and ecological exposure to PCB via direct contact.	High for Quarry Pond—capping technologies are well established, widely applied. Flow velocities are assumed to be low and the potential mechanisms for cap disturbance are minimal in the Quarry Pond. Not reliable for Wilshire Pond. The Wilshire Pond is a storm water basin subject to high flow rates during periods of heavy rain which has the potential to compromise the cap and reduce reliability.	High—experienced contractors and suitable capping materials are readily available. Appropriate engineering controls are readily available to mitigate short-term risks. Not implementable for Wilshire Pond due to the shallow nature of the inner basins.	High to Very High	Retained for further evaluation with other GRAs.

Table 3-3. Screening of Process Options—Sediment (Quarry Pond and Wilshire Pond)
Feasibility Study Report
Amcast Industrial Site, Cedarburg, Wisconsin

General Response Action/Remedial Technology	Process Option	Description	Effectiveness—Ability to Meet RAOs	Reliability	Implementability	Relative Cost	Screening Assessment
Removal							
Source Excavation	Excavation	Excavation of sediment exceeding PRGs using ordinary construction equipment (backhoes, bulldozers, front-end loaders) under "dry" or dewatered conditions.	High for Wilshire Pond. In combination with offsite transportation and disposal, removal of PCB-containing sediment would effectively reduce potential for human exposure and PCB migration in the long-term. High for Quarry Pond bank sediment.	High—excavation is a commonly implemented remedial technology.	High—experienced contractors and materials are readily available. Handling, transportation, and disposal of larger volumes of material are a significant implementation challenge.	Low for Excavation High to Very High for Transportation and Disposal (see disposal technologies below)	Retained for further evaluation with other GRAs.
	Dredging	Physical removal of sediment containing constituents of concern. Potential excavation methods include mechanical removal/dredging of submerged materials.	High for Quarry Pond. In combination with offsite transportation and disposal, removal of PCB-containing sediment would effectively reduce potential for human exposure and PCB migration in the long-term.	High—dredging is a commonly implemented remedial technology.	High—experienced contractors and materials are readily available. Handling, transportation, and disposal of larger volumes of material are a significant implementation challenge.	High High to Very High for Transportation and Disposal (see disposal technologies below).	Retained for further evaluation with other GRAs.
In Situ Treatment							
Biological	Natural Attenuation	Natural subsurface processes such as dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials are allowed to reduce contaminant concentrations to acceptable levels.	Poor.	Low. PCBs are very slow to biodegrade and would be present for decades. Carcinogenic PAHs are also slow to degrade in shallow sediment.	Readily Implementable.	Low.	Not retained. Not well suited for site contaminants of concern and related concentrations.
Chemical	Activated Carbon Sequestration	Bioavailability of contaminant is reduced by addition of sorbent amendment (activated carbon). Carbon coated with a weighting agent is broadcast over top of biologically active sediment layer where coating material breaks down and amendment is slowly mixed in by benthic organisms through bioturbation.	Moderately effective in reducing human and ecological exposure to PCB via direct contact.	Moderate. Pilot testing required.	Moderate. Broadcasting material over sediments should be easy to implement. Availability of trademarked agglomerate material may be limited.	Moderate to high	Not retained given effectiveness and must be used with other GRAs.
	Chemical Extraction, Chemical Destruction	Chemical surfactants/solvents or oxidants are injected into the treatment area to remove or destroy constituents of concern.	Minimally effective in reducing human and ecological exposure to PCB via direct contact.	Moderate. Pilot testing required.	Moderate.	Moderate to high	Not retained. Not feasible for aquatic sediments.
	Fixation/ Stabilization	Involves applying or mixing of an amendment into sediments through mechanical means (using augers, for instance) to immobilize contaminants by physically binding or enclosing the sediments within a stabilized mass or chemically treating these to become immobile.	Fair. PCBs and PAHs are already relatively immobile in sediment.	Moderate.	Readily implementable.	High.	Not retained given effectiveness.
Ex Situ Treatment							

Table 3-3. Screening of Process Options—Sediment (Quarry Pond and Wilshire Pond)
Feasibility Study Report
Amcast Industrial Site, Cedarburg, Wisconsin

General Response Action/Remedial Technology	Process Option	Description	Effectiveness—Ability to Meet RAOs	Reliability	Implementability	Relative Cost	Screening Assessment
Biological	Bioventing	Oxygen is delivered to impacted dewatered sediment by forced air movement (either extraction or injection of air) to increase oxygen concentrations and stimulate biodegradation. Bioventing uses low airflow rates to provide only enough oxygen to sustain microbial activity.	Poor. Not effective for PCBs and fine-grained sediment.	Low.	Moderate to difficult.	Moderate	Not retained. Not well suited for site contaminants of concern and concentrations, or hydrogeologic conditions.
	Biopiles or Land Farming	Biopile treatment is a full-scale technology in which dredged sediments are mixed with amendments and placed on a treatment area that includes leachate collection systems and some form of aeration.	Not effective. PCBs are very slow to biodegrade and would be present for decades.	Low.	Moderate.	Low to Moderate	Not retained. Not effective.
	Composting	Dredged sediment is mixed with bulking agents and proper organic amendments such as wood chips, hay, manure, and vegetative (e.g., potato) wastes to ensure adequate porosity and provide a balance of carbon and nitrogen to promote thermophilic, microbial activity.	Not effective. PCBs are very slow to biodegrade and would be present for decades. Carcinogenic PAHs are also slow to degrade.	Low. Technology has not been proven to be effective to reliably reduce PCBs to target levels for projects of this scale.	Moderate.	Low to Moderate	Not retained. Not effective.
Chemical	Basic Extractive Sludge Treatment	Using the BEST approach, solvent (having inverse miscibility [i.e., resistant to dissolving] in water) is used to remove PCBs from solids.	Low to Moderate—Would be used in conjunction with other removal actions.	Moderate—Would require treatability study to determine whether site-specific factors make it feasible.	Low—quantity of PCB-containing materials subject to treatment presents a significant limitation to application of treatment technologies.	High to Very High	Not retained based on dependence of other removal actions and related costs for transportation, treatment and ultimate disposal of residual waste.
	Low Energy Extraction Process (LEEP)	The LEEP option calls for the use of acetone and kerosene as solvents to extract PCB from dewatered sediment.	Low. Technology has not been proven to be effective to reliably reduce PCBs.	Low.	Moderate to difficult.	High	Not retained.
	Sediment Washing	Dewatered sediment is separated into fractions based on particle size and density. Water with surfactants can then be used to "wash" PCBs from solid fraction(s).	Low	Low	Moderate	Moderate to high.	Not retained.
Thermal	Onsite incineration	Dewatered sediment is thermally treated in a fluidized bed, rotary kiln, or infrared incinerator that is transported to the site.	High—Would be used in conjunction with removal actions to satisfy RAOs.	High—Process proven to be effective at destroying PCBs in sediments. Can result in creation of dioxins.	Low—quantity of PCB-containing materials subject to treatment presents a significant limitation to application of treatment technologies. Issues associated with offsite transportation component are present as with removal response action.	High to Very High	Not retained.
	Offsite incineration	Dewatered sediment is thermally treated in a fluidized bed, rotary kiln, or infrared incinerator located offsite.	High—Would be used in conjunction with removal actions to satisfy RAOs.	High—Process proven to be effective at destroying PCBs in sediments. Can result in creation of dioxins.	Low—Issues associated with offsite transportation component are present as with removal response action.	Very High	Retained for a portion of the excavated sediment with the highest PCB concentrations.

Table 3-3. Screening of Process Options—Sediment (Quarry Pond and Wilshire Pond)
Feasibility Study Report
Amcast Industrial Site, Cedarburg, Wisconsin

General Response Action/Remedial Technology	Process Option	Description	Effectiveness—Ability to Meet RAOs	Reliability	Implementability	Relative Cost	Screening Assessment
	Low Temperature Thermal Desorption	Thermal separation of PCBs from dewatered sediment at temperatures that volatilize PCBs. PCBs are then condensed and treated/disposed separately.	Moderate to High—Would be used in conjunction with other removal actions to satisfy RAOs. Treatment may not be as effective for sediment with high PCB concentrations.	Moderate—Process proven to be effective at destroying PCBs in sediments but require high temperatures. Can result in creation of dioxins.	Low - quantity of PCB-containing materials subject to treatment presents a significant limitation to application of treatment technologies. PCBs need high temperatures for desorption. Wet sediment requires drying prior to treatment. Issues associated with offsite transportation component are present as with removal response action.	High to Very High	Not retained given high cost, potential to not meet RAOs at lower temperatures and must be used with other GRAs.
	Vitrification/Pyrolysis	Ex situ treatment method where dewatered sediment is melted inside a chamber via electrical current, pyrolyzing PCB and incorporating remaining PCB and other constituents into glass-like monolith.	Would be used in conjunction with removal actions and/or onsite consolidation to satisfy RAOs.	Process proven to be effective.	Moderate—technologies, equipment and materials are available; however, quantity of PCB-containing materials subject to treatment presents a significant limitation to application of treatment technologies.	High to Very High	Not retained given high cost and must be used with other GRAs.
Immobilization	Solidification/Stabilization	Removed dewatered sediment are mixed with an immobilization agent to bind material within a solid mass (monolith).	Would be used in conjunction with removal actions to satisfy RAOs.	High—Has been used ex situ full-scale at other Superfund sites. Utilized to reduce free moisture and stabilize materials for disposal purposes.	Moderate—technologies, equipment and materials are available; however, quantity of PCB-containing materials subject to treatment presents a significant limitation to application of treatment technologies.	High	Not retained given high cost and must be used with other GRAs.
Disposal							
	Overland transport and offsite disposal of non-hazardous sediment at RCRA Subtitle D Solid Waste Landfill.	Solid non-hazardous and non-TSCA wastes are permanently disposed of in a solid waste landfill.	High—in combination with removal, offsite transportation and disposal of PCB-containing materials would effectively reduce potential for human exposure and PCB migration in the long-term.	High—offsite transportation and disposal is commonly implemented practice.	Moderately High—experienced contractors and materials are readily available. Timing of implementation is dependent upon proper project planning and availability of offsite disposal locations. External factors (for example, community concerns, traffic routes, trucking resources, offsite landfill capacity) may limit rate of disposal and increase overall duration of remedy implementation.	Moderate—Depends on material volumes.	Retained for further evaluation with other GRAs.
	Overland transport and offsite disposal of hazardous sediment at TSCA-Compliant Landfill or Resource Conservation and	Solid hazardous wastes are permanently disposed of in a TSCA or RCRA-compliant landfill.	High—in combination with removal, offsite transportation and disposal of PCB-containing materials would effectively reduce potential for human exposure and PCB migration in the long-term.	High—offsite transportation and disposal is commonly implemented practice.	Moderately High—experienced contractors and materials are readily available. Timing of implementation is dependent upon proper project planning and	High to Very High—Depending on TSCA material volumes relative to total volume.	Retained for further evaluation with other GRAs.

Table 3-3. Screening of Process Options—Sediment (Quarry Pond and Wilshire Pond)
Feasibility Study Report
Amcast Industrial Site, Cedarburg, Wisconsin

General Response Action/Remedial Technology	Process Option	Description	Effectiveness—Ability to Meet RAOs	Reliability	Implementability	Relative Cost	Screening Assessment
	Recovery Act (RCRA) Subtitle C Landfill				availability of offsite disposal locations. External factors (for example, community concerns, traffic routes, trucking resources, offsite landfill capacity) may limit rate of disposal and increase overall duration of remedy implementation.		
	Onsite Consolidation/Disposal	Construct onsite containment cell for placement and consolidation of excavated and dredged sediment.	In association with excavation, relocation to disposal cell would contribute to attainment of RAO.	Once cell completed, dependent on design and construction of cell components and cap.	Low to Moderate—limited implementability subject to space limitations for onsite relocation, temporary storage, cell construction and filling operations. There may be disposal capacity constraints, depending on the volume of material to be relocated.	Very High	Not retained given limited implementability and high cost.

Notes:

Shading denotes process options not retained for further consideration.

N/A = not applicable

GRAs = general response actions

IRMs = interim remedial measures

PCBs = polychlorinated biphenyls

PRG = Preliminary Remediation Goals

RAOs = remedial action objectives

RCRA = Resource Conservation and Recovery Act

TSCA = Toxic Substances Control Act

Table 3-4. Screening of Process Options—Sewers
Feasibility Study Report
Amcast Industrial Site, Cedarburg, Wisconsin

General Response Action/Remedial Technology	Process Option	Description	Effectiveness—Ability to Meet RAOs	Reliability	Implementability	Relative Cost	Screening Assessment
No Further Action							
	No Further Action; reliance on IRMs implemented to date	The "no action" technology does not include any engineering or institutional controls to mitigate exposure, or monitoring to assess ongoing contact with constituents of concern, and as such serves as a baseline for comparison to all other remedial technologies. Inclusion of this technology is required by the National Contingency Plan	None. Will not achieve RAOs.	N/A	N/A	N/A	Required by CERCLA for comparison
Institutional Controls							
	Deed Restrictions	Deed restrictions issued for property within potentially affected areas to restrict property use	None. Current potential for PCB migration persists; however, as an interim measure could be combined with other technologies to more effectively meet these RAOs (for example, capping, erosion controls).	Not Reliable.	High—Negotiations with potentially affected landowner(s) would be necessary.	Low	Retained for further evaluation with other GRAs.
	Access Restrictions (for example, security fencing, warning signs)	Security fences installed around potentially affected areas to limit access.	None. Current potential for PCB migration persists; however, could be combined with other technologies to more effectively meet these RAOs (for example, capping, erosion controls).	Not Reliable.	Low—fencing and signage currently in place. Further restrictions readily implementable. Restrictions for other properties require landowner agreement.	Low	Not retained given effectiveness and implementability.
Monitoring							
	Periodic Visual Observations and/or Field Sampling to Monitor Site Conditions	Monitoring involves the collection and analysis of site samples (sewer sediment) and/or performance of visual reconnaissance (inspections) to track site conditions.	None. Current potential for human exposure and future PCB migration persists; however, could be combined with other technologies to confirm stability of site exposure controls, source controls, and/or containment to more effectively meet the RAOs.	Monitoring techniques well established. Reliability subject to adequacy of supporting monitoring plans.	High—readily implementable. Experienced field personnel, sampling equipment, and supplies are readily available.	Moderately Low (depending on time period and intensity of monitoring activities)	Retained for further evaluation with other GRAs.

Table 3-4. Screening of Process Options—Sewers
Feasibility Study Report
Amcast Industrial Site, Cedarburg, Wisconsin

General Response Action/Remedial Technology	Process Option	Description	Effectiveness—Ability to Meet RAOs	Reliability	Implementability	Relative Cost	Screening Assessment
	Natural Processes	The effects of ongoing physical, biological, and chemical processes that reduce contaminant (PCB, PAH, SVOC, and VOC) exposure, toxicity, and mobility are monitored to verify decreasing concentration trends. The persistence and immobility of PCBs do not support natural degradation of PCBs.	None. Current potential for contaminant migration persists.	Monitoring techniques well established. Reliability subject to adequacy of supporting monitoring plans.	High—readily implementable. Experienced field personnel, sampling equipment, and supplies are readily available.	Moderately Low (depending on time period and intensity of monitoring activities)	Not retained. Not effective.
Containment							
Engineered Barrier	Shotcrete Lining	Shotcrete around the inside of the sewers, immobilizing PCB-contaminated sediment.	Effectively reduces potential for human and ecological exposure to PCB via direct contact.	Moderate. Will crack in time reducing long-term effectiveness.	High—experienced contractors and suitable lining materials are readily available.	Moderate	Retained for use in conjunction with other technologies, but not to be used as a standalone technology.
	Cure-in-Place Liners	Line the existing sewer pipes with cure-in-place epoxy liners, creating a barrier between the water in the pipes and impacted sediment.	Effectively reduces potential for human and ecological exposure to PCB via direct contact.	Does not cut off the transport of the contaminated sediment or affected stormwater through the sewer pipes	Moderate to High—experienced contractors and suitable lining materials are readily available.	Low to Moderate	Retained for use in conjunction with other technologies, but not to be used as a standalone technology.
	Polyethylene Liners	Line any new backfill and bedding to create a barrier between the new clean backfill around the pipe and impacted pipe backfill/adjacent soils.	Effectively reduces potential for human and ecological exposure to PCB via direct contact.	Does not cut off the transport of the contaminated sediment or affected stormwater through the sewer pipes	Moderate to High—experienced contractors and suitable lining materials are readily available.	Moderate to High	Retained for use in conjunction with other technologies, but not to be used as a standalone technology.
	Concrete Plugs	Place concrete plugs to segregate sections of the sewer line to collect PCB-impacted sediment. Requires re-routing stormwater.	Effectively reduces potential for human and ecological exposure to PCB via direct contact.	Reliable—prevents flow of PCB-contaminated stormwater.	High—experienced contractors and suitable lining materials are readily available.	Low	Retained for use in conjunction with other technologies, but not to be used as a standalone technology.
Removal							
Source Excavation	Excavation	Physical removal of solid media potentially contaminated by constituents of concern such as sediment and associated water in the pipe, pipe backfill, the surrounding soil and pipe materials. Requires re-routing stormwater and/or replacing sections of the sewers.	High—In combination with offsite transportation and disposal, removal of PCB-containing materials would effectively reduce potential for human exposure and PCB migration in the long-term.	High—excavation is a commonly implemented remedial technology.	High—experienced contractors and materials are readily available.	Low for Excavation High to Very High for Transportation and Disposal (see disposal technologies below)	Retained for further evaluation with other GRAs.

Table 3-4. Screening of Process Options—Sewers
Feasibility Study Report
Amcast Industrial Site, Cedarburg, Wisconsin

General Response Action/Remedial Technology	Process Option	Description	Effectiveness—Ability to Meet RAOs	Reliability	Implementability	Relative Cost	Screening Assessment
In Situ Treatment							
Cleaning	Power Washing	Power-wash the sewer pipes using high-pressured water and cleaning agents to remove impacted PCB material from within pipes. Sewers can be inspected to determine whether all associated piping/sumps have been fully cleaned. Use in conjunction with other technologies.	Moderate —In combination with offsite transportation and disposal, removal of PCB-containing materials from sewer lines would reduce potential for human exposure and PCB migration in the long-term. Does not address backfill material which could re-contaminate sewers	Moderate—residual contamination would re-enter sewer lines	Moderate to High—readily implementable.	Moderate to High—may require re-routing storm water	Retained for further evaluation with other GRAs.
Abandonment	Abandon-in-Place and Replace stormwater drainage system	Abandon sewers in place using common abandonment materials and reroute/replace the abandoned sections of storm water drainage via new infrastructure.	Moderate to High —New stormwater drainage system would convey clean water to and through Wilshire Pond. Abandonment in place does not address backfill material (in sewers to be abandoned) which could re-contaminate sewers	Moderate—residual contamination would remain adjacent to abandoned sewer lines	High—readily implementable.	High to Very High	Retained for further evaluation with other GRAs.
Disposal							
Offsite Disposal	Overland transport and offsite disposal of non-hazardous material at RCRA Subtitle D Solid Waste Landfill.	Disposal of non-TSCA level PCB-contaminated sediment from sewers in a solid waste landfill.	High—in combination with removal, offsite transportation and disposal of PCB-containing materials would effectively reduce potential for human exposure and PCB migration in the long-term.	High—offsite transportation and disposal is commonly implemented practice.	Moderately High—experienced contractors and materials are readily available. Timing of implementation is dependent upon proper project planning and availability of offsite disposal locations. External factors (for example, community concerns, traffic routes, trucking resources, offsite landfill capacity) may limit rate of disposal and increase overall duration of remedy implementation.	Moderate—Depends on material volumes.	Retained for further evaluation with other GRAs.
	Overland transport and offsite disposal of hazardous material at TSCA-Compliant Landfill or Resource Conservation and Recovery Act (RCRA) Subtitle C Landfill	Solid hazardous wastes (contaminated sediment from sewers) are permanently disposed of in a TSCA or RCRA-compliant landfill.	High—in combination with removal, offsite transportation and disposal of PCB-containing materials would effectively reduce potential for human exposure and PCB migration in the long-term.	High—offsite transportation and disposal is commonly implemented practice.	Moderately High—experienced contractors and materials are readily available. Timing of implementation is dependent upon proper project planning and availability of offsite disposal locations. External factors (for example, community concerns, traffic routes, trucking resources, offsite landfill capacity) may limit rate of disposal and increase overall duration of remedy implementation.	High to Very High—Depending on TSCA material volumes relative to total volume.	Retained for further evaluation with other GRAs.

Notes:

Shading denotes process options not retained for further consideration.

N/A = not applicable

GRAs = general response action

IRMs = interim remedial measures

PCBs = polychlorinated biphenyls

RAOs = remedial action objectives

RCRA = Resource Conservation and Recovery Act

TSCA = Toxic Substances Control Act

Table 3-5. Screening of Process Options—Groundwater
Feasibility Study Report
Amcast Industrial Site, Cedarburg, Wisconsin

General Response Action/Remedial Technology	Process Option	Description	Effectiveness—Ability to Meet RAOs	Reliability	Implementability	Relative Cost	Screening Assessment
No Further Action							
	No Further Action	The "no action" technology does not include any engineering or institutional controls to mitigate exposure, or monitoring to assess ongoing contact with constituents of concern, and as such serves as a baseline for comparison to all other remedial technologies. Inclusion of this technology is required by the National Contingency Plan.	None. Will not achieve RAOs.	N/A	N/A	N/A	Required by CERCLA for comparison.
Institutional Controls							
	Deed Restrictions	Deed restrictions issued for property within potentially affected areas to restrict groundwater use.	Low to Moderately effective in reducing direct human exposure to contaminated groundwater by informing property owners of potential risks associated with the property and limiting groundwater use. Low effectiveness in reducing ecological exposure.	Reliable with appropriate enforcement in place.	High—Negotiations with potentially affected landowner(s) would be necessary.	Low	Retained for further evaluation with other GRAs.
	Permits	Regulations promulgated to require a permit for various activities (i.e., well installations, etc.).	Low to Moderately effective in reducing direct human exposure to contaminated groundwater by informing property owners of potential risks associated with the property and limiting groundwater use. Low effectiveness in reducing ecological exposure.	Reliable with appropriate enforcement in place.	High	Low	Retained for further evaluation with other GRAs.
	Alternative Water Supply	Variety of alternate water supply methods used to replace contaminated water supply. Not applicable to Amcast site though because groundwater is not used as a water supply.	High	High	High	Moderate capital cost and High O&M costs.	Not retained. Not applicable. Drinking water is supplied by the City.
Monitoring							
	Periodic Visual Observations and/or Field Sampling to Monitor Site Conditions	Monitoring involves the collection and analysis of site groundwater samples and/or performance of visual reconnaissance (inspections) to track site conditions.	None. Current potential for human exposure and future PCB migration persists; however, could be combined with other technologies to confirm stability of site exposure controls, source controls, and/or containment to more effectively meet the RAOs.	Monitoring techniques well established. Reliability subject to adequacy of supporting monitoring plans.	High—readily implementable. Experienced field personnel, sampling equipment, and supplies are readily available.	Moderately Low (depending on time period and intensity of monitoring activities)	Retained for further evaluation with other GRAs.
	Monitored Natural Attenuation	The effects of ongoing physical, biological, and chemical processes that reduce contaminant (PCB, PAH, SVOC, and VOC) exposure, toxicity, and mobility are monitored to verify decreasing concentration trends.	None. Current potential for human exposure and future PCB migration persists; however, could be combined with other technologies to confirm stability of site exposure controls, source controls, and/or containment to more effectively meet the RAOs.	Monitoring techniques well established. Reliability subject to adequacy of supporting monitoring plans.	High—readily implementable. Experienced field personnel, sampling equipment, and supplies are readily available.	Moderately Low (depending on time period and intensity of monitoring activities)	Retained for further evaluation with other GRAs.

Table 3-5. Screening of Process Options—Groundwater
Feasibility Study Report
Amcast Industrial Site, Cedarburg, Wisconsin

General Response Action/Remedial Technology	Process Option	Description	Effectiveness—Ability to Meet RAOs	Reliability	Implementability	Relative Cost	Screening Assessment
Containment							
Engineered Barrier	Groundwater Extraction	Installation of extraction wells/trenches, slurry cut-off walls, sumps, or French drains for the collection of groundwater in an alignment designed to capture/contain affected water.	Not effective given low hydraulic permeability soils and low groundwater contaminant concentrations.	Low to Moderate	Implementable	High	Not retained given minimal effectiveness.
	Slurry Walls	Installation of a trench that surrounds an impacted area and is filled with a slurry of low-permeability material to provide a barrier to groundwater flow. Slurry walls are typically placed at depths up to 100 feet and are generally 2 to 4 feet in thickness.	Not effective given low hydraulic permeability soils and low groundwater contaminant concentrations.	Moderate	Implementable. This process has been successfully demonstrated full-scale.	High	Not retained given minimal effectiveness.
	Vibrating Beam Walls	A vibratory force advances steel beams into the ground. A relatively thin wall of cement or bentonite is injected as the beam is withdrawn.	Not effective given low hydraulic permeability soils and low groundwater contaminant concentrations.	Moderate	Not effective given low hydraulic permeability soils	High	Not retained given minimal effectiveness.
	Grout Curtain Walls	Grout is pressure-injected along contamination boundaries in a regular overlapping pattern of drilled holes.	Not effective given low hydraulic permeability soils and low groundwater contaminant concentrations.	Moderate	Implementable. Though not effective given low hydraulic permeability soils and sitewide low groundwater contaminant concentrations.	High	Not retained given minimal effectiveness.
	Permeability Reduction Agents	Cement grout or organic polymer is injected into the soil matrix to reduce permeability.	Not effective given low hydraulic permeability soils and low groundwater contaminant concentrations.	Moderate	Implementable; though ineffective given already low hydraulic permeability soils.	Moderate to High	Not retained given minimal effectiveness.
	Funnel and Gate	Use of an impermeable flow barrier to divert groundwater flow, may be combined with targeted groundwater removal or reactive gate.	Not effective given low hydraulic permeability soils and low groundwater contaminant concentrations.	Low	Implementable; though ineffective given already low hydraulic permeability soils.	Moderate to High	Not retained given minimal effectiveness.
Removal							
Groundwater Removal	Extraction Wells, Drains and Trenches	This process option includes installation of recovery wells/trenches or drains, and the collection of groundwater for further treatment, if necessary.	Not effective given low hydraulic permeability soils and low groundwater contaminant concentrations.	Low to Moderate	Implementable	High	Retained for further evaluation with other GRAs.

Table 3-5. Screening of Process Options—Groundwater
Feasibility Study Report
Amcast Industrial Site, Cedarburg, Wisconsin

General Response Action/Remedial Technology	Process Option	Description	Effectiveness—Ability to Meet RAOs	Reliability	Implementability	Relative Cost	Screening Assessment
In Situ Treatment							
Biological	Phytoremediation	Phytoremediation is a set of processes that uses plants to remove contaminants from the groundwater and transfer them to the biomass.	Low—does little to reduce potential for human and ecological exposure to PCB via direct contact or PCB migration via erosion or surface water runoff.	Moderate—Used in conjunction with monitoring. Would require treatability studies to determine whether site specific factors make it feasible.	Moderate	High	Not retained based on minimal effectiveness.
Disposal							
Offsite Water Disposal	Water Treatment and Discharge	Offsite treatment of groundwater through, air stripping, filtration, flocculation, gravity settling, oil & grease separation, and/or activated carbon prior to discharging directly to surface water, evaporation ponds, or discharging to a municipal sewer system.	Not effective for meeting RAOs as a stand-alone technology. Must be used with groundwater removal.	High—proven remedial technology	High—experienced contractors and equipment are readily available.	High to Very High	Retained for further evaluation with other GRAs.

Notes:

Shading denotes process options not retained for further consideration.

N/A = not applicable

GRA = general response action

IRM = interim remedial measure

PCB = polychlorinated biphenyl

RAO = remedial action objective

Table 5-1. Detailed Evaluation of Alternatives – Amcast North (Soil)
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	Alternative AMN-1 No Action	Alternative AMN-2 Excavation, Offsite Disposal, Backfill, and Site Restoration	Alternative AMN-3 Excavation, Backfill, Isolation Cover, and Site Restoration
1. Overall protection of human health and the environment	RAOs to reduce the potential for dermal contact or ingestion of PCB-contaminated soil not likely to be met within a reasonable timeframe.	Removal of contaminated soil eliminates the onsite risk to human health and the environment. Offsite disposal of contaminated soil is protective of human health and the environment.	Removal and capping of contaminated soil reduces the potential for dermal contact or ingestion of PCB-contaminated soil. Offsite disposal of contaminated soil is protective of human health and the environment.
2. Compliance with ARARs	No remedial action; therefore, not applicable.	Must meet substantive requirements for air pollution control using dust suppression. Final disposition of soil managed according to the requirements of TSCA and Wisconsin solid waste regulations.	Must meet substantive requirements for air pollution control using dust suppression. Final disposition of soil managed according to the requirements of TSCA and Wisconsin solid waste regulations.
3. Long-term Effectiveness and Permanence			
(a) Magnitude of residual risks	Unchanged from existing conditions.	Very low residual risks.	Soil with higher contaminant concentrations removed and exposure to contamination reduced in top 24 inches. Lower residual risks remain at depth in areas not excavated under cover.
(b) Adequacy and reliability of controls	Warnings regarding dermal contact or ingestion of PCB-contaminated soil can reduce, but not eliminate risks.	Not applicable.	Long-term maintenance and inspection of cover required for reliability. Limited control over disturbance of cover by humans or the environment.
4. Reduction of Toxicity, Mobility, and Volume			
(a) Treatment process used and materials treated	No remedial action; therefore, not applicable.	No treatment performed. Contaminated soil removed from site.	No treatment performed. Some contaminated soil removed from site with the remainder being capped.
(b) Amount of hazardous materials destroyed or treated	No remedial action; therefore, no material treated.	No hazardous material destroyed. Contaminated soil removed from site.	No hazardous material destroyed. Some contaminated soil removed from site with the remainder being capped.
(c) Degree of expected reductions in toxicity, mobility, and volume	No remedial action; therefore, no reduction.	No reductions would occur because no treatment would be performed, although mobility would be reduced through containment at an offsite disposal facility.	No reductions would occur because no treatment would be performed, although mobility would be reduced through capping.
(d) Degree to which treatment is irreversible	No remedial action; therefore, not applicable.	No treatment is performed, although the alternative is irreversible because contaminated soil is removed from site.	No treatment is performed. Alternative is somewhat reversible if the cover is damaged or removed.

Table 5-1. Detailed Evaluation of Alternatives – Amcast North (Soil)
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	Alternative AMN-1 No Action	Alternative AMN-2 Excavation, Offsite Disposal, Backfill, and Site Restoration	Alternative AMN-3 Excavation, Backfill, Isolation Cover, and Site Restoration
(e) Type and quantity of residuals remaining after treatment	No remedial action; therefore, not applicable.	Treatment is not performed, so treatment residuals are not generated. Contaminated soil is removed from site.	Treatment is not performed, so treatment residuals are not generated. Contaminated material would remain in place below cover.
(f) Statutory preference for treatment as principal element	No remedial action; therefore, not applicable.	No treatment is performed. Would not meet statutory preference for treatment as principal element.	No treatment is performed. Would not meet statutory preference for treatment as principal element.
5. Short-term Effectiveness			
(a) Protection of community during remedial action	No remedial action; therefore, not applicable.	Dust emissions can be controlled with air monitoring and engineering methods to protect the community. Decontamination of and covering trucks used to transport contaminated materials prevents the spread of contamination along haul routes.	Dust emissions can be controlled with air monitoring and engineering methods to protect the community. Decontamination of and covering trucks used to transport contaminated materials prevents the spread of contamination along haul routes.
(b) Protection of workers during remedial action	No remedial action; therefore, not applicable.	Excavation of soil may result in potential exposure of workers via direct contact. Proper health and safety procedures such as use of appropriate PPE, truck decontamination, and air monitoring procedures can reduce impacts to workers.	Placement of cover to follow appropriate construction procedures for safety. Excavation of soil may result in potential exposure of workers via direct contact. Proper health and safety procedures such as use of appropriate PPE, truck decontamination, and air monitoring procedures can reduce impacts to workers.
(c) Environmental impacts of remedial action	No remedial action; therefore, not applicable.	Impacts from excavation due to disturbance of ground surface.	Impacts from excavation due to disturbance of ground surface. Without removal of contaminated soil thickness equal to cover thickness, placement may increase site elevation and cause drainage problems.
(d) Time until RAOs are achieved	Significant period of time to achieve RAOs.	RAOs would generally be achieved after implementation of remedial action and ground surface restoration.	RAOs would generally be achieved after implementation of remedial action and ground surface restoration.

Table 5-1. Detailed Evaluation of Alternatives – Amcast North (Soil)
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	Alternative AMN-1 No Action	Alternative AMN-2 Excavation, Offsite Disposal, Backfill, and Site Restoration	Alternative AMN-3 Excavation, Backfill, Isolation Cover, and Site Restoration
6. Implementability			
(a) Ability to construct and operate the technology	No remedial action; therefore, not applicable.	No impediments.	No impediments.
(b) Reliability of the technology	No remedial action; therefore, not applicable.	Excavation of soil is very reliable.	Excavation of soil is very reliable. Long-term maintenance and inspection of cover required for reliability. May require replacement/repair if cover material is disturbed.
(c) Ease of undertaking additional remedial actions, if necessary	No remedial action; therefore, not applicable.	No impediments.	Isolation cover may impede additional remedial actions.
(d) Ability to monitor the effectiveness of remedy	No remedial action; therefore, not applicable.	No impediments.	Some impediments; vegetation over isolation cover will reduce the ease of monitoring the cover.
(e) Ability to obtain approvals from other agencies	No remedial action; therefore, not applicable.	No impediments.	Isolation cover may make agency approval more difficult.
(f) Coordination with other agencies	No remedial action; therefore, not applicable.	No impediments.	No impediments.
(g) Availability of offsite treatment, storage, and disposal services and capacity	No remedial action; therefore, not applicable.	No impediments; anticipated that local disposal facilities will have enough capacity for soil disposed offsite given volumes.	No impediments; anticipated that local disposal facilities will have enough capacity for soil disposed offsite given volumes.
(h) Availability of necessary equipment and specialists	No remedial action; therefore, not applicable.	No impediments; general contractors and standard construction techniques can be used to construct remedy.	No impediments; general contractors and standard construction techniques can be used to construct remedy.
(i) Availability of prospective technologies	No remedial action; therefore, not applicable.	No impediments; excavation and offsite disposal are well-developed technologies.	No impediments; excavation, offsite disposal, and isolation covers are well-developed technologies.
7. Cost			
(a) Capital Costs	$0	$2,297,000	$937,000
(b) Operating and Maintenance Costs	$0	$0	$486,000
(c) Periodic Costs	$0	$0	$100,000
(d) Present Worth Costs	$0	$2,297,000	$1,523,000
8. State Acceptance	Will be evaluated after receipt of comments from state agency.		
9. Community Acceptance	Will be evaluated after the public comment period.		

Notes:
PCB = polychlorinated biphenyl
RAO = Remedial Action Objective
TSCA = Toxic Substances Control Act

Table 5-2. Detailed Evaluation of Alternatives – Residential Yards (Soil)
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	Alternative RY-1 No Action	Alternative RY-2 Soil Excavation, Offsite Disposal, Backfill, and Site Restoration
1. Overall protection of human health and the environment	RAOs to reduce the potential for dermal contact or ingestion of PCB-contaminated soil not likely to be met within a reasonable timeframe.	Removal of contaminated soil eliminates the onsite risk to human health and the environment. Offsite disposal of contaminated soil is protective of human health and the environment.
2. Compliance with ARARs	No remedial action; therefore, not applicable.	Must meet substantive requirements for air pollution control using dust suppression. Final disposition of soil managed according to the requirements of TSCA and Wisconsin solid waste regulations.
3. Long-term Effectiveness and Permanence		
(a) Magnitude of residual risks	Unchanged from existing conditions.	Very low residual risks.
(b) Adequacy and reliability of controls	Warnings regarding dermal contact or ingestion of PCB-contaminated soil can reduce, but not eliminate risks.	Not applicable.
4. Reduction of Toxicity, Mobility, and Volume		
(a) Treatment process used and materials treated	No remedial action; therefore, not applicable.	No treatment performed. Contaminated soil removed from site.
(b) Amount of hazardous materials destroyed or treated	No remedial action; therefore, no material treated.	No hazardous material destroyed. Contaminated soil removed from site.
(c) Degree of expected reductions in toxicity, mobility, and volume	No remedial action; therefore, no reduction.	No reductions would occur because no treatment would be performed, although mobility would be reduced through containment at an offsite disposal facility.
(d) Degree to which treatment is irreversible	No remedial action; therefore, not applicable.	No treatment is performed, although the alternative is irreversible because contaminated soil is removed from site.
(e) Type and quantity of residuals remaining after treatment	No remedial action; therefore, not applicable.	Treatment is not performed, so treatment residuals are not generated. Contaminated soil is removed from site.
(f) Statutory preference for treatment as principal element	No remedial action; therefore, not applicable.	No treatment is performed. Would not meet statutory preference for treatment as principal element.
5. Short-term Effectiveness		
(a) Protection of community during remedial action	No remedial action; therefore, not applicable.	Dust emissions can be controlled with air monitoring and engineering methods to protect the community. Decontamination of and covering trucks used to transport contaminated materials prevents the spread of contamination along haul routes.

Table 5-2. Detailed Evaluation of Alternatives – Residential Yards (Soil)
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	Alternative RY-1 No Action	Alternative RY-2 Soil Excavation, Offsite Disposal, Backfill, and Site Restoration
(b) Protection of workers during remedial action	No remedial action; therefore, not applicable.	Excavation of soil may result in potential exposure of workers via direct contact. Proper health and safety procedures such as use of appropriate PPE, truck decontamination, and air monitoring procedures can reduce impacts to workers.
(c) Environmental impacts of remedial action	No remedial action; therefore, not applicable.	Impacts from excavation due to disturbance of habitats.
(d) Time until RAOs are achieved	Significant period of time to achieve RAOs.	RAOs would generally be achieved after implementation of remedial action and habitat restoration.
6. Implementability		
(a) Ability to construct and operate the technology	No remedial action; therefore, not applicable.	No impediments.
(b) Reliability of the technology	No remedial action; therefore, not applicable.	Excavation of soil is very reliable.
(c) Ease of undertaking additional remedial actions, if necessary	No remedial action; therefore, not applicable.	No impediments.
(d) Ability to monitor the effectiveness of remedy	No remedial action; therefore, not applicable.	No impediments.
(e) Ability to obtain approvals from other agencies	No remedial action; therefore, not applicable.	No impediments.
(f) Coordination with other agencies	No remedial action; therefore, not applicable.	No impediments.
(g) Availability of offsite treatment, storage, and disposal services and capacity	No remedial action; therefore, not applicable.	No impediments; anticipated that local disposal facilities will have enough capacity for soil disposed offsite given volumes.
(h) Availability of necessary equipment and specialists	No remedial action; therefore, not applicable.	No impediments; general contractors and standard construction techniques can be used to construct remedy.
(i) Availability of prospective technologies	No remedial action; therefore, not applicable.	No impediments; excavation and offsite disposal are well-developed technologies.

Table 5-2. Detailed Evaluation of Alternatives – Residential Yards (Soil)
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	**Alternative RY-1 No Action**	**Alternative RY-2 Soil Excavation, Offsite Disposal, Backfill, and Site Restoration**
7. Cost		
(a) Capital Costs	$0	$2,375,000
(b) Operating and Maintenance Costs	$0	$0
(c) Periodic Costs	$0	$0
(d) Present Worth Costs	$0	$2,375,000
8. State Acceptance	Will be evaluated after receipt of comments from state agency.	
9. Community Acceptance	Will be evaluated after the public comment period.	

Notes:
PCB = polychlorinated biphenyl
RAO = Remedial Action Objective
TSCA = Toxic Substances Control Act

Table 5-3. Detailed Evaluation of Alternatives – Wilshire Pond (Sediment/Bank Soil)
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	Alternative WP-1 No Action	Alternative WP-2 Sediment and Bank Soil Excavation, Offsite Disposal, Backfill, and Site Restoration	Alternative WP-3 Sediment, Bank Soil and Structural Excavation, Offsite Disposal, Backfill, and Site Restoration
1. Overall protection of human health and the environment	RAOs to reduce the potential accumulation of PCBs in fish/frog tissue and potential for dermal contact or ingestion of PCB-contaminated sediment and soil not likely to be met within a reasonable timeframe.	Removal of contaminated sediment and soil eliminates the onsite risk to human health and the environment. Offsite disposal of contaminated sediment is protective of human health and the environment.	Removal of contaminated sediment and soil eliminates the onsite risk to human health and the environment. Offsite disposal of contaminated sediment is protective of human health and the environment.
2. Compliance with ARARs	No remedial action; therefore, not applicable.	Must meet substantive requirements for air pollution control using dust suppression. Final disposition of sediment and soil managed according to the requirements of TSCA and Wisconsin solid waste regulations.	Must meet substantive requirements for air pollution control using dust suppression. Final disposition of sediment and soil managed according to the requirements of TSCA and Wisconsin solid waste regulations.
3. Long-term Effectiveness and Permanence			
(a) Magnitude of residual risks	Unchanged from existing conditions.	Very low residual risks.	Very low residual risks.
(b) Adequacy and reliability of controls	Fish consumption advisories and warnings regarding dermal contact or ingestion of PCB contaminated sediment or soil can reduce, but not eliminate risks.	Not applicable.	Not applicable.
4. Reduction of Toxicity, Mobility, and Volume			
(a) Treatment process used and materials treated	No remedial action; therefore, not applicable.	No treatment performed. Contaminated soil removed from site.	No treatment performed. Contaminated soil removed from site.
(b) Amount of hazardous materials destroyed or treated	No remedial action; therefore, no material treated.	No hazardous material destroyed. Contaminated soil removed from site.	No hazardous material destroyed. Contaminated soil removed from site.
(c) Degree of expected reductions in toxicity, mobility, and volume	No remedial action; therefore, no reduction.	No reductions would occur because no treatment would be performed, although mobility would be reduced through containment at an offsite disposal facility.	No reductions would occur because no treatment would be performed, although mobility would be reduced through containment at an offsite disposal facility.

Alternative Description: Criterion	Alternative WP-1 No Action	Alternative WP-2 Sediment and Bank Soil Excavation, Offsite Disposal, Backfill, and Site Restoration	Alternative WP-3 Sediment, Bank Soil and Structural Excavation, Offsite Disposal, Backfill, and Site Restoration
(d) Degree to which treatment is irreversible	No remedial action; therefore, not applicable.	No treatment is performed, although the alternative is irreversible because contaminated soil is removed from site.	No treatment is performed, although the alternative is irreversible because contaminated soil is removed from site.
(e) Type and quantity of residuals remaining after treatment	No remedial action; therefore, not applicable.	Treatment is not performed, so treatment residuals are not generated. Contaminated soil is removed from site.	Treatment is not performed, so treatment residuals are not generated. Contaminated soil is removed from site.
(f) Statutory preference for treatment as principal element	No remedial action; therefore, not applicable.	No treatment is performed. Would not meet statutory preference for treatment as principal element.	No treatment is performed. Would not meet statutory preference for treatment as principal element.
5. Short-term Effectiveness			
(a) Protection of community during remedial action	No remedial action; therefore, not applicable.	Dust emissions can be controlled with air monitoring and engineering methods to protect the community. Decontamination of and covering trucks used to transport contaminated materials prevents the spread of contamination along haul routes.	Dust emissions can be controlled with air monitoring and engineering methods to protect the community. Decontamination of and covering trucks used to transport contaminated materials prevents the spread of contamination along haul routes.
(b) Protection of workers during remedial action	No remedial action; therefore, not applicable.	Excavation of sediment and soil may result in potential exposure of workers via direct contact. Proper health and safety procedures such as use of appropriate PPE, truck decontamination, and air monitoring procedures can reduce impacts to workers.	Excavation of sediment and soil may result in potential exposure of workers via direct contact. Proper health and safety procedures such as use of appropriate PPE, truck decontamination, and air monitoring procedures can reduce impacts to workers.
(c) Environmental impacts of remedial action	No remedial action; therefore, not applicable.	Impacts from excavation due to disturbance of habitats.	Impacts from excavation due to disturbance of habitats.
(d) Time until RAOs are achieved	Significant period of time to achieve RAOs.	RAOs would generally be achieved after implementation of remedial action and habitat restoration, though a decrease in the fish tissue PCB concentrations may only occur over a period of time.	RAOs would generally be achieved after implementation of remedial action and habitat restoration, though a decrease in the fish tissue PCB concentrations may only occur over a period of time.
6. Implementability			
(a) Ability to construct and operate the technology	No remedial action; therefore, not applicable.	No impediments.	No impediments.

Table 5-3. Detailed Evaluation of Alternatives – Wilshire Pond (Sediment/Bank Soil)
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	**Alternative WP-1 No Action**	**Alternative WP-2 Sediment and Bank Soil Excavation, Offsite Disposal, Backfill, and Site Restoration**	**Alternative WP-3 Sediment, Bank Soil and Structural Excavation, Offsite Disposal, Backfill, and Site Restoration**
(b) Reliability of the technology	No remedial action; therefore, not applicable.	Excavation of sediment and soil is very reliable.	Excavation of sediment and soil is very reliable.
(c) Ease of undertaking additional remedial actions, if necessary	No remedial action; therefore, not applicable.	No impediments.	No impediments.
(d) Ability to monitor the effectiveness of remedy	No remedial action; therefore, not applicable.	No impediments.	No impediments.
(e) Ability to obtain approvals from other agencies	No remedial action; therefore, not applicable.	No impediments.	No impediments.
(f) Coordination with other agencies	No remedial action; therefore, not applicable.	No impediments.	No impediments.
(g) Availability of offsite treatment, storage, and disposal services and capacity	No remedial action; therefore, not applicable.	No impediments; anticipated that local disposal facilities will have enough capacity for soil disposed offsite given volumes.	No impediments; anticipated that local disposal facilities will have enough capacity for soil disposed offsite given volumes.
(h) Availability of necessary equipment and specialists	No remedial action; therefore, not applicable.	No impediments; general contractors and standard construction techniques can be used to construct remedy.	No impediments; general contractors and standard construction techniques can be used to construct remedy.
(i) Availability of prospective technologies	No remedial action; therefore, not applicable.	No impediments; excavation and offsite disposal are well-developed technologies.	No impediments; excavation and offsite disposal are well-developed technologies.
7. Cost			
(a) Capital Costs	$0	$1,327,000	$1,536,000
(b) Operating and Maintenance Costs	$0	$0	$0
(c) Periodic Costs	$0	$0	$0
(d) Present Worth Costs	$0	$1,327,000	$1,536,000
8. State Acceptance	Will be evaluated after receipt of comments from state agency.		
9. Community Acceptance	Will be evaluated after the public comment period.		

Notes:
PCB = polychlorinated biphenyl
RAO = Remedial Action Objective
TSCA = Toxic Substances Control Act

Table 5-4. Detailed Evaluation of Alternatives – Amcast South (Soil)
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	Alternative AMS-1 No Action	Alternative AMS-2 Excavation, Offsite Disposal, Backfill, and Site Restoration	Alternative AMS-3 Isolation Cover and Site Restoration
1. Overall protection of human health and the environment	RAOs to reduce the potential for dermal contact or ingestion of PCB-contaminated soil not likely to be met within a reasonable timeframe.	Removal of contaminated soil eliminates the onsite risk to human health and the environment. Offsite disposal of contaminated soil is protective of human health and the environment.	Removal and capping of contaminated soil reduces the potential for dermal contact or ingestion of PCB-contaminated soil. Offsite disposal of contaminated soil is protective of human health and the environment.
2. Compliance with ARARs	No remedial action; therefore, not applicable.	Must meet substantive requirements for air pollution control using dust suppression. Final disposition of soil managed according to the requirements of TSCA and Wisconsin solid waste regulations.	Must meet substantive requirements for air pollution control using dust suppression. Final disposition of soil managed according to the requirements of TSCA and Wisconsin solid waste regulations.
3. Long-term Effectiveness and Permanence			
(a) Magnitude of residual risks	Unchanged from existing conditions.	Very low residual risks.	Soil with higher contaminant concentrations removed and exposure to contamination reduced in top 24 inches. Lower residual risks remain in areas not excavated under cover at depth.
(b) Adequacy and reliability of controls	Warnings regarding dermal contact or ingestion of PCB-contaminated soil can reduce, but not eliminate risks.	Not applicable.	Long-term maintenance and inspection of cover required for reliability. Limited control over disturbance of cover by humans or the environment.
4. Reduction of Toxicity, Mobility, and Volume			
(a) Treatment process used and materials treated	No remedial action; therefore, not applicable.	No treatment performed. Contaminated soil removed from site.	No treatment performed. Some contaminated soil removed from site with the remainder being capped.
(b) Amount of hazardous materials destroyed or treated	No remedial action; therefore, no material treated.	No hazardous material destroyed. Contaminated soil removed from site.	No hazardous material destroyed. Some contaminated soil removed from site with the remainder being capped.
(c) Degree of expected reductions in toxicity, mobility, and volume	No remedial action; therefore, no reduction.	No reductions would occur because no treatment would be performed, although mobility would be reduced through containment at an offsite disposal facility.	No reductions would occur because no treatment would be performed, although mobility would be reduced through capping.
(d) Degree to which treatment is irreversible	No remedial action; therefore, not applicable.	No treatment is performed, although the alternative is irreversible because contaminated soil is removed from site.	No treatment is performed. Alternative is somewhat reversible if the cover is damaged or removed.

Table 5-4. Detailed Evaluation of Alternatives – Amcast South (Soil)
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	Alternative AMS-1 No Action	Alternative AMS-2 Excavation, Offsite Disposal, Backfill, and Site Restoration	Alternative AMS-3 Isolation Cover and Site Restoration
(e) Type and quantity of residuals remaining after treatment	No remedial action; therefore, not applicable.	Treatment is not performed, so treatment residuals are not generated. Contaminated soil is removed from site.	Treatment is not performed, so treatment residuals are not generated. Contaminated material would remain in place below cover.
(f) Statutory preference for treatment as principal element	No remedial action; therefore, not applicable.	No treatment is performed. Would not meet statutory preference for treatment as principal element.	No treatment is performed. Would not meet statutory preference for treatment as principal element.
5. Short-term Effectiveness			
(a) Protection of community during remedial action	No remedial action; therefore, not applicable.	Dust emissions can be controlled with air monitoring and engineering methods to protect the community. Decontamination of and covering trucks used to transport contaminated materials prevents the spread of contamination along haul routes.	Dust emissions can be controlled with air monitoring and engineering methods to protect the community. Decontamination of and covering trucks used to transport contaminated materials prevents the spread of contamination along haul routes.
(b) Protection of workers during remedial action	No remedial action; therefore, not applicable.	Excavation of soil may result in potential exposure of workers via direct contact. Proper health and safety procedures such as use of appropriate PPE, truck decontamination, and air monitoring procedures can reduce impacts to workers.	Placement of cover to follow appropriate construction procedures for safety. Excavation of soil may result in potential exposure of workers via direct contact. Proper health and safety procedures such as use of appropriate PPE, truck decontamination, and air monitoring procedures can reduce impacts to workers.
(c) Environmental impacts of remedial action	No remedial action; therefore, not applicable.	Impacts from excavation due to disturbance of ground surface.	Impacts from excavation due to disturbance of ground surface. Without removal of contaminated soil thickness equal to cover thickness, placement may increase site elevation and cause drainage problems.
(d) Time until RAOs are achieved	Significant period of time to achieve RAOs.	RAOs would generally be achieved after implementation of remedial action and ground surface restoration.	RAOs would generally be achieved after implementation of remedial action and ground surface restoration.
6. Implementability			
(a) Ability to construct and operate the technology	No remedial action; therefore, not applicable.	No impediments.	No impediments.
(b) Reliability of the technology	No remedial action; therefore, not applicable.	Excavation of soil is very reliable	Excavation of soil is very reliable. Long-term maintenance and inspection of cover required for reliability. May require replacement/repair if material is disturbed.

Table 5-4. Detailed Evaluation of Alternatives – Amcast South (Soil)
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	**Alternative AMS-1 No Action**	**Alternative AMS-2 Excavation, Offsite Disposal, Backfill, and Site Restoration**	**Alternative AMS-3 Isolation Cover and Site Restoration**
(c) Ease of undertaking additional remedial actions, if necessary	No remedial action; therefore, not applicable.	No impediments.	Isolation cover may impede additional remedial actions.
(d) Ability to monitor the effectiveness of remedy	No remedial action; therefore, not applicable.	No impediments.	Some impediments; vegetation over isolation cover will reduce the ease of monitoring the cover.
(e) Ability to obtain approvals from other agencies	No remedial action; therefore, not applicable.	No impediments.	Isolation cover may make agency approval more difficult.
(f) Coordination with other agencies	No remedial action; therefore, not applicable.	No impediments.	No impediments.
(g) Availability of offsite treatment, storage, and disposal services and capacity	No remedial action; therefore, not applicable.	No impediments; anticipated that local disposal facilities will have enough capacity for soil disposed offsite given volumes.	No impediments; anticipated that local disposal facilities will have enough capacity for soil disposed offsite given volumes.
(h) Availability of necessary equipment and specialists	No remedial action; therefore, not applicable.	No impediments; general contractors and standard construction techniques can be used to construct remedy.	No impediments; general contractors and standard construction techniques can be used to construct remedy.
(i) Availability of prospective technologies	No remedial action; therefore, not applicable.	No impediments; excavation and offsite disposal are well-developed technologies.	No impediments; excavation, offsite disposal, and isolation covers are well-developed technologies.
7. Cost			
(a) Capital Costs	$0	$6,678,000	$3,475,000
(b) Operating and Maintenance Costs	$0	$0	$716,000
(c) Periodic Costs	$0	$0	$100,000
(d) Present Worth Costs	$0	$6,678,000	$4,292,000
8. State Acceptance	Will be evaluated after receipt of comments from state agency.		
9. Community Acceptance	Will be evaluated after the public comment period.		

Notes:
PCB = polychlorinated biphenyl
RAO = Remedial Action Objective
TSCA = Toxic Substances Control Act

Table 5-5. Detailed Evaluation of Alternatives – Quarry Pond (Sediment)
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	**Alternative QP-1 No Action**	**Alternative QP-2 Sediment Dredging, Bank Soil Excavation, Offsite Disposal, and Site Restoration**	**Alternative QP-3 Construct Permeable Reactive Barrier To Isolate Contaminated Sediment, Excavate Bank Soil, Offsite Disposal, and Site Restoration**	**Alternative QP-4 Sediment Dredging to 1 mg/kg PCBs, Bank Soil Excavation, Offsite Disposal, and Site Restoration**
1. Overall protection of human health and the environment	RAOs to reduce the potential ingestion of PCBs through fish tissue and potential for dermal contact or ingestion of PCB-contaminated sediment not likely to be met within a reasonable timeframe.	Removal of contaminated sediment and soil eliminates the onsite risk to human health and the environment. Offsite disposal of contaminated sediment is protective of human health and the environment.	Removal of bank soil and capping of contaminated sediments reduces the PCBs available to bioaccumulate in fish and reduces potential for dermal contact or ingestion of PCB-contaminated sediment. Offsite disposal of contaminated sediment and soil is protective of human health and the environment.	Removal of contaminated sediment and soil eliminates the onsite risk to human health and the environment. Offsite disposal of contaminated sediment is protective of human health and the environment.
2. Compliance with ARARs	No remedial action; therefore, not applicable.	Must meet substantive requirements for air pollution control using dust suppression. Final disposition of sediment and soil managed according to the requirements of TSCA and Wisconsin solid waste regulations.	Must meet substantive requirements for air pollution control using dust suppression. Requires proper protection of streams during construction.	Must meet substantive requirements for air pollution control using dust suppression. Final disposition of sediment and soil managed according to the requirements of TSCA and Wisconsin solid waste regulations.
3. Long-term Effectiveness and Permanence				
(a) Magnitude of residual risks	Unchanged from existing conditions.	Very low residual risks.	Residual risks remain under cover.	Very low residual risks.
(b) Adequacy and reliability of controls	Fish consumption advisories and warnings regarding dermal contact or ingestion of PCB-contaminated sediment can reduce, but not eliminate risks.	Not applicable.	Long-term maintenance and monitoring of cover required for reliability and adequacy. Limited potential disturbance of cover by humans or the environment due to armor layer; however, possibility remains.	Not applicable.

Table 5-5. Detailed Evaluation of Alternatives – Quarry Pond (Sediment)
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	**Alternative QP-1 No Action**	**Alternative QP-2 Sediment Dredging, Bank Soil Excavation, Offsite Disposal, and Site Restoration**	**Alternative QP-3 Construct Permeable Reactive Barrier To Isolate Contaminated Sediment, Excavate Bank Soil, Offsite Disposal, and Site Restoration**	**Alternative QP-4 Sediment Dredging to 1 mg/kg PCBs, Bank Soil Excavation, Offsite Disposal, and Site Restoration**
4. Reduction of Toxicity, Mobility, and Volume				
(a) Treatment process used and materials treated	No remedial action; therefore, not applicable.	No treatment performed. Contaminated sediment removed from site.	Contaminated sediment will be treated with a permeable reactive barrier.	No treatment performed. Contaminated sediment removed from site.
(b) Amount of hazardous materials destroyed or treated	No remedial action; therefore, no material treated.	No hazardous material destroyed. Contaminated sediment removed from site.	A permeable reactive barrier will be used to treat hazardous materials. No hazardous material destroyed.	No hazardous material destroyed. Contaminated sediment removed from site.
(c) Degree of expected reductions in toxicity, mobility, and volume	No remedial action; therefore, no reduction.	No reductions would occur because no treatment would be performed, although mobility would be reduced through containment at an offsite disposal facility.	Reductions would occur because treatment would be performed. Mobility would be reduced through capping.	No reductions would occur because no treatment would be performed, although mobility would be reduced through containment at an offsite disposal facility.
(d) Degree to which treatment is irreversible	No remedial action; therefore, not applicable.	No treatment is performed, although the alternative is irreversible because contaminated sediment is removed from site.	Alternative is somewhat reversible if the cover is damaged or removed.	No treatment is performed, although the alternative is irreversible because contaminated sediment is removed from site.
(e) Type and quantity of residuals remaining after treatment	No remedial action; therefore, not applicable.	Treatment is not performed, so treatment residuals are not generated. Contaminated sediment is removed from site.	Treatment is performed, so treatment residuals may be generated. Contaminated material would remain in place below cover.	Treatment is not performed, so treatment residuals are not generated. Contaminated sediment is removed from site.
(f) Statutory preference for treatment as principal element	No remedial action; therefore, not applicable.	No treatment is performed. Would not meet statutory preference for treatment as principal element.	Treatment is performed via permeable reactive barrier. Would meet statutory preference for treatment as principal element.	No treatment is performed. Would not meet statutory preference for treatment as principal element.

Table 5-5. Detailed Evaluation of Alternatives – Quarry Pond (Sediment)
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	**Alternative QP-1 No Action**	**Alternative QP-2 Sediment Dredging, Bank Soil Excavation, Offsite Disposal, and Site Restoration**	**Alternative QP-3 Construct Permeable Reactive Barrier To Isolate Contaminated Sediment, Excavate Bank Soil, Offsite Disposal, and Site Restoration**	**Alternative QP-4 Sediment Dredging to 1 mg/kg PCBs, Bank Soil Excavation, Offsite Disposal, and Site Restoration**
5. Short-term Effectiveness				
(a) Protection of community during remedial action	No remedial action; therefore, not applicable.	Dust emissions can be controlled with air monitoring and engineering methods to protect the community. Decontamination of and covering trucks used to transport contaminated materials prevents the spread of contamination along haul routes.	Dust emissions can be controlled with air monitoring and engineering methods to protect the community. Decontamination of and covering trucks used to transport contaminated materials prevents the spread of contamination along haul routes.	Dust emissions can be controlled with air monitoring and engineering methods to protect the community. Decontamination of and covering trucks used to transport contaminated materials prevents the spread of contamination along haul routes.
(b) Protection of workers during remedial action	No remedial action; therefore, not applicable.	Dredging of sediment and excavation of soil may result in potential exposure of workers via direct contact. Proper health and safety procedures such as use of appropriate PPE, truck decontamination, and air monitoring procedures can reduce impacts to workers.	Placement of cover to follow appropriate construction procedures for safety. Excavation of sediment and soil may result in potential exposure of workers via direct contact. Proper health and safety procedures such as use of appropriate PPE, truck decontamination, and air monitoring procedures can reduce impacts to workers.	Dredging of sediment and excavation of soil may result in potential exposure of workers via direct contact. Proper health and safety procedures such as use of appropriate PPE, truck decontamination, and air monitoring procedures can reduce impacts to workers.
(c) Environmental impacts of remedial action	No remedial action; therefore, not applicable.	Impacts from dredging and excavation due to disturbance of habitats.	Impacts from dredging and excavation due to disturbance of habitats. Cover delivery methods can disturb and re-suspend contaminated sediment. Without removal of contaminated sediment thickness equal to cover thickness, placement will decrease pond storage.	Impacts from dredging and excavation due to disturbance of habitats.

Table 5-5. Detailed Evaluation of Alternatives – Quarry Pond (Sediment)
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	**Alternative QP-1 No Action**	**Alternative QP-2 Sediment Dredging, Bank Soil Excavation, Offsite Disposal, and Site Restoration**	**Alternative QP-3 Construct Permeable Reactive Barrier To Isolate Contaminated Sediment, Excavate Bank Soil, Offsite Disposal, and Site Restoration**	**Alternative QP-4 Sediment Dredging to 1 mg/kg PCBs, Bank Soil Excavation, Offsite Disposal, and Site Restoration**
(d) Time until RAOs are achieved	Significant period of time to achieve RAOs.	RAOs would generally be achieved after implementation of remedial action and habitat restoration, though a decrease in the fish tissue PCB concentrations may only occur over a period of time.	RAOs would generally be achieved after implementation of remedial action and habitat restoration, though a decrease in the fish tissue PCB concentrations may only occur over a period of time.	RAOs would generally be achieved after implementation of remedial action and habitat restoration, though a decrease in the fish tissue PCB concentrations may only occur over a period of time.
6. Implementability				
(a) Ability to construct and operate the technology	No remedial action; therefore, not applicable.	No impediments.	Difficult in areas of shallow water depth. Limited methods of installation. Difficult to achieve consistent thickness of cover in deeper conditions.	No impediments.
(b) Reliability of the technology	No remedial action; therefore, not applicable.	Excavation of sediment and soil is very reliable	Long-term maintenance and inspection of cover required for reliability. May require replacement/repair if material is disturbed.	Excavation of sediment and soil is very reliable
(c) Ease of undertaking additional remedial actions, if necessary	No remedial action; therefore, not applicable.	No impediments.	Additional remedial actions will need to take into account the permeable reactive barrier.	No impediments.
(d) Ability to monitor the effectiveness of remedy	No remedial action; therefore, not applicable.	Depth of water may make monitoring difficult.	Difficult to measure consistent thickness of cover in deeper areas of pond. Depth of water may make monitoring difficult.	Depth of water may make monitoring difficult.

Table 5-5. Detailed Evaluation of Alternatives – Quarry Pond (Sediment)

Feasibility Study Report

Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	**Alternative QP-1 No Action**	**Alternative QP-2 Sediment Dredging, Bank Soil Excavation, Offsite Disposal, and Site Restoration**	**Alternative QP-3 Construct Permeable Reactive Barrier To Isolate Contaminated Sediment, Excavate Bank Soil, Offsite Disposal, and Site Restoration**	**Alternative QP-4 Sediment Dredging to 1 mg/kg PCBs, Bank Soil Excavation, Offsite Disposal, and Site Restoration**
(e) Ability to obtain approvals from other agencies	No remedial action; therefore, not applicable.	No impediments.	Permeable reactive barrier may be difficult to obtain approvals.	No impediments.
(f) Coordination with other agencies	No remedial action; therefore, not applicable.	No impediments.	No impediments.	No impediments.
(g) Availability of offsite treatment, storage, and disposal services and capacity	No remedial action; therefore, not applicable.	No impediments; anticipated that local disposal facilities will have enough capacity for sediment and soil disposed offsite given volumes.	No impediments; anticipated that local disposal facilities will have enough capacity for soil disposed offsite given volumes.	No impediments; anticipated that local disposal facilities will have enough capacity for sediment and soil disposed offsite given volumes.
(h) Availability of necessary equipment and specialists	No remedial action; therefore, not applicable.	No impediments; general contractors and standard construction techniques can be used to construct remedy.	Methods of placement limited in shallow water depth.	No impediments; general contractors and standard construction techniques can be used to construct remedy.
(i) Availability of prospective technologies	No remedial action; therefore, not applicable.	No impediments; excavation and offsite disposal are well-developed technologies.	Permeable reactive barrier technology is newer but available.	No impediments; excavation and offsite disposal are well-developed technologies.
7. Cost				
(a) Capital Costs	$0	$6,184,000	$4,400,000	$7,462,000
(b) Operating and Maintenance Costs	$0	$0	$1,795,000	$0
(c) Periodic Costs	$0	$0	$0	$0
(d) Present Worth Costs	$0	$6,184,000	$6,194,000	$7,462,000

Table 5-5. Detailed Evaluation of Alternatives – Quarry Pond (Sediment)
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	**Alternative QP-1 No Action**	**Alternative QP-2 Sediment Dredging, Bank Soil Excavation, Offsite Disposal, and Site Restoration**	**Alternative QP-3 Construct Permeable Reactive Barrier To Isolate Contaminated Sediment, Excavate Bank Soil, Offsite Disposal, and Site Restoration**	**Alternative QP-4 Sediment Dredging to 1 mg/kg PCBs, Bank Soil Excavation, Offsite Disposal, and Site Restoration**
8. State Acceptance	Will be evaluated after receipt of comments from state agency			
9. Community Acceptance	Will be evaluated after the public comment period			

Notes:
PCB = polychlorinated biphenyl
RAO = Remedial Action Objective
TSCA = Toxic Substances Control Act

Table 5-6. Detailed Evaluation of Alternatives – Groundwater
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	Alternative GW-1 No Action	Alternative GW-2 Groundwater Monitoring and Institutional Controls
1. Overall protection of human health and the environment	RAOs to reduce the potential for dermal contact, ingestions and inhalation exposures to COCs in tapwater for residents and industrial workers not likely to be met within a reasonable timeframe.	RAOs to reduce the potential for dermal contact, ingestion and inhalation exposures to COCs in tapwater by residents and industrial workers not likely to be met within a reasonable timeframe.
2. Compliance with ARARs	No remedial action; therefore, not applicable.	ARARs would be met using institutional controls for groundwater use.
3. Long-term Effectiveness and Permanence		
(a) Magnitude of residual risks	Unchanged from existing conditions.	Unchanged from existing conditions.
(b) Adequacy and reliability of controls	Advisories and warnings regarding dermal contact or ingestion of PCB-contaminated groundwater can reduce, but not eliminate risks.	Advisories and warnings regarding dermal contact or ingestion of PCB-contaminated groundwater can reduce, but not eliminate risks.
4. Reduction of Toxicity, Mobility, and Volume		
(a) Treatment process used and materials treated	No remedial action; therefore, not applicable.	No treatment performed. Alternative relies on natural degradation of PCBs.
(b) Amount of hazardous materials destroyed or treated	No remedial action; therefore, no material treated.	No hazardous material destroyed. Alternative relies on natural degradation of PCBs.
(c) Degree of expected reductions in toxicity, mobility, and volume	No remedial action; therefore, no reduction.	No reductions would occur because no treatment would be performed other than natural degradation of PCBs.
(d) Degree to which treatment is irreversible	No remedial action; therefore, not applicable.	Slightly irreversible as groundwater monitoring can be stopped and institutional controls can be removed.
(e) Type and quantity of residuals remaining after treatment	No remedial action; therefore, not applicable.	No treatment performed. Alternative relies on natural degradation of PCBs.
(f) Statutory preference for treatment as principal element	No remedial action; therefore, not applicable.	No treatment is performed. Would not meet statutory preference for treatment as principal element.
5. Short-term Effectiveness		
(a) Protection of community during remedial action	No remedial action; therefore, not applicable.	No impact to community during remedial action.
(b) Protection of workers during remedial action	No remedial action; therefore, not applicable.	Limited potential exposure to workers installing new monitoring wells and groundwater sampling during remedial action.
(c) Environmental impacts of remedial action.	No remedial action; therefore, not applicable.	No impact to environment during remedial action.

Table 5-6. Detailed Evaluation of Alternatives – Groundwater
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	**Alternative GW-1 No Action**	**Alternative GW-2 Groundwater Monitoring and Institutional Controls**
(d) Time until RAOs are achieved	Significant period of time to achieve RAOs.	Significant period of time to achieve RAOs.
6. Implementability		
(a) Ability to construct and operate the technology	No remedial action; therefore, not applicable.	No impediments.
(b) Reliability of the technology	No remedial action; therefore, not applicable.	No impediments.
(c) Ease of undertaking additional remedial actions, if necessary	No remedial action; therefore, not applicable.	No impediments.
(d) Ability to monitor the effectiveness of remedy	No remedial action; therefore, not applicable.	No impediments.
(e) Ability to obtain approvals from other agencies	No remedial action; therefore, not applicable.	No impediments.
(f) Coordination with other agencies	No remedial action; therefore, not applicable.	No impediments.
(g) Availability of offsite treatment, storage, and disposal services and capacity	No remedial action; therefore, not applicable.	No impediments; anticipated that local disposal facilities will have enough capacity for water disposed offsite given volumes.
(h) Availability of necessary equipment and specialists	No remedial action; therefore, not applicable.	No impediments.
(i) Availability of prospective technologies	No remedial action; therefore, not applicable.	No impediments.
7. Cost		
(a) Capital Costs	$0	$526,000
(b) Operating and Maintenance Costs	$0	$1,742,000
(c) Periodic Costs	$0	$156,000
(d) Present Worth Costs	$0	$2,424,000
8. State Acceptance	Will be evaluated after receipt of comments from state agency	
9. Community Acceptance	Will be evaluated after the public comment period	

Notes:
ARAR = Applicable or Relevant and Appropriate Requirement
COC = chemical of concern
PCB = polychlorinated biphenyl
RAO = Remedial Action Objective
TSCA = Toxic Substances Control Act

Table 5-7. Detailed Evaluation of Alternatives – Amcast North Storm Sewers
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	Alternative SSN-1 No Action	Alternative SSN-2 Abandon Amcast North Building Storm Sewers, Pressure Wash Non-Building and Downgradient Storm Sewers, Sewer Backfill Excavation and Offsite Disposal, and Site Restoration	Alternative SSN-3 Abandon Amcast North Building Storm Sewers, Remove Non-Building Storm Sewer Piping, Pressure Wash Downgradient Storm Sewers, Excavation of Pipes and Backfill, Offsite Disposal, Backfill, and Site Restoration
1. Overall protection of human health and the environment	RAOs to reduce the potential ingestion of PCBs through dermal contact or ingestion of PCB-contaminated sediment not likely to be met within a reasonable timeframe.	Removal of contaminated sediment and soil eliminates the onsite risk to human health and the environment. Offsite disposal of contaminated sediment is protective of human health and the environment.	Removal of contaminated soil eliminates the onsite risk to human health and the environment. Offsite disposal of contaminated sediment is protective of human health and the environment.
2. Compliance with ARARs	No remedial action; therefore, not applicable.	Must meet substantive requirements for air pollution control using dust suppression. Requires proper protection of existing infrastructure during construction. Final disposition of sediment and soil managed according to the requirements of TSCA and Wisconsin solid waste regulations.	Must meet substantive requirements for air pollution control using dust suppression. Requires proper protection of existing infrastructure during construction. Final disposition of soil managed according to the requirements of TSCA and Wisconsin solid waste regulations.
3. Long-term Effectiveness and Permanence			
(a) Magnitude of residual risks	Unchanged from existing conditions.	Low residual risks.	Very low residual risks.
(b) Adequacy and reliability of controls	Advisories and warnings regarding dermal contact or ingestion of PCB-contaminated sediment can reduce, but not eliminate risks.	Not applicable.	Not applicable.
4. Reduction of Toxicity, Mobility, and Volume			
(a) Treatment process used and materials treated	No remedial action; therefore, not applicable.	No treatment performed. Pipes pressure washed and contaminated sediment removed from site.	No treatment performed. Contaminated sediment and soil removed from site.
(b) Amount of hazardous materials destroyed or treated	No remedial action; therefore, no material treated.	No hazardous material destroyed. Pipes pressure washed and contaminated sediment removed from site.	No hazardous material destroyed. Contaminated sediment and soil removed from site.
(c) Degree of expected reductions in toxicity, mobility, and volume	No remedial action; therefore, no reduction.	No reductions would occur because no treatment would be performed, although mobility would be reduced through containment at an offsite disposal facility.	No reductions would occur because no treatment would be performed, although mobility would be reduced through containment at an offsite disposal facility.

Table 5-7. Detailed Evaluation of Alternatives – Amcast North Storm Sewers
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	Alternative SSN-1 No Action	Alternative SSN-2 Abandon Amcast North Building Storm Sewers, Pressure Wash Non-Building and Downgradient Storm Sewers, Sewer Backfill Excavation and Offsite Disposal, and Site Restoration	Alternative SSN-3 Abandon Amcast North Building Storm Sewers, Remove Non-Building Storm Sewer Piping, Pressure Wash Downgradient Storm Sewers, Excavation of Pipes and Backfill, Offsite Disposal, Backfill, and Site Restoration
(d) Degree to which treatment is irreversible	No remedial action; therefore, not applicable.	No treatment is performed, although the alternative is irreversible because contaminated sediment is removed from site.	No treatment is performed, although the alternative is irreversible because contaminated sediment and soil is removed from site.
(e) Type and quantity of residuals remaining after treatment	No remedial action; therefore, not applicable.	Treatment is not performed, so treatment residuals are not generated. Contaminated sediment is removed from site.	Treatment is not performed, so treatment residuals are not generated. Contaminated sediment and soil is removed from site.
(f) Statutory preference for treatment as principal element	No remedial action; therefore, not applicable.	No treatment is performed. Would not meet statutory preference for treatment as principal element.	No treatment is performed. Would not meet statutory preference for treatment as principal element.
5. Short-term Effectiveness			
(a) Protection of community during remedial action	No remedial action; therefore, not applicable.	Dust emissions can be controlled with air monitoring and engineering methods to protect the community. Decontamination of and covering trucks used to transport contaminated materials prevents the spread of contamination along haul routes.	Dust emissions can be controlled with air monitoring and engineering methods to protect the community. Decontamination of and covering trucks used to transport contaminated materials prevents the spread of contamination along haul routes.
(b) Protection of workers during remedial action	No remedial action; therefore, not applicable.	Pressure washing of sediment may result in potential exposure of workers via direct contact. Proper health and safety procedures such as use of appropriate PPE, truck decontamination, and air monitoring procedures can reduce impacts to workers.	Excavation of soil may result in potential exposure of workers via direct contact. Proper health and safety procedures such as use of appropriate PPE, truck decontamination, and air monitoring procedures can reduce impacts to workers.
(c) Environmental impacts of remedial action	No remedial action; therefore, not applicable.	Impacts from excavation due to disturbance of ground surface.	Impacts from excavation due to disturbance of ground surface.
d) Time until RAOs are achieved	Significant period of time to achieve RAOs.	RAOs would generally be achieved after implementation of remedial action and ground surface restoration.	RAOs would generally be achieved after implementation of remedial action and ground surface restoration.

Table 5-7. Detailed Evaluation of Alternatives – Amcast North Storm Sewers
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	Alternative SSN-1 No Action	Alternative SSN-2 Abandon Amcast North Building Storm Sewers, Pressure Wash Non-Building and Downgradient Storm Sewers, Sewer Backfill Excavation and Offsite Disposal, and Site Restoration	Alternative SSN-3 Abandon Amcast North Building Storm Sewers, Remove Non-Building Storm Sewer Piping, Pressure Wash Downgradient Storm Sewers, Excavation of Pipes and Backfill, Offsite Disposal, Backfill, and Site Restoration
6. Implementability			
(a) Ability to construct and operate the technology	No remedial action; therefore, not applicable.	No impediments.	No impediments.
(b) Reliability of the technology	No remedial action; therefore, not applicable.	Pressure washing of storm sewers is reliable.	Excavation of soil is very reliable and abandoning pipes is reliable.
(c) Ease of undertaking additional remedial actions, if necessary	No remedial action; therefore, not applicable.	No impediments.	No impediments.
(d) Ability to monitor the effectiveness of remedy	No remedial action; therefore, not applicable.	No impediments.	No impediments.
(e) Ability to obtain approvals from other agencies	No remedial action; therefore, not applicable.	No impediments.	No impediments.
(f) Coordination with other agencies	No remedial action; therefore, not applicable.	No impediments.	No impediments.
(g) Availability of offsite treatment, storage, and disposal services and capacity	No remedial action; therefore, not applicable.	No impediments; anticipated that local disposal facilities will have enough capacity for sediment disposed offsite given volumes.	No impediments; anticipated that local disposal facilities will have enough capacity for sediment and soil disposed offsite given volumes.
(h) Availability of necessary equipment and specialists	No remedial action; therefore, not applicable.	No impediments.	No impediments.
(i) Availability of prospective technologies	No remedial action; therefore, not applicable.	No impediments; pressure washing is a well-developed technology.	No impediments; excavation and offsite disposal are well-developed technologies.
7. Cost			
(a) Capital Costs	$0	$2,201,000	$2,287,000
(b) Operating and Maintenance Costs	$0	$0	$0
(c) Periodic Costs	$0	$0	$0
(d) Present Worth Costs	$0	$2,201,000	$2,287,000

Table 5-7. Detailed Evaluation of Alternatives – Amcast North Storm Sewers
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	**Alternative SSN-1 No Action**	**Alternative SSN-2 Abandon Amcast North Building Storm Sewers, Pressure Wash Non-Building and Downgradient Storm Sewers, Sewer Backfill Excavation and Offsite Disposal, and Site Restoration**	**Alternative SSN-3 Abandon Amcast North Building Storm Sewers, Remove Non-Building Storm Sewer Piping, Pressure Wash Downgradient Storm Sewers, Excavation of Pipes and Backfill, Offsite Disposal, Backfill, and Site Restoration**
8. State Acceptance	Will be evaluated after receipt of comments from state agency		
9. Community Acceptance	Will be evaluated after the public comment period		

Notes:
PCB = polychlorinated biphenyl
PPE = personal protective equipment
RAO = Remedial Action Objective
TSCA = Toxic Substances Control Act

Table 5-8. Detailed Evaluation of Alternatives – Amcast South Storm Sewers
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	Alternative SSS-1 No Action	Alternative SSS-2 Pressure Wash Non-Building and Downgradient Storm Sewers, Excavation, Offsite Disposal, Backfill, and Site Restoration	Alternative SSS-3 Abandon Amcast South Building Storm Sewers, Pressure Wash Downgradient Storm Sewers, Excavation, Offsite Disposal, Backfill, and Site Restoration	Alternative SSS-4 Remove Non-Building Storm Sewers, Pressure Wash Downgradient Storm Sewers, Excavation, Offsite Disposal, Backfill, and Site Restoration
1. Overall protection of human health and the environment	RAOs to reduce the potential ingestion of PCBs through dermal contact or ingestion of PCB contaminated sediment not likely to be met within a reasonable timeframe.	Removal of contaminated sediment and soil eliminates the onsite risk to human health and the environment. Offsite disposal of contaminated sediment is protective of human health and the environment.	Removal of contaminated soil eliminates the onsite risk to human health and the environment. Offsite disposal of contaminated sediment is protective of human health and the environment.	Removal of contaminated soil eliminates the onsite risk to human health and the environment. Offsite disposal of contaminated sediment is protective of human health and the environment.
2. Compliance with ARARs	No remedial action; therefore, not applicable.	Must meet substantive requirements for air pollution control using dust suppression. Requires proper protection of existing infrastructure during construction. Final disposition of sediment and soil managed according to the requirements of TSCA and Wisconsin solid waste regulations.	Must meet substantive requirements for air pollution control using dust suppression. Requires proper protection of existing infrastructure during construction. Final disposition of soil managed according to the requirements of TSCA and Wisconsin solid waste regulations.	Must meet substantive requirements for air pollution control using dust suppression. Requires proper protection of existing infrastructure during construction. Final disposition of soil managed according to the requirements of TSCA and Wisconsin solid waste regulations.
3. Long-term Effectiveness and Permanence				
(a) Magnitude of residual risks	Unchanged from existing conditions.	Low residual risks.	Very low residual risks.	Very low residual risks.
(b) Adequacy and reliability of controls	Advisories and warnings regarding dermal contact or ingestion of PCB contaminated sediment can reduce, but not eliminate risks.	Not applicable.	Not applicable.	Not applicable.
4. Reduction of Toxicity, Mobility, and Volume				
(a) Treatment process used and materials treated	No remedial action; therefore, not applicable.	No treatment performed. Pipes pressure washed and contaminated sediment removed from site.	No treatment performed. Contaminated sediment and soil removed from site.	No treatment performed. Contaminated sediment and soil removed from site.

Table 5-8. Detailed Evaluation of Alternatives – Amcast South Storm Sewers
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	Alternative SSS-1 No Action	Alternative SSS-2 Pressure Wash Non-Building and Downgradient Storm Sewers, Excavation, Offsite Disposal, Backfill, and Site Restoration	Alternative SSS-3 Abandon Amcast South Building Storm Sewers, Pressure Wash Downgradient Storm Sewers, Excavation, Offsite Disposal, Backfill, and Site Restoration	Alternative SSS-4 Remove Non-Building Storm Sewers, Pressure Wash Downgradient Storm Sewers, Excavation, Offsite Disposal, Backfill, and Site Restoration
(b) Amount of hazardous materials destroyed or treated	No remedial action; therefore, no material treated.	No hazardous material destroyed. Pipes pressure washed and contaminated sediment removed from site.	No hazardous material destroyed. Contaminated sediment and soil removed from site.	No hazardous material destroyed. Contaminated sediment and soil removed from site.
(c) Degree of expected reductions in toxicity, mobility, and volume	No remedial action; therefore, no reduction.	No reductions would occur because no treatment would be performed, although mobility would be reduced through containment at an offsite disposal facility.	No reductions would occur because no treatment would be performed, although mobility would be reduced through containment at an offsite disposal facility.	No reductions would occur because no treatment would be performed, although mobility would be reduced through containment at an offsite disposal facility.
(d) Degree to which treatment is irreversible	No remedial action; therefore, not applicable.	No treatment is performed, although the alternative is irreversible because contaminated sediment is removed from site.	No treatment is performed, although the alternative is irreversible because contaminated sediment and soil is removed from site.	No treatment is performed, although the alternative is irreversible because contaminated sediment and soil is removed from site.
(e) Type and quantity of residuals remaining after treatment	No remedial action; therefore, not applicable.	Treatment is not performed, so treatment residuals are not generated. Contaminated sediment is removed from site.	Treatment is not performed, so treatment residuals are not generated. Contaminated sediment and soil is removed from site.	Treatment is not performed, so treatment residuals are not generated. Contaminated sediment and soil is removed from site.
(f) Statutory preference for treatment as principal element	No remedial action; therefore, not applicable.	No treatment is performed. Would not meet statutory preference for treatment as principal element.	No treatment is performed. Would not meet statutory preference for treatment as principal element.	No treatment is performed. Would not meet statutory preference for treatment as principal element.
5. Short-term Effectiveness				
(a) Protection of community during remedial action	No remedial action; therefore, not applicable.	Dust emissions can be controlled with air monitoring and engineering methods to protect the community. Decontamination of and covering trucks used to transport contaminated materials prevents the	Dust emissions can be controlled with air monitoring and engineering methods to protect the community. Decontamination of and covering trucks used to transport contaminated materials	Dust emissions can be controlled with air monitoring and engineering methods to protect the community. Decontamination of and covering trucks used to transport contaminated materials prevents the

Alternative Description: Criterion	Alternative SSS-1 No Action	Alternative SSS-2 Pressure Wash Non-Building and Downgradient Storm Sewers, Excavation, Offsite Disposal, Backfill, and Site Restoration	Alternative SSS-3 Abandon Amcast South Building Storm Sewers, Pressure Wash Downgradient Storm Sewers, Excavation, Offsite Disposal, Backfill, and Site Restoration	Alternative SSS-4 Remove Non-Building Storm Sewers, Pressure Wash Downgradient Storm Sewers, Excavation, Offsite Disposal, Backfill, and Site Restoration
		spread of contamination along haul routes.	prevents the spread of contamination along haul routes.	spread of contamination along haul routes.
(b) Protection of workers during remedial action	No remedial action; therefore, not applicable.	Excavation of soil and pressure washing of sediment may result in potential exposure of workers via direct contact. Proper health and safety procedures such as use of appropriate PPE, truck decontamination, and air monitoring procedures can reduce impacts to workers.	Excavation of soil may result in potential exposure of workers via direct contact. Proper health and safety procedures such as use of appropriate PPE, truck decontamination, and air monitoring procedures can reduce impacts to workers.	Excavation of soil may result in potential exposure of workers via direct contact. Proper health and safety procedures such as use of appropriate PPE, truck decontamination, and air monitoring procedures can reduce impacts to workers.
(c) Environmental impacts of remedial action	No remedial action; therefore, not applicable.	Impacts from excavation due to disturbance of ground surface.	Impacts from excavation due to disturbance of ground surface.	Impacts from excavation due to disturbance of ground surface.
(d) Time until RAOs are achieved	Significant period of time to achieve RAOs.	RAOs would generally be achieved after implementation of remedial action and ground surface restoration.	RAOs would generally be achieved after implementation of remedial action and ground surface restoration.	RAOs would generally be achieved after implementation of remedial action and ground surface restoration.
6. Implementability				
(a) Ability to construct and operate the technology	No remedial action; therefore, not applicable.	No impediments.	No impediments.	No impediments.
(b) Reliability of the technology	No remedial action; therefore, not applicable.	Pressure washing of sediment is reliable.	Excavation of soil is very reliable and abandoning pipes is reliable.	Excavation of soil and removal of pipes is very reliable.
(c) Ease of undertaking additional remedial actions, if necessary	No remedial action; therefore, not applicable.	No impediments.	No impediments.	No impediments.
(d) Ability to monitor the effectiveness of remedy	No remedial action; therefore, not applicable.	No impediments.	No impediments.	No impediments.

Table 5-8. Detailed Evaluation of Alternatives – Amcast South Storm Sewers
Feasibility Study Report
Amcast Industrial Superfund Site, Cedarburg, Wisconsin

Alternative Description: Criterion	Alternative SSS-1 No Action	Alternative SSS-2 Pressure Wash Non-Building and Downgradient Storm Sewers, Excavation, Offsite Disposal, Backfill, and Site Restoration	Alternative SSS-3 Abandon Amcast South Building Storm Sewers, Pressure Wash Downgradient Storm Sewers, Excavation, Offsite Disposal, Backfill, and Site Restoration	Alternative SSS-4 Remove Non-Building Storm Sewers, Pressure Wash Downgradient Storm Sewers, Excavation, Offsite Disposal, Backfill, and Site Restoration
(e) Ability to obtain approvals from other agencies	No remedial action; therefore, not applicable.	No impediments.	No impediments.	No impediments.
(f) Coordination with other agencies	No remedial action; therefore, not applicable.	No impediments.	No impediments.	No impediments.
(g) Availability of offsite treatment, storage, and disposal services and capacity	No remedial action; therefore, not applicable.	No impediments; anticipated that local disposal facilities will have enough capacity for sediment disposed offsite given volumes.	No impediments; anticipated that local disposal facilities will have enough capacity for sediment and soil disposed offsite given volumes.	No impediments.
(h) Availability of necessary equipment and specialists	No remedial action; therefore, not applicable.	No impediments.	No impediments.	No impediments.
(i) Availability of prospective technologies	No remedial action; therefore, not applicable.	No impediments; pressure washing is a well-developed technology.	No impediments; excavation and offsite disposal are well-developed technologies.	No impediments; excavation and offsite disposal are well-developed technologies.
7. Cost				
(a) Capital Costs	$0	$1,791,000	$1,658,000	$2,813,000
(b) Operating and Maintenance Costs	$0	$0	$0	$0
(c) Periodic Costs	$0	$0	$0	$0
(d) Present Worth Costs	$0	$1,791,000	$1,658,000	$2,813,000
8. State Acceptance	Will be evaluated after receipt of comments from state agency			
9. Community Acceptance	Will be evaluated after the public comment period			

Notes:
PCB = polychlorinated biphenyl
PPE = personal protective equipment
RAO = Remedial Action Objective
TSCA = Toxic Substances Control Act

Figures

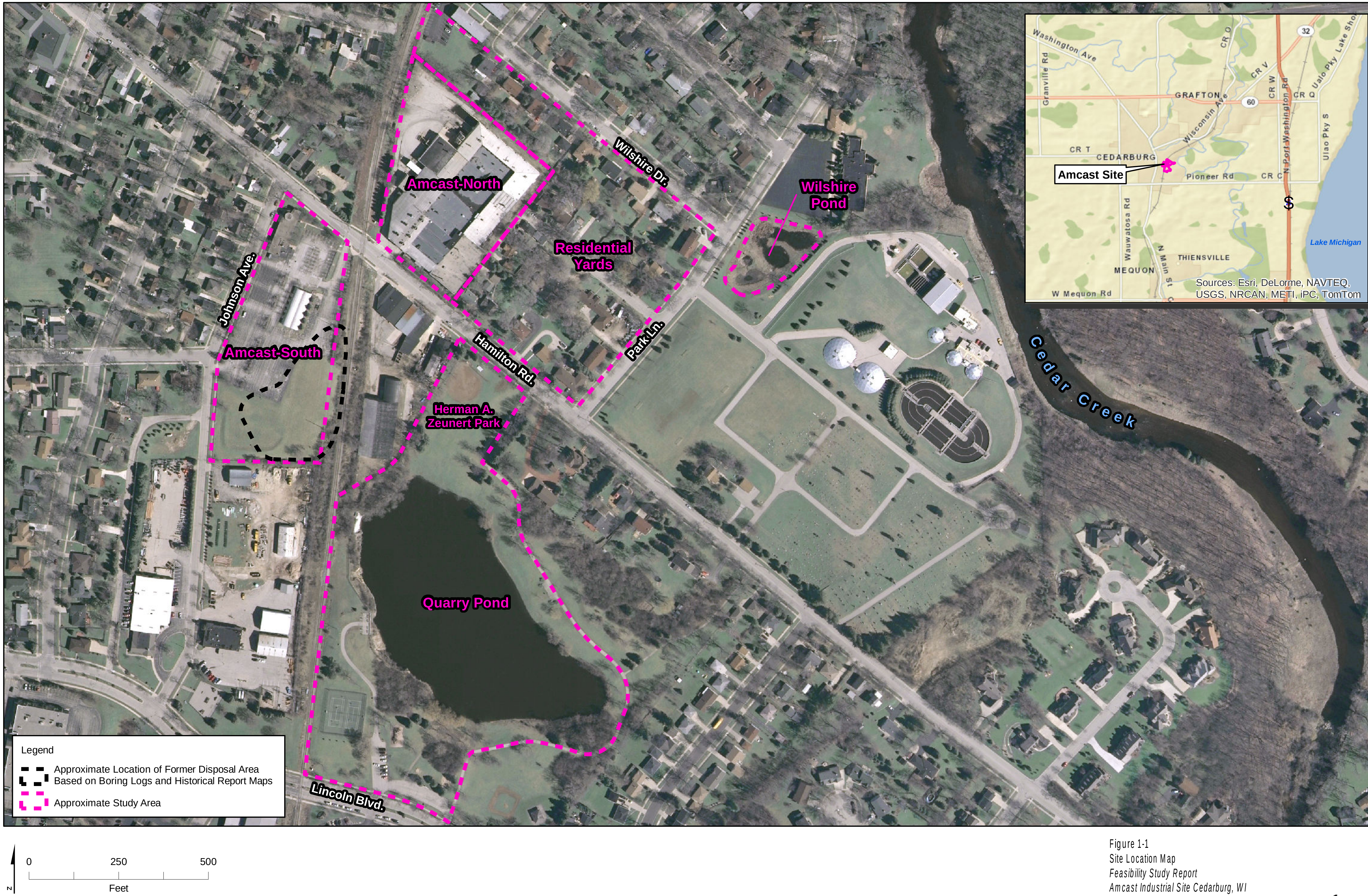
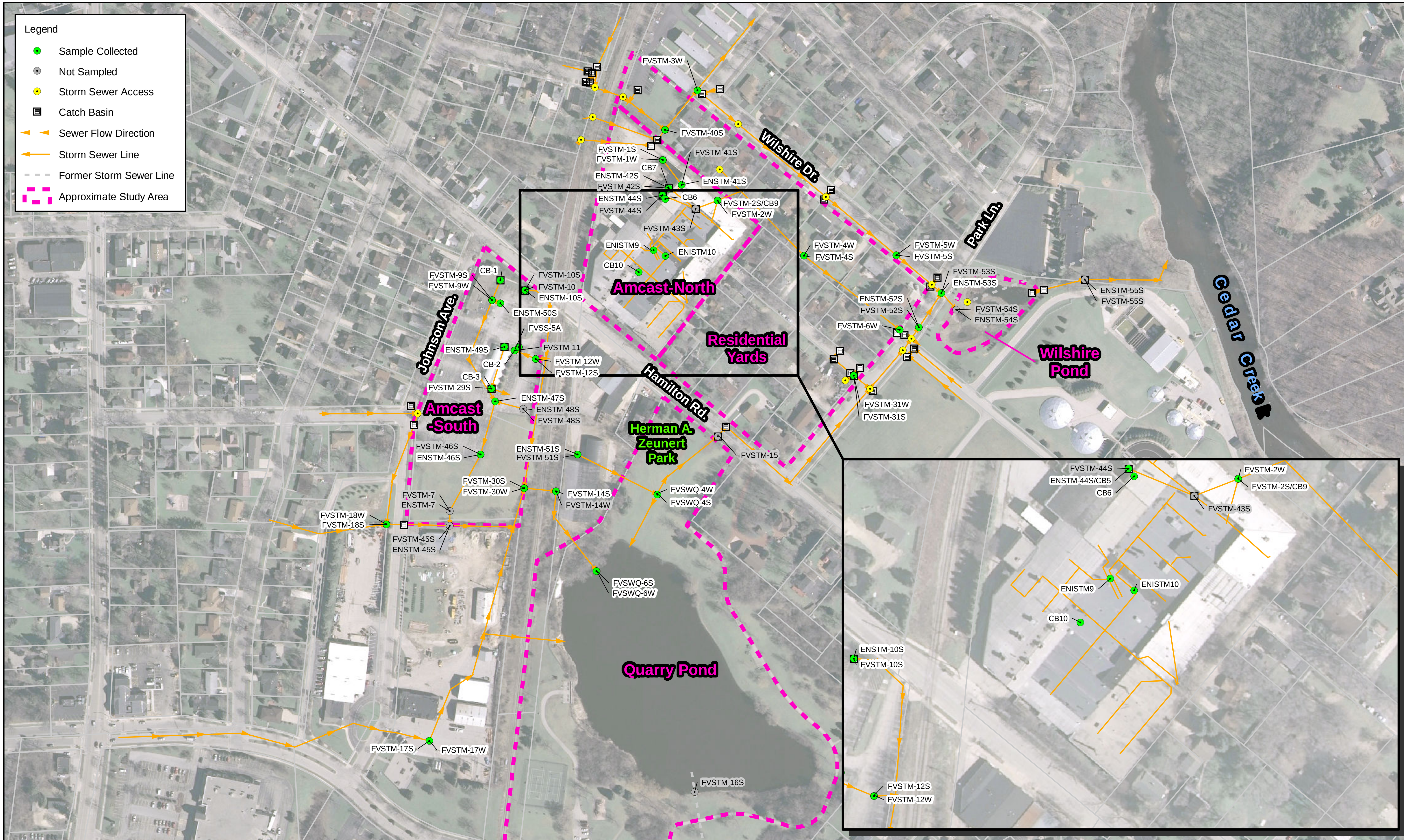


Figure 1-1
Site Location Map
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

ch2m

\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\395072_AMCAST_RIFS\GIS\MAPFILES\2018\FSR\FIGURE 01-01 - SITE LOCATION MAP.MXD AESPEJO 5/23/2018 8:14:57 PM



N

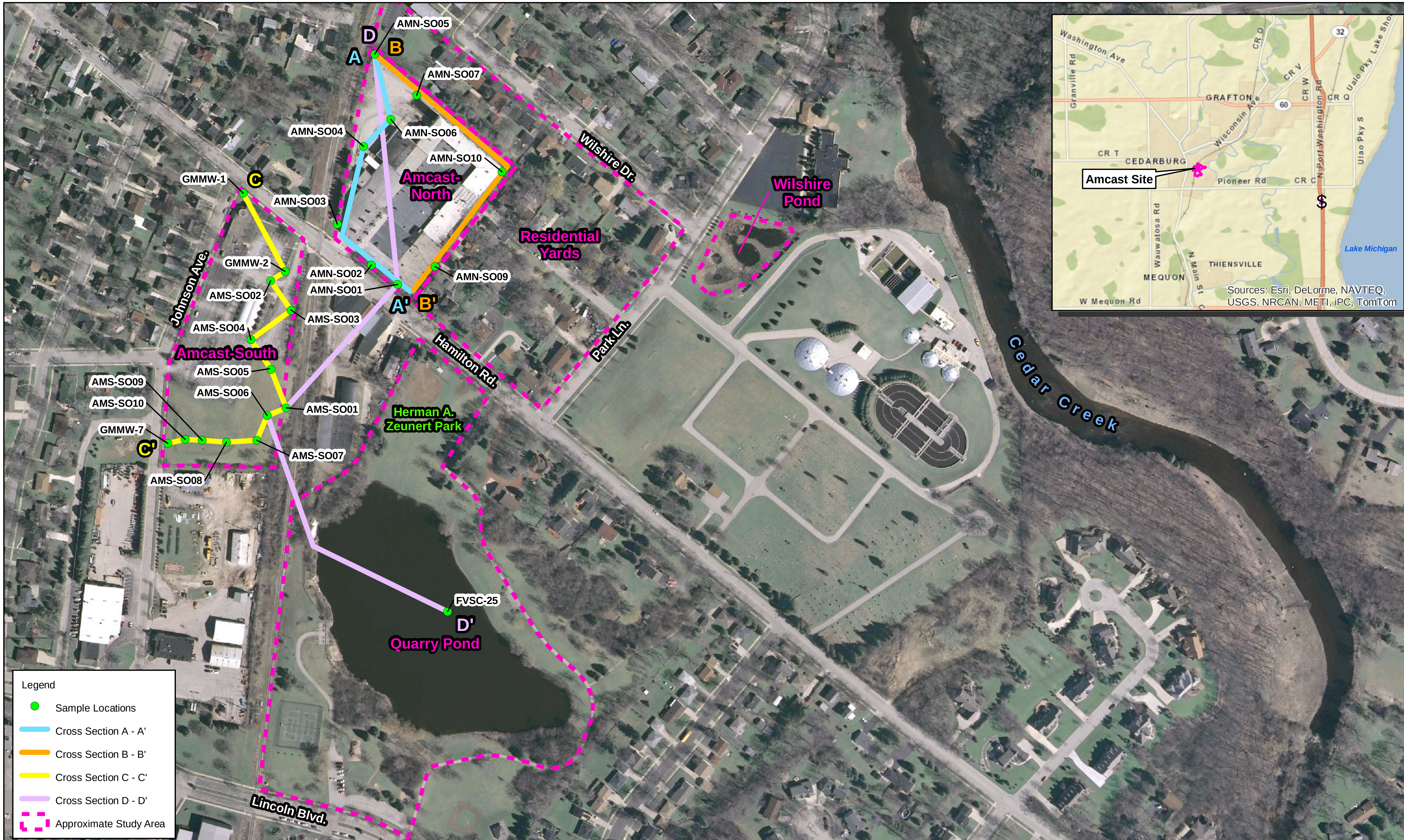
0 125 250
Feet

Notes: All locations and flow direction arrows are approximate, summarized from the following resources:
- City of Cedarburg 2010 Adobe Files
- Foth & Van Dyke, 2004.
- ENSR, 2005, 2007.

Figure 1-2
Storm Sewer Location Map
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\395072_AMCAST_RIFS\GIS\MAPFILES\2018\FSR\FIGURE 01-02 - STORM SEWER LOCATION MAP.MXD AESPEJO 5/23/2018 8:16:47 PM

ch2m:



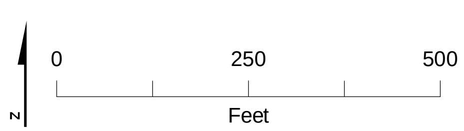
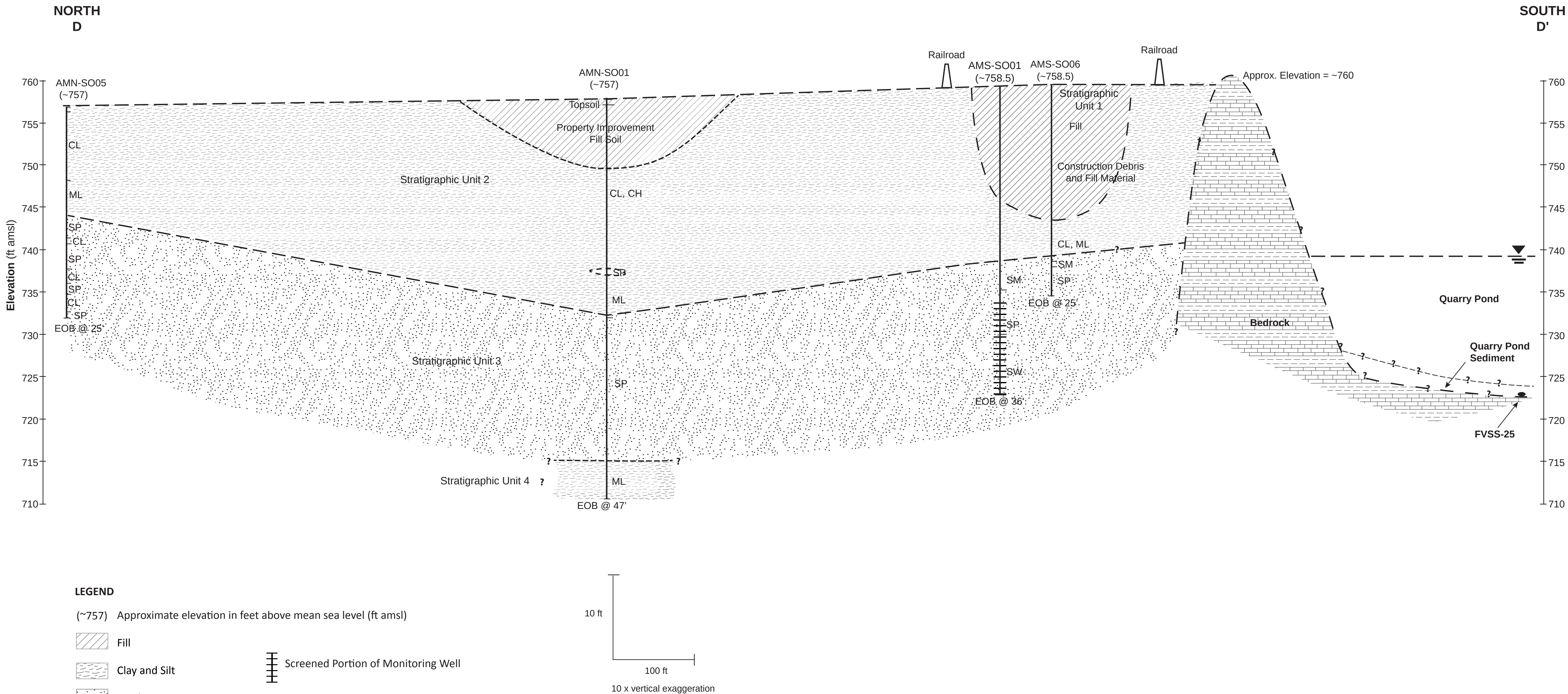


Figure 1-3
Site Cross-Section Location Map
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

ch2m:



LEGEND

(~757) Approximate elevation in feet above mean sea level (ft amsl)

Fill

Clay and Silt

Sand

Bedrock

Screened Portion of Monitoring Well

Approximate Water Surface

ML = Silt
CL, CH = clay and organic clay
SP = Poorly graded (uniform size) sand
SM = Silty sand
EOB = End of Boring

Note: Approximate land and water surface elevations from Foth & Van Dyke, 2003 (Figures 3 and 7) and Foth & Van Dyke, 2004 (Figures 6 and 7)

FIGURE 1-4
Site Cross-section D-D'
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

CH2MHILL.

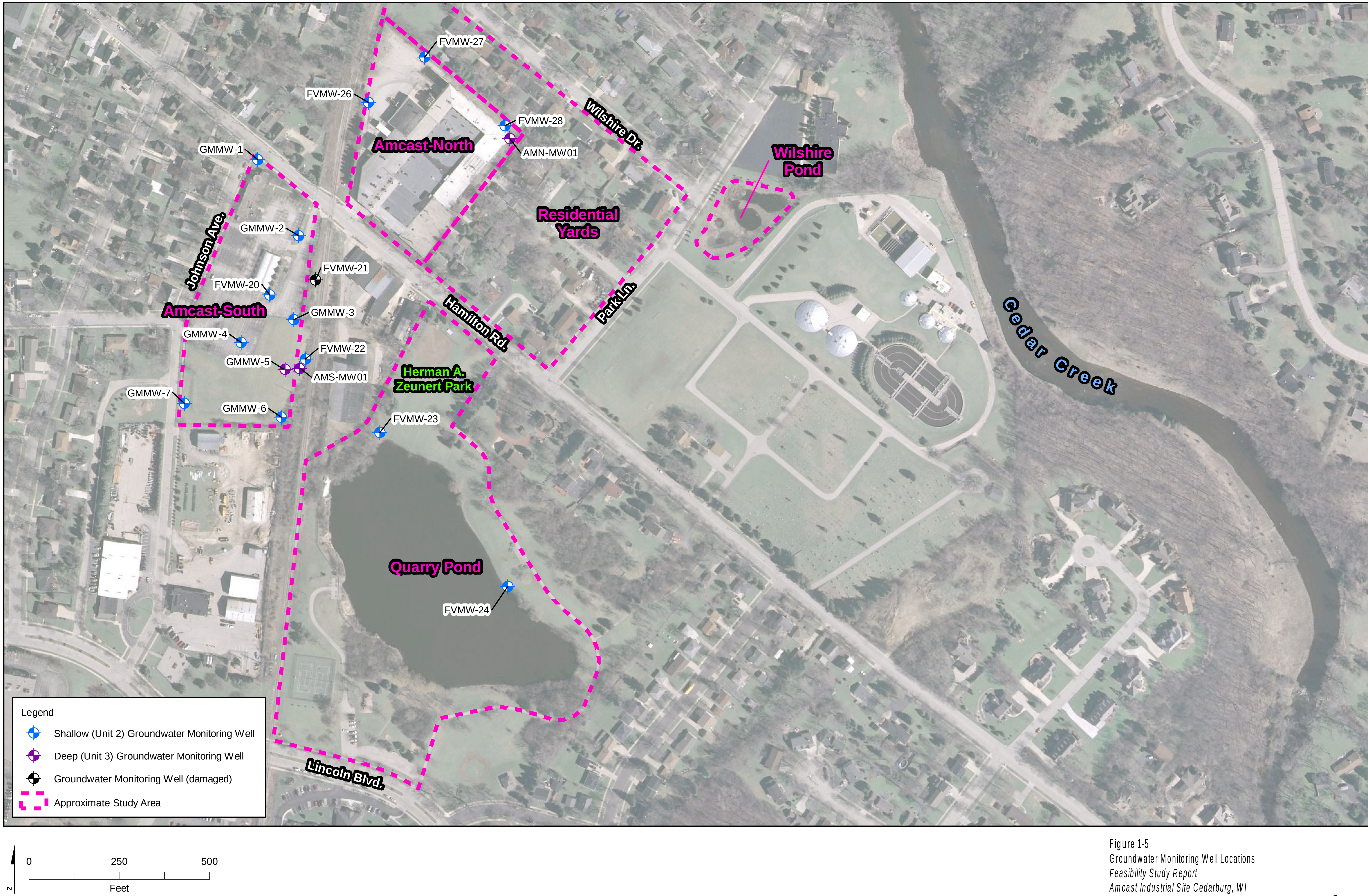
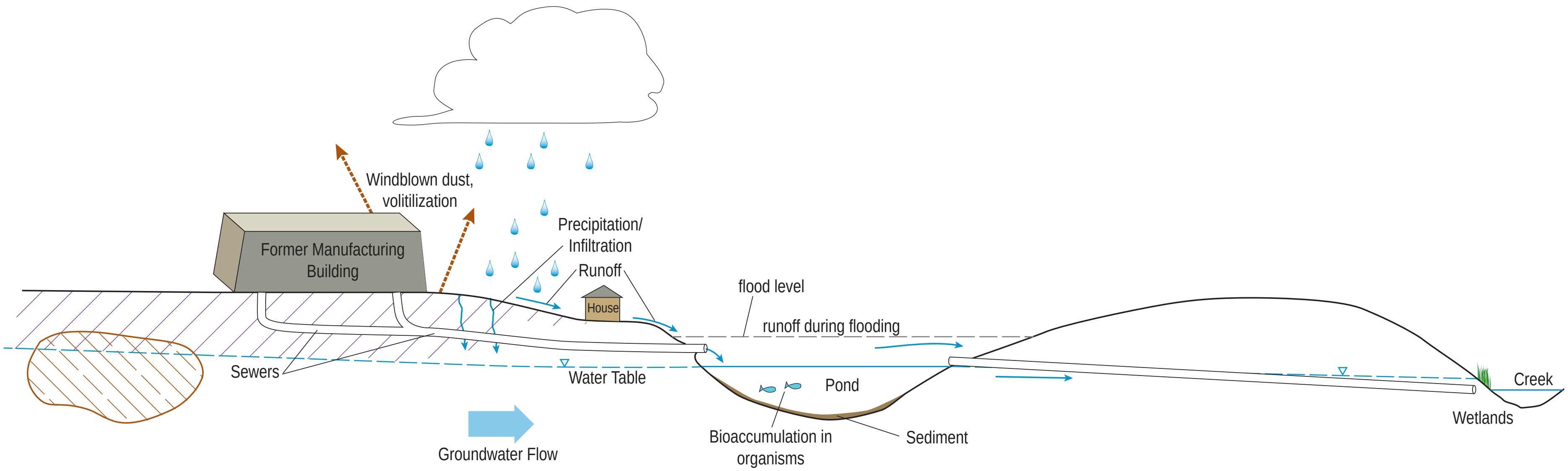


Figure 1-5
Groundwater Monitoring Well Locations
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

ch2m:

\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\395072_AMCAST_RIFS\GIS\MAPFILES\2018\FSR\FIGURE 01-05 - GROUNDWATER MONITORING WELL LOCATIONS.MXD AESPEJO 5/23/2018 8:33:05 PM



Not to scale

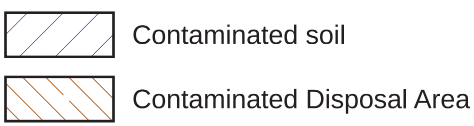


FIGURE 1-6
Conceptual Depiction - Release/ Transport Mechanisms
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

CH2MHILL.

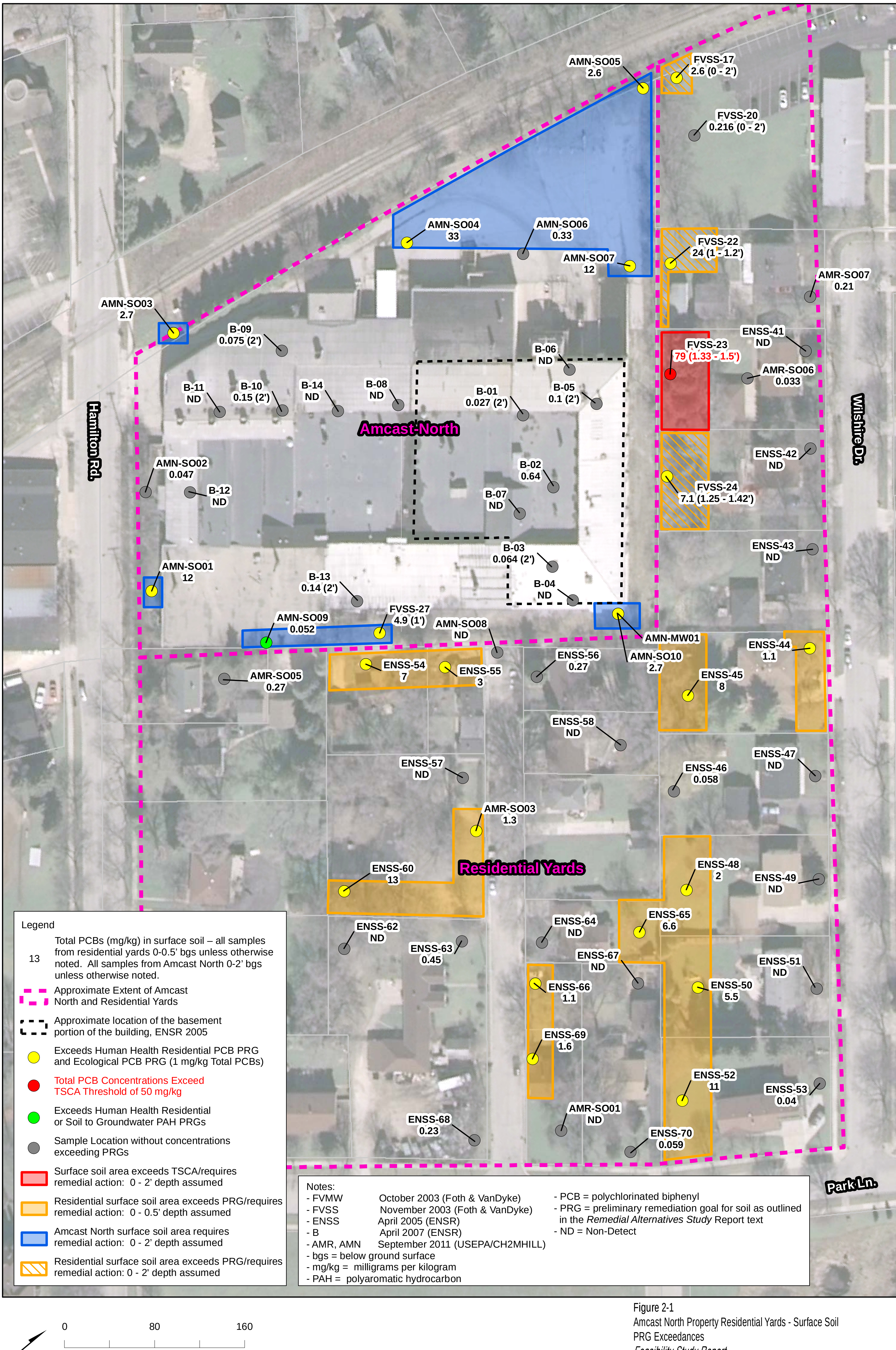


Figure 2-1
Amcast North Property Residential Yards - Surface Soil PRG Exceedances
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\395072_AMCAST_RIFS\GIS\MAPFILES\RAS_TM_MAY2014\FIGURE 02-01 - AMCAST NORTH SURFACE SOIL PRG EXCEEDANCES.MXD JHANSEN1 9/4/2015 9:48:46 AM

CH2MHILL

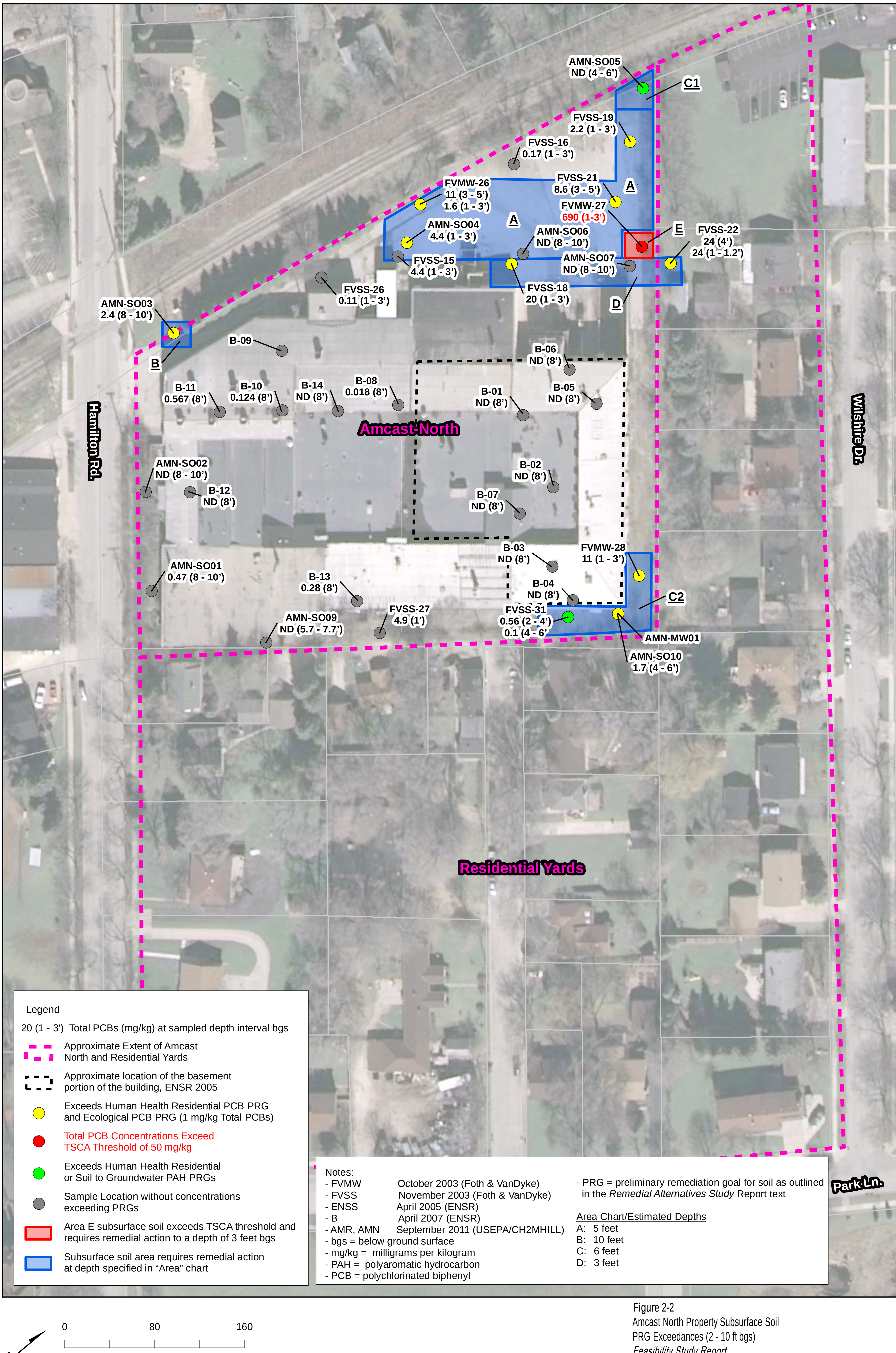


Figure 2-2
Amcast North Property Subsurface Soil PRG Exceedances (2 - 10 ft bgs)
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\395072_AMCAST_RIFS\GIS\MAPFILES\RAS_TM_MAY2014\FIGURE 02-02 - AMCAST NORTH SUBSURFACE SOIL PRG EXCEEDANCES.MXD JHANSEN1 9/4/2015 9:36:58 AM

CH2MHILL

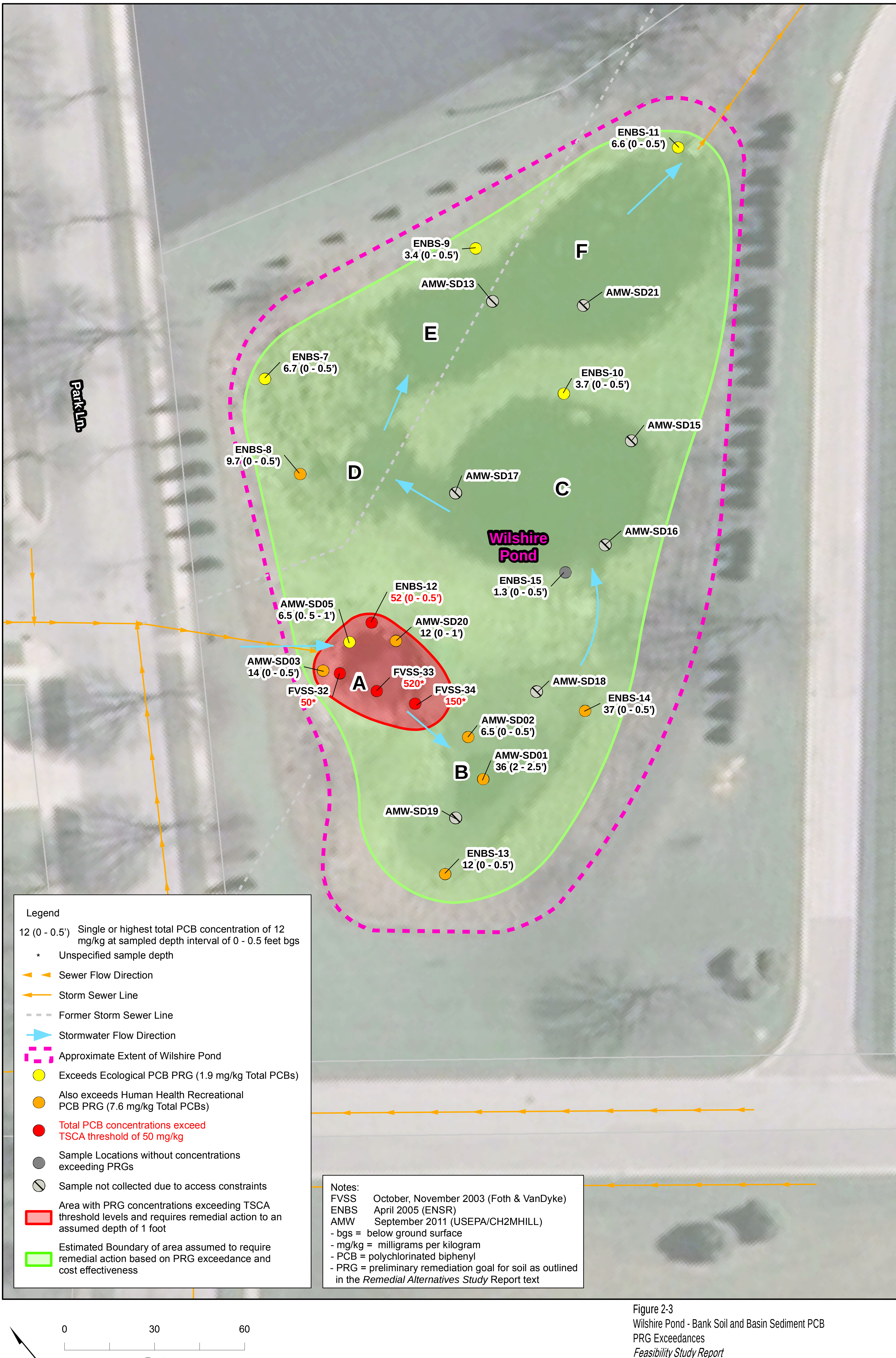


Figure 2-3
Wilshire Pond - Bank Soil and Basin Sediment PCB PRG Exceedances
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

CH2MHILL

\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\395072_AMCAST_RIFS\GIS\MAPFILES\RAS_TM_MAY2014\FIGURE 02-03 - WILSHIRE POND - BANK SOIL AND BASIN SEDIMENT PCB PRG EXCEEDANCES.MXD JHANSEN1 9/4/2015 10:00:50 AM

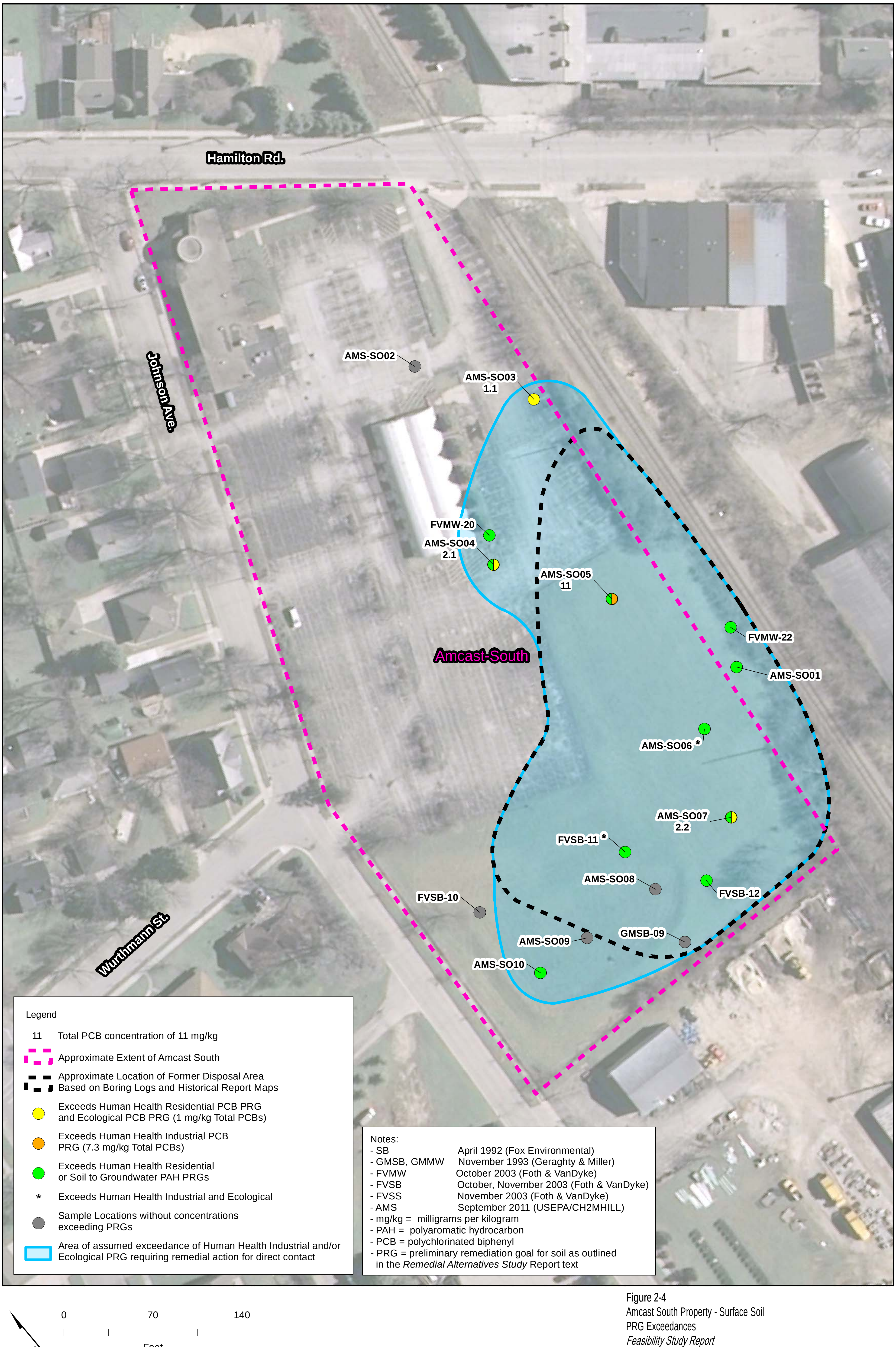


Figure 2-4
Amcast South Property - Surface Soil PRG Exceedances
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

CH2MHILL

\\HERCULES\PROJ\USENVIRONMENTALPROTE\395072_AMCAST_RIFS\GIS\MAPFILES\RAS_TM_MAY2014\FIGURE 02-04 - AMCAST SOUTH SURFACE SOIL PRG EXCEEDANCES.MXD JHANSEN1 6/9/2014 3:14:22 PM

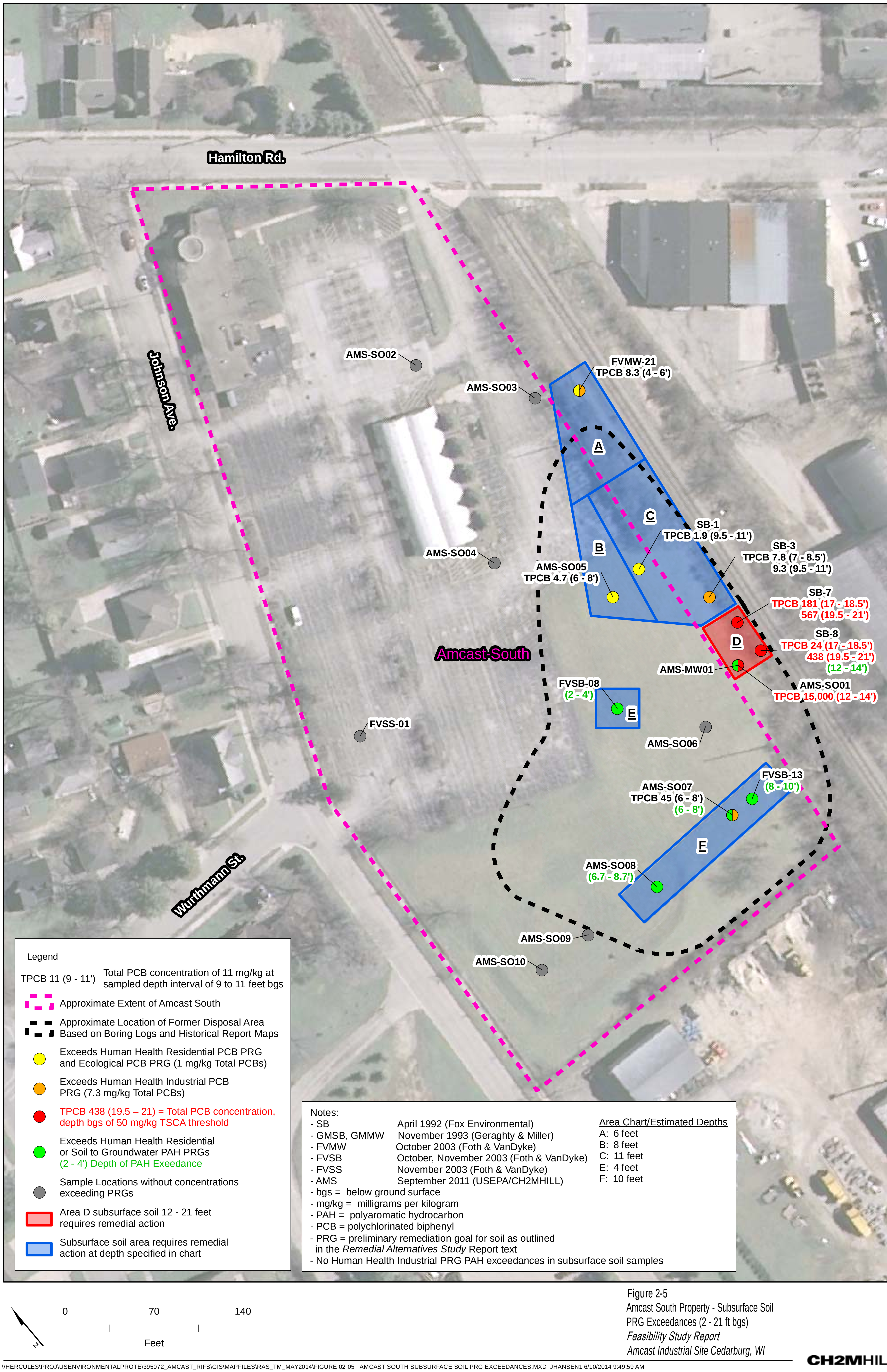


Figure 2-5
Amcast South Property - Subsurface Soil
PRG Exceedances (2 - 21 ft bgs)
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

CH2MHILL

\\HERCULES\PROJ\USENVIRONMENTALPROTE\395072_AMCAST_RIFS\GIS\MAPFILES\RAS_TM_MAY2014\FIGURE 02-05 - AMCAST SOUTH SUBSURFACE SOIL PRG EXCEEDANCES.MXD JHANSEN1 6/10/2014 9:49:59 AM

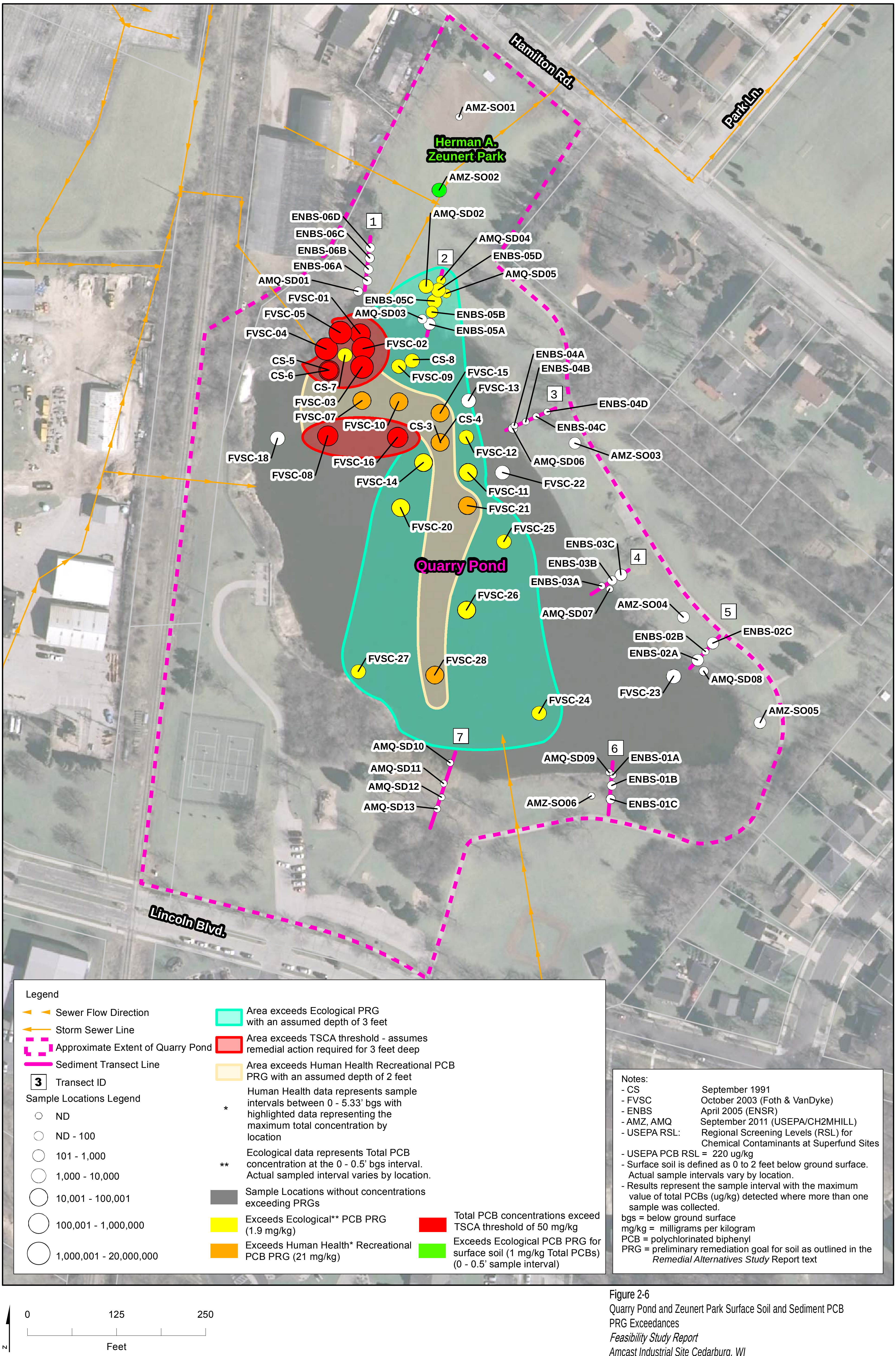
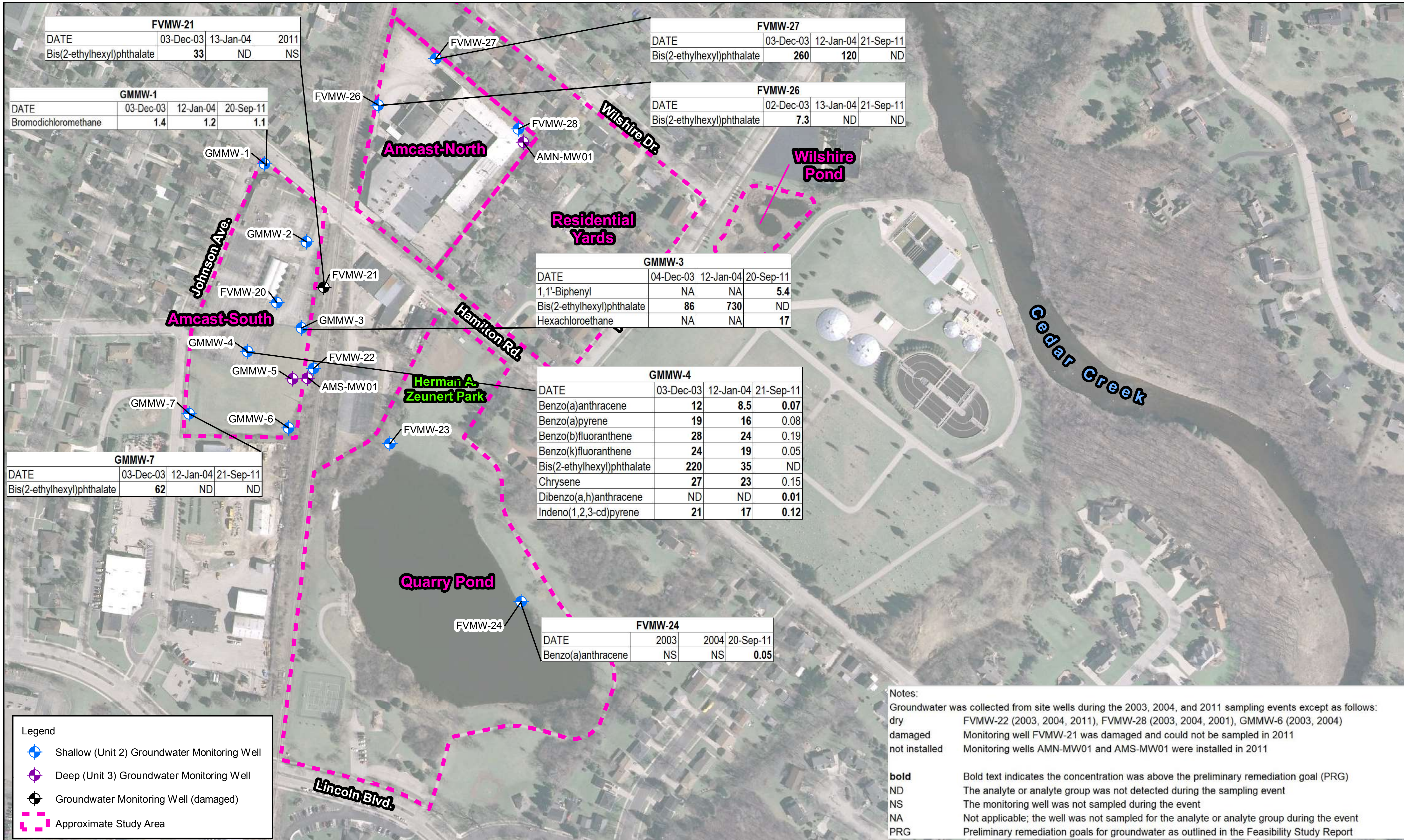


Figure 2-6
Quarry Pond and Zeunert Park Surface Soil and Sediment PCB PRG Exceedances
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

\\HERCULES\PROJ\USENVIRONMENTALPROTE\395072_AMCAST_RIFS\GIS\MAPFILES\RAS_TM_MAY2014\FIGURE 02-06 - QP AND ZUENERT PARK SURFACE SOIL AND SEDIMENT PCB PRG EXCEEDANCES.MXD JHANSEN1 6/10/2014 10:43:38 AM

CH2MHILL



FVMW-21			
DATE	03-Dec-03	13-Jan-04	2011
Bis(2-ethylhexyl)phthalate	**33**	ND	NS

GMMW-1			
DATE	03-Dec-03	12-Jan-04	20-Sep-11
Bromodichloromethane	**1.4**	**1.2**	**1.1**

FVMW-27			
DATE	03-Dec-03	12-Jan-04	21-Sep-11
Bis(2-ethylhexyl)phthalate	**260**	**120**	ND

FVMW-26			
DATE	02-Dec-03	13-Jan-04	21-Sep-11
Bis(2-ethylhexyl)phthalate	**7.3**	ND	ND

GMMW-3			
DATE	04-Dec-03	12-Jan-04	20-Sep-11
1,1'-Biphenyl	NA	NA	**5.4**
Bis(2-ethylhexyl)phthalate	**86**	**730**	ND
Hexachloroethane	NA	NA	**17**

GMMW-4			
DATE	03-Dec-03	12-Jan-04	21-Sep-11
Benzo(a)anthracene	**12**	**8.5**	**0.07**
Benzo(a)pyrene	**19**	**16**	0.08
Benzo(b)fluoranthene	**28**	**24**	0.19
Benzo(k)fluoranthene	**24**	**19**	0.05
Bis(2-ethylhexyl)phthalate	**220**	**35**	ND
Chrysene	**27**	**23**	0.15
Dibenzo(a,h)anthracene	ND	ND	**0.01**
Indeno(1,2,3-cd)pyrene	**21**	**17**	**0.12**

GMMW-7			
DATE	03-Dec-03	12-Jan-04	21-Sep-11
Bis(2-ethylhexyl)phthalate	**62**	ND	ND

FVMW-24			
DATE	2003	2004	20-Sep-11
Benzo(a)anthracene	NS	NS	**0.05**

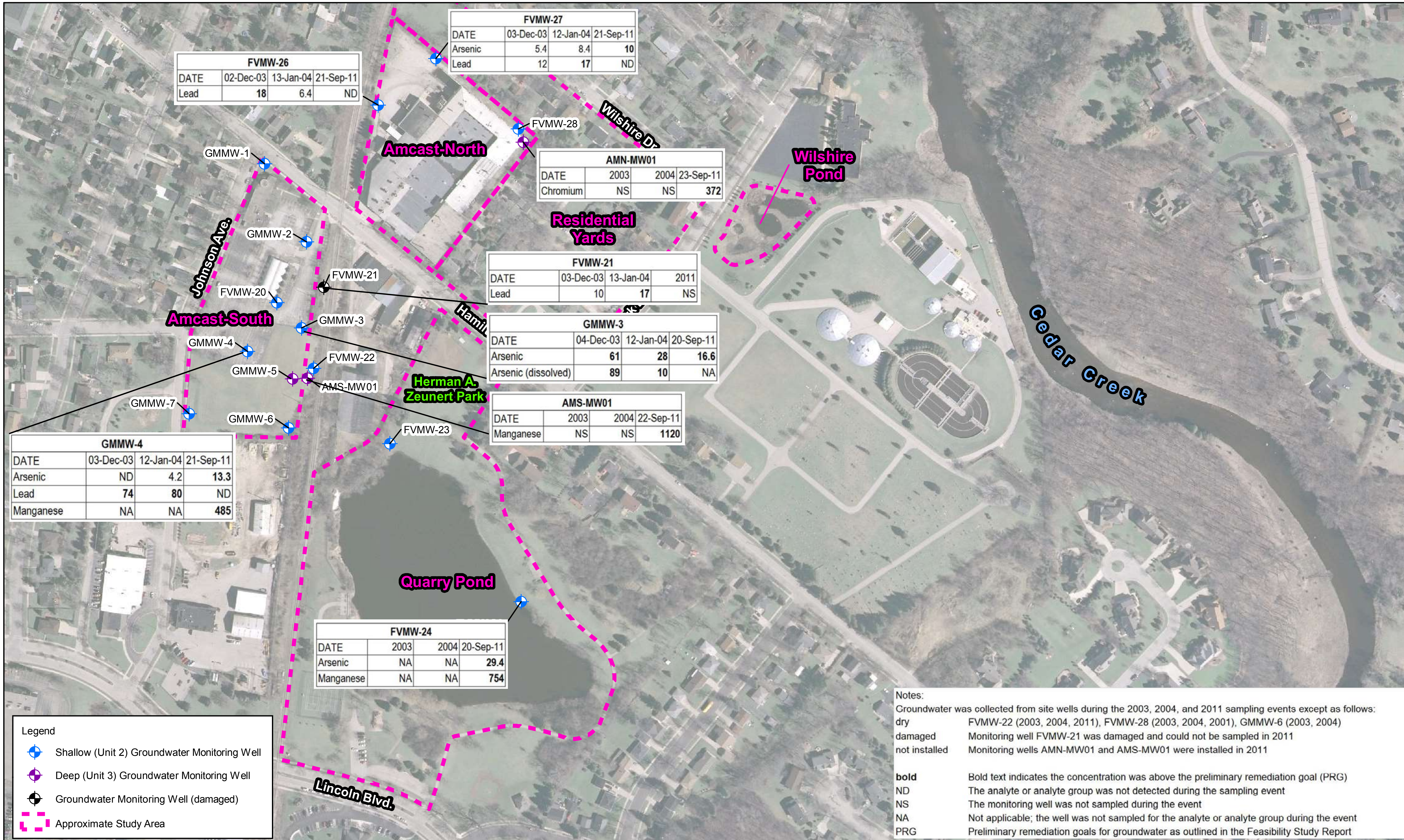
Notes:
Groundwater was collected from site wells during the 2003, 2004, and 2011 sampling events except as follows:

dry	FVMW-22 (2003, 2004, 2011), FVMW-28 (2003, 2004, 2001), GMMW-6 (2003, 2004)
damaged	Monitoring well FVMW-21 was damaged and could not be sampled in 2011
not installed	Monitoring wells AMN-MW01 and AMS-MW01 were installed in 2011
bold	Bold text indicates the concentration was above the preliminary remediation goal (PRG)
ND	The analyte or analyte group was not detected during the sampling event
NS	The monitoring well was not sampled during the event
NA	Not applicable; the well was not sampled for the analyte or analyte group during the event
PRG	Preliminary remediation goals for groundwater as outlined in the Feasibility Study Report

N
0 250 500
Feet

Figure 2-7
Groundwater PRG Exceedances - VOCs and SVOCs
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

ch2m:



FVMW-27

DATE	03-Dec-03	12-Jan-04	21-Sep-11
Arsenic	5.4	8.4	**10**
Lead	12	**17**	ND

FVMW-26

DATE	02-Dec-03	13-Jan-04	21-Sep-11
Lead	**18**	6.4	ND

AMN-MW01

DATE	2003	2004	23-Sep-11
Chromium	NS	NS	**372**

FVMW-21

DATE	03-Dec-03	13-Jan-04	2011
Lead	10	**17**	NS

GMMW-3

DATE	04-Dec-03	12-Jan-04	20-Sep-11
Arsenic	**61**	**28**	**16.6**
Arsenic (dissolved)	**89**	**10**	NA

AMS-MW01

DATE	2003	2004	22-Sep-11
Manganese	NS	NS	**1120**

GMMW-4

DATE	03-Dec-03	12-Jan-04	21-Sep-11
Arsenic	ND	4.2	**13.3**
Lead	**74**	**80**	ND
Manganese	NA	NA	**485**

FVMW-24

DATE	2003	2004	20-Sep-11
Arsenic	NA	NA	**29.4**
Manganese	NA	NA	**754**

Legend
- Shallow (Unit 2) Groundwater Monitoring Well
- Deep (Unit 3) Groundwater Monitoring Well
- Groundwater Monitoring Well (damaged)
- Approximate Study Area

Notes:
Groundwater was collected from site wells during the 2003, 2004, and 2011 sampling events except as follows:

dry	FVMW-22 (2003, 2004, 2011), FVMW-28 (2003, 2004, 2001), GMMW-6 (2003, 2004)
damaged	Monitoring well FVMW-21 was damaged and could not be sampled in 2011
not installed	Monitoring wells AMN-MW01 and AMS-MW01 were installed in 2011
bold	Bold text indicates the concentration was above the preliminary remediation goal (PRG)
ND	The analyte or analyte group was not detected during the sampling event
NS	The monitoring well was not sampled during the event
NA	Not applicable; the well was not sampled for the analyte or analyte group during the event
PRG	Preliminary remediation goals for groundwater as outlined in the Feasibility Study Report

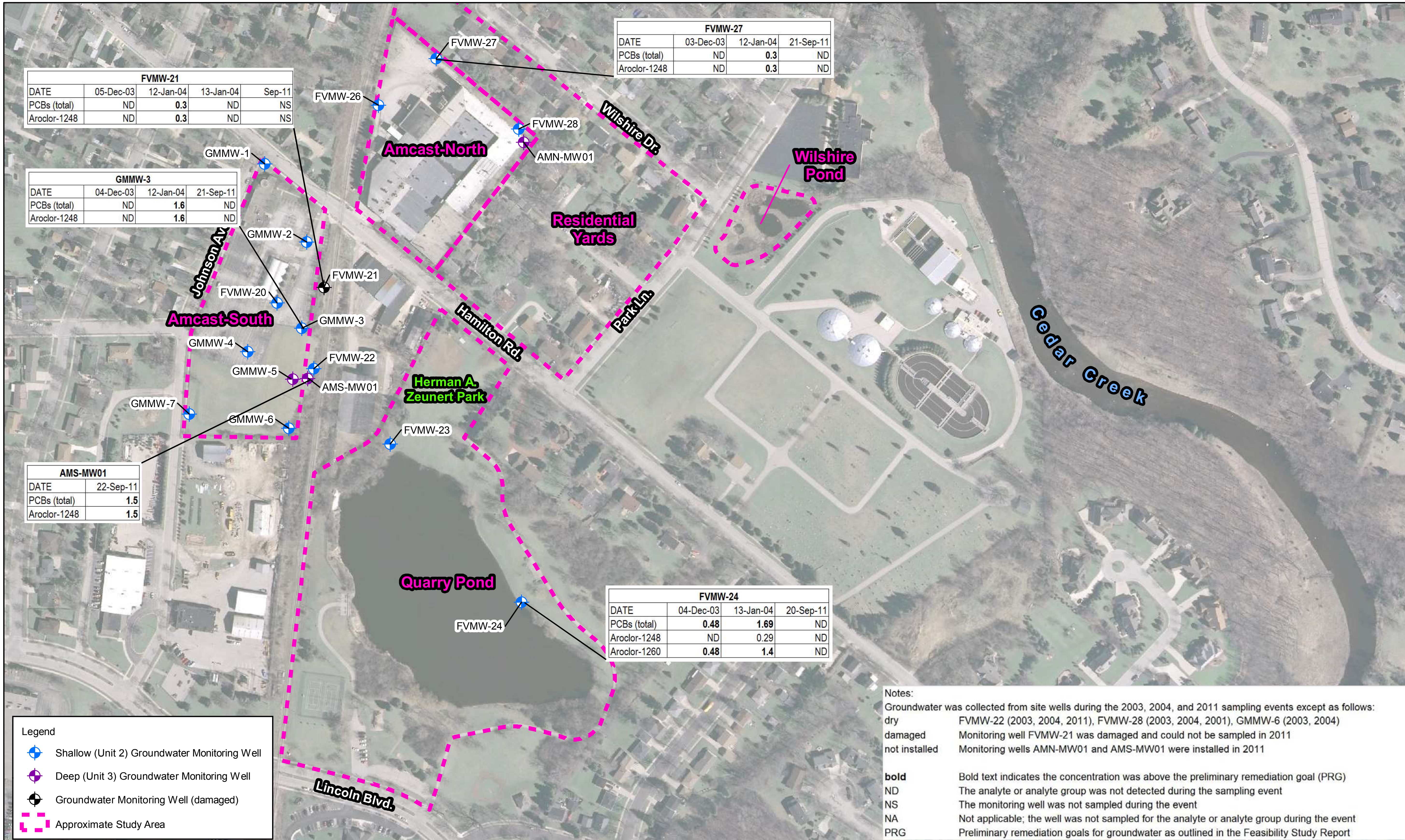
N

0 250 500
Feet

Figure 2-8
Groundwater PRG Exceedances - Metals
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\395072_AMCAST_RIFS\GIS\MAPFILES\2018\FSR\FIGURE 01-05 - GROUNDWATER MONITORING WELL LOCATIONS.MXD AESPEJO 5/23/2018 8:33:05 PM

ch2m:



FVMW-27

DATE	03-Dec-03	12-Jan-04	21-Sep-11
PCBs (total)	ND	**0.3**	ND
Aroclor-1248	ND	**0.3**	ND

FVMW-21

DATE	05-Dec-03	12-Jan-04	13-Jan-04	Sep-11
PCBs (total)	ND	**0.3**	ND	NS
Aroclor-1248	ND	**0.3**	ND	NS

GMMW-3

DATE	04-Dec-03	12-Jan-04	21-Sep-11
PCBs (total)	ND	**1.6**	ND
Aroclor-1248	ND	**1.6**	ND

AMS-MW01

DATE	22-Sep-11
PCBs (total)	**1.5**
Aroclor-1248	**1.5**

FVMW-24

DATE	04-Dec-03	13-Jan-04	20-Sep-11
PCBs (total)	**0.48**	**1.69**	ND
Aroclor-1248	ND	0.29	ND
Aroclor-1260	**0.48**	**1.4**	ND

Notes:

Groundwater was collected from site wells during the 2003, 2004, and 2011 sampling events except as follows:

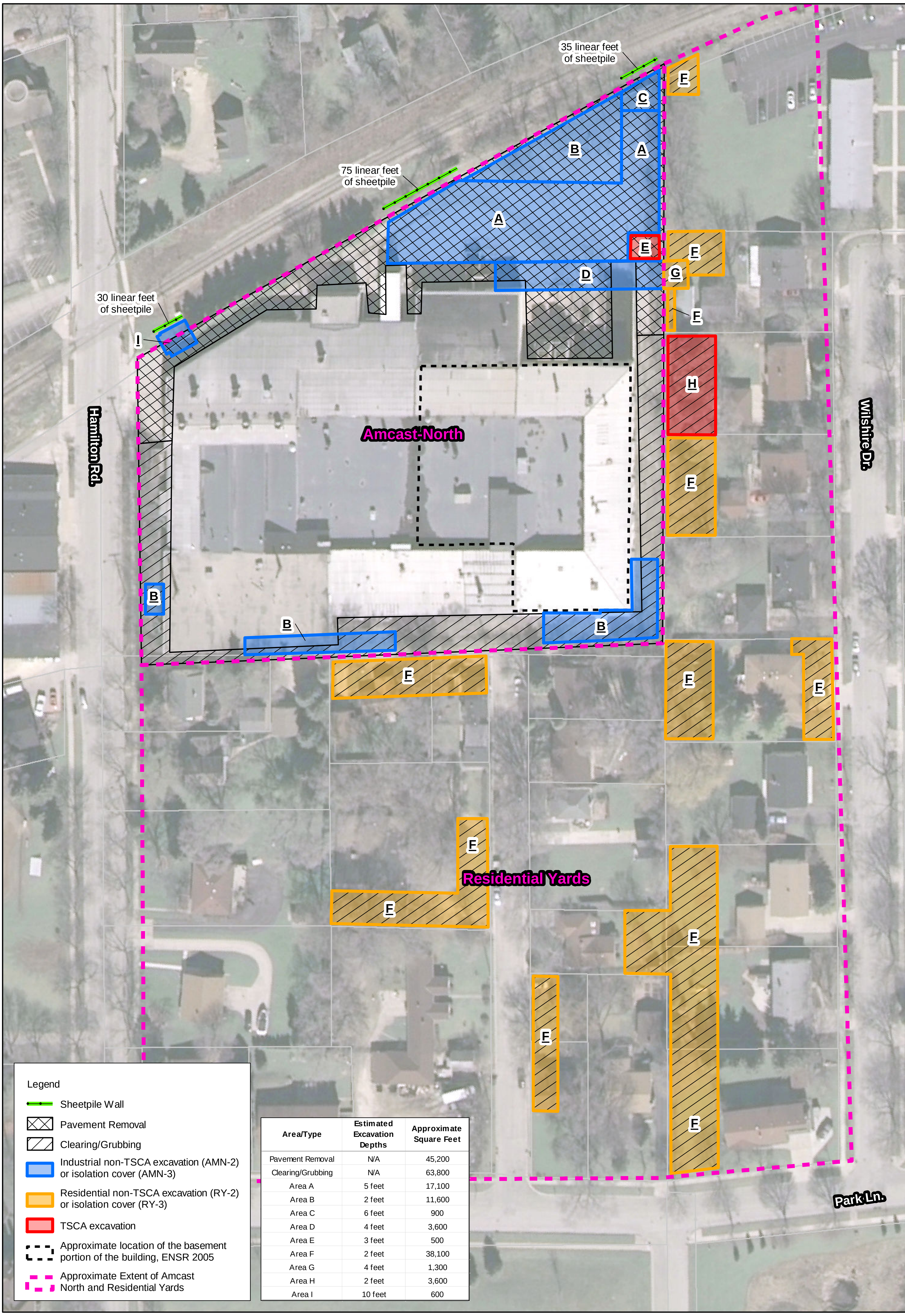
dry	FVMW-22 (2003, 2004, 2011), FVMW-28 (2003, 2004, 2001), GMMW-6 (2003, 2004)
damaged	Monitoring well FVMW-21 was damaged and could not be sampled in 2011
not installed	Monitoring wells AMN-MW01 and AMS-MW01 were installed in 2011
bold	Bold text indicates the concentration was above the preliminary remediation goal (PRG)
ND	The analyte or analyte group was not detected during the sampling event
NS	The monitoring well was not sampled during the event
NA	Not applicable; the well was not sampled for the analyte or analyte group during the event
PRG	Preliminary remediation goals for groundwater as outlined in the Feasibility Study Report

N
0 250 500
Feet

Figure 2-9
Groundwater PRG Exceedances - PCBs
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

ch2m:

\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\395072_AMCAST_RIFS\GIS\MAPFILES\2018\FSR\FIGURE 01-05 - GROUNDWATER MONITORING WELL LOCATIONS.MXD AESPEJO 5/23/2018 8:33:05 PM



Area/Type	Estimated Excavation Depths	Approximate Square Feet
Pavement Removal	N/A	45,200
Clearing/Grubbing	N/A	63,800
Area A	5 feet	17,100
Area B	2 feet	11,600
Area C	6 feet	900
Area D	4 feet	3,600
Area E	3 feet	500
Area F	2 feet	38,100
Area G	4 feet	1,300
Area H	2 feet	3,600
Area I	10 feet	600

0 80 160
Feet

Figure 4-1
Amcast North and Residential Yards Alternatives
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

ch2m.

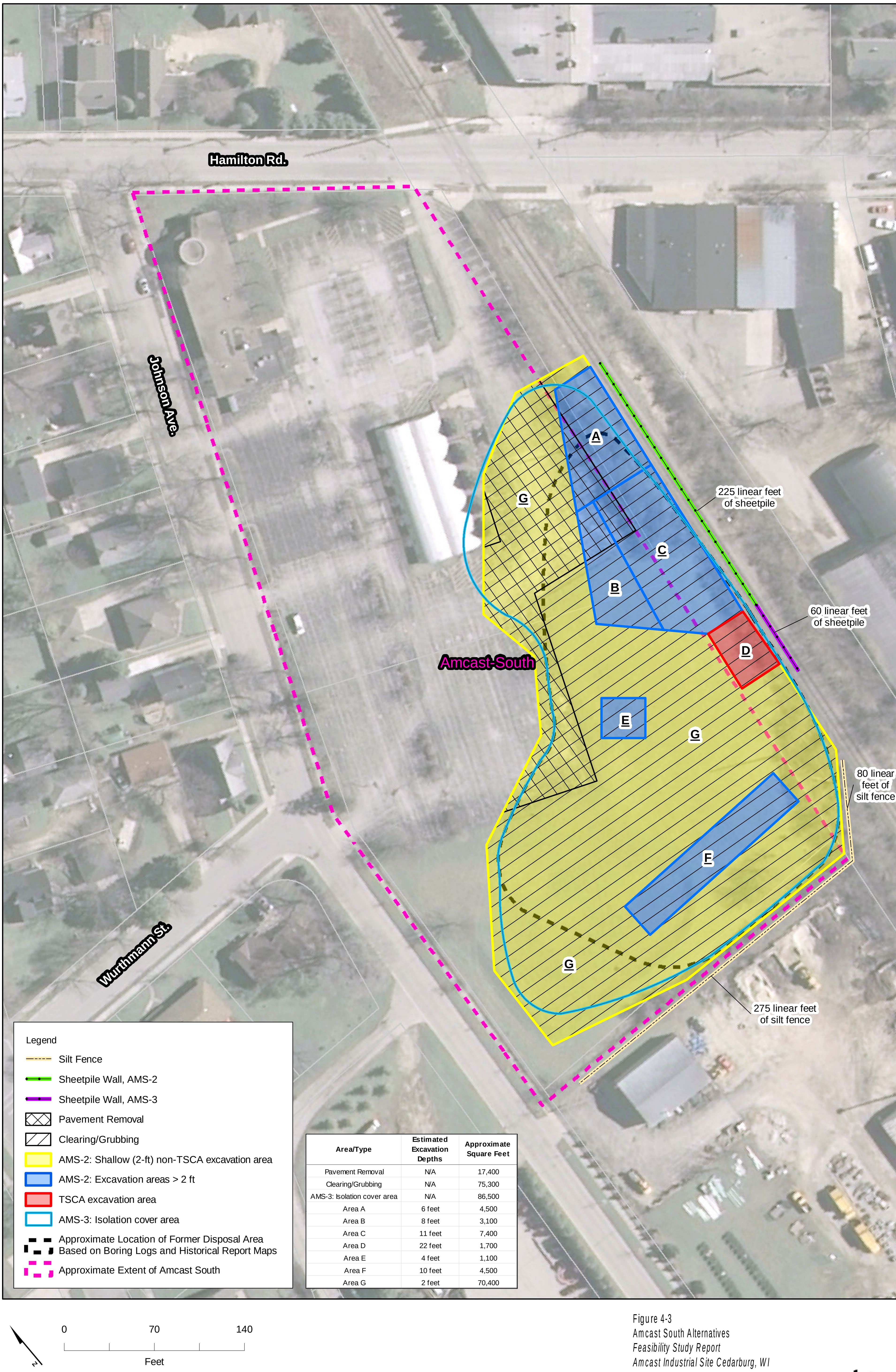
\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\395072_AMCAST_RIFS\GIS\MAPFILES\2018\FSR\FIGURE 04-01 - AMCAST NORTH AND RESIDENTIAL YARDS ALTS.MXD AESPEJO 5/23/2018 8:17:53 PM

Notes:
Drawing source(s) = Figure 2 - City of Cedarburg Detention Ponds (AOI-1) Bank Sample Locations (Phase 2) and Sediment Core Locations (Phase 3), Foth & Van Dyke, June 2004. Original source = "As Constructed" Grading/Erosion Control Plan, Sheet 5 of 7, Bonestroo Rosene Anderlik and Associates, November 1994

Area/Type	Estimated Excavation Depths	Approximate Square Feet
Bank	N/A	10,200
A	2 feet	1,500
B	4 feet	2,700
C	2 feet	18,200
D	2 feet	1,200

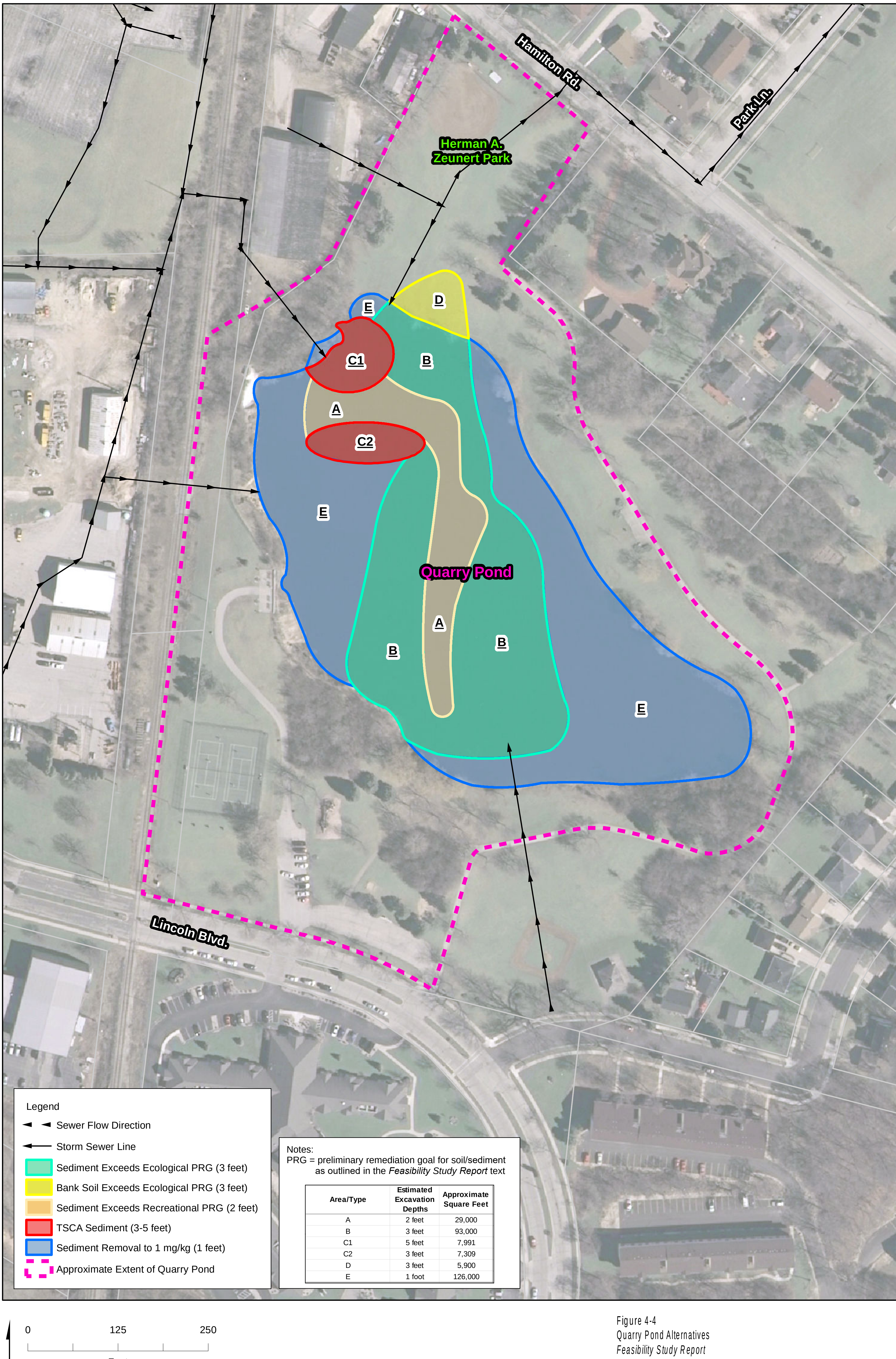
Figure 4-2
Wilshire Pond Alternatives
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

ch2m.



Area/Type	Estimated Excavation Depths	Approximate Square Feet
Pavement Removal	N/A	17,400
Clearing/Grubbing	N/A	75,300
AMS-3: Isolation cover area	N/A	86,500
Area A	6 feet	4,500
Area B	8 feet	3,100
Area C	11 feet	7,400
Area D	22 feet	1,700
Area E	4 feet	1,100
Area F	10 feet	4,500
Area G	2 feet	70,400

Figure 4-3
Amcast South Alternatives
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

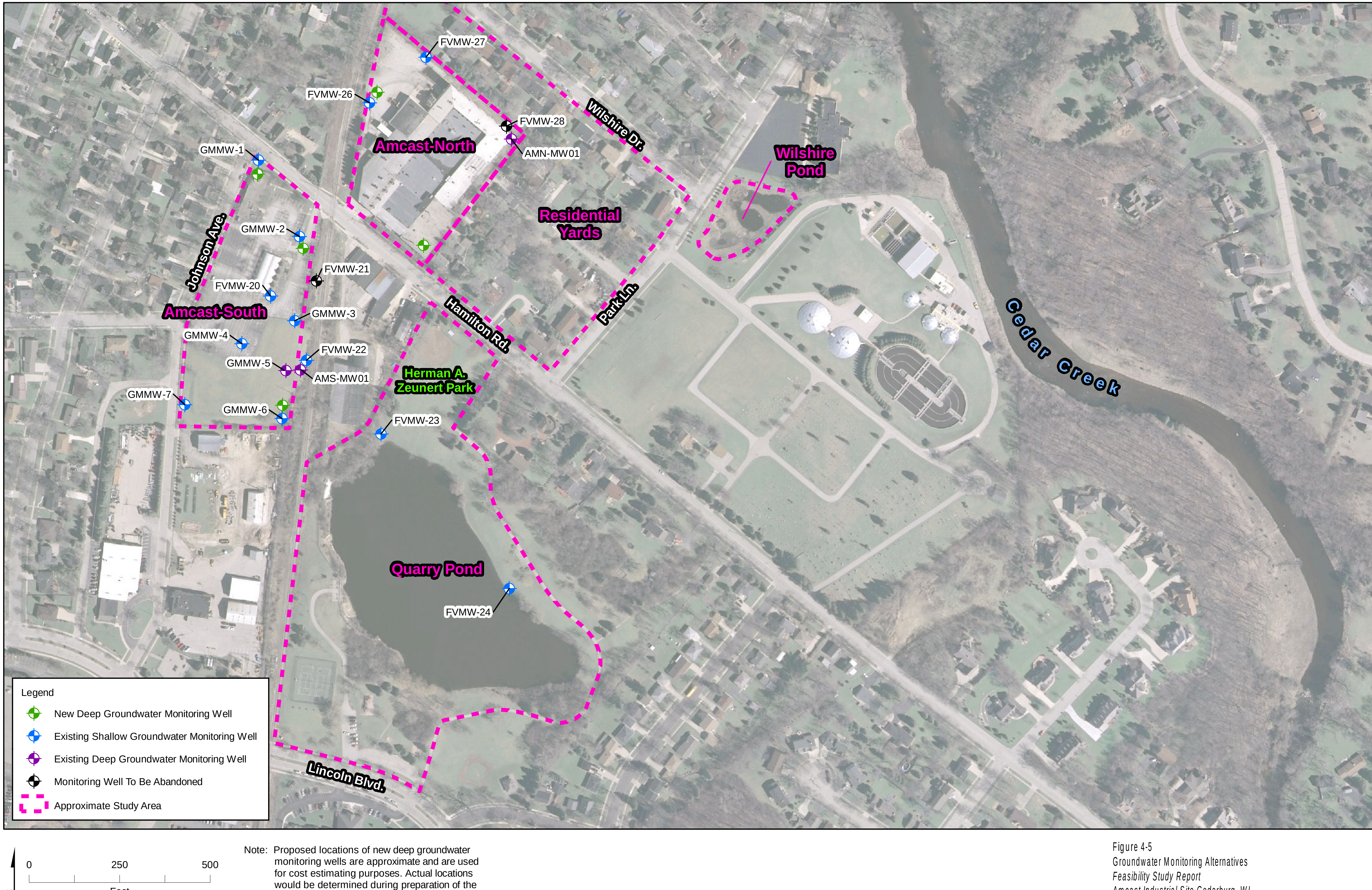


Notes:
PRG = preliminary remediation goal for soil/sediment as outlined in the *Feasibility Study Report* text

Area/Type	Estimated Excavation Depths	Approximate Square Feet
A	2 feet	29,000
B	3 feet	93,000
C1	5 feet	7,991
C2	3 feet	7,309
D	3 feet	5,900
E	1 foot	126,000

Figure 4-4
Quarry Pond Alternatives
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

ch2m

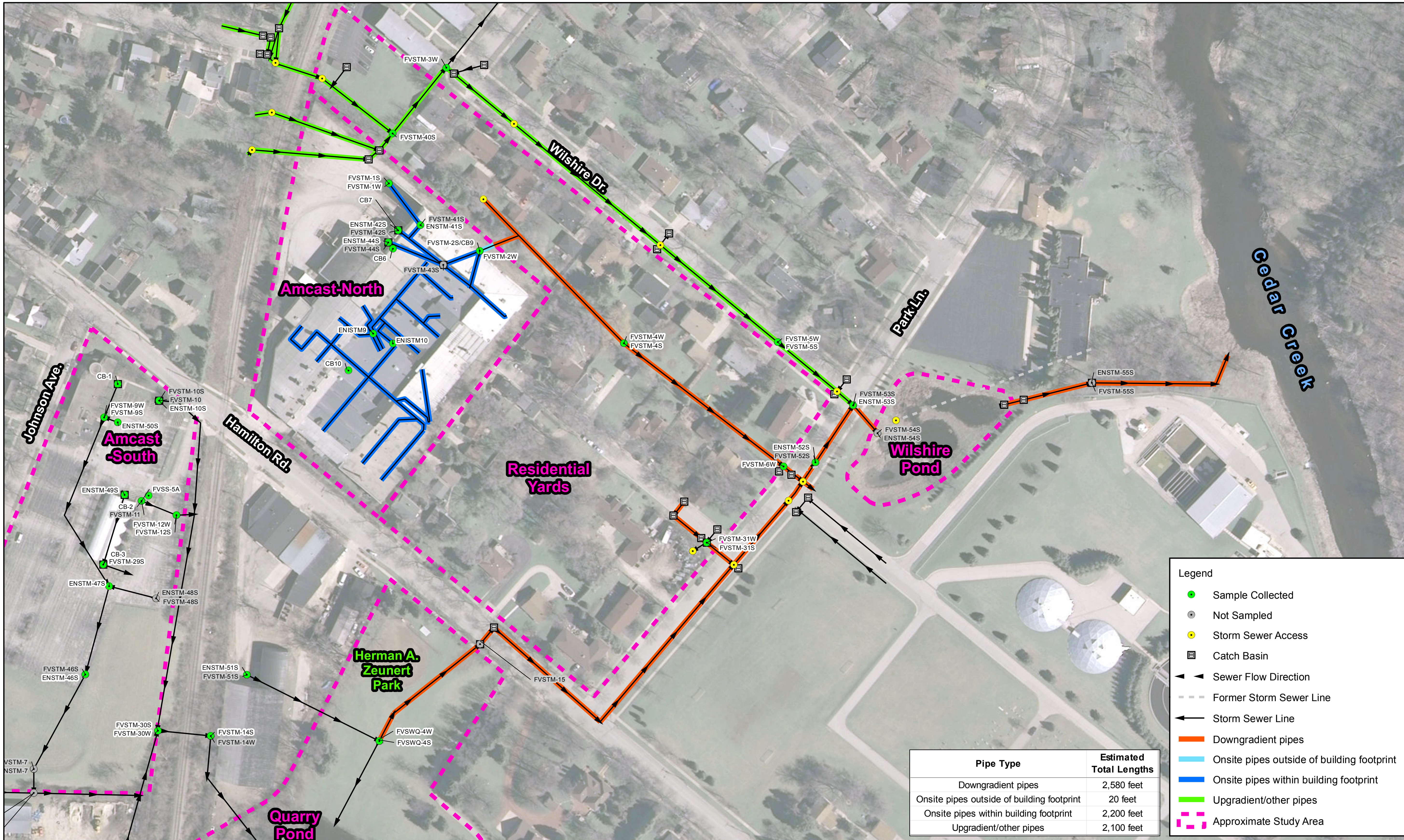


Note: Proposed locations of new deep groundwater monitoring wells are approximate and are used for cost estimating purposes. Actual locations would be determined during preparation of the long-term groundwater monitoring plan.

Figure 4-5
Groundwater Monitoring Alternatives
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

ch2m:

\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\395072_AMCAST_RIFS\GIS\MAPFILES\2018\FSR\FIGURE 04-05 - GROUNDWATER ALTS.MXD AESPEJO 5/23/2018 8:20:39 PM



Pipe Type	Estimated Total Lengths
Downgradient pipes	2,580 feet
Onsite pipes outside of building footprint	20 feet
Onsite pipes within building footprint	2,200 feet
Upgradient/other pipes	2,100 feet

Notes: All locations and flow direction arrows are approximate, summarized from the following resources:
- City of Cedarburg 2010 Adobe Files
- Foth & Van Dyke, 2004.
- ENSR, 2005, 2007.

Figure 4-6
Amcast North Storm Sewer Alternatives
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

ch2m.

\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\395072_AMCAST_RIFS\GIS\MAPFILES\2018\FSR\FIGURE 04-06 - AMCAST NORTH STORM SEWER ALTS.MXD AESPEJO 5/28/2020 5:19:04 PM

Pipe Type	Estimated Total Lengths
Downgradient pipes	700 feet
Onsite pipes outside of building footprint	1,900 feet
Onsite pipes within building footprint	100 feet
Upgradient/other pipes	1,500 feet

Notes: All locations and flow direction arrows are approximate, summarized from the following resources:
- City of Cedarburg 2010 Adobe Files
- Foth & Van Dyke, 2004.
- ENSR, 2005, 2007.

Figure 4-7
Amcast south Storm Sewer Alternatives
Feasibility Study Report
Amcast Industrial Site Cedarburg, WI

\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\395072_AMCAST_RIFS\GIS\MAPFILES\2018\FSR\FIGURE 04-07 - AMCAST SOUTH STORM SEWER ALTS.MXD AESPEJO 5/23/2018 8:28:14 PM

ch2m

Appendix A
Human Health Risk-Based Preliminary Remediation Goals and Summary Tables

DATE: December 14, 2018

Soil Preliminary Remediation Goals for Amcast North and South

As presented in the human health risk assessment (HHRA), the exposure point concentrations (EPCs) of arsenic at Amcast North and South were less than 4 milligrams per kilogram (mg/kg), which is lower than the statewide background concentration (8 mg/kg). Therefore, arsenic is within background levels and was eliminated as a contaminant of concern (COC) in soil. However, for the remaining COCs, human health risk-based preliminary remediation goals (PRGs) were identified for soil (0 to 10 feet). The potential routes of exposure for soil are incidental ingestion, dermal contact, and inhalation.

Based on the risk estimates presented in the HHRA, the most sensitive (highest potential risk) receptor groups for residential and industrial land uses are residents and industrial workers, respectively. Therefore, PRGs were not calculated based on trespasser or construction worker exposures.

EPA's target range for excess lifetime cancer risk (ELCR) associated with Superfund sites and specified in the National Oil and Hazardous Substances Pollution Contingency Plan (40 *Code of Federal Regulations* 300.430) is 1-in-10,000 (10^{-4}) to 1-in-1,000,000 (10^{-6}). That is, the estimated ELCR associated with site-related exposures for a potential receptor population (group) should not exceed this target range. The proposed human health risk-based PRGs were selected based on the more conservative value between the noncarcinogenic (target organ hazard index [HI] = 1) and carcinogenic (target ELCR = 10^{-5}) PRGs. The PRGs were calculated using the ratio of the EPC and risk estimate (presented in the *Remedial Investigation Report*; CH2M 2015) to the target HI and ELCR indicated. A target ELCR of 10^{-5} per chemical was used in the PRG selection process since eight potentially carcinogenic COCs were identified in soil.

The following are the proposed human health risk-based PRGs for soil, as presented in Table A-1:

- Polychlorinated biphenyls (PCBs)
  - Residential – 1 mg/kg based on a hazard quotient (HQ) of 1
  - Industrial – 7.3 mg/kg based on an ELCR of $1x10^{-5}$
- Benzo(a)anthracene
  - Residential – 1.5 mg/kg based on an ELCR of $1x10^{-5}$
  - Industrial – 21 mg/kg based on an ELCR of $1x10^{-5}$
- Benzo(a)pyrene
  - Residential – 0.15 mg/kg based on an ELCR of $1x10^{-5}$
  - Industrial – 2.1 mg/kg based on an ELCR of $1x10^{-5}$
- Benzo(b)fluoranthene
  - Residential – 1.5 mg/kg based on an ELCR of $1x10^{-5}$
  - Industrial – 21 mg/kg based on an ELCR of $1x10^{-5}$
- Benzo(k)fluoranthene
  - Residential – 1.5 mg/kg based on an ELCR of $1x10^{-5}$
  - Industrial – 21 mg/kg based on an ELCR of $1x10^{-5}$
- Chrysene
  - Residential – 5.2 mg/kg based on an ELCR of $1x10^{-5}$

- Dibenzo(a,h)anthracene
  - Residential – 0.15 mg/kg based on an ELCR of $1x10^{-5}$
  - Industrial – 2.1 mg/kg based on an ELCR of $1x10^{-5}$
- Indeno(1,2,3-cd)pyrene
  - Residential – 1.5 mg/kg based on an ELCR of $1x10^{-5}$
  - Industrial – 21 mg/kg based on an ELCR of $1x10^{-5}$

Surface Soil PRGs for Wilshire Pond Banks

Human health risk-based PRGs were identified for the COC (PCBs) in surface soil (0 to 2 feet) on the Wilshire Pond Banks. The potential routes of exposure for soil are incidental ingestion, dermal contact, and inhalation by recreational users.

The proposed human health risk-based PRG was selected based on the more conservative value between the noncarcinogenic (target organ HI = 1) and carcinogenic (target ELCR = 10^{-5}) PRGs. The PRGs were calculated using the ratio of the EPC and risk estimate (presented in the *Remedial Investigation Report*; CH2M 2015) to the target HI and ELCR indicated. A target ELCR of 10^{-5} was used in the PRG selection process, consistent with soil PRGs for the Amcast North and South properties. The following is the proposed human health risk-based PRG for surface soil for the Wilshire Pond Banks, as presented in Table A-3:

- PCBs: 7.6 mg/kg based on a HQ of 1

Groundwater PRGs

Human health risk-based PRGs were identified for the COCs in groundwater. The potential routes of exposure for groundwater are incidental ingestion, dermal contact, and inhalation during showering/bathing.

Based on the risk estimates presented in the HHRA, the most sensitive (highest potential risk) receptor group for tapwater use is residents. In addition, the site is surrounded by residential land use. Therefore, groundwater PRGs were not calculated based on industrial worker exposures to tapwater.

A tiered approach was used to identify PRGs for groundwater COCs. The state Public Health Enforcement Standard (ES) was used when available. If an ES was not available, the state Maximum Contaminant Level (MCL) was used when available. When both an ES and MCL were not available, human health risk-based PRGs were selected based on the more conservative value between the noncarcinogenic (target organ HI = 1) and carcinogenic (target ELCR = 10^{-5}) PRGs. The PRGs were calculated using the ratio of the EPC and risk estimate (presented in the *Remedial Investigation Report*; CH2M 2015) to the target HI and ELCR indicated. A target ELCR of 10^{-5} per COC was used in the PRG selection process since approximately 10 potentially carcinogenic COCs were identified in groundwater.

The following are the proposed human health risk-based PRGs for potable use of groundwater, as presented in Table A-4:

- PCBs: 0.03 micrograms per liter (µg/L) based on the ES
- Arsenic: 10 µg/L based on the ES and MCL
- Chromium: 100 µ/L based on the ES and MCL
- Manganese: 300 µg/L based on the ES
- Lead: 15 µg/L based on the ES and MCL
- Benzo(a)anthracene: 0.016 µg/L based on an ELCR of $1x10^{-5}$
- Benzo(a)pyrene: 0.2 µg/L based on the ES and MCL
- Benzo(b)fluoranthene: 0.2 µg/L based on the ES
- Benzo(k)fluoranthene: 0.011 µg/L based on an ELCR of $1x10^{-5}$

- Chrysene: 0.2 µg/L based on the ES
- Dibenzo(a,h)anthracene: 0.0007 µg/L based on an ELCR of $1x10^{-5}$
- Indeno(1,2,3-c,d)pyrene): 0.0065 µg/L based on an ELCR of $1x10^{-5}$
- Bis(2-ethylhexyl)phthalate: 6 µg/L based on the ES and MCL
- Hexachloroethane: 3 µg/L based on a target organ HI of 1
- Pentachlorophenol: 0.32 µg/L based on an ELCR of $1x10^{-5}$
- 1,1'-Biphenyl: 0.3 µg/L based on a target organ HI of 1
- 1,2,4-trimethylbenzene: 480 µg/L based on the ES
- Benzene: 5 µg/L based on the ES and MCL
- Bromodichloromethane: 0.6 µg/L based on the ES
- Chloroform: 6 µg/L based on the ES
- Ethylbenzene: 700 µg/L based on the ES and MCL
- Naphthalene: 100 µg/L based on the ES

Sediment PRG

A human health risk-based PRG was identified for the COC (PCBs) in Quarry Pond sediment. The potential routes of exposure for sediment are incidental ingestion and dermal contact. Bioaccumulation in fish tissue was not considered in calculating the PRG but should be considered during selection of the final remediation goal.

The proposed human health risk-based PRG was selected based on the more conservative value between the noncarcinogenic (target organ HI = 1) and carcinogenic (target ELCR = 10^{-5}) PRGs. The PRGs were calculated using the ratio of the EPC and risk estimate (presented in the *Remedial Investigation Report*; CH2M 2015) to the target HI and ELCR indicated. A target ELCR of 10^{-5} was used in the PRG selection process consistent with the target risk level on Amcast North and South. The following human health risk-based PRG is proposed for sediment for direct-contact exposures, as presented in Table A-5:

- PCBs: 21 mg/kg based on a target organ HI of 1.

Fish Fillet PRG

A human health risk-based PRG was identified for the COC (PCBs) in Quarry Pond fish fillets. The potential route of exposure for fish is ingestion.

The proposed human health risk-based PRG was selected based on the more conservative value between the noncarcinogenic (target organ HI = 1) and carcinogenic (target ELCR = 10^{-5}) PRGs. The PRGs were calculated using the ratio of the EPC and risk estimate (presented in the *Remedial Investigation Report*; CH2M 2015) to the target HI and ELCR indicated. A target ELCR of 10^{-5} was used in the PRG selection process consistent with the target risk level on Amcast North and South. The following human health risk-based PRG is proposed for fish fillets, as presented in Table A-6:

- PCBs: 0.025 mg/kg based on a target organ HI of 1.

References

CH2M HILL, Inc. (CH2M). 2015. *Remedial Investigation Report, Amcast Industrial Site, Cedarburg, Wisconsin*. May.

Wisconsin Department of Natural Resources (WDNR). 2011. *Drinking Water & Groundwater Quality Standards/Advisory Levels.* Accessed at https://dnr.wi.gov/topic/DrinkingWater/documents/HALtable.pdf.

Table A-1. Preliminary Remediation Goals for Total Soil (0-10 ft bgs)
Amcast Industrial Site, Cedarburg, Wisconsin

Receptor and Area	EPC (mg/kg)	Cancer Calculated Risk	Noncancer Calculated Hazard Quotient	PRG Based on Cancer Risk Level (mg/kg) 1E-06	1E-05	1E-04	PRG Based on Hazard Quotient Level (mg/kg) 1	Final HQ Level / Target Organ	Recommended PRG (mg/kg)
Adult - Amcast North									
PCBs, Total	130	NA	14	NA	NA	NA	9	HQ = 1 (Finger Nails, Eyes)	1
Child - Amcast North									
PCBs, Total	130	NA	118	NA	NA	NA	1	HQ = 1 (Finger Nails, Eyes)	1
Adult/Child Aggregate - Amcast North									
PCBs, Total	130	6E-04	NA	2.2E-01	2.2E+00	2.2E+01	NA		1
Benzo(a)anthracene	2.515	2E-05	NA	1.5E-01	1.5E+00	1.5E+01	NA		1.5
Benzo(a)pyrene	1.885	1E-04	NA	1.5E-02	1.5E-01	1.5E+00	NA		0.15
Benzo(b)fluoranthene	1.846	1E-05	NA	1.5E-01	1.5E+00	1.5E+01	NA		1.5
Benzo(k)fluoranthene	1.765	1E-05	NA	1.5E-01	1.5E+00	1.5E+01	NA		1.5
Dibenzo(a,h)anthracene	0.15	1E-05	NA	1.5E-02	1.5E-01	1.5E+00	NA		0.15
Indeno(1,2,3-cd)pyrene	0.59	4E-06	NA	1.5E-01	1.5E+00	1.5E+01	NA		1.5
Industrial Worker - Amcast North									
PCBs, Total	130	2E-04	13	7.3E-01	7.3E+00	7.3E+01	10	HQ = 1 (Finger Nails, Eyes)	7.3
Benzo(a)pyrene	1.885	9E-06	NA	2.1E-01	2.1E+00	2.1E+01	NA		2.1
Child - Amcast South									
PCBs, Total	8.659	NA	8	NA	NA	NA	1	HQ = 1 (Finger Nails, Eyes)	1
Adult/Child Aggregate - Amcast South									
PCBs, Total	8.659	4E-05	NA	2.2E-01	2.2E+00	2.2E+01	NA		1
Benzo(a)anthracene	29.91	2E-04	NA	1.5E-01	1.5E+00	1.5E+01	NA		1.5
Benzo(a)pyrene	33.32	2E-03	NA	1.5E-02	1.5E-01	1.5E+00	NA		0.15
Benzo(b)fluoranthene	35.69	2E-04	NA	1.5E-01	1.5E+00	1.5E+01	NA		1.5
Benzo(k)fluoranthene	26.12	2E-04	NA	1.5E-01	1.5E+00	1.5E+01	NA		1.5
Chrysene	21.94	4E-05	NA	5.2E-01	5.2E+00	5.2E+01	NA		5.2
Dibenzo(a,h)anthracene	7.545	5E-04	NA	1.5E-02	1.5E-01	1.5E+00	NA		0.15
Indeno(1,2,3-cd)pyrene	37.82	3E-04	NA	1.5E-01	1.5E+00	1.5E+01	NA		1.5
Industrial Workers - Amcast South									
PCBs, Total	8.659	1E-05	NA	7.4E-01	7.4E+00	7.4E+01	NA		7.3
Benzo(a)anthracene	29.91	1E-05	NA	2.1E+00	2.1E+01	2.1E+02	NA		21
Benzo(a)pyrene	33.32	2E-04	NA	2.1E-01	2.1E+00	2.1E+01	NA		2.1
Benzo(b)fluoranthene	35.69	2E-05	NA	2.1E+00	2.1E+01	2.1E+02	NA		21
Benzo(k)fluoranthene	26.12	1E-05	NA	2.1E+00	2.1E+01	2.1E+02	NA		21
Dibenzo(a,h)anthracene	7.545	4E-05	NA	2.1E-01	2.1E+00	2.1E+01	NA		2.1
Indeno(1,2,3-cd)pyrene	37.82	2E-05	NA	2.1E+00	2.1E+01	2.1E+02	NA		21

Notes:
ELCR = excess lifetime cancer risk
EPC = exposure point concentration
ft bgs = feet below ground surface
HQ = hazard quotient
mg/kg = milligram per kilogram
NA = not applicable
PRG = Preliminary Remediation Goal

Wisconsin's Residual Concentration Limits (RCLs) have To-Be-Considered status. The RCLs are based on the use of EPA's Regional Screening Level calculator, with modifications for Chicago's climate and a cumulative target ELCR of $1x10^{-5}$ and cumulative noncancer Hazard Index (HI) of 1. The exposure factors used in the HHRA incorporate the site-specific climate, and the calculated RGs are based on the same exposure factors used in the HHRA. Because PRGs based on various target risk levels ($1x10^{-4}$, $1x10^{-5}$, and $1x10^{-6}$) and a target organ-specific HI of 1 are presented, PRGs that address the intent of the RCLs are provided.

Table A-2. Preliminary Remediation Goals for Surface Soil on Wilshire Pond Banks

Amcast Industrial Site, Cedarburg, Wisconsin

Receptor	EPC (mg/kg)	Cancer Calculated Risk	Noncancer Calculated Hazard Quotient	PRG Based on Cancer Risk Level (mg/kg) 1E-06	1E-05	1E-04	PRG Based on Hazard Quotient Level (mg/kg) 1	Final HQ Level / Target Organ	Recommended PRG (mg/kg)
Recreational Adult - Wilshire Pond Bank									
PCBs, Total	2.18E+02	NA	3	NA	NA	NA	6.3E+01	HQ = 1 (Finger Nails, Eyes)	7.6
Recreational Child - Wilshire Pond Bank									
PCBs, Total	2.18E+02	NA	29	NA	NA	NA	7.6E+00	HQ = 1 (Finger Nails, Eyes)	7.6
Recreational Adult/Child Aggregate- Wilshire Pond Bank									
PCBs, Total	2.18E+02	1E-04	NA	1.5E+00	1.5E+01	1.5E+02	NA		7.6

Notes:

EPC = exposure point concentration

ELCR = excess lifetime cancer risk

HQ = Hazard quotient

mg/kg = milligram per kilogram

NA = Not applicable

PCB = polychlorinated biphenyl

PRG = Preliminary remediation goal

Wisconsin's Residual Concentration Limits (RCLs) have To-Be-Considered status. The RCLs are based on the use of EPA's Regional Screening Level calculator, with modifications for Chicago's climate and a cumulative target ELCR of $1x10^{-5}$ and cumulative noncancer HI of 1. The exposure factors used in the HHRA incorporate the site-specific climate, and the calculated PRGs are based on the same exposure factors used in the HHRA. Because PRGs based on various target risk levels ($1x10^{-4}$, $1x10^{-5}$, and $1x10^{-6}$) and a target-organ-specific HI of 1 are presented, PRGs that address the intent of the RCLs are provided.

Table A-3. Preliminary Remediation Goals for Groundwater

Amcast Industrial Site, Cedarburg, Wisconsin

Receptor	EPC (µg/L)	Cancer Calculated Risk	Noncancer Calculated Hazard Quotient	PRG Based on Cancer Risk Level (µg/L) 1E-06	PRG Based on Cancer Risk Level (µg/L) 1E-05	PRG Based on Cancer Risk Level (µg/L) 1E-04	PRG Based on Hazard Quotient Level (µg/L) 1	Final HQ Level / Target Organ	WDNR Groundwater Quality Standards/Advisory Levels (Source) (µg/L)	Recommended PRG (µg/L)
Adult Resident - Groundwater										
Total PCB (Calc)	0.767	NA	24	NA	NA	NA	0.03	HQ = 1 (Finger Nails, Eyes)	0.03 (1), 0.5 (2)	0.03
Arsenic	24.54	NA	2	NA	NA	NA	11	HQ = 1 (Skin, Cardiovascular System)	10 (1, 2)	10
Lead	14.47	NA	NA	NA	NA	NA	NA		15 (1,2)	15
Bis(2-ethylhexyl)phthalate	125.1	NA	15	NA	NA	NA	4	HQ = 0.5 (Liver)	6 (1, 2)	6
Hexachloroethane	17	NA	1.4	NA	NA	NA	6	HQ = 0.5 (Kidney)	1 (3)	3
1,1'-Biphenyl	5.4	NA	3	NA	NA	NA	1	HQ = 0.5 (Liver, Kidney)	NA	0.3
1,2,4-Trimethylbenzene	58	NA	2	NA	NA	NA	37	HQ = 1 (Blood)	480 (1)	480
Naphthalene	17	NA	1.1	NA	NA	NA	15	HQ = 1 (Respiratory)	100 (1)	100
Child Resident - Groundwater										
Total PCB (Calc)	0.767	NA	54	NA	NA	NA	0.01	HQ = 1 (Finger Nails, Eyes)	0.03 (1), 0.5 (2)	0.03
Arsenic	24.54	NA	5	NA	NA	NA	5	HQ = 1 (Skin, Cardiovascular System)	10 (1, 2)	10
Chromium	92.48	NA	2	NA	NA	NA	37	HQ = 1 (NOE)	100 (1, 2)	100
Lead	14.47	NA	NA	NA	NA	NA	NA		15 (1,2)	15
Manganese	673.4	NA	2	NA	NA	NA	322	HQ = 1 (Nervous System)	300 (1)	300
Bis(2-ethylhexyl)phthalate	125.1	NA	34	NA	NA	NA	2	HQ = 0.5 (Liver)	6 (1, 2)	6
Hexachloroethane	17	NA	3	NA	NA	NA	3	HQ = 0.5 (Kidney)	1 (3)	3
1,1'-Biphenyl	5.4	NA	8	NA	NA	NA	0.3	HQ = 0.5 (Liver, Kidney)	NA	0.3
1,2,4-Trimethylbenzene	58	NA	5	NA	NA	NA	12	HQ = 1 (Blood)	480 (1)	480
Naphthalene	17	NA	3	NA	NA	NA	5	HQ = 1 (Respiratory)	100 (1)	100
Adult/Child Aggregate - Groundwater										
Total PCB (Calc)	0.767	5E-04	NA	1.5E-03	1.5E-02	1.5E-01	NA		0.03 (1), 0.5 (2)	0.03
Arsenic	24.54	6E-04	NA	4.4E-02	4.4E-01	4.4E+00	NA		10 (1, 2)	10
Chromium	92.48	4E-03	NA	2.4E-02	2.4E-01	2.4E+00	NA		100 (1, 2)	100
Lead	14.47	NA	NA	NA	NA	NA	NA		15 (1,2)	15
Benzo(a)anthracene	3.003	2E-03	NA	1.6E-03	1.6E-02	1.6E-01	NA		NA	0.016
Benzo(a)pyrene	19	2E-01	NA	1.1E-04	1.1E-03	1.1E-02	NA		0.2 (1, 2)	0.2
Benzo(b)fluoranthene	28	2E-02	NA	1.8E-03	1.8E-02	1.8E-01	NA		0.2 (1)	0.2
Benzo(k)fluoranthene	24	2E-02	NA	1.1E-03	1.1E-02	1.1E-01	NA		NA	0.011
Chrysene	7.219	5E-03	NA	1.6E-03	1.6E-02	1.6E-01	NA		0.2 (1)	0.2
Dibenzo(a,h)anthracene	0.01	1E-04	NA	7.0E-05	7.0E-04	7.0E-03	NA		NA	0.0007
Indeno(1,2,3-cd)pyrene	21	3E-02	NA	6.5E-04	6.5E-03	6.5E-02	NA		0.03 (3)	0.0065
Bis(2-ethylhexyl)phthalate	125.1	2E-03	NA	5.6E-02	5.6E-01	5.6E+00	NA		6 (1, 2)	6
Hexachloroethane	17	2E-05	NA	7.8E-01	7.8E+00	7.8E+01	NA		1 (3)	3
Pentachlorophenol	0.079	2E-06	NA	3.2E-02	3.2E-01	3.2E+00	NA		NA	0.32
1,1'-Biphenyl	5.4	2E-06	NA	3.3E+00	3.3E+01	3.3E+02	NA		NA	0.3
Benzene	3.8	7E-06	NA	5.4E-01	5.4E+00	5.4E+01	NA		5 (1, 2)	5
Bromodichloromethane	1.4	7E-06	NA	1.9E-01	1.9E+00	1.9E+01	NA		0.6 (1) 80 (2)	0.6
Chloroform	1.1	3E-06	NA	3.1E-01	3.1E+00	3.1E+01	NA		6 (1), 80 (2)	6
Ethylbenzene	8.035	4E-06	NA	1.8E+00	1.8E+01	1.8E+02	NA		700 (1, 2)	700
Naphthalene	17	7E-05	NA	2.5E-01	2.5E+00	2.5E+01	NA		100 (1)	100

Notes:

(1) Wisconsin Natural Resource (NR) 140 Public Health Enforcement Standard (ES) value (Wisconsin Department of Natural Resources [WDNR] 2011)

(2) NR 809 Maximum Contaminant Level (MCL) value (WDNR 2011)

(3) Wisconsin Department of Health Services (DHS)/EPA Lifetime Health Advisory/Cancer Risk (HAL/CR) value (WDNR 2011)

µg/L = microgram per liter
EPC = exposure point concentration
ELCR = excess lifetime cancer risk
HQ = hazard quotient
NA = not applicable
NOE = No Observed Effect
PCB = polychlorinated biphenyl
PRG = Preliminary Remediation Goal

Table A-4. Preliminary Remediation Goals for Quarry Pond Sediment (For Direct Contact Only)
Amcast Industrial Site, Cedarburg, Wisconsin

Receptor	EPC (mg/kg)	Cancer Calculated Risk	Noncancer Calculated Hazard Quotient	PRG Based on Cancer Risk Level (mg/kg) 1E-06	1E-05	1E-04	PRG Based on Hazard Quotient Level (mg/kg) 1	Final HQ Level / Target Organ	Recommended PRG (mg/kg)
Recreational Adult - Quarry Pond Sediment									
PCBs, Total	1.05E+03	NA	18	NA	NA	NA	5.8E+01	HQ = 1 (Finger Nails, Eyes)	21
Recreational Child - Quarry Pond Sediment									
PCBs, Total	1.05E+03	NA	49	NA	NA	NA	2.1E+01	HQ = 1 (Finger Nails, Eyes)	21
Recreational Adult/Child Aggregate- Quarry Pond Sediment									
PCBs, Total	1.05E+03	4E-04	NA	2.5E+00	2.5E+01	2.5E+02	NA		21

Notes:
EPC = exposure point concentration
ELCR = excess lifetime cancer risk
HQ = hazard quotient
mg/kg = milligram per kilogram
NA = not applicable
PCB = polychlorinated biphenyl
PRG = Preliminary Remediation Goal

Table A-5. Preliminary Remediation Goals for Fish Fillets from Quarry Pond

Amcast Industrial Site, Cedarburg, Wisconsin

Receptor	EPC (mg/kg)	Cancer Calculated Risk	Noncancer Calculated Hazard Quotient	PRG Based on Cancer Risk Level (mg/kg) 1E-06	1E-05	1E-04	PRG Based on Hazard Quotient Level (mg/kg) 1	Final HQ Level / Target Organ	Recommended PRG (mg/kg)
Adult Recreational Angler - Quarry Pond									
PCBs, Total	8.13E+00	3E-03	215	2.8E-03	2.8E-02	2.8E-01	3.8E-02	HQ = 1 (Finger Nails, Eyes)	0.025
Child Recreational Angler - Quarry Pond									
PCBs, Total	8.13E+00	1E-03	325	7.3E-03	7.3E-02	7.3E-01	2.5E-02	HQ = 1 (Finger Nails, Eyes)	0.025

Notes:

EPC = exposure point concentration

ELCR = excess lifetime cancer risk

HQ = hazard quotient

mg/kg = milligram per kilogram

NA = not applicable

PCB = polychlorinated biphenyl

PRG = Preliminary Remediation Goal

Appendix B
Ecological Risk-Based Preliminary Remediation Goals and Summary Tables

DATE: April 10, 2014

Tables B-1 through B-5 present the ecological risk-based preliminary remediation goals (PRGs). Medium-specific PRGs based on various ecological effect levels were developed for the chemicals of potential concern (COPCs) identified in Step 3A of the baseline ecological risk assessment (BERA). The development of these PRGs considered the following:

- The ecological screening values used in the Step 3A BERA.
- Alternate ecological screening values from the literature.
- Back-calculated food web exposure values (from a hazard quotient [HQ] of 1.0) using literature-based bioaccumulation factors (BERA values from the Step 3A BERA report) and ingestion-based screening values (based on the No Observed Adverse Effect Level [NOAEL], Lowest Observed Adverse Effect Level [LOAEL], and Maximum Acceptable Toxicant Concentration [MATC; the geometric mean of the NOAEL and LOAEL]). The most sensitive receptor was selected for this calculation (based on the HQs from the Step 3A BERA) for each applicable medium/pathway. Receptor-specific input parameter values and ingestion-based screening values were the same as those used in the Step 3A BERA.

Where available data allowed, a range of PRGs (more conservative, middle range, and less conservative) was calculated for each relevant COPC and medium/pathway. The more conservative estimates were based on no-effect levels, the middle range estimates were based on MATCs, and the less conservative estimates were based on lowest-effect levels. The lowest calculated value was used in the derivations if estimates from multiple receptors were available for the same medium/pathway. The middle-range PRGs based on the MATC (shaded gray in Table B-1) are the recommended values, and it is assumed that they will be applied by comparing them with 95 percent upper confidence limit concentrations from post-remedial confirmation samples. If the PRGs are to be used as not-to-exceed values, it is recommended that the lowest observed effect concentration-based PRGs, where available, be used instead.

Direct-exposure soil PRGs for metals and polynuclear aromatic hydrocarbons were based on soil invertebrate effect levels because constituents within these chemical groups were only identified as soil COPCs at Amcast South. The habitat at Amcast South is partially developed, with the remainder (landfill area) covered by herbaceous, invasive plant species tolerant of urbanized conditions. Thus, effect levels based on terrestrial plants were not considered during the derivation of soil PRGs. It is recommended that site-specific background surface soil concentrations for the two metal COPCs from this area (copper and manganese) be derived (this will require additional sampling) and, if higher than the calculated soil PRGs in Table B-1, be used as the soil PRGs for these two metals.

Table B-1 summarizes the selected ecological PRGs, and Tables B-2 through B-5 provide the derivation of these values. It should be noted that ecological soil PRGs are, typically, only applicable to the top 2 feet of soil.

References

Jarvinen, A.W. and G.T. Ankley. 1999. *Linkage of effects to tissue residues: development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals.* Society of Environmental Toxicology and Chemistry Press, Pensacola, FL. 358 pp.

Jones, D.S., G.W. Suter II, and R.N. Hull. 1997. T*oxicological benchmarks for screening contaminants of potential concern for effects on sediment-associated biota*: 1997 revision. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-95/R4.

U.S. Army Engineer Research and Development Center Environmental Laboratory (ERDCEL). 2013. Environmental Residue Effects Database. Retrieved (April 5, 2013) from http://el.erdc.usace.army.mil/ered/.

U.S. Environmental Protection Agency (EPA). 2007a. Ecological soil screening levels for copper. OSWER Directive 9285.7-68. February.

U.S. Environmental Protection Agency (EPA). 2007b. Ecological soil screening levels for manganese. OSWER Directive 9285.7-71. April.

U.S. Environmental Protection Agency (EPA). 2007c. *Ecological soil screening levels for polycyclic aromatic hydrocarbons (PAHs).* OSWER Directive 9285.7-78. June.

Table B-1
Summary of Ecological Risk-Based PRGs
Amcast Industrial Site, Cedarburg, Wisconsin

Ecological COPC	Pathway/Receptor: Direct Exposure	Pathway/Receptor: Food Web	Medium	Area: Amcast North	Area: Amcast South	Area: Residential Area	Area: Zeunert Park	Area: Quarry Pond	Area: Wilshire Pond	PRG: NOEC	PRG: MATC	PRG: LOEC	PRG: Units	PRG: Basis
Metals														
Copper	X		Surface soil[1]		X					--	80.0	--	mg/kg	Eco-SSL (EPA 2007a) - soil invertebrates
Manganese	X		Surface soil[1]		X					--	450	--	mg/kg	Eco-SSL (EPA 2007b) - soil invertebrates
Semivolatile Organic Compounds														
PAHs, High Molecular Weight[2]	X		Surface soil[1]		X					--	18,000	--	µg/kg	Eco-SSL (EPA 2007c) - soil invertebrates
Polychlorinated Biphenyls														
Aroclor-1248	X		Surface soil[1]	X	X	X				20,000	28,284	40,000	µg/kg	Aroclor-1254 value
		X		X	X	X	X			542	985	1,790	µg/kg	Back-calculated food web (shrew)[3]
Aroclor-1254	X		Surface soil[1]		X	X				20,000	28,284	40,000	µg/kg	Efroymson et al. (1997) - plants
		X				X				542		1,790	µg/kg	Back-calculated food web (shrew)[3]
Total PCBs	X		Surface soil[1]	X	X	X				20,000	28,284	40,000	µg/kg	Aroclor-1254 value
		X		X	X	X	X			542	985	1,790	µg/kg	Back-calculated food web (shrew)[3]
Aroclor-1248	X		Fish/frog tissue					X	X	2.80	5.55	11.0	mg/kg (wet-weight)	Literature-based tissue residue effect levels[4]
Total PCBs	X		Fish/frog tissue					X	X	2.80	5.55	11.0	mg/kg (wet-weight)	Literature-based tissue residue effect levels[4]
Aroclor-1248	X		Basin sediment					X		--	6,880	--	µg/kg	Equilibrium partitioning-based sediment ESV normalized to mean site-specific TOC[5]
		X						X		793	1,870	4,400	µg/kg	Back-calculated food web (tree swallow)[6]
Total PCBs	X		Basin sediment					X		--	6,880	--	µg/kg	Equilibrium partitioning-based sediment ESV normalized to mean site-specific TOC[5]
		X						X		793	1,870	4,400	µg/kg	Back-calculated food web (tree swallow)[6]
Aroclor-1248	X		Basin and Bank sediment						X	--	6,870	--	µg/kg	Equilibrium partitioning-based sediment ESV normalized to mean site-specific TOC[5]
		X							X	793	1,870	4,400	µg/kg	Back-calculated food web (tree swallow)[6]
Total PCBs	X		Basin and Bank sediment						X	--	6,870	--	µg/kg	Equilibrium partitioning-based sediment ESV normalized to mean site-specific TOC[5]
		X							X	793	1,870	4,400	µg/kg	Back-calculated food web (tree swallow)[6]

NOEC = No Observed Effect Concentration; MATC = Maximum Acceptable Toxicant Concentration; LOEC = Lowest Observed Effect Concentration

1 - Applies only to soil from 0 to 2 feet below ground surface
2 - HMW PAHs are the sum total of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and pyrene
3 - See Table B-2
4 - See Table B-3
5 - See Table B-4
6 - See Table B-5

Table B-2a
Derivation of Ecological Risk-Based PRGs For PCBs Based on Food Web Models for the Short-tailed Shrew - NOAEL
Amcast Industrial Site, Cedarburg, WI

Chemical	Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	NOAEL HQ
Polychlorinated Biphenyls									
Aroclor-1248	5.42E-01	Regression	1.78E+00	0.184	9.99E-02	0	1.36E-01	0.136	**1.00E+00**
Aroclor-1254	5.42E-01	Regression	1.78E+00	0.139	7.55E-02	0	1.36E-01	0.136	**1.00E+00**
PCB (total)	5.42E-01	Regression	1.78E+00	0.184	9.99E-02	0	1.36E-01	0.136	**1.00E+00**

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI =	Chemical-specific	= Dietary intake for chemical (mg chemical/kg body weight/day)
FIR =	0.0015	= Food ingestion rate (kg/day dry weight)
FCxi =	Chemical-specific	= Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi =	0.823	= Proportion of diet composed of food item (soil invertebrates)
FCxi =	Chemical-specific	= Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi =	0.047	= Proportion of diet composed of food item (terrestrial plants)
SCx =	Chemical-specific	= Concentration of chemical in soil (mg/kg, dry weight)
PDS =	0.130	= Proportion of diet composed of soil
WIR =	0.0038	= Water ingestion rate (L/day)
WC =	Chemical-specific	= Concentration of chemical in water (mg/L)
BW =	0.01687	= Body weight (kg)

Table B-2b
Derivation of Ecological Risk-Based PRGs For PCBs Based on Food Web Models for the Short-tailed Shrew - MATC
Amcast Industrial Site, Cedarburg, WI

Chemical	Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	MATC TRV (mg/kg/d)	MATC HQ
Polychlorinated Biphenyls									
Aroclor-1248	9.85E-01	Regression	4.01E+00	0.184	1.82E-01	0	3.04E-01	0.304	**1.00E+00**
Aroclor-1254	9.85E-01	Regression	4.01E+00	0.139	1.37E-01	0	3.04E-01	0.304	**1.00E+00**
PCB (total)	9.85E-01	Regression	4.01E+00	0.184	1.82E-01	0	3.04E-01	0.304	**1.00E+00**

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI =	Chemical-specific	= Dietary intake for chemical (mg chemical/kg body weight/day)
FIR =	0.0015	= Food ingestion rate (kg/day dry weight)
FCxi =	Chemical-specific	= Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi =	0.823	= Proportion of diet composed of food item (soil invertebrates)
FCxi =	Chemical-specific	= Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi =	0.047	= Proportion of diet composed of food item (terrestrial plants)
SCx =	Chemical-specific	= Concentration of chemical in soil (mg/kg, dry weight)
PDS =	0.130	= Proportion of diet composed of soil
WIR =	0.0038	= Water ingestion rate (L/day)
WC =	Chemical-specific	= Concentration of chemical in water (mg/L)
BW =	0.01687	= Body weight (kg)

Table B-2c
Derivation of Ecological Risk-Based PRGs For PCBs Based on Food Web Models for the Short-tailed Shrew - LOAEL
Amcast Industrial Site, Cedarburg, WI

Chemical	Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	LOAEL TRV (mg/kg/d)	LOAEL HQ
Polychlorinated Biphenyls									
Aroclor-1248	1.79E+00	Regression	9.05E+00	0.184	3.30E-01	0	6.81E-01	0.680	**1.00E+00**
Aroclor-1254	1.79E+00	Regression	9.05E+00	0.139	2.49E-01	0	6.81E-01	0.680	**1.00E+00**
PCB (total)	1.79E+00	Regression	9.05E+00	0.184	3.30E-01	0	6.81E-01	0.680	**1.00E+00**

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0015 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.823 = Proportion of diet composed of food item (soil invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.047 = Proportion of diet composed of food item (terrestrial plants)
SCx = Chemical-specific = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.130 = Proportion of diet composed of soil
WIR = 0.0038 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.01687 = Body weight (kg)

Table B-3
Fish/Frog Tissue-Based PRGs (wet-weight)
Amcast Industrial Site, Cedarburg, Wisconsin

Chemical	Type	Organism	Life Stage	NOEC (wet-weight)	Basis[1]	LOEC (wet-weight)	Basis[1]	Reference
Whole-Body Fish (mg/kg wet-weight)								
Aroclor-1016	Whole body	Sheepshead minnow	adult	110	NOEC - S	550	NOEC x 5	Jarvinen and Ankley 1999
Aroclor-1221	--	--	--	No value	--	No value	--	--
Aroclor-1232	--	--	--	No value	--	No value	--	--
Aroclor-1242	Whole body	Channel catfish	fingerling	14.3	NOEC - S,G	71.5	NOEC x 5	Jarvinen and Ankley 1999
Aroclor-1248	Whole body	Fathead minnow	embryo-adult	2.80	NOEC - S,G,R	11.0	LOEC - G	Jarvinen and Ankley 1999
Aroclor-1254	Whole body	Channel catfish	fingerling	21.0	NOEC - S,G	105	NOEC x 5	Jarvinen and Ankley 1999
Aroclor-1260	Whole body	Channel catfish	fingerling	32.0	NOEC - S,G	160	NOEC x 5	Jarvinen and Ankley 1999
Total PCBs	Whole body	--	--	2.80	--	11.0	--	Lowest Aroclor value
Whole-Body Frogs (mg/kg wet-weight)								
Aroclor-1016	--	--	--	No value	--	No value	--	--
Aroclor-1221	--	--	--	No value	--	No value	--	--
Aroclor-1232	--	--	--	No value	--	No value	--	--
Aroclor-1242	--	--	--	No value	--	No value	--	--
Aroclor-1248	--	--	--	No value	--	No value	--	--
Aroclor-1254	Whole body	*Xenopus laevis*	larval	22.8	LOEC / 5	114	LOEC - G	ERDCEL 2013
Aroclor-1260	--	--	--	No value	--	No value	--	--
Total PCBs	Whole body	--	--	22.8	--	114	--	Lowest Aroclor value

[1] NOEC - No Observed Effect Concentration; LOEC - Lowest Observed Effect Concentration. S - Survival; G - Growth; R - Reproduction

Table B-4
Sediment Ecological Screening Values (ESVs)
Amcast Industrial Site, Cedarburg, Wisconsin

Chemical	Equilibrium Partitioning Value (µg/kg)	Total Organic Carbon (percent)[1]	Equilibrium Partitioning Value (µg/kg)	Total Organic Carbon (percent)[1]	Reference
	Quarry Pond		Wilshire Pond		
Polychlorinated Biphenyls					
Aroclor-1248	6,880	6.88	6,870	6.87	Jones et al. 1997
PCB (total)	6,880	6.88	6,870	6.87	Aroclor-1248

1 - Adjusted based on mean site-specific measured total organic carbon concentrations from site water bodies

Table B-5a
Derivation of Ecological Risk-Based PRGs For PCBs Based on Food Web Models for the Tree Swallow - NOAEL
Amcast Industrial Site, Cedarburg, WI

Chemical	Sediment Concentration (mg/kg)	Sediment-Invertebrate BAF	Aquatic Invertebrate Concentration (mg/kg dw)	Sediment-Plant BAF	Aquatic Plant Concentration (mg/kg dw)	Sediment-Fish BAF	Fish Concentration (mg/kg dw)	Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	NOAEL TRV (mg/kg/d)	NOAEL HQ
Polychlorinated Biphenyls											
Aroclor-1248	7.93E-01	Regression	3.20E+01	0.184	1.46E-01	2.18	1.73E+00	0.00E+00	1.50E+00	1.50	**1.00E+00**
PCB (total)	7.93E-01	Regression	3.20E+01	0.184	1.46E-01	2.18	1.73E+00	0.00E+00	1.50E+00	1.50	**1.00E+00**

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI =	Chemical-specific	= Dietary intake for chemical (mg chemical/kg body weight/day)		Fish
FIR =	0.00094	= Food ingestion rate (kg/day dry weight)	Lipids (%):	1.97
FCxi =	Chemical-specific	= Concentration of chemical in food item (aquatic invertebrates, dry weight basis)	TOC (%):	6.88
PDFi =	1.000	= Proportion of diet composed of food item (aquatic invertebrates)		0.24
FCxi =	Chemical-specific	= Concentration of chemical in food item (aquatic plants, dry weight basis)		
PDFi =	0.000	= Proportion of diet composed of food item (aquatic plants)		
FCxi =	Chemical-specific	= Concentration of chemical in food item (fish, dry weight basis)		
PDFi =	0.000	= Proportion of diet composed of food item (fish)		
SCx =	Chemical-specific	= Concentration of chemical in sediment (mg/kg, dry weight)		
PDS =	0.000	= Proportion of diet composed of sediment		
WIR =	0.0043	= Water ingestion rate (L/day)		
WC =	Chemical-specific	= Concentration of chemical in water (mg/L)		
BW =	0.0201	= Body weight (kg)		

Table B-5b
Derivation of Ecological Risk-Based PRGs For PCBs Based on Food Web Models for the Tree Swallow - MATC
Amcast Industrial Site, Cedarburg, WI

Chemical	Sediment Concentration (mg/kg)	Sediment-Invertebrate BAF	Aquatic Invertebrate Concentration (mg/kg dw)	Sediment-Plant BAF	Aquatic Plant Concentration (mg/kg dw)	Sediment-Fish BAF	Fish Concentration (mg/kg dw)	Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	MATC TRV (mg/kg/d)	MATC HQ
Polychlorinated Biphenyls											
Aroclor-1248	1.87E+00	Regression	7.17E+01	0.184	3.45E-01	2.18	4.08E+00	0.00E+00	3.36E+00	3.35	**1.00E+00**
PCB (total)	1.87E+00	Regression	7.17E+01	0.184	3.45E-01	2.18	4.08E+00	0.00E+00	3.36E+00	3.35	**1.00E+00**

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.00094 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (aquatic invertebrates, dry weight basis)
PDFi = 1.000 = Proportion of diet composed of food item (aquatic invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (aquatic plants, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (aquatic plants)
FCxi = Chemical-specific = Concentration of chemical in food item (fish, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (fish)
SCx = Chemical-specific = Concentration of chemical in sediment (mg/kg, dry weight)
PDS = 0.000 = Proportion of diet composed of sediment
WIR = 0.0043 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.0201 = Body weight (kg)

	Fish
Lipids (%):	1.97
TOC (%):	6.88
	0.24

Table B-5c
Derivation of Ecological Risk-Based PRGs For PCBs Based on Food Web Models for the Tree Swallow - LOAEL
Amcast Industrial Site, Cedarburg, WI

Chemical	Sediment Concentration (mg/kg)	Sediment-Invertebrate BAF	Aquatic Invertebrate Concentration (mg/kg dw)	Sediment-Plant BAF	Aquatic Plant Concentration (mg/kg dw)	Sediment-Fish BAF	Fish Concentration (mg/kg dw)	Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	LOAEL TRV (mg/kg/d)	LOAEL HQ
Polychlorinated Biphenyls											
Aroclor-1248	4.40E+00	Regression	1.60E+02	0.184	8.11E-01	2.18	9.59E+00	0.00E+00	7.51E+00	7.50	**1.00E+00**
PCB (total)	4.40E+00	Regression	1.60E+02	0.184	8.11E-01	2.18	9.59E+00	0.00E+00	7.51E+00	7.50	**1.00E+00**

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specific = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.00094 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specific = Concentration of chemical in food item (aquatic invertebrates, dry weight basis)
PDFi = 1.000 = Proportion of diet composed of food item (aquatic invertebrates)
FCxi = Chemical-specific = Concentration of chemical in food item (aquatic plants, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (aquatic plants)
FCxi = Chemical-specific = Concentration of chemical in food item (fish, dry weight basis)
PDFi = 0.000 = Proportion of diet composed of food item (fish)
SCx = Chemical-specific = Concentration of chemical in sediment (mg/kg, dry weight)
PDS = 0.000 = Proportion of diet composed of sediment
WIR = 0.0043 = Water ingestion rate (L/day)
WC = Chemical-specific = Concentration of chemical in water (mg/L)
BW = 0.0201 = Body weight (kg)

	Fish
Lipids (%):	1.97
TOC (%):	6.88
	0.24

Appendix C
Alternative Cost Estimates

Table C-1
Amcast North
Alternative AMN-2 - Excavation and Offsite Disposal
Cedarburg, WI

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
CAPITAL COSTS						
Pre-Construction and Mobilization					$ 176,524	
Mobilization	4	EA	$ 3,068	$ 12,273		2 Personnel + Project Schedule + Supt 1 week for setup
Site Preparation (Clearing, grubbing, trimming)	12,111	SY	$ 1.12	$ 13,526		
Decontamination pad (20 x 40 asphalt sloped to sump)	800	SF	$ 15.20	$ 12,157		Includes trench drain at end of sloped pad
Traffic control signage	1	LS	$ 8,260	$ 8,260		detail truck routes - photographs, line painting and barricades - Civil Superintendent - 1 week
Construction survey	2	EA	$ 2,277	$ 4,554		2 surveys (pre- and post-remediation, plus office time to Evaluate Data; assume one day per mob)
Miscellaneous equipment and supplies	1	LS	$ 1,879	$ 1,879		(PPE, H&S monitoring, paper goods, ice, coolers)
Site Trailer and Utilities	4	MO	$ 2,303	$ 9,211		
Electrical Connection Allowance	400	LF	$ 93.49	$ 37,397		Electrical power feed and transformer
Erosion Control and Perimeter Fencing	1	LS	$ 18,957	$ 18,957		Silt fence around laydown areas, snow fence around excavations, hay bales, misc. Use BMPs.
Dust Control	4	MO	$ 8,308	$ 33,234		
Submittals	1	Lot	$ 25,076	$ 25,076		1 month - on-site personnel
Pre-Construction Activities					$ 11,198	
Pre-construction sampling	15	EA	746.55	$ 11,198		Includes utility clearance, soil sample collection, and analysis for PCBs in soil.
Soil Removal and Backfill					$ 422,139	
Demolish Bituminous Pavement	5,022	SY	$ 5.95	$ 29,901		assumed 3" thick pavement
Misc. Equipment Handling	80	HR	$ 242	$ 19,321		Misc. soil handling
Excavation, 3/4 CY Hydraulic Excavator	5,037	CY	$ 17.08	$ 86,026		Small Dumps - 8 to 9 cyds
Loading Into Truck - landfill	5,037	CY	$ 6.00	$ 30,222		
Soil Double Handle - Excavation to Stock Pile to Truck	504	CY	$ 35.00	$ 17,630		Assume direct-load for most soil and double-handling for 10% of total volume excavated.
Shoring for excavations	1,770	SF	$ 33.77	$ 59,768		Sheet pile for excavations greater than 2 feet along railroad, depth of twice excavation depth.
Air Monitoring Station	4	MO	$ 1,246	$ 4,984		
Backfill Material	5,037	CY	$ 25.68	$ 129,363		
Compaction Equipment	140	HR	$ 272	$ 38,090		Backfill duration
Compaction Testing	2	WK	$ 3,417	$ 6,834		Testing of backfill samples, compaction testing via ASTM D6938
Confirmation Sampling					$ 25,676	
Sample Collection	10	DAY	$ 1,170	$ 11,703		Labor - need assumptions
PID, per day	10	DAY	$ 81.02	$ 810		Soil screening
PCBs, Soil Analysis	30	EA	$ 163.35	$ 4,901		Confirmation sampling plus disposal screening
Metals, Soil Analysis	30	EA	$ 166.62	$ 4,999		Confirmation Sampling
Polynuclear Aromatic Hydrocarbons, Soil Analysis	30	EA	$ 93.66	$ 2,810		Confirmation Sampling
Sample Jars	90	EA	$ 5.05	$ 455		
Transporation and Disposal Offsite					$ 538,738	
Transport soil <50ppm PCBs to Subtitle D landfill	8,468	TON	$ 15.73	$ 133,158		1.7 T/CY; 4,981 CY of non-TSCA soil
Dispose of soil <50ppm PCBs at Subtitle D landfill	8,468	TON	$ 34.02	$ 288,033		1.7 T/CY; 4,981 CY of non-TSCA soil
Transport soil >50ppm PCBs to TSCA landfill	95	TON	$ 299.28	$ 28,492		1.7 T/CY; 56 CY of TSCA soil
Dispose of soil >50ppm PCBs at TSCA landfill	95	TON	$ 88.33	$ 8,409		1.7 T/CY; 56 CY of TSCA soil
Characterization sampling of soil prior to transport	17	EA	1,386	$ 23,734		Full waste characerization/500 Tons - Includes Sampling Labor
Transportation and Disposal of debris to Subtitle D landfill	732	TON	$ 38.90	$ 28,487		Includes asphalt and miscellaneous disposal
Contact water disposal	0	GAL	$ -	$ -		Assumes contact water will be treated by filter and discharged to sanitary sewer at de minimis cost.
32 Ft. Dump Truck Disposable Liner, 6 Mil	546	EA	$ 52.10	$ 28,424		assume 10CY loads
Site Restoration					$ 194,156	
Removal of Decon Pad	800	SF	$ 5.52	$ 4,415		
Topsoil and Seed	7,089	SY	$ 0.92	$ 6,496		6" of topsoil
Gravel (road stone)	1,116	CY	$ 155.00	$ 172,980		8" of gravel, compacted, placed over area where asphalt is removed.
Erosion Control	742	LF	$ 13.83	$ 10,265		
Demobilization and Closeout					$ 48,278	
Record Drawings/Topo Information	1	LS	$ 2,058	$ 2,058		
Subcontract Project Closeout	1	LS	$ 26,661	$ 26,661		
Demobilize Equipment	1	LS	$ 19,559	$ 19,559		
SUBCONTRACT SUBTOTAL					$ 1,416,709	
Contingency (15%)					$ 212,506	
SUBCONTRACT TOTAL					$ 1,629,216	
Payment/Performance Bonds and Insurance (2%)					$ 32,584	Applied to the Subcontract total
Contractor Professional/Technical Services					$ 635,394	
Engineering/Design (6%)	1	LS	$ 97,753	$97,753		Applied to the Subcontract total.
Prime Contractor Markup (8%)	1	LS	$ 130,337	$130,337		Applied to the Subcontract total.
Project Management and Field Oversight (25%)	1	LS	$ 407,304	$407,304		Applied to the Subcontract total.
TOTAL ESTIMATED CAPITAL COST (FY 2017 Dollars)					$ 2,297,194	

O&M Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
O&M COSTS						
O&M Items					$ -	
None						
O&M ANNUAL SUBTOTAL					$ -	
Contingency (15%)					$ -	
O&M ANNUAL TOTAL					$ -	
Payment/Performance Bonds and Insurance (2%)					$ -	
Contractor Professional/Technical Services					$ -	
Engineering/Design (6%)						
Prime Contractor Markup (8%)						
Project Management and Field Oversight (25%)						
TOTAL ESTIMATED ANNUAL O&M COST (FY 2017 Dollars)					$ -	

Periodic Cost Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
PERIODIC COSTS						
Years 5, 10, 15, 20, 25, 30					$ -	
None						

PRESENT VALUE ANALYSIS

Cost Type	Total Cost Per Year	Total Cost	Present Value	
Capital Cost (Year 0)	$2,297,194	$2,297,194	**$2,297,194**	
O&M Cost (Year 1 - 30)	$0	$0	**$0**	
Periodic Cost (Years 5, 10, 15, 20, 25, 30)	$0	$0	**$0**	
TOTAL EST. PV OF ALTERNATIVE (FY 2017 Dollars)			**$2,297,194**	**Assumes 5% Discount**

Table C-2
Amcast North
Alternative AMN-3 - Excavation, Backfill, Isolation Cover, and Site Restoratior
Cedarburg, WI

CAPITAL COSTS

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Pre-Construction and Mobilization					$ 167,479	
Mobilization	4	EA	$ 3,068	$ 12,273		2 Personnel + Project Schedule + Supt 1 week for setup
Site Preparation (Clearing, grubbing, trimming)	12,111	SY	$ 1.12	$ 13,526		
Decontamination pad (20 x 40 asphalt sloped to sump)	800	SF	$ 15.20	$ 12,157		
Traffic control signage	1	LS	$ 8,260	$ 8,260		detail truck routes - photographs, line painting and barricades - Civil Superintendent - 1 week
Construction survey crew	2	EA	$ 2,277	$ 4,554		2 surveys (pre- and post-remediation, plus office time to Evaluate Data; assume one day per mob)
Miscellaneous equipment and supplies	1	LS	$ 1,879	$ 1,879		(PPE, H&S monitoring, paper goods, ice, coolers)
Site Trailer and Utilities	3	MO	$ 2,800	$ 8,399		
Electrical Connection Allowance	400	LF	$ 93.49	$ 37,397		Electrical power feed and transformer
Erosion Control and Perimeter Fencing	1	LS	$ 18,957	$ 18,957		Silt fence around laydown areas, snow fence around excavations, hay bales, misc. Use BMPs.
Dust Control	3	MO	$ 8,334	$ 25,001		
Submittals	1	Lot	$ 25,076	$ 25,076		1 month - on-site personnel
Pre-Construction Activities					$ 11,198	
Pre-construction sampling	15	EA	$ 746.55	$ 11,198		Includes utility clearance, soil sample collection, and analysis for PCBs in soil.
Soil Removal and Backfill					$ 54,791	
Demolish Bituminous Pavement	5,022	SY	$ 5.95	$ 29,901		assumed 3" thick pavement
Misc. Equipment Handling	40	WK	$ 242	$ 9,661		Misc. soil handling
Excavation, 3/4 CY Hydraulic Excavator	56	CY	$ 15.81	$ 885		
Loading Into Truck	56	CY	$ 6.00	$ 336		Load soil into dump truck
Soil Double Handle - Excavation to Stock Pile to Truck	6	CY	$ 35.00	$ 196		Assume direct-load for most soil and double-handling for 10% of total volume excavated.
Air Monitoring Station	3	MO	$ 1,246	$ 3,738		Perimeter air monitoring station
Backfill Material	56	CY	$ 29.71	$ 1,664		Material
Compaction Equipment	71	HR	$ 26.22	$ 1,861		Assumes hand tamping
Compaction Testing	2	WK	$ 3,275	$ 6,550		Testing of backfill samples, compaction testing via ASTM D6938
Confirmation Sampling					$ 21,270	
Sample Collection	10	DAY	1,170	$ 11,703		
PID, per day	10	DAY	$ 81.02	$ 810		Soil screening
PCBs, Soil Analysis	20	EA	$ 163.35	$ 3,267		Confirmation sampling plus disposal screening
Metals, Soil Analysis	20	EA	$ 166.62	$ 3,332		Confirmation Sampling
Polynuclear Aromatic Hydrocarbons, Soil Analysis	20	EA	$ 93.66	$ 1,873		Confirmation Sampling
Sample Jars	60	EA	$ 4.74	$ 284		
Transporation and Disposal Offsite					$ 72,053	
Transport soil >50ppm PCBs to TSCA landfill	121	TON	$ 236.06	$ 28,492		1.7 T/CY; 56 CY of TSCA soil
Dispose of soil >50ppm PCBs at TSCA landfill	121	TON	$ 69.67	$ 8,409		1.7 T/CY; 56 CY of TSCA soil
Characterization sampling of soil prior to transport	2	EA	$ 1,816	$ 3,631		1 sample/500 Tons, minimum 1/waste stream
Transportation and Disposal of debris to Subtitle D landfill	732	TON	$ 38.90	$ 28,487		Includes asphalt and miscellaneous disposal
Contact water disposal	0	GAL	$ -	$ -		Assumes contact water will be treated by filter and discharged to sanitary sewer at de minimis cost.
32 Ft. Dump Truck Disposable Liner, 6 Mil	47	EA	$ 63.91	$ 3,033		assume 10 cyd loads
Isolation Cover					$ 124,592	
Proof Roll of existing subgrade	1	LS	$ 5,078	$ 5,078		fully loaded, quad axle dump truck
Clay for isolation cover	2,541	CY	$ 37.36	$ 94,934		material
Placement of 2' thick clay cap	2,541	CY	$ 8.09	$ 20,561		placement over all excavation areas
Compaction Testing	2,541	CY	$ 1.58	$ 4,018		geotech testing of clay, compaction testing via ASTM D6938
Site Restoration					$ 58,098	
Removal of Decon Pad	800	SF	$ 5.52	$ 4,415		
Topsoil and Seed	3,811	SY	$ 9.73	$ 37,082		6" of topsoil placed over isolation cover area
Erosion Control	1,200	LF	$ 13.83	$ 16,601		
Demobilization and Closeout					$ 48,278	
Record Drawings/Topo Information	1	LS	$ 2,058	$ 2,058		
Subcontract Project Closeout	1	LS	$ 26,661	$ 26,661		
Demobilize Equipment	1	LS	$ 19,559	$ 19,559		
Institutional Controls					$ 20,000	
Develop institutional control plan and implement institutional controls	1	LS	$ 20,000	$ 20,000		
SUBCONTRACT SUBTOTAL					$ 577,758	
Contingency (15%)					$ 86,664	
SUBCONTRACT TOTAL					$ 664,422	
Payment/Performance Bonds and Insurance (2%)					$ 13,288	Applied to the Subcontract total
Contractor Professional/Technical Services					$ 259,125	
Engineering/Design (6%)	1	LS	$ 39,865	$39,865		Applied to the Subcontract total
Prime Contractor Markup (8%)	1	LS	$ 53,154	$53,154		Applied to the Subcontract total
Project Management and Field Oversight (25%)	1	LS	$ 166,106	$166,106		Applied to the Subcontract total
TOTAL ESTIMATED CAPITAL COST (FY 2017 Dollars)					$ 936,835	

O&M COSTS

O&M Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Annual Inspections					$ 13,280	
Onsite inspections - labor	1	LS	$ 4,800	$4,800		Travel to site, conduct inspection, identify deficiencies, and document findings - 2 personnel.
Onsite inspections - per diem, car rental	1	LS	$ 480	$480		Assumes 2 days.
Documenting findings	1	LS	$ 8,000	$8,000		preparation of inspection report.
Maintenance and Repair					$ 6,230	
Repair/replacement of portions of soil cover	1	LS	$6,230	$6,230		Assume 5 percent (on a cost basis) of the isolation cover is repaired/replaced every years.
O&M ANNUAL SUBTOTAL					$ 19,510	
Contingency (15%)					$ 2,926	
O&M ANNUAL TOTAL					$ 22,436	
Payment/Performance Bonds and Insurance (2%)					$ 449	
Contractor Professional/Technical Services					$ 8,750	
Engineering/Design (6%)	1	LS	$ 1,346	$1,346		
Prime Contractor Markup (8%)	1	LS	$ 1,795	$1,795		
Project Management and Field Oversight (25%)	1	LS	$ 5,609	$5,609		
TOTAL ESTIMATED ANNUAL O&M COST (FY 2017 Dollars)					$ 31,635	

PERIODIC COSTS

Periodic Cost Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Years 5, 10, 15, 20, 25, 30					$ 36,000	
Five Year Review Report	1	LS	$16,000	$16,000		
Update Institutional Controls Plan	1	LS	$20,000	$20,000		

PRESENT VALUE ANALYSIS

Cost Type	Total Cost Per Year	Total Cost	Present Value	
Capital Cost (Year 0)	$936,835	$936,835	**$936,835**	
O&M Cost (Year 1 - 30)	$31,635	$949,043	**$486,304**	
Periodic Cost (Years 5, 10, 15, 20, 25, 30)	$36,000	$216,000	**$100,153**	
TOTAL EST. PV OF ALTERNATIVE (FY 2017 Dollars)			**$1,523,292**	**Assumes 5% Discount**

Table C-3
Residential Yards
Alternative RY-2 - Soil Excavation, Offsite Disposal, Backfill, and Site Restoration
Cedarburg, WI

CAPITAL COSTS						
Capital Item	**Quantity**	**Units**	**Unit Cost**	**Subtotal**	**Total**	**Comments**
Mobilization/Demobilization					$ **229,230**	21.60%
Mobilization	4	EA	$ 5,081	$ 20,324		
Site Preparation (Clearing, grubbing, trimming, tree removal)	4,778	SY	$ 9.95	$ 47,537		
Decontamination pad (20 x 40 asphalt sloped to sump)	800	SF	$ 15.20	$ 12,157		one central location
Traffic control signage	1	LS	$ 8,260	$ 8,260		
Construction survey	2	EA	$ 3,303	$ 6,605		2 surveys (pre- and post-remediation, plus office time to Evaluate Data; assume one day per mob)
Miscellaneous equipment and supplies	1	LS	$ 3,186	$ 3,186		(PPE, H&S monitoring, paper goods, ice, coolers)
Site Trailer and Utilities	7	MO	$ 1,664	$ 11,648		
Electrical Connection Allowance	1	LS	$ 37,397	$ 37,397		
Erosion Control and Perimeter Fencing	1	LS	$ 25,299	$ 25,299		Silt fence around laydown areas, snow fence around excavations, hay bales, misc. Use BMPs.
Dust Control	7	MO	$ 4,534	$ 31,741		
Submittals	1	Lot	$ 25,076	$ 25,076		
Pre-Construction Activities					$ **126,229**	
Access agreements	14	EA	$ 4,521	$ 63,287		site visits with reporesentative from EPA
Property sketches	14	EA	$ 2,633	$ 36,858		
Pre-construction sampling	14	EA	$ 1,863	$ 26,084		Sampling per property
Soil Removal and Backfill					$ **288,746**	
Misc. Soil Handling	120	HRS	$ 241.51	$ 28,982		Misc. soil handling - skid steer
Tree removal	14	EA	$ 1,000	$ 14,000		Assume one tree removed per property
Excavation, 3/4 Cy Hydraulic Excavator	3,282	CY	$ 15.81	$ 51,881		
Soil Double Handle - Excavation to Stock Pile to Truck	1,641	CY	$ 35.00	$ 57,435		Assume 50% double-handling; move soil from excavation to stockpile loading to truck covered below
Loading Into Truck	3,282	CY	$ 6.00	$ 19,692		Load soil into dump truck
Visual warning barrier	12,900	SY	$ 0.44	$5,676		8-oz Geotextile; placement within excavations for 30 percent of excavated surface area.
Air Monitoring Station	6	MO	$ 1,246	$ 7,476		Perimeter air monitoring station
Backfill Material	3,282	CY	$ 23.43	$ 76,902		
Compaction Equipment	80	HR	$ 174.67	$ 13,974		sheepsfoot roller
Compaction Testing	1	LS	$ 12,728	$ 12,728		Testing of backfill samples, compaction testing via ASTM D6938
Confirmation Sampling					$ **32,188**	
Sample Collection	20	DAY	$ 1,056.77	$ 21,135		Labor - need assumptions
PID, per day	20	DAY	$ 81.02	$ 1,620		Soil screening
PCBs, Soil Analysis	56	EA	$ 163.35	$ 9,148		Confirmation sampling plus disposal screening
Sample Jars	56	EA	$ 5.08	$ 284		
Transporation and Disposal Offsite					$ **473,846**	
Transport soil <50ppm PCBs to Subtitle D landfill	5,126	TON	$ 17.10	$ 87,650		1.7 T/CY; 3,015 CY of non-TSCA soil
Dispose of soil <50ppm PCBs at Subtitle D landfill	5,126	TON	$ 36.99	$ 189,596		1.7 T/CY; 3,015 CY of non-TSCA soil
Transport soil >50ppm PCBs to TSCA landfill	454	TON	$ 289.76	$ 131,523		1.7 T/CY; 267 CY of TSCA soil
Dispose of soil >50ppm PCBs at TSCA landfill	454	TON	$ 85.52	$ 38,818		1.7 T/CY; 267 CY of TSCA soil
Characterization sampling of soil prior to transport	12	EA	$ 1,283	$ 15,613		Full waste characerization/500 Tons - Includes Sampling Labor
Transportation and Disposal of debris to Subtitle D landfill	5	TON	$ 61.93	$ 310		
Contact water disposal	0	GAL	$ -	$ -		Assumes no contact water will be generated in residential areas.
32 Ft. Dump Truck Disposable Liner, 6 Mil	328	EA	$ 31.49	$ 10,335		assume 10CY loads
Site Restoration					$ **240,321**	
Removal of Decon Pad	800	SF	$ 5.52	$ 4,415		
Sod	4,778	SY	$ 24.06	$ 114,937		6" of topsoil
Reestablish yards	4,778	SY	$ 9.52	$ 45,507		Includes fine grading, spreading topsoil/loam, and preparing soil.
Tree replacement	14	EA	$ 650.00	$ 9,100		Assumes 1 tree per property
Replacing shrubs and plants - per property	14	EA	$ 1,000.00	$ 14,000		
Watering (30 days)	14	EA	$ 1,740.00	$ 24,360		Assumes watering of trees, sod, and vegetation for 30 days prior to final acceptance.
Misc. damage control	1	LS	$ 28,000	$ 28,000		any repairs needed to driveways, streets, sidewalks, personal property, garages, etc.
Demobilize					$ **76,998**	
Record Drawings/Topo Information	1	LS	$ 8,233	$ 8,233		
Subcontract Project Closeout	1	LS	$ 49,206	$ 49,206		
Demobilize Equipment	1	LS	$ 19,559	$ 19,559		
SUBCONTRACT SUBTOTAL					$ **1,467,556**	
Contingency (15%)					$ **220,133**	
SUBCONTRACT TOTAL					$ **1,687,689**	
Payment/Performance Bonds and Insurance (2%)					$ **29,351**	
Contractor Professional/Technical Services					$ **658,199**	
Engineering/Design (6%)	1	LS	$ 101,261	$101,261		Applied to the Subcontract total.
Prime Contractor Markup (8%)	1	LS	$ 135,015	$135,015		Applied to the Subcontract total.
Project Management and Field Oversight (25%)	1	LS	$ 421,922	$421,922		Applied to the Subcontract total.
TOTAL ESTIMATED CAPITAL COST (FY 2017 Dollars)					$ **2,375,239**	

O&M COSTS						
O&M Item	**Quantity**	**Units**	**Unit Cost**	**Subtotal**	**Total**	**Comments**
O&M Items					$ **-**	
None						
O&M ANNUAL SUBTOTAL					$ **-**	
Contingency (15%)					$ **-**	
O&M ANNUAL TOTAL					$ **-**	
Payment/Performance Bonds and Insurance (2%)					$ **-**	
Contractor Professional/Technical Services					$ **-**	
Engineering/Design (6%)						
Prime Contractor Markup (8%)						
Project Management and Field Oversight (25%)						
TOTAL ESTIMATED ANNUAL O&M COST (FY 2017 Dollars)					$ **-**	

PERIODIC COSTS						
Periodic Cost Item	**Quantity**	**Units**	**Unit Cost**	**Subtotal**	**Total**	**Comments**
Years 5, 10, 15, 20, 25, 30					$ **-**	
None						

PRESENT VALUE ANALYSIS				
Cost Type	**Total Cost Per Year**	**Total Cost**	**Present Value**	
Capital Cost (Year 0)	$2,375,239	$2,375,239	**$2,375,239**	
O&M Cost (Year 1 - 30)	$0	$0	**$0**	
Periodic Cost (Years 5, 10, 15, 20, 25, 30)	$0	$0	**$0**	
TOTAL EST. PV OF ALTERNATIVE (FY 2017 Dollars)			**$2,375,239**	**Assumes 5% Discount**

Table C-4
Wilshire Pond
Alternative 2 - Sediment and Bank Soil Excavation, Offsite Disposal, Backfill, and Site Restoratior
Cedarburg, WI

CAPITAL COSTS

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Mobilization/Demobilizatior					$ 155,647	
Mobilization	1	LS	$ 33,170	$ 33,170		Assumed 5%
Site Preparation (Clearing, grubbing, trimming)	0.78	AC	$ 8,500	$ 6,596		$8500 per acre, assumed area of Wilshire Pond (banks, berms, and basin)
Decontamination pad (20' x 40' asphalt sloped to sump)	1	LS	$ 22,000	$ 22,000		
Traffic control signage	1	LS	$ 3,000	$ 3,000		detail truck routes
Construction survey crew	2	EA	$ 1,500	$ 3,000		2 surveys (pre- and post-remediation, plus office time to Evaluate Data; assume one day per mob)
Miscellaneous equipment and supplies	1	LS	$ 5,000	$ 5,000		(PPE, H&S monitoring, paper goods, ice, coolers)
Site Trailer and Utilities	2	MO	$ 3,000	$ 6,000		2 months=2 weeks site mob/site prep, 4 days pump out, 10 days excavation, 10 days back fill, 2 weeks demob
Electrical Connection Allowance	1	LS	$ 50,000	$ 50,000		
Erosion Control and Perimeter Fencing	1	LS	$ 10,000	$ 10,000		Silt fence around laydown areas, snow fence around excavations, hay bales, misc. Use BMPs.
Dust Control	2	MO	$ 4,000	$ 8,000		
Submittals	1	LS	$ 8,882	$ 8,882		1% of total remediation cost
Pre-Construction Activities					$ 21,672	
Per Diem	5	DAY	$ 300	$ 1,500		$150/day for 2 personnel
Vehicle Rental	5	DAY	$ 90	$ 450		
Sample Collection	5	DAY	$ 2,300	$ 11,500		$115/hr, 10hr/day, 2 personnel
PCBs, Soil Analysis	30	EA	$ 269	$ 8,070		Confirmation sampling plus disposal screening
Sample Jars	30	EA	$ 5.05	$ 152		
Dewatering and Water Treatment					$ 217,204	Assumes that sediments are dewatered on pond bank
Sump	1	LS	$ 5,000	$ 5,000		sediment dewatering
Sump Pump	2	MO	$ 5,000	$ 10,000		sediment dewatering
Mob/demob system	1	LS	$ 32,000	$ 32,000		
Water treatment system rental	2	MO	$ 21,000	$ 42,000		40 gpm system; bag filters, GAC, effluent tank, 2 pumps; 1000 CY/Day production + 2 months
O&M cost per gallon	481,554	GAL	$ 0.26	$ 125,204		Assumes 2x water volume to be drained to account for dewatering and storm water
Discharge Monitoring and Reporting	2	MO	$ 1,500	$ 3,000		
Soil Removal and Backfill					$ 76,649	
Mechanical dredging of Non-TSCA sediment	1,348	CY	$ 45	$ 61,192		
Mechanical dredging of TSCA sediment	89	CY	$ 45	$ 4,035		
Loading Into Truck	1,437	CY	$ 6	$ 8,622		Load soil into dump truck
Air Monitoring Station	2	MO	$ 1,400	$ 2,800		Perimeter air monitoring station
Confirmation Sampling					$ 12,280	20 samples evenly spread throughout the pond area including banks and berms
Sample Collection	3	DAY	$ 2,300	$ 6,900		$115/hr, 10hr/day, 2 personnel
PCBs, Soil Analysis	20	EA	$ 269	$ 5,380		
PID,per day	3	DAY	$ 180	$ 540		
Transporation and Disposal Offsite					$ 148,876	
Transport soil <50ppm PCBs to Subtitle D landfill	1,887	TON	$ 15	$ 27,518		1.4 T/CY
Dispose of soil <50ppm PCBs at Subtitle D landfill	1,887	TON	$ 32	$ 59,548		1.4 T/CY
Transport soil >50ppm PCBs to TSCA landfill	124	TON	$ 53	$ 6,596		1.4 T/CY
Dispose of soil >50ppm PCBs at TSCA landfill	124	TON	$ 107	$ 13,316		1.4 T/CY
Reagent mixing, Stabilization non-TSCA sediment	1,887	TON	$ 18	$ 33,634		
Reagent mixing, Stabilization of TSCA sediment	124	TON	$ 18	$ 2,218		
Characterization sampling of soil prior to transport	4	EA	$ 1,283	$ 5,162		Full waste characerization/500 Tons - Includes Sampling Labor
Transportation and Disposal of debris to Subtitle D landfill	20	TON	$ 44	$ 885		assume 1% of total excavation
32 Ft. Dump Truck Disposable Liner, 6 Mil	144	EA	$ 53	$ 7,616		assume 10CY loads
Site Restoration					$ 30,760	
Removal of Decon Pad	80	SF	$ 2	$ 160		
Erosion Control	10,200	SF	$ 3	$ 30,600		Bank area
Habitat Restoration					$ 105,060	
Plantings	2,040	EA	$ 50	$ 102,000		1 planting (shrubs) per 5 SF over bank area
Erosion Control	1,020	SF	$ 3	$ 3,060		Coconut fiber; 10% of bank restoration area
Demobilize					$ 51,500	
Record Drawings/Topo Information	1	LS	$ 1,500	$ 1,500		
Subcontract Project Closeout	1	LS	$ 25,000	$ 25,000		
Demobilize Equipment	1	LS	$ 25,000	$ 25,000		
SUBCONTRACT SUBTOTAL					**$ 819,648**	
Contingency (15%)					**$ 122,947**	
SUBCONTRACT TOTAL					**$ 942,595**	
Payment/Performance Bonds and Insurance (2%)					**$ 16,393**	Applied to the Subcontract total.
Contractor Professional/Technical Services					**$ 367,612**	
Engineering/Design (6%)	1	LS	$ 56,556	$56,556		Applied to the Subcontract total.
Prime Contractor Markup (8%)	1	LS	$ 75,408	$75,408		Applied to the Subcontract total.
Project Management and Field Oversight (25%)	1	LS	$ 235,649	$235,649		Applied to the Subcontract total.
TOTAL ESTIMATED CAPITAL COST (FY 2017 Dollars)					**$ 1,326,600**	

O&M COSTS

O&M Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
O&M Items					$ -	
None						
O&M ANNUAL SUBTOTAL					**$ -**	
Contingency (15%)					**$ -**	
O&M ANNUAL TOTAL					**$ -**	
Payment/Performance Bonds and Insurance (2%)					**$ -**	
Contractor Professional/Technical Services					**$ -**	
Engineering/Design (6%)	1	LS	$ -	$0		
Prime Contractor Markup (8%)	1	LS	$ -	$0		
Project Management and Field Oversight (25%)	1	LS	$ -	$0		
TOTAL ESTIMATED ANNUAL O&M COST (FY 2017 Dollars)					**$ -**	

PERIODIC COSTS

Periodic Cost Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Years 5, 10, 15, 20, 25, 30					$ -	
None						

PRESENT VALUE ANALYSIS

Cost Type	Total Cost Per Year	Total Cost	Present Value	
Capital Cost (Year 0)	$1,326,600	$1,326,600	**$1,326,600**	
O&M Cost (Year 1 - 30)	$0	$0	**$0**	
Periodic Cost (Years 5, 10, 15, 20, 25, 30)	$0	$0	**$0**	
TOTAL EST. PV OF ALTERNATIVE (FY 2017 Dollars)			**$1,326,600**	**Assumes 5% Discount**

Wilshire Pond
Alternative 3 - Sediment and Bank Soil Excavation, Structural Excavation, Offsite Disposal, Backfill, and Site Restoration
Cedarburg, WI

CAPITAL COSTS

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Mobilization/Demobilization					**$ 156,338**	
Mobilization	1	LS	$ 33,170	$ 33,170		Assumed 5%
Site Preparation (Clearing, grubbing, trimming)	0.78	AC	$ 8,500	$ 6,596		$8500 per acre, assumed area of Wilshire Pond (banks, berms, and basin)
Decontamination pad (20' x 40' asphalt sloped to sump)	1	LS	$ 22,000	$ 22,000		50000 for 100x50 dewatering pad, Waterloo Cost estimate. Price seems to be lower
Traffic control signage	1	LS	$ 3,000	$ 3,000		detail truck routes
Construction survey crew	2	EA	$ 1,500	$ 3,000		2 surveys (pre- and post-remediation, plus office time to Evaluate Data; assume one day per mob)
Miscellaneous equipment and supplies	1	LS	$ 5,000	$ 5,000		(PPE, H&S monitoring, paper goods, ice, coolers)
Site Trailer and Utilities	2	MO	$ 3,000	$ 6,000		2 months=2 weeks site mob/site prep, 4 days pump out, 10 days excavation, 10 days back fill, 2 weeks demo
Electrical Connection Allowance	1	LS	$ 50,000	$ 50,000		
Erosion Control and Perimeter Fencing	1	LS	$ 10,000	$ 10,000		Silt fence around laydown areas, snow fence around excavations, hay bales, misc. Use BMPs.
Dust Control	2	MO	$ 4,000	$ 8,000		
Submittals	1	LS	$ 9,573	$ 9,573		1% of total remediation cost
Pre-Construction Activities					**$ 21,672**	
Per Diem	5	DAY	$ 300	$ 1,500		$150/day for 2 personnel
Vehicle Rental	5	DAY	$ 90	$ 450		
Sample Collection	5	DAY	$ 2,300	$ 11,500		$115/hr, 10hr/day, 2 personnel
PCBs, Soil Analysis	30	EA	$ 269	$ 8,070		Confirmation sampling plus disposal screening
Sample Jars	30	EA	$ 5.05	$ 152		
Dewatering and Water Treatment					**$ 217,204**	Assumes that sediments are dewatered on pond bank
Sump	1	LS	$ 5,000	$ 5,000		sediment dewatering
Sump Pump	2	MO	$ 5,000	$ 10,000		sediment dewatering
Mob/demob system	1	LS	$ 32,000	$ 32,000		
Water treatment system rental	2	MO	$ 21,000	$ 42,000		40 gpm system; bag filters, GAC, effluent tank, 2 pumps; 1000 CY/Day production + 2 months
O&M cost per gallon	481,554	GAL	$ 0.26	$ 125,204		Assumes 2x water volume to be drained to account for dewatering and storm water
Discharge Monitoring and Reporting	2	MO	$ 1,500	$ 3,000		
Soil Removal and Backfill					**$ 119,865**	
Mechanical dredging of Non-TSCA sediment	1,859	CY	$ 45	$ 84,392		
Mechanical dredging of TSCA sediment	89	CY	$ 45	$ 4,035		
Loading Into Truck	1,948	CY	$ 6	$ 11,689		Load soil into dump truck
Air Monitoring Station	2	MO	$ 1,400	$ 2,800		Perimeter air monitoring station
Import Backfill and grading	511	CY	$ 23	$ 11,950		Import Backfill and Compact 95% to reconstruct berms
Compaction Testing	1	LS	$ 5,000	$ 5,000		Testing of backfill samples, compaction testing via ASTM D6938
Confirmation Sampling					**$ 12,280**	20 samples evenly spread throughout the pond area including banks and berms
Sample Collection	3	DAY	$ 2,300	$ 6,900		$115/hr, 10hr/day, 2 personnel
PCBs, Soil Analysis	20	EA	$ 269	$ 5,380		
PID,per day	3	DAY	$ 180	$ 540		
Transporation and Disposal Offsite					**$ 234,133**	
Transport soil <50ppm PCBs to Subtitle D landfill	3,161	TON	$ 15	$ 46,084		1.7 T/CY
Dispose of soil <50ppm PCBs at Subtitle D landfill	3,161	TON	$ 32	$ 99,721		1.7 T/CY
Transport soil >50ppm PCBs to TSCA landfill	124	TON	$ 53	$ 6,596		1.4 T/CY
Dispose of soil >50ppm PCBs at TSCA landfill	124	TON	$ 107	$ 13,316		1.4 T/CY
Reagent mixing, Stabilization non-TSCA sediment	3,161	TON	$ 18	$ 56,324		
Reagent mixing, Stabilization of TSCA sediment	124	TON	$ 18	$ 2,218		
Characterization sampling of soil prior to transport	7	EA	$ 1,283	$ 8,430		Full waste characerization/500 Tons - Includes Sampling Labor
Transportation and Disposal of debris to Subtitle D landfill	33	TON	$ 44	$ 1,445		assume 1% of total excavation
32 Ft. Dump Truck Disposable Liner, 6 Mil	195	EA	$ 53	$ 10,325		assume 10CY loads
Site Restoration					**$ 30,760**	
Removal of Decon Pad	80	SF	$ 2	$ 160		
Erosion Control	10,200	SF	$ 3	$ 30,600		Bank area
Habitat Restoration					**$ 105,060**	
Plantings	2,040	EA	$ 50	$ 102,000		1 planting (shrubs) per 5 SF over bank area
Erosion Control	1,020	SF	$ 3	$ 3,060		Coconut fiber; 10% of bank restoration area
Demobilize					**$ 51,500**	
Record Drawings/Topo Information	1	LS	$ 1,500	$ 1,500		
Subcontract Project Closeout	1	LS	$ 25,000	$ 25,000		
Demobilize Equipment	1	LS	$ 25,000	$ 25,000		
SUBCONTRACT SUBTOTAL					**$ 948,812**	
Contingency (15%)					**$ 142,322**	
SUBCONTRACT TOTAL					**$ 1,091,134**	
Payment/Performance Bonds and Insurance (2%)					**$ 18,976**	
Contractor Professional/Technical Services					**$ 425,542**	
Engineering/Design (6%)	1	LS	$ 65,468	$65,468		Applied to the Subcontract total.
Prime Contractor Markup (8%)	1	LS	$ 87,291	$87,291		Applied to the Subcontract total.
Project Management and Field Oversight (25%)	1	LS	$ 272,783	$272,783		Applied to the Subcontract total.
TOTAL ESTIMATED CAPITAL COST (FY 2017 Dollars)					**$ 1,535,652**	

O&M COSTS

O&M Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
O&M Items					**$ -**	
None						
O&M ANNUAL SUBTOTAL					**$ -**	
Contingency (15%)					**$ -**	
O&M ANNUAL TOTAL					**$ -**	
Payment/Performance Bonds and Insurance (2%)					**$ -**	
Contractor Professional/Technical Services					**$ -**	
Engineering/Design (6%)	1	LS	$ -	$0		
Prime Contractor Markup (8%)	1	LS	$ -	$0		
Project Management and Field Oversight (25%)	1	LS	$ -	$0		
TOTAL ESTIMATED ANNUAL O&M COST (FY 2017 Dollars)					**$ -**	

PERIODIC COSTS

Periodic Cost Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Years 5, 10, 15, 20, 25, 30					**$ -**	
None						

PRESENT VALUE ANALYSIS

Cost Type	Total Cost Per Year	Total Cost	Present Value	
Capital Cost (Year 0)	$1,535,652	$1,535,652	**$1,535,652**	
O&M Cost (Year 1 - 30)	$0	$0	**$0**	
Periodic Cost (Years 5, 10, 15, 20, 25, 30)	$0	$0	**$0**	
TOTAL EST. PV OF ALTERNATIVE (FY 2017 Dollars)			**$1,535,652**	**Assumes 5% Discount**

Table C-6
Amcast South
Alternative AMS-2 - Excavation, Offsite Disposal, Backfill, and Site Restoration
Cedarburg, WI

CAPITAL COSTS

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Mobilization/Demobilization					**$ 275,627**	
Mobilization	1	LS	$ 12,273	$ 12,273		
Site Preparation (Clearing, grubbing, trimming)	8,367	SY	$ 9.02	$ 75,502		
Decontamination pad (20 x 40 asphalt sloped to sump)	800	SF	$ 15.20	$ 12,157		
Traffic control signage	1	LS	$ 8,260	$ 8,260		
Construction survey crew	2	EA	$ 3,303	$ 6,605		2 surveys (pre- and post-remediation, plus office time to evaluate data; assume one day per mob)
Miscellaneous equipment and supplies	1	LS	$ 1,879	$ 1,879		(PPE, H&S monitoring, paper goods, ice, coolers)
Site Trailer and Utilities	4	MO	$ 2,303	$ 9,211		
Electrical Connection Allowance	1	LS	$ 37,397	$ 37,397		
Erosion Control and Perimeter Fencing	1	LS	$ 17,977	$ 17,977		Silt fence around laydown areas, snow fence around excavations, hay bales, misc. Use BMPs.
Railroad Flaggers	4	MO	$ 16,466	$ 65,863		Assumed required for work on and alongside railroad property - 2 laborers
Dust Control	4	MO	$ 857	$ 3,428		
Submittals	1	LS	$ 25,076	$ 25,076		
Pre-Construction Activities					**$ 16,514**	
Pre-construction sampling	20	EA	$ 825.69	$ 16,514		Assumes analysis of PCBs
Soil Removal and Backfill					**$ 1,061,160**	
Demolish Bituminous Pavement with Air Equipment	1,933	SY	$ 17.92	$ 34,642		Break up pavement for excavation
Misc. Soil Handling	240	HR	$ 241.51	$ 57,964		Misc. soil handling
Excavation, 3/4 Cy Hydraulic Excavator	13,364	CY	$ 15.81	$ 211,255		
Soil Double Handle - Excavation to Stock Pile to Truck	1,336	CY	$ 35.00	$ 46,774		Move soil from excavation to stockpile. Assumes 10% double-handling
Loading Into Truck	13,364	CY	$ 6.00	$ 80,184		Load soil into dump truck
Shoring for Deep Excavations	7,590	SF	$ 27.05	$ 205,295		Sheet pile along railroad installed to twice the excavation depth
Contact water disposal	0	GAL	$ -	$ -		Assumes contact water will be treated by filter and discharged to sanitary sewer at de minimis cost.
Air Monitoring Station	4	MO	$ 1,246	$ 4,984		Perimeter air monitoring station
Backfill Material	13,364	CY	$ 23.43	$ 313,138		
Compaction	13,364	CY	$ 7.00	$ 93,539		80% in 8-inch layers with vibratory roller, 20% in 6-inch layers with hand tamping
Compaction Testing	1	LS	$ 13,385	$ 13,385		Testing of backfill samples, compaction testing via ASTM D6938
Confirmation Sampling					**$ 38,080**	
Sample Collection	20	DAY	$ 1,057	$ 21,135		Labor - need assumptions
PID, per day	20	DAY	$ 81.02	$ 1,620		Soil screening
PCBs, Soil Analysis	35	EA	$ 163.35	$ 5,717		Confirmation sampling plus disposal screening
Metals, Soil Analysis	35	EA	$ 166.62	$ 5,832		Confirmation Sampling
Polynuclear Aromatic Hydrocarbons, Soil Analysis	35	EA	$ 93.66	$ 3,278		Confirmation Sampling
Sample Jars	105	EA	$ 4.74	$ 497		
Transporation and Disposal Offsite					**$ 2,488,769**	
Transport soil <50ppm PCBs to Subtitle D landfill	20,364	TON	$ 17.71	$ 360,594		1.7 T/CY; 11,979 CY of non-TSCA soil
Dispose of soil <50ppm PCBs at Subtitle D landfill	20,364	TON	$ 38.30	$ 780,000		1.7 T/CY; 11,979 CY of non-TSCA soil
Transport soil >50ppm PCBs to TSCA landfill	2,355	TON	$ 287.80	$ 677,617		1.7 T/CY; 1,385 CY of TSCA soil
Dispose of soil >50ppm PCBs at TSCA landfill	2,355	TON	$ 84.94	$ 199,996		1.7 T/CY; 1,385 CY of TSCA soil
Characterization sampling of soil prior to transport	46	EA	$ 1,283	$ 59,018		Full waste characerization/500 Tons - Includes Sampling Labor
Transportation and Disposal of debris to Subtitle D landfill	5,680	TON	$ 61.93	$ 351,740		assume 25% of excavated material is debris; 1.7 T/CY
32 Ft. Dump Truck Disposable Liner, 6 Mil	1,336	EA	$ 44.75	$ 59,806		assume 10CY loads
Site Restoration					**$ 197,603**	
Removal of Decon Pad	800	SF	$ 5.52	$ 4,415		
Topsoil and Seed	8,367	SY	$ 9.35	$ 78,251		6" of topsoil, fine grading
Gravel (road stone)	1,933	SY	$ 29.44	$ 56,917		8" of gravel, compacted, placed over area where asphalt is removed.
Erosion Control	8,367	SY	$ 6.93	$ 58,019		erosion matting in grass areas
Demobilize					**$ 48,278**	
Record Drawings/Topo Information	1	LS	$ 2,058	$ 2,058		
Subcontract Project Closeout	1	LS	$ 26,661	$ 26,661		
Demobilize Equipment	1	LS	$ 19,559	$ 19,559		
SUBCONTRACT SUBTOTAL					**$ 4,126,032**	
Contingency (15%)					**$ 618,905**	
SUBCONTRACT TOTAL					**$ 4,744,936**	
Payment/Performance Bonds and Insurance (2%)					**$ 82,521**	Applied to the Subcontract total
Contractor Professional/Technical Services					**$ 1,850,525**	
Engineering/Design (6%)	1	LS	$ 284,696	$284,696		Applied to the Subcontract total.
Prime Contractor Markup (8%)	1	LS	$ 379,595	$379,595		Applied to the Subcontract total.
Project Management and Field Oversight (25%)	1	LS	$ 1,186,234	$1,186,234		Applied to the Subcontract total.
TOTAL ESTIMATED CAPITAL COST (FY 2017 Dollars)					**$ 6,677,982**	

O&M COSTS

O&M Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
O&M Items					**$ -**	
None						
O&M ANNUAL SUBTOTAL					**$ -**	
Contingency (15%)					**$ -**	
O&M ANNUAL TOTAL					**$ -**	
Payment/Performance Bonds and Insurance (2%)					**$ -**	
Contractor Professional/Technical Services					**$ -**	
Engineering/Design (6%)	1	LS	$ -	$0		
Prime Contractor Markup (8%)	1	LS	$ -	$0		
Project Management and Field Oversight (25%)	1	LS	$ -	$0		
TOTAL ESTIMATED ANNUAL O&M COST (FY 2017 Dollars)					**$ -**	

PERIODIC COSTS

Periodic Cost Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Years 5, 10, 15, 20, 25, 30					**$ -**	
None						

PRESENT VALUE ANALYSIS

Cost Type	Total Cost Per Year	Total Cost	Present Value	
Capital Cost (Year 0)	$6,677,982	$6,677,982	**$6,677,982**	
O&M Cost (Year 1 - 30)	$0	$0	**$0**	
Periodic Cost (Years 5, 10, 15, 20, 25, 30)	$0	$0	**$0**	
TOTAL EST. PV OF ALTERNATIVE (FY 2017 Dollars)			**$6,677,982**	**Assumes 5% Discount**

Table C-7
Amcast South
Alternative AMS-3 - Isolation Cover and Site Restoration
Cedarburg, WI

CAPITAL COSTS						
Capital Item	**Quantity**	**Units**	**Unit Cost**	**Subtotal**	**Total**	**Comments**
Mobilization/Demobilization					$ 376,684	
Mobilization	4	EA	$ 3,068	$ 12,273		2 Personnel + Project Schedule + Supt 1 week for setup
Site Preparation (Clearing, grubbing, trimming)	8,367	SY	$ 9.02	$ 75,502		
Decontamination pad (20 x 40 asphalt sloped to sump)	800	SF	$ 15.20	$ 12,157		
Traffic control signage	1	LS	$ 8,260	$ 8,260		detail truck routes - photographs, line painting and barricades
Construction survey crew	2	EA	$ 3,303	$ 6,605		2 surveys (pre- and post-remediation, plus office time to Evaluate Data; assume one day per mob)
Miscellaneous equipment and supplies	1	LS	$ 1,879	$ 1,879		(PPE, H&S monitoring, paper goods, ice, coolers)
Site Trailer and Utilities	5	MO	$ 2,005	$ 10,023		
Electrical Connection Allowance	400	LF	$ 93.49	$ 37,397		
Erosion Control and Perimeter Fencing	1	LS	$ 118,221	$ 118,221		Silt fence around laydown areas, snow fence around excavations, hay bales, misc. Use BMPs.
Railroad Flagger	4	MO	$ 16,466	$ 65,863		Assumed required for work on and alongside railroad property - 2 laborers
Dust Control	4	MO	$ 857	$ 3,428		
Submittals	1	LS	$ 25,076	$ 25,076		
Pre-Construction Activities					$ 16,514	
Pre-construction sampling	20	EA	896.51	$ 16,514		
Soil Removal and Backfill					$ 260,029	
Demolish Bituminous Pavement with Air Equipment	1,933	SY	$ 17.92	$ 34,642		Break up pavement for excavation and isolation cover
Misc. Soil Handling	240	HR	$ 241.51	$ 57,964		Misc. soil handling
Excavation, 3/4 Cy Hydraulic Excavator	1,385	CY	$ 15.81	$ 21,894		TSCA material and 2' thick elsewhere under cap area
Loading Into Truck	1,385	CY	$ 6.00	$ 8,310		Load soil into dump truck
Soil Double Handle - Excavation to Stock Pile to Truck	139	CY	$ 35.00	$ 4,848		Move soil from excavation to stockpile. Assumes 10% double-handling
Shoring for Deep Excavations	2,640	SF	$ 27.05	$ 71,407		Sheet pile along railroad installed to twice the excavation depth
Contact water disposal	0	GAL	$ -	$ -		Assumes contact water will be treated by filter and discharged to sanitary sewer at de minimis cost.
Air Monitoring Station	5	MO	$ 1,246	$ 6,230		Perimeter air monitoring station
Backfill Material	1,385	CY	$ 23.43	$ 32,453		Material
Compaction	1,385	CY	$ 7.00	$ 9,694		
Compaction Testing	1	LS	$ 12,589	$ 12,589		Testing of backfill samples, compaction testing via ASTM D6938
Confirmation Sampling					$ 29,323	
Sample Collection	20	DAY	$ 1,056.77	$ 21,135		Labor - need assumptions
PID, per day	20	DAY	$ 81.02	$ 1,620		Soil screening
PCBs, Soil Analysis	15	EA	$ 163.35	$ 2,450		Confirmation sampling plus disposal screening
Metals, Soil Analysis	15	EA	$ 166.62	$ 2,499		Confirmation Sampling
Polynuclear Aromatic Hydrocarbons, Soil Analysis	15	EA	$ 93.66	$ 1,405		Confirmation Sampling
Sample Jars	45	EA	$ 4.74	$ 213		
Transporation and Disposal Offsite					$ 926,679	
Transport soil <50ppm PCBs to Subtitle D landfill	0	TON	$ -	$ -		No non-TSCA soil will be excavated and disposed
Dispose of soil <50ppm PCBs at Subtitle D landfill	0	TON	$ -	$ -		No non-TSCA soil will be excavated and disposed
Transport soil >50ppm PCBs to TSCA landfill	2,355	TON	$ 287.80	$ 677,617		1.7 T/CY; 1,385 CY of TSCA soil
Dispose of soil >50ppm PCBs at TSCA landfill	2,355	TON	$ 84.94	$ 199,996		1.7 T/CY; 1,385 CY of TSCA soil
Characterization sampling of soil prior to transport	5	EA	$ 1,283	$ 6,415		Full waste characerization/500 Tons - Includes Sampling Labor
Transportation and Disposal of debris to Subtitle D landfill	589	TON	$ 61.93	$ 36,453		assume 25% of excavated material is debris; 1.7 T/CY
32 Ft. Dump Truck Disposable Liner, 6 Mil	139	EA	$ 44.75	$ 6,198		assume 10CY loads
Isolation Cover					$ 308,890	
Proof Roll of existing subgrade	1	LS	$ 12,769	$ 12,769		fully loaded, quad axle dump truck
Clay for isolation cover	6,407	CY	$ 37.24	$ 238,621		2 feet of clay material
Placement of cap	6,407	CY	$ 7.37	$ 47,197		placed in lifts not exceeding 1', compacted to 98% of ASTM D698
Compaction Testing	1	LS	$ 10,303	$ 10,303		geotech testing of clay, compaction testing via ASTM D6938
Site Restoration					$ 160,954	
Removal of Decon Pad	800	SF	$ 5.52	$ 4,415		
Topsoil and Seed	9,611	SY	$ 9.35	$ 89,890		6" of topsoil
Erosion Control	9,611	SY	$ 6.93	$ 66,649		erosion mat
Demobilization and Closeout					$ 48,278	
Record Drawings/Topo Information	1	LS	$ 2,058.21	$ 2,058		
Subcontract Project Closeout	1	LS	$ 26,661.22	$ 26,661		
Demobilize Equipment	1	LS	$ 19,558.92	$ 19,559		
Institutional Controls					$ 20,000	
Develop institutional control plan and implement institutional controls	1	LS	$ 20,000	$ 20,000		
SUBCONTRACT SUBTOTAL					$ 2,147,352	
Contingency (15%)					$ 322,103	
SUBCONTRACT TOTAL					$ 2,469,455	
Payment/Performance Bonds and Insurance (2%)					$ 42,947	Applied to the Subcontract total.
Contractor Professional/Technical Services					$ 963,087	
Engineering/Design (6%)	1	LS	$ 148,167	$148,167		Applied to the Subcontract total.
Prime Contractor Markup (8%)	1	LS	$ 197,556	$197,556		Applied to the Subcontract total.
Project Management and Field Oversight (25%)	1	LS	$ 617,364	$617,364		Applied to the Subcontract total.
TOTAL ESTIMATED CAPITAL COST (FY 2017 Dollars)					$ 3,475,489	

O&M COSTS						
O&M Item	**Quantity**	**Units**	**Unit Cost**	**Subtotal**	**Total**	**Comments**
Annual Inspections					$ 13,280	
Onsite inspections - labor	1	LS	$ 4,800	$4,800		Travel to site, conduct inspection, identify deficiencies, and document findings - 2 personnel.
Onsite inspections - per diem, car rental	1	LS	$ 480	$480		Assumes 2 days.
Documenting findings	1	LS	$ 8,000	$8,000		preparation of inspection report.
Maintenance and Repair					$ 15,445	
Repair/replacement of portions of soil cover	1	LS	$15,445	$15,445		Assume 5 percent (on a cost basis) of the isolation cover is repaired/replaced every year.
O&M ANNUAL SUBTOTAL					$ 28,725	
Contingency (15%)					$ 4,309	
O&M ANNUAL TOTAL					$ 33,033	
Payment/Performance Bonds and Insurance (2%)					$ 661	
Contractor Professional/Technical Services					$ 12,883	
Engineering/Design (6%)	1	LS	$ 1,982	$1,982		
Prime Contractor Markup (8%)	1	LS	$ 2,643	$2,643		
Project Management and Field Oversight (25%)	1	LS	$ 8,258	$8,258		
TOTAL ESTIMATED ANNUAL O&M COST (FY 2017 Dollars)					$ 46,577	

PERIODIC COSTS						
Periodic Cost Item	**Quantity**	**Units**	**Unit Cost**	**Subtotal**	**Total**	**Comments**
Years 5, 10, 15, 20, 25, 30					$ 36,000	
Five Year Review Report	1	LS	$16,000	$16,000		
Update Institutional Controls Plan	1	LS	$20,000	$20,000		

PRESENT VALUE ANALYSIS				
Cost Type	**Total Cost Per Year**	**Total Cost**	**Present Value**	
Capital Cost (Year 0)	$3,475,489	$3,475,489	**$3,475,489**	
O&M Cost (Year 1 - 30)	$46,577	$1,397,304	**$716,000**	
Periodic Cost (Years 5, 10, 15, 20, 25, 30)	$36,000	$216,000	**$100,153**	
TOTAL EST. PV OF ALTERNATIVE (FY 2017 Dollars)			**$4,291,641**	**Assumes 5% Discount**

Table C-8
Quarry Pond
Alternative QP-2 - Sediment Dredging, Bank Soil Excavation, Offsite Disposal, and Site Restoration
Cedarburg, WI

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
CAPITAL COSTS						
Mobilization/Demobilization					$ 483,111	
Mobilization	1	LS	$ 225,000	$ 225,000		
Site Preparation (Clearing, grubbing, trimming)	656	SY	$ 20	$ 13,111		Bank area
Construction of temporary offloading area.	1	LS	$ 125,000	$ 125,000		
Traffic control signage	1	LS	$ 3,000	$ 3,000		detail truck routes
Construction survey crew	2	EA	$ 1,500	$ 3,000		2 surveys (pre- and post-remediation, plus office time to Evaluate Data; assume one day per mob)
Miscellaneous equipment and supplies	1	LS	$ 5,000	$ 5,000		(PPE, H&S monitoring, paper goods, ice, coolers)
Site Trailer and Utilities	4	MO	$ 3,000	$ 12,000		
Electrical Connection Allowance	1	LS	$ 50,000	$ 50,000		
Erosion Control and Perimeter Fencing	1	LS	$ 10,000	$ 10,000		Silt fence around laydown areas, snow fence around excavations, hay bales, misc. Use BMPs.
Dust Control	3	MO	$ 4,000	$ 12,000		
Submittals	1	LS	$ 25,000	$ 25,000		
Pre-Construction Activities					$ 21,672	
Per Diem	5	DAY	$ 300	$ 1,500		$150/day for 2 personnel
Vehicle Rental	5	DAY	$ 90	$ 450		
Sample Collection	5	DAY	$ 2,300	$ 11,500		$115/hr, 10hr/day, 2 personnel
PCBs, Soil Analysis	30	EA	$ 269	$ 8,070		Confirmation sampling plus disposal screening
Sample Jars	30	EA	$ 5.05	$ 152		
Dewatering					$ 20,000	
Sump	1	LS	$ 5,000	$ 5,000		Assumes that dewatering occurs on the barge; water is filtered and discharged back into Quarry Pond. If PCB free product exists, water would need to be containerized and treated as TSCA.
Sump Pump	3	MO	$ 5,000	$ 15,000		
Bank Soil Excavation					$ 146,924	
Excavation, 1 Cy Hydraulic Excavator, Med. Mat'l, 40 CY/HR	656	CY	$ 151	$ 98,989		Bank Soil
Loading of soil into Truck	656	CY	$ 10	$ 6,228		Load soil into dump truck assuming direct-load
Backfill Material	656	CY	$ 50	$ 32,778		Bank Soil Material
Compaction Equipment	30	HR	$ 131	$ 3,930		Assumes 3 10-hr days for backfill and compaction operations for bank soil
Compaction Testing	1	LS	$ 5,000	$ 5,000		Testing of backfill samples, compaction testing via ASTM D6938
Sediment Removal					$ 1,423,069	
Sediment Dredging - includes 1 barge for equipment and 2 barges for sediment.	14,907	CY	$ 51	$ 752,790		Assumes mechanical sediment dredging using a long-reach excavator with clam-shell bucket
Furnish sediment solidification additive and complete mixing process	2,087	TON	$ 244	$ 509,214		10% additive by weight
Loading of sediments to the Trucks	16,512	CY	$ 10	$ 156,865		Load soil into dump truck
Air Monitoring Station	3	MO	$ 1,400	$ 4,200		Perimeter air monitoring station
Confirmation Sampling					$ 12,820	20 samples evenly spread throughout the pond and bank area
Sample Collection	3	DAY	$ 2,300	$ 6,900		$115/hr, 10hr/day, 2 personnel
PCBs, Soil Analysis	20	EA	$ 269	$ 5,380		
PID, per day	3	DAY	$ 180	$ 540		
Transporation and Disposal Offsite					$ 1,535,972	
Transport soil <50ppm PCBs to Subtitle D landfill	20,436	TON	$ 13	$ 265,673		1.4 T/CY; 13,137 CY of non-TSCA sediment/soil + admixture
Dispose of soil <50ppm PCBs at Subtitle D landfill	20,436	TON	$ 31	$ 633,527		1.4 T/CY; 13,137 CY of non-TSCA sediment/soil + admixture
Transport soil >50ppm PCBs to TSCA landfill	3,530	TON	$ 53	$ 187,067		1.4 T/CY; 1,700 CY of TSCA sediment +admixture
Dispose of soil >50ppm PCBs at TSCA landfill	3,530	TON	$ 107	$ 377,664		1.4 T/CY; 1,700 CY of TSCA sediment +admixture
Characterization sampling of soil prior to transport	48	EA	$ 1,283	$ 61,497		Full waste characerization/500 Tons - Includes Sampling Labor
Transportation and Disposal of debris to Subtitle D landfill	240	TON	$ 44	$ 10,545		assume 1% of total excavation
32 Ft. Dump Truck Disposable Liner, 6 Mil	1,717	EA	$ 53	$ 90,988		assume 10CY loads
Site Restoration					$ 25,679	
Removal of Decon Pad	800	SF	$ 2	$ 1,600		
Topsoil and Seed	656	SY	$ 9.73	$ 6,379		6" of topsoil and seed placed over bank area
Erosion Control	5,900	SF	$ 3	$ 17,700		Assumes erosion control over bank area
Demobilize					$ 151,500	
Record Drawings/Topo Information	1	LS	$ 1,500	$ 1,500		
Subcontract Project Closeout	1	LS	$ 25,000	$ 25,000		
Demobilize Equipment	1	LS	$ 125,000	$ 125,000		Includes decon of equipment, demobilization of equipment and labor, restoration of staging area, contract clo
SUBCONTRACT SUBTOTAL					$ 3,820,748	
Contingency (15%)					$ 573,112	
SUBCONTRACT TOTAL					$ 4,393,860	
Payment/Performance Bonds and Insurance (2%)					$ 76,415	Applied to the Subcontract total.
Contractor Professional/Technical Services					$ 1,713,605	
Engineering/Design (6%)	1	LS	$ 263,632	$263,632		Applied to the Subcontract total.
Prime Contractor Markup (8%)	1	LS	$ 351,509	$351,509		Applied to the Subcontract total.
Project Management and Field Oversight (25%)	1	LS	$ 1,098,465	$1,098,465		Applied to the Subcontract total.
TOTAL ESTIMATED CAPITAL COST (FY 2017 Dollars)					$ 6,183,880	

O&M Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
O&M COSTS						
O&M Items					$ -	
None						
O&M ANNUAL SUBTOTAL					$ -	
Contingency (15%)					$ -	
O&M ANNUAL TOTAL					$ -	
Payment/Performance Bonds and Insurance (2%)					$ -	
Contractor Professional/Technical Services					$ -	
Engineering/Design (6%)	1	LS	$ -	$0		
Prime Contractor Markup (8%)	1	LS	$ -	$0		
Project Management and Field Oversight (25%)	1	LS	$ -	$0		
TOTAL ESTIMATED ANNUAL O&M COST (FY 2017 Dollars)					$ -	

Periodic Cost Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
PERIODIC COSTS						
Years 5, 10, 15, 20, 25, 30					$ -	
None						

PRESENT VALUE ANALYSIS

Cost Type	Total Cost Per Year	Total Cost	Present Value	
Capital Cost (Year 0)	$6,183,880	$6,183,880	**$6,183,880**	
O&M Cost (Year 1 - 30)	$0	$0	**$0**	
Periodic Cost (Years 5, 10, 15, 20, 25, 30)	$0	$0	**$0**	
TOTAL EST. PV OF ALTERNATIVE (FY 2017 Dollars)			**$6,183,880**	**Assumes 5% Discount**

Table C-9
Quarry Pond
Alternative QP-3 - Construct Permeable Reactive Barrier to Isolate Contaminated Sediment, Excavate Bank Soil, Offsite Disposal, and Site Restoration
Cedarburg, WI

CAPITAL COSTS Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Mobilization/Demobilization					$ 469,111	
Mobilization	1	LS	$ 225,000	$ 225,000		
Site Preparation (Clearing, grubbing, trimming)	656	SY	$ 20	$ 13,111		Bank area
marine access facilities	1	LS	$ 125,000	$ 125,000		
Traffic control signage	1	LS	$ 3,000	$ 3,000		detail truck routes
Construction survey crew	2	EA	$ 1,500	$ 3,000		2 surveys (pre- and post-remediation, plus office time to Evaluate Data; assume one day per mob)
Miscellaneous equipment and supplies	1	LS	$ 5,000	$ 5,000		(PPE, H&S monitoring, paper goods, ice, coolers)
Site Trailer and Utilities	2	MO	$ 3,000	$ 6,000		
Electrical Connection Allowance	1	LS	$ 50,000	$ 50,000		
Erosion Control and Perimeter Fencing	1	LS	$ 10,000	$ 10,000		Silt fence around laydown areas, snow fence around excavations, hay bales, misc. Use BMPs.
Dust Control	1	MO	$ 4,000	$ 4,000		
Submittals	1	LS	$ 25,000	$ 25,000		
Pre-Construction Activities					$ 152	
Per Diem	5	DAY	$ 300	$ 1,500		$150/day for 2 personnel
Vehicle Rental	5	DAY	$ 90	$ 450		
Sample Collection	5	DAY	$ 2,300	$ 11,500		$115/hr, 10hr/day, 2 personnel
PCBs, Soil Analysis	30	EA	$ 269	$ 8,070		Confirmation sampling plus disposal screening
Sample Jars	30	EA	$ 5.05	$ 152		
Permeable Reactive Barrier					$ 1,874,291	
Debris Removal	139,100	SF	$ 0.60	$83,460		Assumes crew and equipment at $25,000/day, with production of 1 acre a day
Bulk GAC, material - TSCA area	3.3	CY	$ 1,264.28	$ 4,119		1% bulk GAC, assumes 15% extra for material loss/misplacement
Bulk GAC, material - non-TSCA area	18	CY	$ 1,264.28	$ 22,222		1% bulk GAC, assumes 15% extra for material loss/misplacement
Sand, material - TSCA area	323	CY	$ 24.00	$ 7,742		6-inch thick layer, 99% sand, assumes 15% extra for material loss/misplacement
Sand, material - non-TSCA area	1,740	CY	$ 24.00	$ 41,762		4-inch thick layer, 99% sand, assumes 15% extra for material loss/misplacement
Gravel Armor Layer - TSCA and non-TSCA area	2,962	CY	$ 17.01	$ 50,389		6-inch thick layer, 100% well-graded ½ inch coarse aggregate (D50), assumes 15% extra for material loss/misplacement
Excavation, 1 Cy Hydraulic Excavator, Med. Mat'l, 40 CY/HR	5,803	CY	$ 151	$ 876,204		Used to mix sand and GAC, assumes 15% extra for material loss/misplacement
Transportation of Sand/GAC/gravel material to barge	5,803	CY	$ 6	$ 34,816		
Placement of sand/GAC/gravel material	5,803	CY	$ 100	$ 580,267		
Organophilic clay layer for NAPL management, material, shipping	17,595	SF	$ 3.00	$ 52,785		Assume that NAPL will be present within TSCA areas; includes 15% overlap
Organophilic clay layer, placement	17,595	SF	$ 6.85	$ 120,526		Assumes $30,000 /day for equipment and crew (including dive support), and placement of 3 rolls (4,500 sf) per day for estimated 4 days
Bank Soil Excavation					$ 146,030	
Excavation, 1 Cy Hydraulic Excavator, Med. Mat'l, 40 CY/HR	656	CY	$ 151	$ 98,989		Bank Soil
Loading Into Truck	656	CY	$ 6	$ 3,933		Load soil into dump truck assuming direct-load
Air Monitoring Station	1	MO	$ 1,400	$ 1,400		Perimeter air monitoring station
Backfill Material	656	CY	$ 50	$ 32,778		Bank Soil Material
Compaction Equipment	30	HR	$ 131	$ 3,930		Assumes 3 10-hr days for backfill and compaction operations for bank soil
Compaction Testing	1	LS	$ 5,000	$ 5,000		Testing of backfill samples, compaction testing via ASTM D6938
Confirmation Sampling					$ 2,406	4 samples evenly spread throughout the bank area
Sample Collection	0.5	DAY	$ 2,300	$ 1,150		$115/hr, 10hr/day, 2 personnel
PCBs, Soil Analysis	4	EA	$ 269	$ 1,076		
PID, per day	1	DAY	$ 180	$ 180		
Transporation and Disposal Offsite					$ 49,261	Excavation of bank soil
Transport soil <50ppm PCBs to Subtitle D landfill	918	TON	$ 13	$ 11,931		1.4 T/CY
Dispose of soil <50ppm PCBs at Subtitle D landfill	918	TON	$ 31	$ 28,451		1.4 T/CY
Transport soil >50ppm PCBs to TSCA landfill	0	TON	$ 53	$ -		bank soil is assumed to be non-TSCA
Dispose of soil >50ppm PCBs at TSCA landfill	0	TON	$ 107	$ -		bank soil is assumed to be non-TSCA
Characterization sampling of soil prior to transport	2	EA	$ 1,283	$ 2,355		Full waste characerization/500 Tons - Includes Sampling Labor
Transportation and Disposal of debris to Subtitle D landfill	148	TON	$ 44	$ 6,524		assume 1% of total excavation in bank area and 1 ton per 1000 sf of bottom area for the cap
32 Ft. Dump Truck Disposable Liner, 6 Mil	80	EA	$ 53	$ 4,260		assume 10 CY loads
Site Restoration					$ 25,679	
Removal of Decon Pad	800	SF	$ 2	$ 1,600		
Topsoil and Seed	656	SY	$ 9.73	$ 6,379		6" of topsoil and seed placed over bank area
Erosion Control	5,900	SF	$ 3	$ 17,700		Assumes erosion control over bank area
Demobilize					$ 151,500	
Record Drawings/Topo Information	1	LS	$ 1,500	$ 1,500		
Subcontract Project Closeout	1	LS	$ 25,000	$ 25,000		
Demobilize Equipment	1	LS	$ 125,000	$ 125,000		
SUBCONTRACT SUBTOTAL					$ 2,718,430	
Contingency (15%)					$ 407,764	
SUBCONTRACT TOTAL					$ 3,126,194	
Payment/Performance Bonds and Insurance (2%)					$ 54,369	Applied to the Subcontract total.
Contractor Professional/Technical Services					$ 1,219,216	
Engineering/Design (6%)	1	LS	$ 187,572	$187,572		Applied to the Subcontract total.
Prime Contractor Markup (8%)	1	LS	$ 250,096	$250,096		Applied to the Subcontract total.
Project Management and Field Oversight (25%)	1	LS	$ 781,549	$781,549		Applied to the Subcontract total.
TOTAL ESTIMATED CAPITAL COST (FY 2017 Dollars)					$ 4,399,779	

O&M COSTS O&M Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Annual Inspections					$ 13,580	
Onsite inspections - labor	1	LS	$ 4,800	$4,800		Travel to site, conduct inspection, identify deficiencies, and document findings - 2 personnel.
Onsite inspections - per diem, car rental	1	LS	$ 780	$780		Assumes per diem for 2 days, 2 personnel, and 1 vehicle.
Documenting findings	1	LS	$ 8,000	$8,000		preparation of inspection report.
Sampling					$ 20,930	
Sample collection - labor	1	LS	$ 10,000	$10,000		Assumes 5 days for 2 staff, 10 hours/day.
Sample collection - per diem, car rental	1	LS	$ 1,950	$1,950		Assumes per diem for 5 days, 2 personnel, and 1 vehicle.
PCBs, Soil Analysis	20	EA	$ 269	$5,380		
Sample Jars	20	EA	$ 180.00	$3,600		
Maintenance and Repair					$ 37,486	
Repair/replacement of portions of PRB	1	LS	$37,486	$37,486		Assume 2 percent (on a cost basis) of the PRB is repaired/replaced every year.
O&M ANNUAL SUBTOTAL					$ 71,996	
Contingency (15%)					$ 10,799	
O&M ANNUAL TOTAL					$ 82,795	
Payment/Performance Bonds and Insurance (2%)					$ 1,656	
Contractor Professional/Technical Services					$ 32,290	
Engineering/Design (6%)	1	LS	$ 4,968	$4,968		
Prime Contractor Markup (8%)	1	LS	$ 6,624	$6,624		
Project Management and Field Oversight (25%)	1	LS	$ 20,699	$20,699		
TOTAL ESTIMATED ANNUAL O&M COST (FY 2017 Dollars)					$ 116,741	

PERIODIC COSTS Periodic Cost Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Years 5, 10, 15, 20, 25, 30					$ 36,000	
Five Year Review Report	1	LS	$16,000	$16,000		
Update Institutional Controls Plan	1	LS	$20,000	$20,000		

PRESENT VALUE ANALYSIS

Cost Type	Total Cost Per Year	Total Cost	Present Value	
Capital Cost (Year 0)	$4,399,779	$4,399,779	$4,399,779	
O&M Cost (Year 1 - 30)	$116,741	$3,502,237	$1,794,599	
TOTAL EST. PV OF ALTERNATIVE (FY 2017 Dollars)			$6,194,378	**Assumes 5% Discount**

Table C-10
Quarry Pond
Alternative QP-4 - Sediment Dredging, Bank Soil Excavation, Offsite Disposal, and Site Restoration
Cedarburg, WI

CAPITAL COSTS						
Capital Item	**Quantity**	**Units**	**Unit Cost**	**Subtotal**	**Total**	**Comments**
Mobilization/Demobilization					$ 483,111	
Mobilization	1	LS	$ 225,000	$ 225,000		
Site Preparation (Clearing, grubbing, trimming)	656	SY	$ 20	$ 13,111		Bank area
Construction of temporary offloading area.	1	LS	$ 125,000	$ 125,000		
Traffic control signage	1	LS	$ 3,000	$ 3,000		detail truck routes
Construction survey crew	2	EA	$ 1,500	$ 3,000		2 surveys (pre- and post-remediation, plus office time to Evaluate Data; assume one day per mob)
Miscellaneous equipment and supplies	1	LS	$ 5,000	$ 5,000		(PPE, H&S monitoring, paper goods, ice, coolers)
Site Trailer and Utilities	4	MO	$ 3,000	$ 12,000		
Electrical Connection Allowance	1	LS	$ 50,000	$ 50,000		
Erosion Control and Perimeter Fencing	1	LS	$ 10,000	$ 10,000		Silt fence around laydown areas, snow fence around excavations, hay bales, misc. Use BMPs.
Dust Control	3	MO	$ 4,000	$ 12,000		
Submittals	1	LS	$ 25,000	$ 25,000		
Pre-Construction Activities					$ 21,672	
Per Diem	5	DAY	$ 300	$ 1,500		$150/day for 2 personnel
Vehicle Rental	5	DAY	$ 90	$ 450		
Sample Collection	5	DAY	$ 2,300	$ 11,500		$115/hr, 10hr/day, 2 personnel
PCBs, Soil Analysis	30	EA	$ 269	$ 8,070		Confirmation sampling plus disposal screening
Sample Jars	30	EA	$ 5.05	$ 152		
Dewatering					$ 20,000	
Sump	1	LS	$ 5,000	$ 5,000		Assumes that dewatering occurs on the barge; water is filtered and discharged back into Quarry Pond. If PCB free product exists, water would need to be containerized and treated as TSCA.
Sump Pump	3	MO	$ 5,000	$ 15,000		
Bank Soil Excavation					$ 146,924	
Excavation, 1 Cy Hydraulic Excavator, Med. Mat'l, 40 CY/HR	656	CY	$ 151	$ 98,989		Bank Soil
Loading of soil into Truck	656	CY	$ 10	$ 6,228		Load soil into dump truck assuming direct-load
Backfill Material	656	CY	$ 50	$ 32,778		Bank Soil Material
Compaction Equipment	30	HR	$ 131	$ 3,930		Assumes 3 10-hr days for backfill and compaction operations for bank soil
Compaction Testing	1	LS	$ 5,000	$ 5,000		Testing of backfill samples, compaction testing via ASTM D6938
Sediment Removal					$ 1,867,257	
Sediment Dredging - includes 1 barge for equipment and 2 barges for sediment.	19,573	CY	$ 51	$ 988,457		Assumes mechanical sediment dredging using a long-reach excavator with clam-shell bucket
Furnish sediment solidification additive and complete mixing process	2,740	TON	$ 244	$ 668,628		10% additive by weight
Loading of sediments to the Trucks	21,681	CY	$ 10	$ 205,972		Load soil into dump truck
Air Monitoring Station	3	MO	$ 1,400	$ 4,200		Perimeter air monitoring station
Confirmation Sampling					$ 20,470	20 samples evenly spread throughout the pond and bank area
Sample Collection	5	DAY	$ 2,300	$ 11,500		$115/hr, 10hr/day, 2 personnel
PCBs, Soil Analysis	30	EA	$ 269	$ 8,070		
PID, per day	5	DAY	$ 180	$ 900		
Transporation and Disposal Offsite					$ 1,873,789	
Transport soil <50ppm PCBs to Subtitle D landfill	27,623	TON	$ 13	$ 359,099		1.4 T/CY; 13,137 CY of non-TSCA sediment/soil + admixture
Dispose of soil <50ppm PCBs at Subtitle D landfill	27,623	TON	$ 31	$ 856,314		1.4 T/CY; 13,137 CY of non-TSCA sediment/soil + admixture
Transport soil >50ppm PCBs to TSCA landfill	3,530	TON	$ 53	$ 187,067		1.4 T/CY; 1,700 CY of TSCA sediment +admixture
Dispose of soil >50ppm PCBs at TSCA landfill	3,530	TON	$ 107	$ 377,664		1.4 T/CY; 1,700 CY of TSCA sediment +admixture
Characterization sampling of soil prior to transport	62	EA	$ 1,283	$ 79,938		Full waste characerization/500 Tons - Includes Sampling Labor
Transportation and Disposal of debris to Subtitle D landfill	312	TON	$ 44	$ 13,707		assume 1% of total excavation
32 Ft. Dump Truck Disposable Liner, 6 Mil	2,234	EA	$ 53	$ 118,385		assume 10CY loads
Site Restoration					$ 25,679	
Removal of Decon Pad	800	SF	$ 2	$ 1,600		
Topsoil and Seed	656	SY	$ 9.73	$ 6,379		6" of topsoil and seed placed over bank area
Erosion Control	5,900	SF	$ 3	$ 17,700		Assumes erosion control over bank area
Demobilize					$ 151,500	
Record Drawings/Topo Information	1	LS	$ 1,500	$ 1,500		
Subcontract Project Closeout	1	LS	$ 25,000	$ 25,000		
Demobilize Equipment	1	LS	$ 125,000	$ 125,000		Includes decon of equipment, demobilization of equipment and labor, restoration of staging area, contract clo
SUBCONTRACT SUBTOTAL					$ 4,610,402	
Contingency (15%)					$ 691,560	
SUBCONTRACT TOTAL					$ 5,301,962	
Payment/Performance Bonds and Insurance (2%)					$ 92,208	Applied to the Subcontract total.
Contractor Professional/Technical Services					$ 2,067,765	
Engineering/Design (6%)	1	LS	$ 318,118	$318,118		Applied to the Subcontract total.
Prime Contractor Markup (8%)	1	LS	$ 424,157	$424,157		Applied to the Subcontract total.
Project Management and Field Oversight (25%)	1	LS	$ 1,325,490	$1,325,490		Applied to the Subcontract total.
TOTAL ESTIMATED CAPITAL COST (FY 2017 Dollars)					$ 7,461,935	
O&M COSTS						
O&M Item	**Quantity**	**Units**	**Unit Cost**	**Subtotal**	**Total**	**Comments**
O&M Items					$ -	
None						
O&M ANNUAL SUBTOTAL					$ -	
Contingency (15%)					$ -	
O&M ANNUAL TOTAL					$ -	
Payment/Performance Bonds and Insurance (2%)					$ -	
Contractor Professional/Technical Services					$ -	
Engineering/Design (6%)	1	LS	$ -	$0		
Prime Contractor Markup (8%)	1	LS	$ -	$0		
Project Management and Field Oversight (25%)	1	LS	$ -	$0		
TOTAL ESTIMATED ANNUAL O&M COST (FY 2017 Dollars)					$ -	
PERIODIC COSTS						
Periodic Cost Item	**Quantity**	**Units**	**Unit Cost**	**Subtotal**	**Total**	**Comments**
Years 5, 10, 15, 20, 25, 30					$ -	
None						

PRESENT VALUE ANALYSIS

Cost Type	**Total Cost Per Year**	**Total Cost**	**Present Value**	
Capital Cost (Year 0)	$7,461,935	$7,461,935	**$7,461,935**	
O&M Cost (Year 1 - 30)	$0	$0	**$0**	
Periodic Cost (Years 5, 10, 15, 20, 25, 30)	$0	$0	**$0**	
TOTAL EST. PV OF ALTERNATIVE (FY 2017 Dollars)			**$7,461,935**	**Assumes 5% Discount**

Table C-11
Groundwater
Alternative GW-2 - Groundwater Monitoring and Institutional Controls
Cedarburg, WI

CAPITAL COSTS						
Capital Item	**Quantity**	**Units**	**Unit Cost**	**Subtotal**	**Total**	**Comments**
Groundwater Monitoring Program					**$ 70,518**	
Existing Data Evaluation	1	LS	$ 29,374	$ 29,374		
Submittals	1	LS	$ 29,374	$ 29,374		
Review	1	LS	$ 11,769	$ 11,769		
Monitoring Well Abandonment					**$ 1,400**	
Monitoring well abandonment	2	EA	$ 700	$ 1,400		
Monitoring Well Installation					**$ 75,079**	
Mobilization/Demobilization	1	LS	$ 5,461	$ 5,461		Includes submittals, decon, etc.
Private Utility Locate	1	LS	$ 2,614	$ 2,614		
Hollow-Stem Auger Drilling (8.25" ID)	250	LF	$ 36.00	$ 20,833		
4-inch PVC Well Casing	200	LF	$ 18.00	$ 21,875		
4-inch Stainless Steel Well Screen (10')	50	LF	$ 57.75	$ 111		
Well Construction Materials (bentonite, sand, etc.)	250	LF	$ 29.36	$ 7,339		
Well Development	5	EA	$ 286.45	$ 1,432		
Surveying	1	DAY	$ 2,051	$ 2,051		
Transport soil cuttings to Subtitle D landfill	16	TON	$ 15.43	$ 248		1.7 T/CY, 30% swell
Dispose of soil cuttings at Subtitle D landfill	16	TON	$ 33.38	$ 536		1.7 T/CY, 30% swell
Oversight Labor	100	HR	$ 89.19	$ 8,919		1 staff, 10 Days, 10 HR/Day
Drilling Crew Per Diem, assume 2 persons	10	DAY	$ 365.90	$ 3,659		
Quarterly Sampling, First 2 Years (8 events)					**$ 166,210**	
Groundwater Compliance Samples	176	EA	$ 65.67	$ 11,559		Assumes 22 samples for each event, including 2 QA/QC samples
Labor	720	HR	$ 119.53	$ 86,062		Assumes 3 10-hr days for 2 samplers and 1 sample processor for each event
Equipment - meters	1	LS	$ 13,536	$ 13,536		
Consumables	1	LS	$ 5,324	$ 5,324		
Data Validation	160	HR	$ 103.60	$ 16,576		Assumes 20 hours for each event
Reporting	320	HR	$ 103.60	$ 33,153		Assumes 40 hours for each event
Institutional Controls					**$ 11,865**	
Implement Groundwater Use Restrictions	1	LS	$ 11,865	$ 11,865		
SUBCONTRACT SUBTOTAL					**$ 325,073**	
Contingency (15%)					**$ 48,761**	
SUBCONTRACT TOTAL					**$ 373,834**	
Payment/Performance Bonds and Insurance (2%)					**$ 6,501**	Applied to the Subcontract total.
Contractor Professional/Technical Services					**$ 145,795**	
Engineering/Design (6%)	1	LS	$ 22,430	$22,430		Applied to the Subcontract total.
Prime Contractor Markup (8%)	1	LS	$ 29,907	$29,907		Applied to the Subcontract total.
Project Management and Field Oversight (25%)	1	LS	$ 93,458	$93,458		Applied to the Subcontract total.
TOTAL ESTIMATED CAPITAL COST (FY 2017 Dollars)					**$ 526,130**	

O&M COSTS						
O&M Item	**Quantity**	**Units**	**Unit Cost**	**Subtotal**	**Total**	**Comments**
Semi-annual Sampling					**$ 20,776**	
Groundwater Compliance Samples	22	EA	$ 65.67	$ 1,445		Assumes 20 wells sampled and 2 QA/QC samples
Labor	90	HR	$ 119.53	$ 10,758		Assumes 3 10-hr days for 2 samplers and 1 sample processor
Equipment - meters	1	LS	$ 1,692	$ 1,692		
Consumables	1	LS	$ 665.50	$ 666		
Data Validation	20	HR	$ 103.60	$ 2,072		
Reporting	40	HR	$ 103.60	$ 4,144		
Trend Analysis					**$ 58,748**	
Data Evaluation	1	LS	$ 29,374	$ 29,374		
Submittals	1	LS	$ 29,374	$ 29,374		
O&M ANNUAL SUBTOTAL					**$ 79,525**	
Contingency (15%)					**$ 11,929**	
O&M ANNUAL TOTAL					**$ 91,453**	
Payment/Performance Bonds and Insurance (2%)					**$ 1,829**	
Contractor Professional/Technical Services					**$ 35,667**	
Engineering/Design (6%)	1	LS	$ 5,487	$5,487		
Prime Contractor Markup (8%)	1	LS	$ 7,316	$7,316		
Project Management and Field Oversight (25%)	1	LS	$ 22,863	$22,863		
TOTAL ESTIMATED ANNUAL O&M COST (FY 2017 Dollars)					**$ 128,949**	

PERIODIC COSTS						
Periodic Cost Item	**Quantity**	**Units**	**Unit Cost**	**Subtotal**	**Total**	**Comments**
Years 5, 10, 15, 20, 25, 30					**$ 56,000**	
Five Year Review Report	1	LS	$16,000	$16,000		
Update Institutional Controls Plan	1	LS	$20,000	$20,000		
Monitoring well inspections/repairs	1	LS	$10,000	$10,000		
Well repairs and maintenance	1	LS	$10,000	$10,000		Assumes 3 10-hr days for 2 staff and materials.

PRESENT VALUE ANALYSIS				
Cost Type	**Total Cost Per Year**	**Total Cost**	**Present Value**	
Capital Cost (Year 0)	$526,130	$526,130	**$526,130**	
O&M Cost (Year 3 - 30)	$128,949	$3,868,475	**$1,742,495**	
Periodic Cost (Years 5, 10, 15, 20, 25, 30)	$56,000	$336,000	**$155,793**	
TOTAL EST. PV OF ALTERNATIVE (FY 2017 Dollars)			**$2,424,419**	**Assumes 5% Discount**

Table C-13
Amcast North Storm Sewers
Alternative SSN-2 - Abandon Amcast North Building Storm Sewers, Pressure Wash Non-Building Storm Sewer Piping, Sewer Backfill Excavation and Offsite Disposal, and Site Restoration
Cedarburg, WI

CAPITAL COSTS

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Mobilization/Demobilization					$ 187,697	
Subcontractor Submittals	4	EA	$ 1,500	$ 6,000		Work Plan, H&S Plans, AHAs, Epoxy Coating
Mobilization/Demobilization of Cleaning and Treatment Equipment	1	LS	$ 100,000	$ 100,000		Per quote from FECC
Decontamination pad (50 x 50 bermed asphalt sloped to sump)	2500	SF	$ 8.50	$ 21,250		
Traffic control signage	1	LS	$ 2,000	$ 2,000		
Construction survey crew	2	DAY	$ 2,227	$ 4,454		2 surveys (pre- and post-remediation, plus office time to Evaluate Data; assume one day per mob)
Site Trailer and Utilities	2	MO	$ 3,793	$ 7,586		
Electrical Connection Allowance	1	LS	$ 37,397	$ 37,397		
Erosion Control and Perimeter Fencing	1	LS	$ 7,510	$ 7,510		Silt fence around laydown areas, snow fence around excavations, hay bales, misc. Use BMPs.
Dust Control	1	MO	$ 1,500	$ 1,500		
Pre-Construction Activities					$ 15,986	
Private Utility Clearance	2	DAYS	$ 2,500	$ 5,000		
Building Structural Assessment	40	HR	$ 125	$ 5,000		Local Structural Engineer, Survey plus report
Sample Collection	2	DAY	$ 2,015	$ 4,030		CH2M Team
PCBs, Soil Analysis	12	EA	$ 163	$ 1,956		Confirmation sampling plus disposal screening
Storm Sewer Abandonment/Cleaning Under Building					$ 252,530	
Building Structural Modification to Allow Work Inside	1	Allow	$ 50,000.00	$ 50,000		Allowance to insure safe entry into building areas to clean and plug lines
Mob/Demob Video Eqpt, Reports	1	LS	$ 7,500.00	$ 7,500		Video 2200 lf of pipe,$150/hr, 1000 ft per day
In-Line Video Inspection	5	DAY	$ 1,150.00	$ 5,750		Video after bulldozing and cleaning of 2200 lf of pipe,$150/hr, 500 ft per day
Clean Out and Pressure Wash Pipes Underneath Building to Extent Possible	10	DAY	$ 9,150.00	$ 91,500		Cost includes crew time to dredge "bulldoze" and "pressure wash" lines underneath the building. Equipment for separation includes dirty and clean frac tanks and carbon and bag filters. Washwater is assumed to be reused.
Processing of Flush Water and Sediment	10	DAY	$ 5,500.00	$ 55,000		Cost includes processing of flush water to separate removed sediment from flush water, carbon treat flush water for reuse. See Assumptions and Calcs Tab for details
Plugging of Lines After Cleaning	5	DAY	$ 7,500.00	$ 37,500		Assume a total of 25 plugs have to be done. Assume 6/day. Plugs are assumed to be flowable fill (4 bag mix) pumped in to greatest extent possible. Total volume in pipe = 0.79 cf/ft
Flowable Fill	48	CY	$ 110.00	$ 5,280		
Storm Sewer Abandonment/Cleaning Outside Building - SSN Sewers					$ 737,500	
Mob/Demob Video Eqpt, Reports	1	LS	$ 7,500	$ 7,500		Video 2600 lf of pipe,$150/hr, 1000 ft per day
In-Line Video Inspection	10	DAY	$ 1,150	$ 11,500		Video after bulldozing and cleaning of 2600 lf of pipe,$150/hr, 500 ft per day
Clean Out and Pressure Wash Pipes Downgradient Sewers	10	DAY	$ 9,150	$ 91,500		Cost includes crew time to dredge "bulldoze" and "pressure wash" downgradient lines. Cost also includes processing of flush water to separate removed sediment from flush water, carbon treat flush water for reuse. Equipment for separation includes dirty and clean frac tanks and carbon and bag filters. Washwater is assumed to be reused.
Processing of Flush Water and Sediment	10	DAY	$ 5,500	$ 55,000		See Assumptions & Calcs Tab for details
Epoxy Coating Lines After Cleaning	2,600	LF	$ 220	$ 572,000		See FECC Tab. Assume 72 in pipes based on Google Earth measurement of outfall to Wilshire Pond
Confirmation Sampling					$ 15,080	
Sample Collection	10	EA	$ 1,170	$ 11,700		
PCBs, Soil Analysis	20	EA	$ 163.00	$ 3,260		Confirmation sampling
Sample Jars	20	EA	$ 6.00	$ 120		
Transportation and Disposal Offsite					$ 73,423	
Characterization sampling of soil prior to transport	2	EA	$ 1,000.00	$ 2,000		1 sample for PCBs and 1 paint filter/500 Tons, plus TCLP
Transport Solidified Sediment from Under Building <50ppm PCBs to Subtitle D landfill	18	TON	$ 15.00	$ 270		See Assumptions and Calcs
Dispose of Solidified Sediment from Under Building <50ppm PCBs to Subtitle D landfill	18	TON	$ 32.00	$ 576		See Assumptions and Calcs
Transport Solidified Sediment from Under Building >50ppm PCBs to TSCA landfill	18	TON	$ 53.00	$ 954		See Assumptions and Calcs
Dispose of Solidified Sediment from Under Building >50ppm PCBs to TSCA landfill	18	TON	$ 107.00	$ 1,926		See Assumptions and Calcs
Transport Solidified Sediment from Downgradient Pipelines <50ppm PCBs to Subtitle D landfill	280	TON	$ 15.00	$ 4,200		See Assumptions and Calcs
Dispose of Solidified Sediment from Downgradient Pipelines <50ppm PCBs to Subtitle D landfill	280	TON	$ 32.00	$ 8,960		See Assumptions and Calcs
Transport Solidified Sediment from Downgradient Pipelines >50ppm PCBs to TSCA landfill	280	TON	$ 53.00	$ 14,840		See Assumptions and Calcs
Dispose of Solidified Sediment from Downgradient Pipelines >50ppm PCBs to TSCA landfill	280	TON	$ 107.00	$ 29,960		See Assumptions and Calcs
Contact water disposal	30,000	GAL	$ 0.26	$ 7,800		Volume provided by potential subcontractor
32 Ft. Dump Truck Disposable Liner, 6 Mil	30	EA	$ 65.00	$ 1,937		Assume 20 Ton loads
Site Restoration					$ 47,750	
Clean Backfill	500	TMCY	$ 24.00	$ 12,000		
Concrete	100	CY	$ 250.00	$ 25,000		4,000 psi fibermesh
Blacktop paving	1,000	SF	$ 8.5	$ 8,500		8" base with 2" asphalt overlay
Removal of Decon Pad	30	CY	$ 75	$ 2,250		
Reports					$ 30,000	
Record Drawings/Topo Information	1	LS	$ 5,000	$ 5,000		
Final Report	1	LS	$ 25,000	$ 25,000		
SUBCONTRACT SUBTOTAL					$ 1,359,966	
Contingency (15%)					$ 203,995	
SUBCONTRACT TOTAL					$ 1,563,961	
Payment/Performance Bonds and Insurance (2%)					$ 27,199	Applied to the Subcontract total.
Contractor Professional/Technical Services					$ 609,945	
Engineering/Design (6%)	1	LS	$ 93,838	$93,838		Applied to the Subcontract total.
Prime Contractor Markup (8%)	1	LS	$ 125,117	$125,117		Applied to the Subcontract total.
Project Management and Field Oversight (25%)	1	LS	$ 390,990	$390,990		Applied to the Subcontract total.
TOTAL ESTIMATED CAPITAL COST (FY 2017 Dollars)					$ 2,201,105	

O&M COSTS

O&M Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
O&M Items					$ -	
None						
O&M ANNUAL SUBTOTAL					$ -	
Contingency (15%)					$ -	
O&M ANNUAL TOTAL					$ -	
Payment/Performance Bonds and Insurance (2%)					$ -	
Contractor Professional/Technical Services					$ -	
Engineering/Design (6%)	1	LS	$ -	$0		
Prime Contractor Markup (8%)	1	LS	$ -	$0		
Project Management and Field Oversight (25%)	1	LS	$ -	$0		
TOTAL ESTIMATED ANNUAL O&M COST (FY 2017 Dollars)					$ -	

PERIODIC COSTS

Periodic Cost Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Years 5, 10, 15, 20, 25, 30					$ -	
None						

PRESENT VALUE ANALYSIS

Cost Type	Total Cost Per Year	Total Cost	Present Value	
Capital Cost (Year 0)	$2,201,105	$2,201,105	**$2,201,105**	
O&M Cost (Year 1 - 30)	$0	$0	**$0**	
Periodic Cost (Years 5, 10, 15, 20, 25, 30)	$0	$0	**$0**	
TOTAL EST. PV OF ALTERNATIVE (FY 2017 Dollars)			**$2,201,105**	**Assumes 5% Discount**

Table C-12
Amcast North Storm Sewers
Alternative SSN-2 - Abandon Amcast North Building Storm Sewers, Pressure Wash Non-Building And Downgradient Storm Sewers, Sewer Backfill Excavation and Offsite Disposal, and Site Restoration Cedarburg, WI

CAPITAL COSTS

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Mobilization/Demobilization					$ 187,697	
Subcontractor Submittals	4	EA	$ 1,500	$ 6,000		Work Plan, H&S Plans, AHAs, Epoxy Coating
Mobilization/Demobilization of Cleaning and Treatment Equipment	1	LS	$ 100,000	$ 100,000		Per quote from FECC
Decontamination pad (50 x 50 bermed asphalt sloped to sump)	2500	SF	$ 8.50	$ 21,250		
Traffic control signage	1	LS	$ 2,000	$ 2,000		
Construction survey crew	2	DAY	$ 2,227	$ 4,454		2 surveys (pre- and post-remediation, plus office time to Evaluate Data; assume one day per mob)
Site Trailer and Utilities	2	MO	$ 3,793	$ 7,586		
Electrical Connection Allowance	1	LS	$ 37,397	$ 37,397		
Erosion Control and Perimeter Fencing	1	LS	$ 7,510	$ 7,510		Silt fence around laydown areas, snow fence around excavations, hay bales, misc. Use BMPs.
Dust Control	1	MO	$ 1,500	$ 1,500		
Pre-Construction Activities					$ 15,986	
Private Utility Clearance	2	DAYS	$ 2,500	$ 5,000		
Building Structural Assessment	40	HR	$ 125	$ 5,000		Local Structural Engineer, Survey plus report
Sample Collection	2	DAY	$ 2,015	$ 4,030		CH2M Team
PCBs, Soil Analysis	12	EA	$ 163	$ 1,956		Confirmation sampling plus disposal screening
Storm Sewer Abandonment/Cleaning Under Building					$ 252,530	
Building Structural Modification to Allow Work Inside	1	Allow	$ 50,000.00	$ 50,000		Allowance to insure safe entry into building areas to clean and plug lines
Mob/Demob Video Eqpt, Reports	1	LS	$ 7,500.00	$ 7,500		Video 2200 lf of pipe,$150/hr, 1000 ft per day
In-Line Video Inspection	5	DAY	$ 1,150.00	$ 5,750		Video after bulldozing and cleaning of 2200 lf of pipe,$150/hr, 500 ft per day
Clean Out and Pressure Wash Pipes Underneath Building to Extent Possible	10	DAY	$ 9,150.00	$ 91,500		Cost includes crew time to dredge "bulldoze" and "pressure wash" lines underneath the building. Equipment for separation includes dirty and clean frac tanks and carbon and bag filters. Washwater is assumed to be reused.
Processing of Flush Water and Sediment	10	DAY	$ 5,500.00	$ 55,000		Cost includes processing of flush water to separate removed sediment from flush water, carbon treat flush water for reuse. See Assumptions and Calcs Tab for details
Plugging of Lines After Cleaning	5	DAY	$ 7,500.00	$ 37,500		Assume a total of 25 plugs have to be done. Assume 6/day. Plugs are assumed to be flowable fill (4 bag mix) pumped in to greatest extent possible. Total volume in pipe = 0.79 cf/ft
Flowable Fill	48	CY	$ 110.00	$ 5,280		
Storm Sewer Abandonment/Cleaning Outside Building - SSN Sewers					$ 737,500	
Mob/Demob Video Eqpt, Reports	1	LS	$ 7,500	$ 7,500		Video 2600 lf of pipe,$150/hr, 1000 ft per day
In-Line Video Inspection	10	DAY	$ 1,150	$ 11,500		Video after bulldozing and cleaning of 2600 lf of pipe,$150/hr, 500 ft per day
Clean Out and Pressure Wash Pipes Downgradient Sewers	10	DAY	$ 9,150	$ 91,500		Cost includes crew time to dredge "bulldoze" and "pressure wash" downgradient lines. Cost also includes processing of flush water to separate removed sediment from flush water, carbon treat flush water for reuse. Equipment for separation includes dirty and clean frac tanks and carbon and bag filters. Washwater is assumed to be reused.
Processing of Flush Water and Sediment	10	DAY	$ 5,500	$ 55,000		See Assumptions & Calcs Tab for details
Epoxy Coating Lines After Cleaning	2,600	LF	$ 220	$ 572,000		See FECC Tab. Assume 72 in pipes based on Google Earth measurement of outfall to Wilshire Pond
Confirmation Sampling					$ 15,080	
Sample Collection	10	EA	$ 1,170	$ 11,700		
PCBs, Soil Analysis	20	EA	$ 163.00	$ 3,260		Confirmation sampling
Sample Jars	20	EA	$ 6.00	$ 120		
Transportation and Disposal Offsite					$ 73,423	
Characterization sampling of soil prior to transport	2	EA	$ 1,000.00	$ 2,000		1 sample for PCBs and 1 paint filter/500 Tons, plus TCLP
Transport Solidified Sediment from Under Building <50ppm PCBs to Subtitle D landfill	18	TON	$ 15.00	$ 270		See Assumptions and Calcs
Dispose of Solidified Sediment from Under Building <50ppm PCBs to Subtitle D landfill	18	TON	$ 32.00	$ 576		See Assumptions and Calcs
Transport Solidified Sediment from Under Building >50ppm PCBs to TSCA landfill	18	TON	$ 53.00	$ 954		See Assumptions and Calcs
Dispose of Solidified Sediment from Under Building >50ppm PCBs to TSCA landfill	18	TON	$ 107.00	$ 1,926		See Assumptions and Calcs
Transport Solidified Sediment from Downgradient Pipelines <50ppm PCBs to Subtitle D landfill	280	TON	$ 15.00	$ 4,200		See Assumptions and Calcs
Dispose of Solidified Sediment from Downgradient Pipelines <50ppm PCBs to Subtitle D landfill	280	TON	$ 32.00	$ 8,960		See Assumptions and Calcs
Transport Solidified Sediment from Downgradient Pipelines >50ppm PCBs to TSCA landfill	280	TON	$ 53.00	$ 14,840		See Assumptions and Calcs
Dispose of Solidified Sediment from Downgradient Pipelines >50ppm PCBs to TSCA landfill	280	TON	$ 107.00	$ 29,960		See Assumptions and Calcs
Contact water disposal	30,000	GAL	$ 0.26	$ 7,800		Volume provided by potential subcontractor
32 Ft. Dump Truck Disposable Liner, 6 Mil	30	EA	$ 65.00	$ 1,937		Assume 20 Ton loads
Site Restoration					$ 47,750	
Clean Backfill	500	TMCY	$ 24.00	$ 12,000		
Concrete	100	CY	$ 250.00	$ 25,000		4,000 psi fibermesh
Blacktop paving	1,000	SF	$ 8.5	$ 8,500		8" base with 2" asphalt overlay
Removal of Decon Pad	30	CY	$ 75	$ 2,250		
Reports					$ 30,000	
Record Drawings/Topo Information	1	LS	$ 5,000	$ 5,000		
Final Report	1	LS	$ 25,000	$ 25,000		
SUBCONTRACT SUBTOTAL					$ 1,359,966	
Contingency (15%)					$ 203,995	
SUBCONTRACT TOTAL					$ 1,563,961	
Payment/Performance Bonds and Insurance (2%)					$ 27,199	Applied to the Subcontract total.
Contractor Professional/Technical Services					$ 609,945	
Engineering/Design (6%)	1	LS	$ 93,838	$93,838		Applied to the Subcontract total.
Prime Contractor Markup (8%)	1	LS	$ 125,117	$125,117		Applied to the Subcontract total.
Project Management and Field Oversight (25%)	1	LS	$ 390,990	$390,990		Applied to the Subcontract total.
TOTAL ESTIMATED CAPITAL COST (FY 2017 Dollars)					$ 2,201,105	

O&M COSTS

O&M Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
O&M Items					$ -	
None						
O&M ANNUAL SUBTOTAL					$ -	
Contingency (15%)					$ -	
O&M ANNUAL TOTAL					$ -	
Payment/Performance Bonds and Insurance (2%)					$ -	
Contractor Professional/Technical Services					$ -	
Engineering/Design (6%)	1	LS	$ -	$0		
Prime Contractor Markup (8%)	1	LS	$ -	$0		
Project Management and Field Oversight (25%)	1	LS	$ -	$0		
TOTAL ESTIMATED ANNUAL O&M COST (FY 2017 Dollars)					$ -	

PERIODIC COSTS

Periodic Cost Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Years 5, 10, 15, 20, 25, 30					$ -	
None						

PRESENT VALUE ANALYSIS

Cost Type	Total Cost Per Year	Total Cost	Present Value	
Capital Cost (Year 0)	$2,201,105	$2,201,105	**$2,201,105**	
O&M Cost (Year 1 - 30)	$0	$0	**$0**	
Periodic Cost (Years 5, 10, 15, 20, 25, 30)	$0	$0	**$0**	
TOTAL EST. PV OF ALTERNATIVE (FY 2017 Dollars)			**$2,201,105**	**Assumes 5% Discount**

Table C-14
Amcast North Storm Sewers
Alternative SSN-3 - Abandon Amcast North Building Storm Sewers, Remove Non-Building Storm Sewers Piping, Pressure Wash Downgradient Storm Sewers, Excavation of Pipes and Backfill, Offsite Disposal, Backfill, and Site Restoration Cedarburg, WI

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
CAPITAL COSTS						
Mobilization/Demobilization					$ 187,697	
Subcontractor Submittals	4	EA	$ 1,500	$ 6,000		Work Plan, H&S Plans, AHAs, Epoxy Coating
Mobilization/Demobilization of Cleaning and Treatment Equipment	1	LS	$ 100,000	$ 100,000		Per quote from FECC
Decontamination pad (50 x 50 bermed asphalt sloped to sump)	2500	SF	$ 8.50	$ 21,250		
Traffic control signage	1	LS	$ 2,000	$ 2,000		
Construction survey crew	2	DAY	$ 2,227	$ 4,454		2 surveys (pre- and post-remediation, plus office time to Evaluate Data; assume one day per mob)
Site Trailer and Utilities	2	MO	$ 3,793	$ 7,586		
Electrical Connection Allowance	1	LS	$ 37,397	$ 37,397		
Erosion Control and Perimeter Fencing	1	LS	$ 7,510	$ 7,510		Silt fence around laydown areas, snow fence around excavations, hay bales, misc. Use BMPs.
Dust Control	1	MO	$ 1,500	$ 1,500		
Pre-Construction Activities					$ 15,986	
Private Utility Clearance	2	DAYS	$ 2,500	$ 5,000		
Sample Collection	40	HR	$ 125	$ 5,000		
PCBs, Soil Analysis	2	DAY	$ 2,015.00	$ 4,030		Confirmation sampling plus disposal screening
Sample Jars	12	EA	$ 163.00	$ 1,956		
Storm Sewer Abandonment/Cleaning Under Building					$ 252,530	
Building Structural Modification to Allow Work Inside	1	Allow	$ 50,000.00	$ 50,000		Allowance to insure safe entry into building areas to clean and plug lines
Mob/Demob Video Eqpt, Reports	1	LS	$ 7,500.00	$ 7,500		Video 2200 lf of pipe,$150/hr, 1000 ft per day
In-Line Video Inspection	5	DAY	$ 1,150.00	$ 5,750		Video after bulldozing and cleaning of 2200 lf of pipe,$150/hr, 500 ft per day
Clean Out and Pressure Wash Pipes Underneath Building to Extent Possible	10	DAY	$ 9,150.00	$ 91,500		Cost includes crew time to dredge "bulldoze" and "pressure wash" lines underneath the building. Equipment for separation includes dirty and clean frac tanks and carbon and bag filters. Washwater is assumed to be reused.
Processing of Flush Water and Sediment	10	DAY	$ 5,500.00	$ 55,000		Cost includes processing of flush water to separate removed sediment from flush water, carbon treat flush water for reuse. See Assumptions and Calcs Tab for details
Plugging of Lines After Cleaning	5	DAY	$ 7,500.00	$ 37,500		Assume a total of 25 plugs have to be done. Assume 6/day. Plugs are assumed to be flowable fill (4 bag mix) pumped in to greatest extent possible. Total volume in pipe = 0.79 cf/ft
Flowable Fill	48	CY	$ 110.00	$ 5,280		
Onsite Storm Sewer Removal					$ 47,351	
Excavate/Load 20 Feet of Pipe Onsite but Not Under Building	4	DAY	$ 9,426.16	$ 37,705		Cost includes crew time to excavate at FVSTM-2S/CB9. Assumes excavation 20 ft long x 7 ft deep with minimal layback. Assumes concrete pipe 72 in. Excavation 8 ft wide x 7 ft deep x 20 ft long.
Backfill Material Cost	71	TONS	$ 25.00	$ 1,775		
Backfill Installation	1	DAY	$ 7,211.62	$ 7,212		
Confirmation Sampling	4	EA	$ 165.00	$ 660		
Storm Sewer Abandonment/Cleaning Outside Building					$ 737,500	
Mob/Demob Video Eqpt, Reports	1	LS	$ 7,500.00	$ 7,500		Video 2600 lf of pipe,$150/hr, 1000 ft per day
In-Line Video Inspection	10	DAY	$ 1,150.00	$ 11,500		Video after bulldozing and cleaning of 2600 lf of pipe,$150/hr, 500 ft per day
Clean Out and Pressure Wash Pipes Downgradient Sewers	10	DAY	$ 9,150.00	$ 91,500		Cost includes crew time to dredge "bulldoze" and "pressure wash" downgradient lines. Cost also includes processing of flush water to separate removed sediment from flush water, carbon treat flush water for reuse. Equipment for separation includes dirty and clean frac tanks and carbon and bag filters. Washwater is assumed to be reused.
Processing of Flush Water and Sediment	10	DAY	$ 5,500.00	$ 55,000		See Assumptions & Calcs Tab for details
Epoxy Coating Lines After Cleaning	2,600	LF	$ 220.00	$ 572,000		See FECC Tab. Assume 72 in pipes based on Google Earth measurement of outfall to Wilshire Pond
Confirmation Sampling					$ 15,080	
Sample Collection	10	EA	$ 1,170	$ 11,700		
PCBs, Soil Analysis	20	EA	$ 163.00	$ 3,260		Confirmation sampling
Sample Jars	20	EA	$ 6.00	$ 120		
Transportation and Disposal Offsite					$ 79,301	
Characterization sampling of soil prior to transport	2	EA	$ 1,000.00	$ 2,000		1 sample for PCBs and 1 paint filter/500 Tons, plus TCLP
Transport Solidified Sediment from Under Building <50ppm PCBs to Subtitle D landfill	18	TON	$ 15.00	$ 270		See Assumptions and Calcs
Dispose of Solidified Sediment from Under Building <50ppm PCBs to Subtitle D landfill	18	TON	$ 32.00	$ 576		See Assumptions and Calcs
Transport Solidified Sediment from Under Building >50ppm PCBs to TSCA landfill	18	TON	$ 53.00	$ 954		See Assumptions and Calcs
Dispose of Solidified Sediment from Under Building >50ppm PCBs to TSCA landfill	18	TON	$ 107.00	$ 1,926		See Assumptions and Calcs
Transport Solidified Sediment from Downgradient Pipelines <50ppm PCBs to Subtitle D landfill	280	TON	$ 15.00	$ 4,200		See Assumptions and Calcs
Dispose of Solidified Sediment from Downgradient Pipelines <50ppm PCBs to Subtitle D landfill	280	TON	$ 32.00	$ 8,960		See Assumptions and Calcs
Transport Solidified Sediment from Downgradient Pipelines >50ppm PCBs to TSCA landfill	280	TON	$ 53.00	$ 14,840		See Assumptions and Calcs
Dispose of Solidified Sediment from Downgradient Pipelines >50ppm PCBs to TSCA landfill	280	TON	$ 107.00	$ 29,960		See Assumptions and Calcs
Transport Excavated Soil and Pipeline >50ppm PCBs to TSCA landfill	36	TON	$ 53.00	$ 1,908		See Assumptions and Calcs
Dispose of Excavated Soil and Pipeline >50ppm PCBs to TSCA landfill	36	TON	$ 107.00	$ 3,852		See Assumptions and Calcs
Contact water disposal	30,000	GAL	$ 0.26	$ 7,800		Volume provided by potential subcontractor
32 Ft. Dump Truck Disposable Liner, 6 Mil	32	EA	$ 65.00	$ 2,054		Assume 20 Ton loads
Site Restoration					$ 47,750	
Clean Backfill	500	TMCY	$ 24.00	$ 12,000		
Concrete	100	CY	$ 250.00	$ 25,000		4,000 psi fibermesh
Blacktop paving	1,000	SF	$ 8.5	$ 8,500		8" base with 2" asphalt overlay
Removal of Decon Pad	30	CY	$ 75	$ 2,250		
Reports					$ 30,000	
Record Drawings/Topo Information	1	LS	$ 5,000	$ 5,000		
Final Report	1	LS	$ 25,000	$ 25,000		
SUBCONTRACT SUBTOTAL					$ 1,413,195	
Contingency (15%)					$ 211,979	
SUBCONTRACT TOTAL					$ 1,625,174	
Payment/Performance Bonds and Insurance (2%)					$ 28,264	Applied to the Subcontract total.
Contractor Professional/Technical Services					$ 633,818	
Engineering/Design (6%)	1	LS	$ 97,510	$97,510		Applied to the Subcontract total.
Prime Contractor Markup (8%)	1	LS	$ 130,014	$130,014		Applied to the Subcontract total.
Project Management and Field Oversight (25%)	1	LS	$ 406,293	$406,293		Applied to the Subcontract total.
TOTAL ESTIMATED CAPITAL COST (FY 2017 Dollars)					$ 2,287,256	

O&M Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
O&M COSTS						
O&M Items					$ -	
None						
O&M ANNUAL SUBTOTAL					$ -	
Contingency (15%)					$ -	
O&M ANNUAL TOTAL					$ -	
Payment/Performance Bonds and Insurance (2%)					$ -	
Contractor Professional/Technical Services					$ -	
Engineering/Design (6%)	1	LS	$ -	$0		
Prime Contractor Markup (8%)	1	LS	$ -	$0		
Project Management and Field Oversight (25%)	1	LS	$ -	$0		
TOTAL ESTIMATED ANNUAL O&M COST (FY 2017 Dollars)					$ -	

Periodic Cost Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
PERIODIC COSTS						
Years 5, 10, 15, 20, 25, 30					$ -	
None						

PRESENT VALUE ANALYSIS

Cost Type	Total Cost Per Year	Total Cost	Present Value	
Capital Cost (Year 0)	$2,287,256	$2,287,256	**$2,287,256**	
O&M Cost (Year 1 - 30)	$0	$0	**$0**	
Periodic Cost (Years 5, 10, 15, 20, 25, 30)	$0	$0	**$0**	
TOTAL EST. PV OF ALTERNATIVE (FY 2017 Dollars)			**$2,287,256**	**Assumes 5% Discount**

Table C-15
Amcast South Storm Sewers
Alternative 2 - Pressure Wash Non-Building and Downgradient Storm Sewers, Excavation, Offsite Disposal, Backfill, and Site Restoration Cedarburg, WI

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
CAPITAL COSTS						
Mobilization/Demobilization					$ 198,197	
Subcontractor Submittals	4	EA	$ 1,500.00	$ 6,000		Work Plan, H&S Plan, AHAs, Epoxy Coating
Mobilization/Demobilization of Cleaning and Treatment Equipment	1	LS	$ 100,000.00	$ 100,000		Per quote from FECC
Decontamination pad (50 x 50 bermed asphalt sloped to sump)	2500	SF	$ 8.50	$ 21,250		
Traffic control signage	1	LS	$ 2,000.00	$ 2,000		
Construction survey crew	2	DAYS	$ 2,227.00	$ 4,454		2 surveys (pre- and post-remediation, plus office time to Evaluate Data; assume one day per mob)
Site Trailer and Utilities	2	MO	$ 3,793.00	$ 7,586		
Electrical Connection Allowance	1	LS	$ 37,397.00	$ 37,397		
Erosion Control and Perimeter Fencing	1	LS	$ 7,510.00	$ 7,510		Silt fence around laydown areas, snow fence around excavations, hay bales, misc. Use BMPs.
Dust Control	8	DAYS	$ 1,500.00	$ 12,000		
Pre-Construction Activities					$ 15,986	
Private Utility Clearance	2	DAYS	$ 2,500.00	$ 5,000		
Building Structural Assessment	40	HR	$ 125.00	$ 5,000		Local Structural Engineer, Survey plus report
Sample Collection	2	DAY	$ 2,015.00	$ 4,030		CH2M Team
PCBs, Soil Analysis	12	EA	$ 163.00	$ 1,956		Confirmation sampling plus disposal screening
Storm Sewer Cleaning					$ 727,900	
Mob/Demob Video Eqpt, Reports	1	LS	$ 7,500.00	$ 7,500		Video 2600 lf of pipe,$150/hr, 1000 ft per day
In-Line Video Inspection	8	DAY	$ 1,150.00	$ 9,200		Video after bulldozing and cleaning of 2600 lf of pipe,$150/hr, 500 ft per day
Clean Out and Pressure Wash Pipes Downgradient Sewers	8	DAY	$ 9,150.00	$ 73,200		Cost includes crew time to dredge "bulldoze" and "pressure wash" downgradient lines. Washwater is assumed to be reused.
Processing of Flush Water and Sediment	8	DAY	$ 5,500.00	$ 44,000		Cost includes processing of flush water to separate removed sediment from flush water, carbon treat flush water for reuse. See Assumptions and Calcs Tab for details
Epoxy Coating Lines After Cleaning	2,700	LF	$ 220.00	$ 594,000		See FECC Tab. Assume 72 in pipes based on Google Earth measurement of outfall to Wilshire Pond
Confirmation Sampling					$ 15,080	
Sample Collection	10	EA	$ 1,170.00	$ 11,700		
PCBs, Soil Analysis	20	EA	$ 163.00	$ 3,260		Confirmation sampling
Sample Jars	20	EA	$ 6.00	$ 120		
Transportation and Disposal Offsite					$ 71,715	
Characterization sampling of soil prior to transport	2	EA	$ 1,000.00	$ 2,000		1 sample for PCBs and 1 paint filter/500 Tons, plus TCLP
Transport Solidified Sediment from All Pipelines <50ppm PCBs to Subtitle D landfill	290	TON	$ 15.00	$ 4,350		See Assumptions and Calcs
Dispose of Solidified Sediment from All Pipelines <50ppm PCBs to Subtitle D landfill	290	TON	$ 32.00	$ 9,280		See Assumptions and Calcs
Transport Solidified Sediment from Downgradient Pipelines >50ppm PCBs to TSCA landfill	290	TON	$ 53.00	$ 15,370		See Assumptions and Calcs
Dispose of Solidified Sediment from All Pipelines <50ppm PCBs to Subtitle D landfill	290	TON	$ 107.00	$ 31,030		See Assumptions and Calcs
Contact water disposal	30,000	GAL	$ 0.26	$ 7,800		Volume provided by potential subcontractor
32 Ft. Dump Truck Disposable Liner, 6 Mil	29	EA	$ 65.00	$ 1,885		Assume 20 Ton loads
Site Restoration					$ 47,750	
Clean Backfill	500	TMCY	$ 24.00	$ 12,000		
Concrete	100	CY	$ 250.00	$ 25,000		4,000 psi fibermesh
Blacktop paving	1,000	SF	$ 8.5	$ 8,500		8" base with 2" asphalt overlay
Removal of Decon Pad	30	CY	$ 75	$ 2,250		
Reports					$ 30,000	
Record Drawings/Topo Information	1	LS	$ 5,000	$ 5,000		
Final Report	1	LS	$ 25,000	$ 25,000		
SUBCONTRACT SUBTOTAL					$ 1,106,628	
Contingency (15%)					$ 165,994	
SUBCONTRACT TOTAL					$ 1,272,622	
Payment/Performance Bonds and Insurance (2%)					$ 22,133	Applied to the Subcontract total.
Contractor Professional/Technical Services					$ 496,323	
Engineering/Design (6%)	1	LS	$ 76,357	$76,357		Applied to the Subcontract total.
Prime Contractor Markup (8%)	1	LS	$ 101,810	$101,810		Applied to the Subcontract total.
Project Management and Field Oversight (25%)	1	LS	$ 318,156	$318,156		Applied to the Subcontract total.
TOTAL ESTIMATED CAPITAL COST (FY 2017 Dollars)					$ 1,791,077	

O&M Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
O&M COSTS						
O&M Items					$ -	
None						
O&M ANNUAL SUBTOTAL					$ -	
Contingency (15%)					$ -	
O&M ANNUAL TOTAL					$ -	
Payment/Performance Bonds and Insurance (2%)					$ -	
Contractor Professional/Technical Services					$ -	
Engineering/Design (6%)	1	LS	$ -	$0		
Prime Contractor Markup (8%)	1	LS	$ -	$0		
Project Management and Field Oversight (25%)	1	LS	$ -	$0		
TOTAL ESTIMATED ANNUAL O&M COST (FY 2017 Dollars)					$ -	

Periodic Cost Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
PERIODIC COSTS						
Years 5, 10, 15, 20, 25, 30					$ -	
None						

PRESENT VALUE ANALYSIS

Cost Type	Total Cost Per Year	Total Cost	Present Value	
Capital Cost (Year 0)	$1,791,077	$1,791,077	**$1,791,077**	
O&M Cost (Year 1 - 30)	$0	$0	**$0**	
Periodic Cost (Years 5, 10, 15, 20, 25, 30)	$0	$0	**$0**	
TOTAL EST. PV OF ALTERNATIVE (FY 2017 Dollars)			**$1,791,077**	**Assumes 5% Discount**

Table C-16
Amcast South Storm Sewers
Alternative 3 - Abandon Amcast South Building Storm Sewers, Pressure Wash Downgradient Storm Sewers, Excavation, Offsite Disposal, Backfill, and Site Restoration Cedarburg, WI

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
CAPITAL COSTS						
Mobilization/Demobilization					$ 187,697	
Subcontractor Submittals	4	EA	$ 1,500	$ 6,000		Work Plan, H&S Plans, AHAs, Epoxy Coating
Mobilization/Demobilization of Cleaning and Treatment Equipment	1	LS	$ 100,000	$ 100,000		Per quote from FECC
Decontamination pad (50 x 50 bermed asphalt sloped to sump)	2500	SF	$ 9	$ 21,250		
Traffic control signage	1	LS	$ 2,000	$ 2,000		
Construction survey crew	2	DAY	$ 2,227	$ 4,454		2 surveys (pre- and post-remediation, plus office time to Evaluate Data; assume one day per mob)
Site Trailer and Utilities	2	MO	$ 3,793	$ 7,586		
Electrical Connection Allowance	1	LS	$ 37,397	$ 37,397		
Erosion Control and Perimeter Fencing	1	LS	$ 7,510	$ 7,510		Silt fence around laydown areas, snow fence around excavations, hay bales, misc. Use BMPs.
Dust Control	1	MO	$ 1,500	$ 1,500		
Pre-Construction Activities					$ 15,986	
Private Utility Clearance	2	DAYS	$ 2,500.00	$ 5,000		
Building Structural Assessment	40	HR	$ 125	$ 5,000		Local Structural Engineer, Survey plus report
Sample Collection	2	DAY	$ 2,015.00	$ 4,030		CH2M Team
PCBs, Soil Analysis	12	EA	$ 163.00	$ 1,956		Confirmation sampling plus disposal screening
Storm Sewer Abandonment					$ 63,985	
Mob/Demob Video Eqpt, Reports	1	LS	$ 7,500.00	$ 7,500		Video 1900 lf of pipe,$150/hr, 1000 ft per day
In-Line Video Inspection	5	DAY	$ 1,150.00	$ 5,750		Video after bulldozing and cleaning of 1900 lf of pipe,$150/hr, 500 ft per day
Plugging of Lines	4	DAY	$ 7,500.00	$ 30,000		Assume a total of 25 plugs have to be done. Assume 6/day. Plugs are assumed to be flowable fill (4 bag mix) pumped in to greatest extent possible. Total volume in pipe = 0.79 cf/ft
Flowable Fill	188	CY	$ 110	$ 20,735		
Storm Sewer Cleaning					$ 674,300	
Mob/Demob Video Eqpt, Reports	1	LS	$ 7,500.00	$ 7,500		Video 2600 lf of pipe,$150/hr, 1000 ft per day
In-Line Video Inspection	6	DAY	$ 1,150.00	$ 6,900		Video after bulldozing and cleaning of 2600 lf of pipe,$150/hr, 500 ft per day
Clean Out and Pressure Wash Pipes Downgradient Sewers	6	DAY	$ 9,150.00	$ 54,900		Cost includes crew time to dredge "bulldoze" and "pressure wash" downgradient lines. Cost also includes processing of flush water to separate removed sediment from flush water, carbon treat flush water for reuse. Equipment for separation includes dirty and clean frac tanks and carbon and bag filters. Washwater is assumed to be reused.
Processing of Flush Water and Sediment	6	DAY	$ 5,500.00	$ 33,000		See Assumptions & Calcs Tab for details
Epoxy Coating Lines After Cleaning	2,600	LF	$ 220.00	$ 572,000		See FECC Tab. Assume 72 in pipes based on Google Earth measurement of outfall to Wilshire Pond
Confirmation Sampling					$ 15,080	
Sample Collection	10	EA	$ 1,170	$ 11,700		
PCBs, Soil Analysis	20	EA	$ 163.00	$ 3,260		Confirmation sampling
Sample Jars	20	EA	$ 6.00	$ 120		
Transportation and Disposal Offsite					$ 25,919	
Characterization sampling of soil prior to transport	2	EA	$ 1,000.00	$ 2,000		1 sample for PCBs and 1 paint filter/500 Tons, plus TCLP
Transport Solidified Sediment from Downgradient Pipelines <50ppm PCBs to Subtitle D landfill	76	TON	$ 15.00	$ 1,133		See Assumptions and Calcs
Dispose of Solidified Sediment from Downgradient Pipelines <50ppm PCBs to Subtitle D landfill	76	TON	$ 32.00	$ 2,416		See Assumptions and Calcs
Transport Solidified Sediment from Downgradient Pipelines >50ppm PCBs to TSCA landfill	76	TON	$ 53.00	$ 4,002		See Assumptions and Calcs
Dispose of Solidified Sediment from Downgradient Pipelines >50ppm PCBs to TSCA landfill	76	TON	$ 107.00	$ 8,079		See Assumptions and Calcs
Contact water disposal	30,000	GAL	$ 0.26	$ 7,800		Volume provided by potential subcontractor
32 Ft. Dump Truck Disposable Liner, 6 Mil	8	EA	$ 65	$ 491		Assume 20 Ton loads
Site Restoration					$ 11,350	
Clean Backfill	100	TMCY	$ 24.00	$ 2,400		
Concrete	20	CY	$ 250.00	$ 5,000		4,000 psi fibermesh
Blacktop paving	200	SF	$ 8.5	$ 1,700		8" base with 2" asphalt overlay
Removal of Decon Pad	30	CY	$ 75	$ 2,250		
Reports					$ 30,000	
Record Drawings/Topo Information	1	LS	$ 5,000	$ 5,000		
Final Report	1	LS	$ 25,000	$ 25,000		
SUBCONTRACT SUBTOTAL					$ 1,024,317	
Contingency (15%)					$ 153,648	
SUBCONTRACT TOTAL					$ 1,177,964	
Payment/Performance Bonds and Insurance (2%)					$ 20,486	Applied to the Subcontract total.
Contractor Professional/Technical Services					$ 459,406	
Engineering/Design (6%)	1	LS	$ 70,678	$70,678		Applied to the Subcontract total.
Prime Contractor Markup (8%)	1	LS	$ 94,237	$94,237		Applied to the Subcontract total.
Project Management and Field Oversight (25%)	1	LS	$ 294,491	$294,491		Applied to the Subcontract total.
TOTAL ESTIMATED CAPITAL COST (FY 2017 Dollars)					$ 1,657,857	

O&M Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
O&M COSTS						
O&M Items					$ -	
None						
O&M ANNUAL SUBTOTAL					$ -	
Contingency (15%)					$ -	
O&M ANNUAL TOTAL					$ -	
Payment/Performance Bonds and Insurance (2%)					$ -	
Contractor Professional/Technical Services					$ -	
Engineering/Design (6%)	1	LS	$ -	$0		
Prime Contractor Markup (8%)	1	LS	$ -	$0		
Project Management and Field Oversight (25%)	1	LS	$ -	$0		
TOTAL ESTIMATED ANNUAL O&M COST (FY 2017 Dollars)					$ -	

Periodic Cost Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
PERIODIC COSTS						
Years 5, 10, 15, 20, 25, 30					$ -	
None						

PRESENT VALUE ANALYSIS

Cost Type	Total Cost Per Year	Total Cost	Present Value	
Capital Cost (Year 0)	$1,657,857	$1,657,857	**$1,657,857**	
O&M Cost (Year 1 - 30)	$0	$0	**$0**	
Periodic Cost (Years 5, 10, 15, 20, 25, 30)	$0	$0	**$0**	
TOTAL EST. PV OF ALTERNATIVE (FY 2017 Dollars)			**$1,657,857**	**Assumes 5% Discount**

Table C-17
Amcast South Storm Sewers
Alternative 4 -Remove Non-Building Storm Sewers, Pressure Wash Downgradient Storm Sewers, Excavation, Offsite Disposal, Backfill, and Site Restoration Cedarburg, WI

CAPITAL COSTS

Capital Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Mobilization/Demobilization					$ 187,697	
Subcontractor Submittals	4	EA	$ 1,500	$ 6,000		Work Plan, H&S Plans, AHAs, Epoxy Coating
Mobilization/Demobilization of Cleaning and Treatment Equipment	1	LS	$ 100,000	$ 100,000		Per quote fron FECC
Decontamination pad (50 x 50 bermed asphalt sloped to sump)	2500	SF	$ 9	$ 21,250		
Traffic control signage	1	LS	$ 2,000	$ 2,000		Detail truck routes
Construction survey crew	2	DAY	$ 2,227	$ 4,454		2 surveys (pre- and post-remediation, plus office time to Evaluate Data; assume one day per mob)
Site Trailer and Utilities	2	MO	$ 3,793	$ 7,586		
Electrical Connection Allowance	1	LS	$ 37,397	$ 37,397		
Erosion Control and Perimeter Fencing	1	LS	$ 7,510	$ 7,510		Silt fence around laydown areas, snow fence around excavations, hay bales, misc. Use BMPs.
Dust Control	1	MO	$ 1,500	$ 1,500		
Pre-Construction Activities					$ 15,986	
Private Utility Clearance	2	DAYS	$ 2,500.00	$ 5,000		Local Structural Engineer, Survey plus report
Building Structural Assessment	40	HR	$ 125.00	$ 5,000		CH2M Team
Sample Collection	2	DAY	$ 2,015.00	$ 4,030		Confirmation sampling plus disposal screening
PCBs, Soil Analysis	12	EA	$ 163.00	$ 1,956		
Storm Sewer Removal					$ 179,581	
Excavation of Onsite Sewer	9	DAY	$ 9,426.16	$ 80,604		Video 1900 lf of pipe,$150/hr, 1000 ft per day
Backfill of Onsite Sewer	11	DAY	$ 7,211.62	$ 80,521		Video after bulldozing and cleaning of 1900 lf of pipe,$150/hr, 500 ft per day
Plugging of Lines	2	DAY	$ 7,500.00	$ 15,000		Assume a total of 25 plugs have to be done. Assume 6/day. Plugs are assumed to be flowable fill (4 bag mix) pumped in to greatest extent possible. Total volume in pipe = 0.79 cf/ft
Flowable Fill	31	CY	$ 110.00	$ 3,456		
Storm Sewer Cleaning					$ 674,300	
Mob/Demob Video Eqpt, Reports	1	LS	$ 7,500.00	$ 7,500		Video 2600 lf of pipe,$150/hr, 1000 ft per day
In-Line Video Inspection	6	DAY	$ 1,150.00	$ 6,900		Video after bulldozing and cleaning of 2600 lf of pipe,$150/hr, 500 ft per day
Clean Out and Pressure Wash Pipes Downgradient Sewers	6	DAY	$ 9,150.00	$ 54,900		Cost includes crew time to dredge "bulldoze" and "pressure wash" downgradient lines. Cost also includes processing of flush water to separate removed sediment from flush water, carbon treat flush water for reuse. Equipment for separation includes dirty and clean frac tanks and carbon and bag filters. Washwater is assumed to be reused.
Processing of Flush Water and Sediment	6	DAY	$ 5,500.00	$ 33,000		See Assumptions & Calcs Tab for details
Epoxy Coating Lines After Cleaning	2,600	LF	$ 220.00	$ 572,000		See FECC Tab. Assume 72 in pipes based on Google Earth measurement of outfall to Wilshire Pond
Confirmation Sampling					$ 66,950	
Sample Collection	50	EA	$ 1,170	$ 58,500		
PCBs, Soil Analysis	50	EA	$ 163	$ 8,150		
Sample Jars	50	EA	$ 6	$ 300		
Transportation and Disposal Offsite					$ 395,892	
Characterization sampling of soil prior to transport	7	EA	$ 1,000.00	$ 6,841		1 sample for PCBs and 1 paint filter/500 Tons, plus TCLP
Transport Solidified Sediment from Downgradient Pipelines <50ppm PCBs to Subtitle D landfill	76	TON	$ 15.00	$ 1,133		See Assumptions and Calcs
Dispose of Solidified Sediment from Downgradient Pipelines <50ppm PCBs to Subtitle D landfill	76	TON	$ 32.00	$ 2,416		See Assumptions and Calcs
Transport Solidified Sediment from Downgradient Pipelines >50ppm PCBs to TSCA landfill	76	TON	$ 53.00	$ 4,002		See Assumptions and Calcs
Dispose of Solidified Sediment from Downgradient Pipelines >50ppm PCBs to TSCA landfill	76	TON	$ 107.00	$ 8,079		See Assumptions and Calcs
Transport Excavated Soil/Pipe/Sediment from Onsite Pipelines <50ppm PCBs to Subtitle D landfill	1,710	TON	$ 15.00	$ 25,653		See Assumptions and Calcs
Dispose of Excavated Soil/Pipe/Sediment from Onsite Pipelines <50ppm PCBs to Subtitle D landfill	1,710	TON	$ 32.00	$ 54,727		See Assumptions and Calcs
Transport Excavated Soil/Pipe/Sediment from Onsite Pipelines >50ppm PCBs to TSCA landfill	1,710	TON	$ 53.00	$ 90,642		See Assumptions and Calcs
Dispose of Excavated Soil/Pipe/Sediment from Onsite Pipelines >50ppm PCBs to TSCA landfill	1,710	TON	$ 107.00	$ 182,994		See Assumptions and Calcs
Contact water disposal	30,000	GAL	$ 0.26	$ 7,800		Volume provided by potential subcontractor
32 Ft. Dump Truck Disposable Liner, 6 Mil	179	EA	$ 65.00	$ 11,607		Assume 20 Ton loads
Site Restoration					$ 187,417	
Clean backfill	6,699	TONS	$ 24.00	$ 160,782		
Concrete	0	CY	$ 250.00	$ -		4,000 psi fibermesh
Blacktop paving	2,500	SF	$ 8.50	$ 21,250		8" base with 2" asphalt overlay
Hydroseeding	28,500	SF	$ 0.11	$ 3,135		
Removal of Decon Pad	30	CY	$ 75.00	$ 2,250		
Reports					$ 30,000	
Record Drawings/Topo Information	1	LS	$ 5,000	$ 5,000		
Final Report	1	LS	$ 25,000	$ 25,000		
SUBCONTRACT SUBTOTAL					$ 1,737,823	
Contingency (15%)					$ 260,673	
SUBCONTRACT TOTAL					$ 1,998,496	
Payment/Performance Bonds and Insurance (2%)					$ 34,756	Applied to the Subcontract total.
Contractor Professional/Technical Services					$ 779,414	
Engineering/Design (6%)	1	LS	$ 119,910	$119,910		Applied to the Subcontract total.
Prime Contractor Markup (8%)	1	LS	$ 159,880	$159,880		Applied to the Subcontract total.
Project Management and Field Oversight (25%)	1	LS	$ 499,624	$499,624		Applied to the Subcontract total.
TOTAL ESTIMATED CAPITAL COST (FY 2017 Dollars)					$ 2,812,667	

O&M COSTS

O&M Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
O&M Items					$ -	
None						
O&M ANNUAL SUBTOTAL					$ -	
Contingency (15%)					$ -	
O&M ANNUAL TOTAL					$ -	
Payment/Performance Bonds and Insurance (2%)					$ -	
Contractor Professional/Technical Services					$ -	
Engineering/Design (6%)	1	LS	$ -	$0		
Prime Contractor Markup (8%)	1	LS	$ -	$0		
Project Management and Field Oversight (25%)	1	LS	$ -	$0		
TOTAL ESTIMATED ANNUAL O&M COST (FY 2017 Dollars)					$ -	

PERIODIC COSTS

Periodic Cost Item	Quantity	Units	Unit Cost	Subtotal	Total	Comments
Years 5, 10, 15, 20, 25, 30					$ -	
None						

PRESENT VALUE ANALYSIS

Cost Type	Total Cost Per Year	Total Cost	Present Value	
Capital Cost (Year 0)	$2,812,667	$2,812,667	**$2,812,667**	
O&M Cost (Year 1 - 30)	$0	$0	**$0**	
Periodic Cost (Years 5, 10, 15, 20, 25, 30)	$0	$0	**$0**	
TOTAL EST. PV OF ALTERNATIVE (FY 2017 Dollars)			**$2,812,667**	**Assumes 5% Discount**

Appendix D
Cap Modeling Output

APPENDIX D - CAP MODELING OUTPUT

Permeable Reactive Barrier Modeling

Design Assumptions
Storm Water Discharge - Erosion control will be required (storm water management/ armor layer on top of reactive cap) to mitigate the impact of storm water discharge and to protect the physical integrity of cap so that effectiveness of cap is not compromised
NAPL Management - Organophilic clay layer between AC-sand reactive cap layer and sediment bed will be required in presence of NAPL
Geotechnical Data - Sediment (geotechnical) properties (sediment strength, bulk density etc.) will sustain the cap weight
Site Specific Parameters - Current model and design parameters such as pore water concentration, upwelling Darcy velocity, geotechnical properties are estimated or assumed based on typical values. Site specific data will be required to further refine the design if capping is selected as an alternative.

Design Considerations	
Cap evaluation timeframe, yrs	100
Porewater concentration criteria, ug/L	0.16
Representative PCB congener used for evaluation	PCB-52

Site Specific Parameters		
	Sediment, mg/kg	**Estimated Porewater, ug/L**
Ecological Target Criteria	1.9	0.16
Max. PCB concentration (site specific)	50	4
Max. PCB concentration (site specific)	11000	938
Sediment thickness (site specific), ft	0.3 - 6.5	

					ESTIMATED
	SEDIMENT				POREWATER (ug/L)
				$K_p = K_{oc}*f_{oc}$	$C_{pw} = 1{,}000*C_{sed}/K_p$
Chemical	**C_{sed} (mg/kg)**	**K_{oc} (L/kg)**	**f_{oc}**	**K_p (L/kg)**	**C_{pw} (ug/L)**
PCB-52	**11000**	2.34E+05	0.05	1.17E+04	**938**
PCB-52	**50**	2.34E+05	0.05	1.17E+04	**4**
Criteria	**1.9**	2.34E+05	0.05	1.17E+04	**0.162**

Av. TOC (mg/kg)	50,139
% TOC =	5.01
foc = TOC/100 =	0.05

Model Assumptions	
Upwelling flux, cm/yr	100
Bioturbation Layer, cm	15
Sorption kinetics	Equilibrium condition

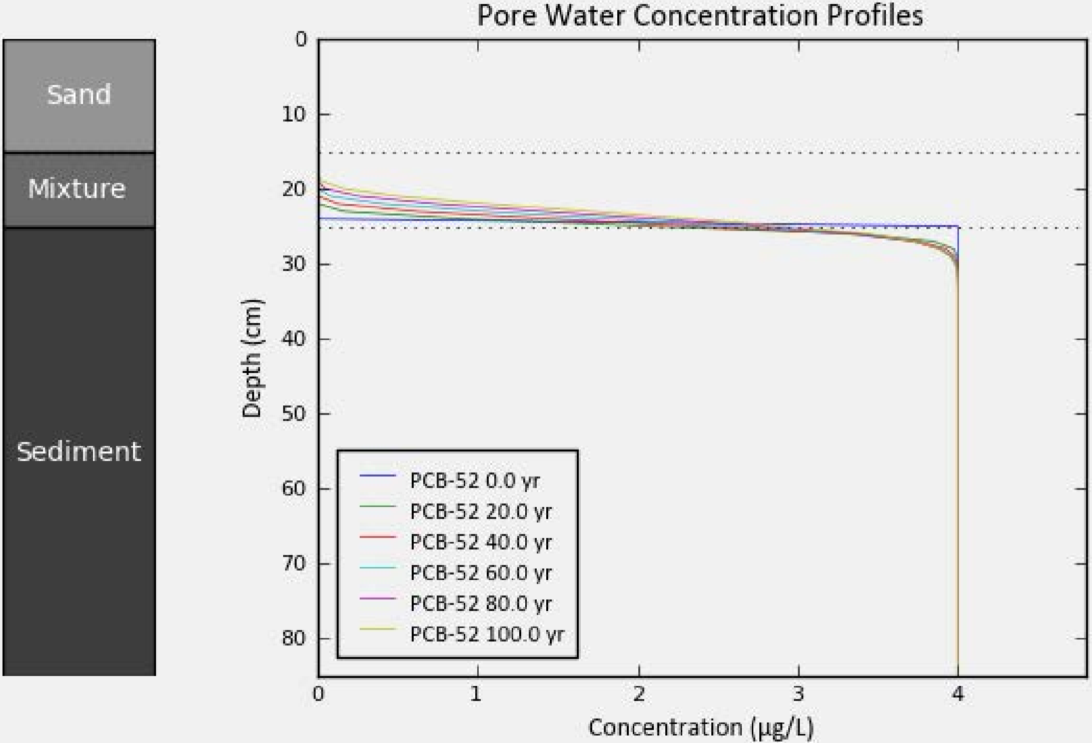
Material Properties	Porosity	Bulk density	foc	Source
Sand (Bioturbation) Layer	0.5	1.25	0.001	Default
Sediment	0.5	1.25	0.01	Default
Reactive Layer				
AquaGate PAC - sand	0.47	1.232	0.011	Estimated
GAC-sand	0.5	1.224	0.011	Estimated

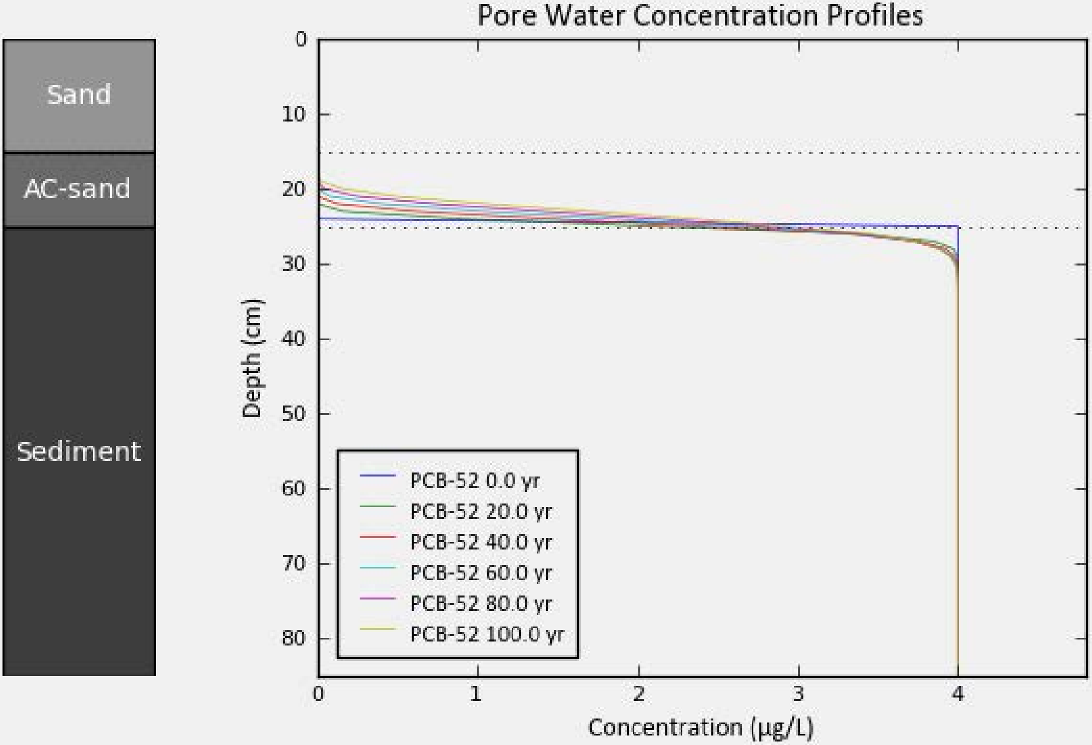
CAPSIM 3.4 Results		
Reactive Layer	Porewater PCB Concentration, 4 ug/L	Porewater PCB Concentration, 938 ug/L
Amendments	Thickness, cm	
AG-PAC 10% - sand 90%	10	15
Bulk GAC 1% - sand 99%	10	15

Result Files
Spatial Profiles - Provides concentration-depth profile for different time frame
Time Profile - Provides concentration - time profile (at 100 years) at a depth of 15 cm (below bioturbation layer on top of reactive layer

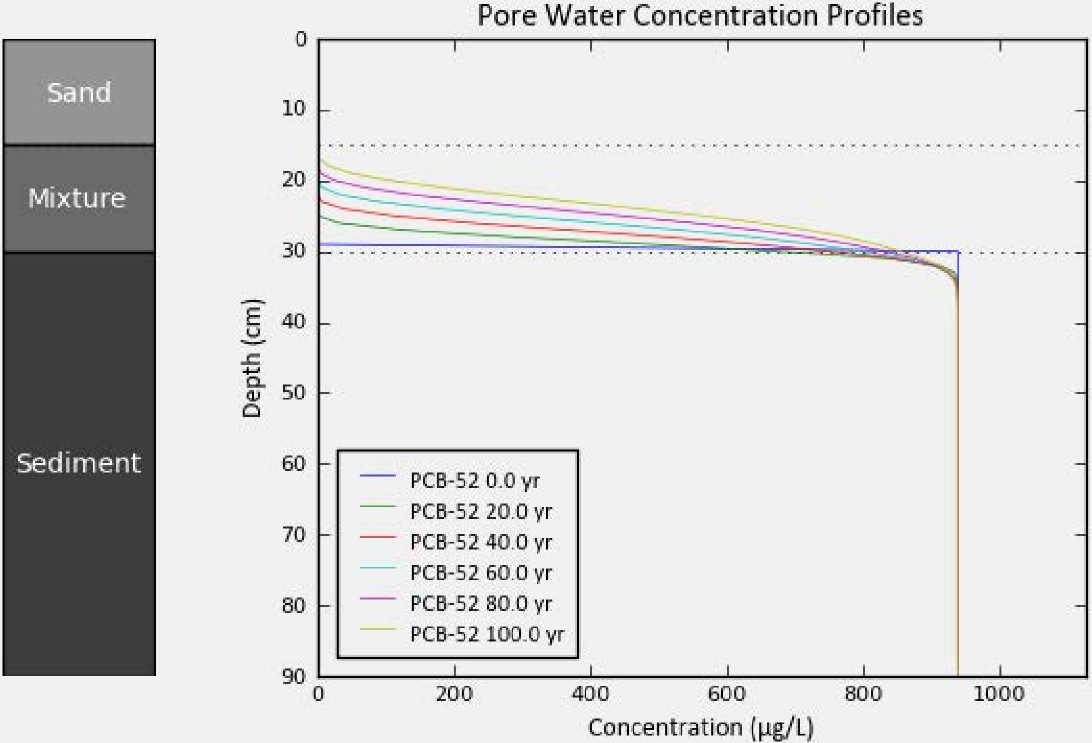
GAC = Granular Activated Carbon

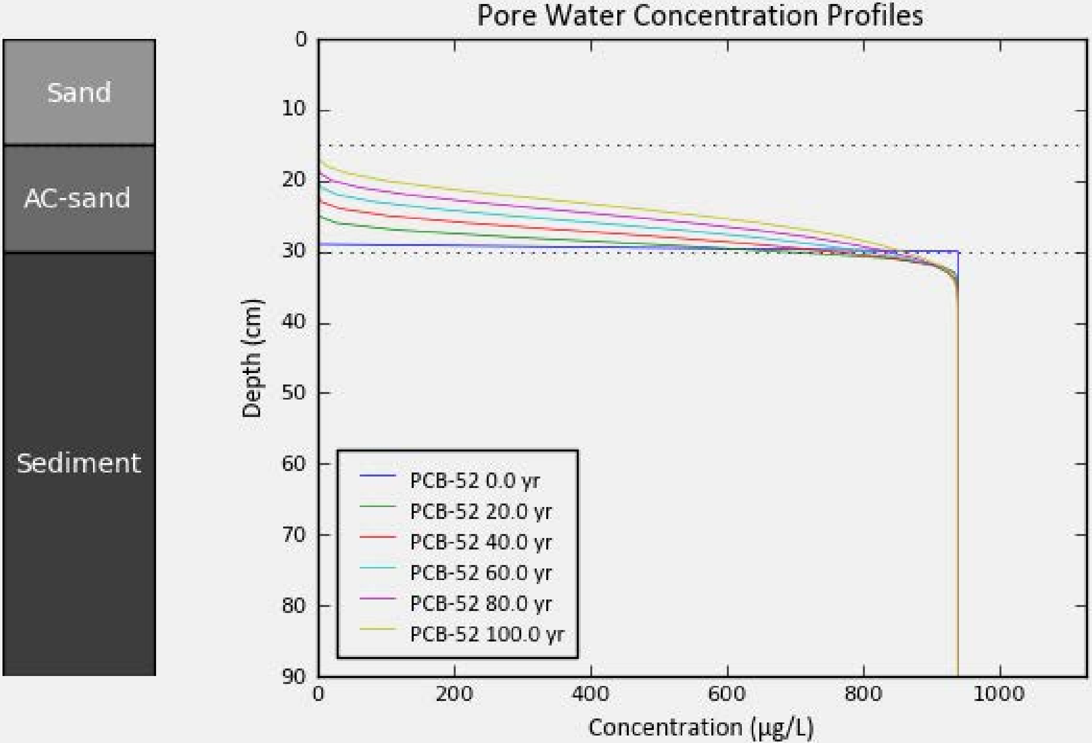
PAC = AquaGate PAC 10% AC

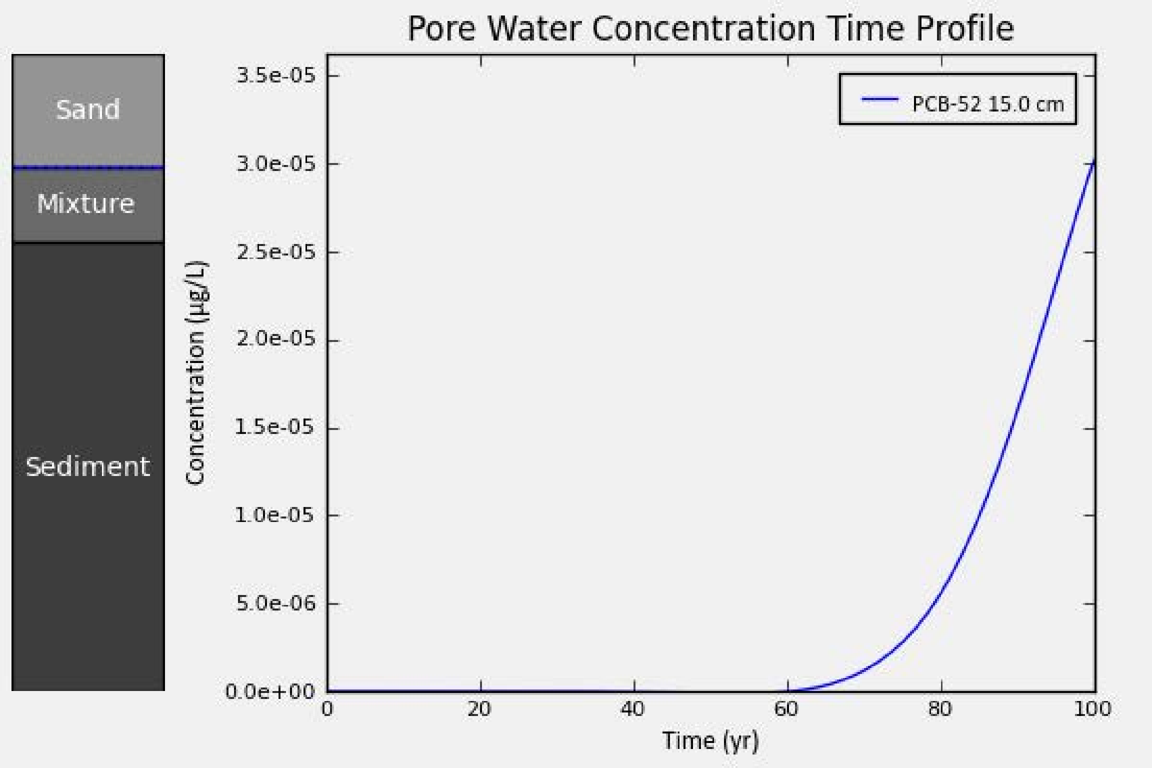

Pore Water Concentration Profiles
Sand
Mixture
Sediment
Depth (cm)
Concentration (μg/L)
0
10
20
30
40
50
60
70
80
0
1
2
3
4
PCB-52 0.0 yr
PCB-52 20.0 yr
PCB-52 40.0 yr
PCB-52 60.0 yr
PCB-52 80.0 yr
PCB-52 100.0 yr



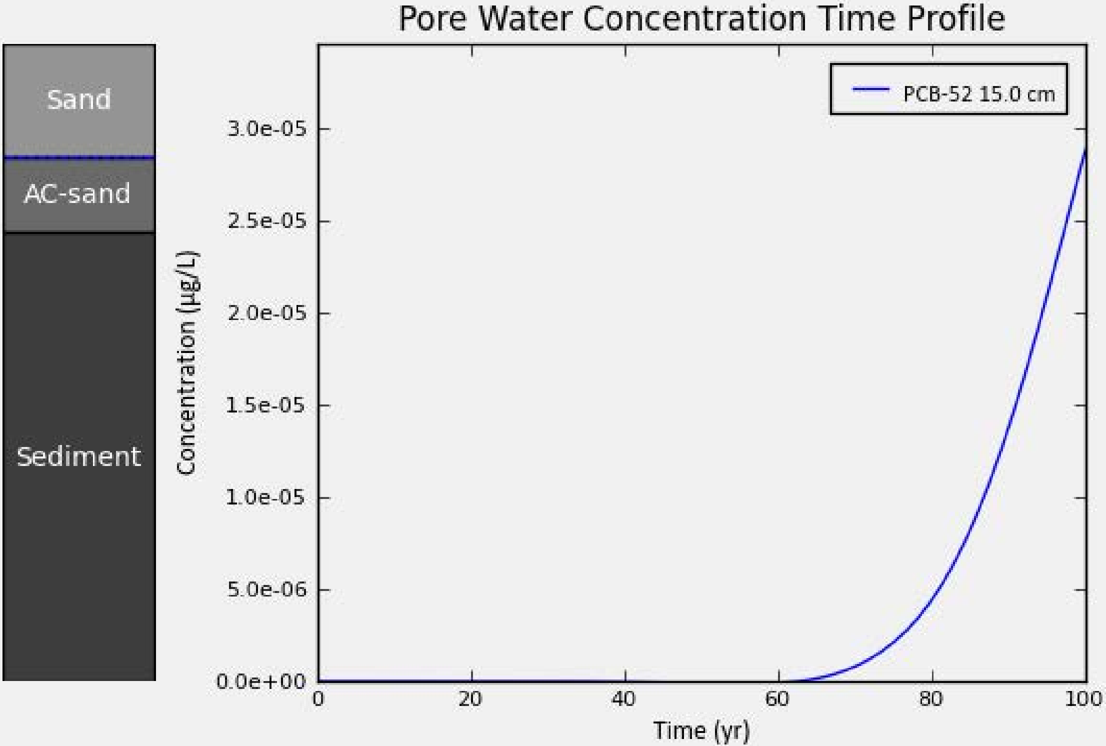
Sand
AC-sand
Sediment
Pore Water Concentration Profiles
Depth (cm)
0
10
20
30
40
50
60
70
80
0
1
2
3
4
Concentration (μg/L)
PCB-52 0.0 yr
PCB-52 20.0 yr
PCB-52 40.0 yr
PCB-52 60.0 yr
PCB-52 80.0 yr
PCB-52 100.0 yr

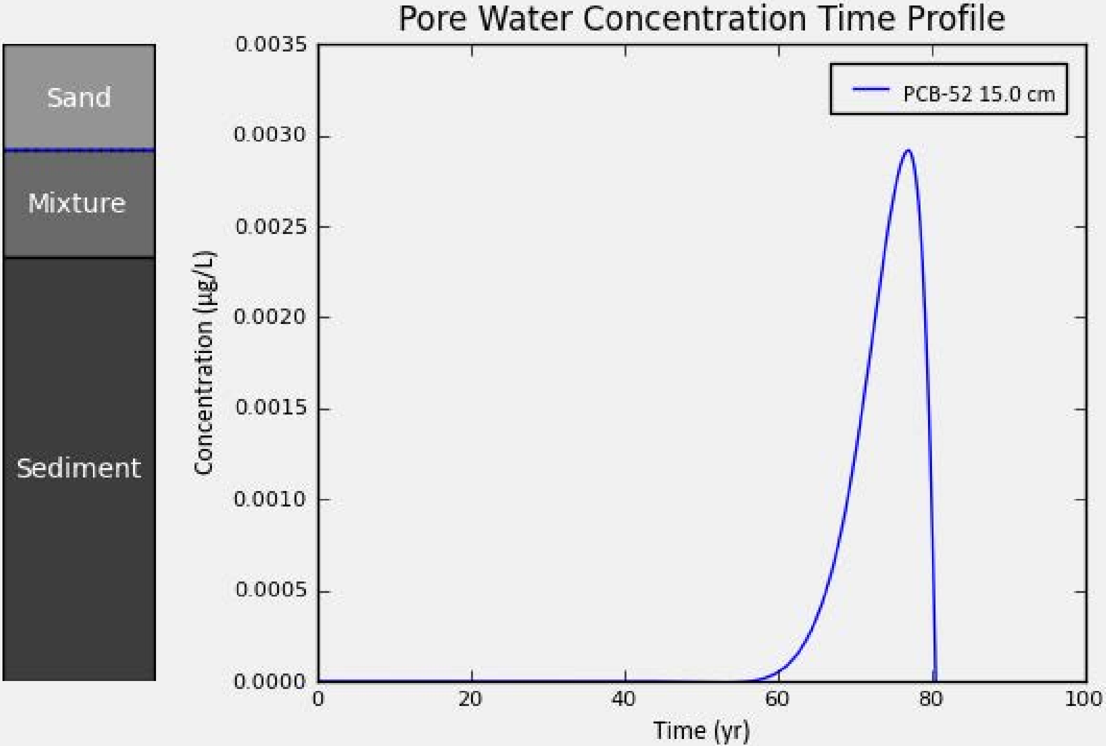

Pore Water Concentration Profiles
Sand
Mixture
Sediment
Depth (cm)
Concentration (μg/L)
0
10
20
30
40
50
60
70
80
90
0
200
400
600
800
1000
PCB-52 0.0 yr
PCB-52 20.0 yr
PCB-52 40.0 yr
PCB-52 60.0 yr
PCB-52 80.0 yr
PCB-52 100.0 yr


Sand
AC-sand
Sediment
Pore Water Concentration Profiles
Depth (cm)
Concentration (μg/L)
0
10
20
30
40
50
60
70
80
90
0
200
400
600
800
1000
PCB-52 0.0 yr
PCB-52 20.0 yr
PCB-52 40.0 yr
PCB-52 60.0 yr
PCB-52 80.0 yr
PCB-52 100.0 yr

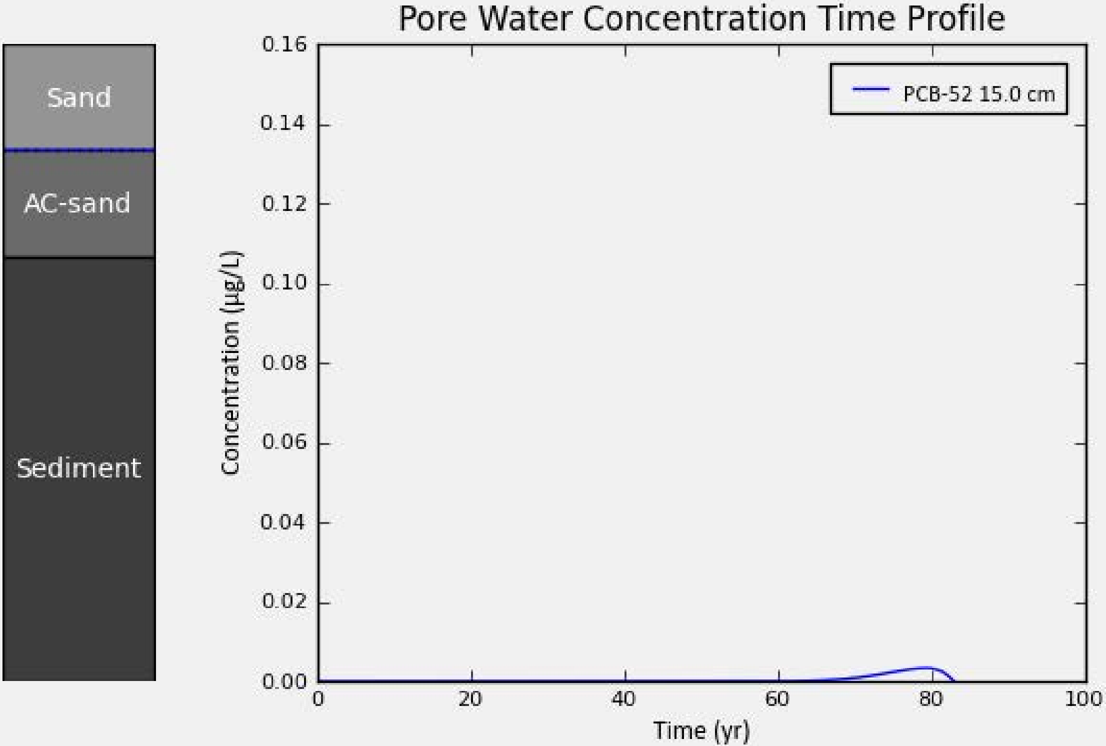


Pore Water Concentration Time Profile
Sand
Mixture
Sediment
PCB-52 15.0 cm
Concentration (µg/L)
Time (yr)
3.5e-05
3.0e-05
2.5e-05
2.0e-05
1.5e-05
1.0e-05
5.0e-06
0.0e+00
0
20
40
60
80
100


Pore Water Concentration Time Profile
Sand
AC-sand
Sediment
PCB-52 15.0 cm
Concentration (μg/L)
3.0e-05
2.5e-05
2.0e-05
1.5e-05
1.0e-05
5.0e-06
0.0e+00
0
20
40
60
80
100
Time (yr)



Pore Water Concentration Time Profile
Sand
Mixture
Sediment
PCB-52 15.0 cm
Concentration (μg/L)
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
0.0000
0
20
40
60
80
100
Time (yr)


Pore Water Concentration Time Profile
Sand
AC-sand
Sediment
PCB-52 15.0 cm
Concentration (µg/L)
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0
20
40
60
80
100
Time (yr)