Prepared for:
USEPA

Prepared by:
AECOM
Chelmsford, Mass.
60308115.12
July 2019

Draft Final

Feasibility Study
Walton & Lonsbury Superfund Site
Attleboro, Massachusetts

EPA Contract No. EP-S1-06-01
EPA Task Order No. 0065-RICO-01GM



AECOM

Prepared for:
USEPA

Prepared by:
AECOM
Chelmsford, Mass.
60308115.12
July 2019

Draft Final

Feasibility Study
Walton & Lonsbury Superfund Site
Attleboro, Massachusetts

EPA Contract No. EP-S1-06-01
EPA Task Order No. 0065-RICO-01GM

Table of Contents

LIST OF ACRONYMS AND ABBREVIATIONS IX

1.0 PROJECT BACKGROUND 1-1

1.1 Purpose and Approach 1-1
1.2 Background Information 1-2
1.2.1 Site Description 1-2
1.2.2 Site History 1-3
1.2.3 Remedial Investigation, Phases 1 through 4 1-6
1.2.4 Remedial Investigation, Phase 5 1-7
1.2.5 Treatability Studies 1-8
1.2.6 Previous Investigations 1-8
1.3 Physical Characteristics 1-12
1.3.1 Geologic Setting 1-12
1.3.2 Hydrologic Setting 1-13
1.3.3 Hydrogeologic Setting 1-14
1.4 Sources of Contamination 1-15
1.4.1 Original Wastewater Discharge to Wetland Area South of Property 1-15
1.4.2 Closed Surface Impoundment Area and Lagoon 1-15
1.4.3 Former Outside TCE Storage Tank 1-16
1.4.4 Outside Drum Storage Pad 1-16
1.4.5 Roof Runoff 1-16
1.4.6 Grinder Exhaust Area 1-16
1.4.7 Plating Room Area 1-16
1.4.8 Abandoned Dry Well 1-16
1.4.9 Former Fuel Oil USTs 1-16
1.5 Nature and Extent of Contamination 1-17
1.5.1 Surface and Subsurface Soil 1-17
1.5.2 Surface Soil and Fine Fraction Total Lead 1-18
1.5.3 Sediment 1-20
1.5.4 Groundwater 1-20
1.5.5 Surface Water 1-21
1.6 Contaminant Fate and Transport 1-22
1.7 Baseline Risk Assessment Summary 1-24
1.7.1 Summary of Human Health Risk Assessment 1-24
1.7.2 Summary of Ecological Risk Assessment 1-28
1.7.3 Supplemental Evaluations Following Risk Assessments 1-31
1.7.4 Actionable Risk Summary 1-35

2.0 DEVELOPMENT OF REMEDIATION CRITERIA AND SCREENING OF TECHNOLOGIES 2-1

2.1 Identification of Preliminary of ARARs and TBCs 2-1
2.1.1 Definition of ARARs 2-2
2.1.2 Chemical-Specific ARARs and TBC 2-3
2.1.3 Location-Specific ARARs 2-3
2.1.4 Action-Specific ARARs 2-3

2.2 Development of Remedial Action Objectives 2-3
2.3 Development of Preliminary Remediation Goals 2-5
2.3.1 Human Health PRGs 2-6
2.3.2 Ecological PRGs 2-9
2.4 Estimation of Areas and Volumes 2-11
2.5 General Response Actions 2-15
2.6 Identification and Screening of Technology Types and Process Options 2-15

3.0 DEVELOPMENT AND SCREENING OF ALTERNATIVES 3-1

3.1 Development of W&L Property Soil Alternatives 3-1
3.1.1 Alternative S-1 – No Action 3-1
3.1.2 Alternative S-2 – Institutional Controls on W&L Property 3-1
3.1.3 Alternative S-3 – Soil Excavation on W&L Property with Off-Site Disposal 3-1
3.1.4 Alternative S-4 – Soil Capping on W&L Property and Institutional Controls 3-2
3.2 Development of Soil in Residential Yards Alternatives 3-2
3.2.1 Alternative SL-1 – No Action 3-2
3.2.2 Alternative SL-2 – Capping and Institutional Controls on Residential Properties 3-3
3.2.3 Alternative SL-3 – Soil Excavation on Residential Properties with Off-Site Disposal 3-3
3.3 Development of Groundwater/Surface Water Alternatives 3-4
3.3.1 Alternative GW/SW-1 – No Action 3-4
3.3.2 Alternative GW/SW-2a – Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat 3-4
3.3.3 Alternative GW/SW-2b – Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat with Mid-Plume Treatment 3-6
3.3.4 Alternative GW/SW-3a – Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier 3-7
3.3.5 Alternative GW/SW-3b – Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier with Mid-Plume Treatment 3-8
3.4 Development of Bedrock Groundwater Alternatives 3-9
3.4.1 Alternative BR-1 – No Action 3-9
3.4.2 Alternative BR-2 – Institutional Controls 3-9
3.4.3 Alternative BR-3 – Institutional Controls and Contingency Remedy of Focused In-Situ Injections (West of North Avenue) 3-11
3.4.4 Alternative BR-4 – Institutional Controls and Contingency Remedy of Pump and Treat 3-13
3.4.5 Alternative BR-5 – Institutional Controls and Contingency Remedy of Enhanced (Deeper) Permeable Reactive Barrier 3-14
3.5 Screening of Alternatives 3-16
3.5.1 Screening of W&L Property Soil Alternatives 3-16
3.5.2 Screening of Soil in Residential Yards Alternatives 3-17
3.5.3 Screening of Groundwater/Surface Water Alternatives 3-17
3.5.4 Screening of Bedrock Groundwater Alternatives 3-17

4.0 DETAILED ANALYSIS OF ALTERNATIVES 4-1

4.1 W&L Property Soil 4-1
4.1.1 Alternative S-1 – No Action 4-1

4.1.2 Alternative S-2 – Institutional Controls on W&L Property 4-1
4.2 Soil in Residential Yards 4-2
4.2.1 Alternative SL-1 – No Action 4-2
4.2.2 Alternative SL-3 – Soil Excavation on Residential Properties with Off-Site Disposal 4-3
4.3 Groundwater/Surface Water 4-5
4.3.1 Alternative GW/SW-1 – No Action 4-5
4.3.2 Alternative GW/SW-2a– Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat 4-5
4.3.3 Alternative GW/SW-2b– Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat with Mid-Plume Treatment 4-13
4.3.4 Alternative GW/SW-3a – Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier 4-15
4.3.5 Alternative GW/SW-3b – Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier with Mid-Plume Treatment 4-17
4.4 Bedrock Groundwater 4-19
4.4.1 Alternative BR-1 – No Action 4-19
4.4.2 Alternative BR-2 – Institutional Controls 4-19
4.4.3 Alternative BR-3 – Institutional Controls and Contingency Remedy of Focused In-Situ Injections (West of North Avenue) 4-22
4.4.4 Alternative BR-4 – Institutional Controls and Contingency Remedy of Pump and Treat 4-24
4.4.5 Alternative BR-5 – Institutional Controls and Contingency Remedy of Enhanced (Deeper) Permeable Reactive Barrier 4-27

5.0 COMPARATIVE ANALYSIS OF ALTERNATIVES 5-1

5.1 Comparative Analysis for W&L Property Soil Alternatives 5-2
5.1.1 Overall Protection of Human Health and the Environment 5-2
5.1.2 Compliance with ARARs 5-2
5.1.3 Long-Term Effectiveness and Permanence 5-2
5.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment 5-3
5.1.5 Short-Term Effectiveness 5-3
5.1.6 Implementability 5-3
5.1.7 Cost 5-5
5.2 Comparative Analysis for Soil in Residential Yards Alternative 5-5
5.2.1 Overall Protection of Human Health and the Environment 5-5
5.2.2 Compliance with ARARs 5-5
5.2.3 Long-Term Effectiveness and Permanence 5-6
5.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment 5-6
5.2.5 Short-Term Effectiveness 5-6
5.2.6 Implementability 5-7
5.2.7 Cost 5-8
5.3 Comparative Analysis for Groundwater/Surface Water Alternatives 5-9
5.3.1 Overall Protection of Human Health and the Environment 5-9
5.3.2 Compliance with ARARs 5-10
5.3.3 Long-Term Effectiveness and Permanence 5-10
5.3.4 Reduction of Toxicity, Mobility, or Volume through Treatment 5-11

5.3.5 Short-Term Effectiveness 5-12
5.3.6 Implementability 5-13
5.3.7 Cost 5-15
5.4 Comparative Analysis for Bedrock Groundwater Alternatives 5-16
5.4.1 Overall Protection of Human Health and the Environment 5-16
5.4.2 Compliance with ARARs 5-17
5.4.3 Long-Term Effectiveness and Permanence 5-17
5.4.4 Reduction of Toxicity, Mobility, or Volume through Treatment 5-18
5.4.5 Short-Term Effectiveness 5-19
5.4.6 Implementability 5-20
5.4.7 Cost 5-22
6.0 REFERENCES 6-1

Tables

Table 1-1 December 2017 Surface Soil Sampling for Lead Risk Evaluation: Results for Total Lead, IVBA Lead, and Total Chromium
Table 1-2 December 2017 and November 2018 Surface Soil Sampling for Lead Risk Evaluation, Residential Area West of North Avenue: Results for Total Lead, Total Chromium, and Total Fine Fraction Lead
Table 1-3 Lead Risk Evaluation: Residential Area West of North Avenue
Table 2-1 Chemical-Specific ARARs and TBCs
Table 2-2 Location-Specific ARARs and TBCs
Table 2-3 Human Health Preliminary Remediation Goals (PRGs) for Soil
Table 2-4 PRGs for Construction Worker Groundwater
Table 2-5 PRGs for Residential Groundwater
Table 2-6a PRGs for Surface Water – Human Health
Table 2-6b PRGs for Surface Water – Ecological
Table 2-7 Technology & Process Option Screening for Soil
Table 2-8 Technology & Process Option Screening for Overburden Groundwater/Surface Water and Bedrock Groundwater
Table 3-1 Components of W&L Property Soil Remedial Alternatives
Table 3-2 Components of Soil in Residential Yards Remedial Alternatives
Table 3-3 Components of Groundwater/Surface Water Remedial Alternatives
Table 3-4 Components of Bedrock Groundwater Remedial Alternatives
Table 3-5 Screening of Remedial Alternative S-1: No Action

Table 3-6 Screening of Remedial Alternative S-2: Institutional Controls on W&L Property

Table 3-7 Screening of Remedial Alternative S-3: Soil Excavation on W&L Property with Off-Site Disposal

Table 3-8 Screening of Remedial Alternative S-4: Soil Capping on W&L Property

Table 3-9 Screening of Remedial Alternative SL-1: No Action

Table 3-10 Screening of Remedial Alternative SL-2: Soil Capping and Institutional Controls on Residential Properties

Table 3-11 Screening of Remedial Alternative SL-3: Soil Excavation on Residential Properties with Off-Site Disposal

Table 3-12 Screening of Remedial Alternative GW/SW-1: No Action

Table 3-13 Screening of Remedial Alternative GW/SW-2a: Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat

Table 3-14 Screening of Remedial Alternative GW/SW-2b: Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat with Mid-Plume Treatment

Table 3-15 Screening of Remedial Alternative GW/SW-3a: Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier

Table 3-16 Screening of Remedial Alternative GW/SW-3b: Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier with Mid-Plume Treatment

Table 3-17 Screening of Remedial Alternative BR-1: No Action

Table 3-18 Screening of Remedial Alternative BR-2: Institutional Controls

Table 3-19 Screening of Remedial Alternative BR-3: Institutional Controls and Contingency Remedy of Focused In-Situ Injections (West of North Avenue)

Table 3-20 Screening of Remedial Alternative BR-4: Institutional Controls and Contingency Remedy of Pump and Treat

Table 3-21 Screening of Remedial Alternative BR-5: Institutional Controls and Contingency Remedy of Enhanced (Deeper) Permeable Reactive Barrier

Table 4-1 Nine Criteria for Detailed Evaluation of Alternatives

Table 4-2 Detailed Evaluation of S-1: No Action

Table 4-3 Detailed Evaluation of S-2: Institutional Controls on W&L Property

Table 4-4 Detailed Evaluation of SL-1: No Action

Table 4-5 Detailed Evaluation of SL-3: Soil Excavation on Residential Properties with Off-Site Disposal

Table 4-6 Detailed Evaluation of GW/SW-1: No Action

Table 4-7 Detailed Evaluation of GW/SW-2a: Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat

Table 4-8 Detailed Evaluation of GW/SW-2b: Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat with Mid-Plume Treatment

Table 4-9 Detailed Evaluation of GW/SW-3a: Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier

Table 4-10 Detailed Evaluation of GW/SW-3b: Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier with Mid-Plume Treatment

Table 4-11 Detailed Evaluation of BR-1: No Action

Table 4-12 Detailed Evaluation of BR-2: Institutional Controls

Table 4-13 Detailed Evaluation of BR-3: Institutional Controls and Contingency Remedy of Focused In-Situ Injections (West of North Avenue)

Table 4-14 Detailed Evaluation of BR-4: Institutional Controls and Contingency Remedy of Pump and Treat

Table 4-15 Detailed Evaluation of BR-5: Institutional Controls and Contingency Remedy of Enhanced (Deeper) Permeable Reactive Barrier

Table 5-1 Comparative Analyses of Remedial Alternatives

Table 5-2 Cost Comparative Analysis of Remedial Alternatives

Figures

Figure 1-1 Site Locus Map

Figure 1-2 Site Features

Figure 1-3 Site Features and Limits of Removal Action

Figure 1-4 Typical Section – Engineered Cover

Figure 1-5 Site Features and FEMA Flood Hazard Areas

Figure 1-6 Generalized Extent of Total Chromium in Soil and Sediment and Hexavalent Chromium in Groundwater

Figure 1-7 Hexavalent Chromium in Bliss Brook Surface Water

Figure 1-8 Phase 3 Groundwater Results for Hexavalent Chromium in Overburden

Figure 1-9 Phase 3 Groundwater Results for Hexavalent Chromium in Bedrock

Figure 1-10 Phase 3 Groundwater Results for TCE in Overburden

Figure 1-11 Phase 3 Groundwater Results for TCE in Bedrock

Figure 1-12 Relationship of TCE in Overburden to Homes Evaluated for Potential Vapor Intrusion

Figure 1-13 Fine Fraction Total Lead Results for Surface Soil Samples (0 to 6 inches): West of North Avenue, 2017 and 2018

Figure 1-14 Hexavalent Chromium Results: December 2017 Piezometer Samples

Figure 2-1 Soil PRG Exceedances for PAHs

Figure 2-2 Soil PRG Exceedances for Metals

Figure 2-3 Surface Soil PRG Exceedances for Lead in Residential Yards West of North Avenue

Figure 2-4 PRG Exceedances for Hexavalent Chromium in Shallow Groundwater on W&L Property

Figure 2-5 Groundwater PRG Exceedances for Irrigation Scenario

Figure 3-1 Conceptual Plan for Alternative S-3: Soil Excavation on W&L Property

Figure 3-2 Conceptual Plan for Alternative S-4: Soil Capping on W&L Property

Figure 3-3 Conceptual Plan for Alternative SL-3: Surface Soil Excavation for Residential Yards West of North Avenue

Figure 3-4 Conceptual Plan for Alternative GW/SW-2a: Source Area Soil Removal with In-Situ Treatment and Groundwater Pump and Treat

Figure 3-5 Conceptual Plan for Alternative GW/SW-2b: Source Area Soil Removal with In-Situ Treatment and Groundwater Pump and Treat with Mid-Plume Treatment

Figure 3-6 Conceptual Plan for Alternative GW/SW-3a: Source Area Soil Removal with In-Situ Treatment and Extension of Permeable Reactive Barrier

Figure 3-7 Conceptual Site Model

Figure 3-8 Conceptual Plan for Alternative GW/SW-3b: Source Area Soil Removal with In-Situ Treatment and Extension of Permeable Reactive Barrier with Mid-Plume Treatment

Figure 3-9 Simulated Bedrock Hexavalent Chromium Plume Extent

Figure 3-10 Conceptual Plan for Contingency Focused In-Situ Injection Component of Alternative BR-3

Figure 3-11 Conceptual Plan for Contingency Pump and Treat Component of Alternative BR-4

Figure 3-12 Conceptual Plan for Contingency Enhanced (Deeper) PRB Component of Alternative BR-5

Figure 3-13 Estimated Extents of Hexavalent Chromium in Groundwater Above Irrigation and Drinking Water PRGs

Figure 4-1 Conceptual Limits for Groundwater Restrictions for Irrigation Wells

Appendices

Appendix A Additional Risk Evaluation

Appendix B Calculation of Preliminary Remediation Goals

Appendix C PRG Exceedances

Appendix D Cost Estimates

Appendix E ARARs Tables

Appendix F Modeling Support

Appendix G Technical Memo – Lead Evaluation

Appendix H Institutional Controls for Individual Properties: Summary by Alternative

List of Acronyms and Abbreviations

ALM	Adult Lead Model
ARAR	Applicable or Relevant and Appropriate Requirement
AUL	Activity and Use Limitation
AVS	Acid Volatile Sulfides
BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
CCC	Criterion Continuous Concentration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMC	Criterion Maximum Concentration
COC	Chemical of Concern
COPC	Chemical of Potential Concern
Cr+6 or Cr(VI)	Hexavalent Chromium
Cr+3 or Cr(III)	Trivalent Chromium
CTE	Central Tendency Exposure
cVOC	Chlorinated Volatile Organic Compound
EA	Exposure Area
EPC	Exposure Point Concentration
ERA	Ecological Risk Assessment
FEMA	Federal Emergency Management Agency
FS	Feasibility Study
gpm	gallons per minute
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
HRS	Hazard Ranking System
IC	Institutional Control
IEUBK	Integrated Exposure Uptake Biokinetic
ILCR	Incremental Lifetime Cancer Risk
LOAEL	Lowest Observed Adverse Effects Level
MassDEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
MCP	Massachusetts Contingency Plan
µg/L	micrograms per liter
µg/dL	micrograms per deciliter
mg/kg	milligrams per kilogram
NCP	National Contingency Plan
NOAEL	No Observed Adverse Effects Level
NPDES	National Pollutant Discharge Elimination System

NPL	National Priorities List
NRWQC	National Recommended Water Quality Criteria
O&M	Operation and Maintenance
OEME	Office of Environmental Measurement and Evaluation
PA/SI	Preliminary Assessment/Site Investigation
PAH	Polycyclic Aromatic Hydrocarbon
PCE	Tetrachloroethene
PDI	Pre-design Investigation
POTW	Publicly Owned Treatment Works
PPE	Personal Protective Equipment
PQL	Practical Quantitation Limit
PRB	Permeable Reactive Barrier
PRG	Preliminary Remediation Goal
RAGS	Risk Assessment Guidance for Superfund
RAO	Remedial Action Objective
RGP	Remediation General Permit
RI	Remedial Investigation
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RME	Reasonable Maximum Exposure
ROD	Record of Decision
RR	Residual Risk
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SEM	Simultaneously Extracted Metals
SSDS	Sub-Slab Depressurization System
TBC	To Be Considered
1,1,1-TCA	1,1,1-Trichloroethane
TCE	Trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TMV	Toxicity, Mobility, or Volume
TOC	Total Organic Carbon
TRV	Toxicity Reference Value
TSDF	Treatment, Storage, and Disposal Facility
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
UU/UE	Unrestricted Use and Unlimited Exposure
VOC	Volatile Organic Compound
W&L	Walton & Lonsbury
ZVI	Zero Valent Iron

1.0 PROJECT BACKGROUND

This Feasibility Study (FS) report presents the development and evaluation of remedial alternatives for the Walton & Lonsbury Superfund Site, located in Attleboro, Massachusetts. It has been prepared by AECOM under Task Order No. 0065-RICO-01GM of EPA's Remedial Action Contract (RAC2) No. EP-S1-06-01.

As part of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process, a Remedial Investigation (RI) Report was completed to assess the conditions of the surface and subsurface soil, sediment, groundwater, and surface water at the site.

The FS was undertaken utilizing the remedy selection process with the goal of selecting remedies that are protective of human health and the environment and maintain protection over time. This report describes the process used to develop preliminary alternatives and includes a detailed evaluation and comparative analysis of alternatives for groundwater, surface water, and soil. Sediment is also discussed due to its relationship to historical Walton & Lonsbury activities; however, as will be summarized in Section 1.7, evaluation of sediment did not result in a determination of unacceptable risk and therefore sediment does not require remedial action. Evaluation of surface water did result in a determination of unacceptable human health and ecological risk for a portion of Bliss Brook. These risks are anticipated to be managed through control of groundwater discharge to the brook and alternatives have been developed with that as the primary objective.

1.1 Purpose and Approach

The associated RI report contains a comprehensive summary of historical activities and investigations at the Walton & Lonsbury site. The RI report (AECOM, June 2019) evaluates and presents findings for soil, sediment, groundwater (and associated indoor air impacts), and surface water investigations.

A baseline human health risk assessment (HHRA) and baseline ecological risk assessment (BERA) were also completed based on the data presented in the RI report; these documents were completed in May 2019 and are included as appendices to the RI Report.

This FS was completed according to the USEPA FS guidelines (USEPA, 1988). Each remedial alternative was evaluated in detail according to the following National Contingency Plan (NCP) criteria.

- Overall Protection of Human Health and Environment
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)
- Long-term Effectiveness and Permanence
- Reduction in toxicity, mobility, or volume (TMV) through treatment
- Short-term effectiveness
- Implementability

- Cost

Two additional criteria, state acceptance and community acceptance, will be evaluated as part of the regulatory and community review phase of the CERCLA process, as the Proposed Plan is prepared with the regulatory agencies and reviewed by the community.

1.2 Background Information

1.2.1 Site Description

The Walton & Lonsbury (W&L) chromium plating facility was located on a 2.72-acre property with the following street address: 78 North Avenue, Attleboro, Bristol County, Massachusetts (Figures 1-1, 1-2, and 1-3). The plating operations were performed in a 13,500 square-foot building that was demolished as part of a United States Environmental Protection Agency (EPA) time-critical removal action implemented between October 2010 and August 2014.

The 78 North Avenue property is currently owned by Walhard Realty Trust. It is bounded to the north by Walton Street, to the south by wetlands and wooded areas, to the east by North Avenue with residences beyond, and to the west by industrial/commercial properties (TtNUS, 2005). The primary contaminants of interest at the property are chromium and chlorinated volatile organic compounds (cVOCs).

The following terms are used to describe the property itself and adjacent areas that were included in previous investigations and/or the RI.

W&L property, W&L facility, and property: These terms refer to the 78 North Avenue property itself (see Figure 1-2), inclusive of the portion of the property that is leased to a tenant (the hatched portion of the property as shown on Figure 1-2).

Site and study area: These terms refer to the 78 North Avenue property and adjoining areas that were investigated in the RI and/or previous investigations, including: the wetland south of the 78 North Avenue property, as far south as Deanville Road; the residential area immediately east of the 78 North Avenue property along Paulette Lane and North Avenue; Bliss Brook and its banks, including residential yards that border the brook from the Paulette Lane area south to its confluence with the Bungay River; the Bungay River just upstream of its confluence with Bliss Brook; Mechanics Pond; and the storm water piping that drains the wetland north of Deanville Road south to its discharge into Bliss Brook at West Street (see Figure 1-3). “Study area” also includes reference soil and sediment sampling locations that are nearby that were selected to be representative of conditions of similar habitat, but not impacted by releases from the W&L property.

Southern Wetland: This term refers to the wetland area just south of the W&L property as far south as Deanville Road, including the northernmost portion excavated by the removal program that is now an open water area.

Covered Area: This term refers to the area behind residences along Paulette Lane and North Avenue that was covered during an EPA time-critical removal action to prevent upwelling of chromium-contaminated groundwater to the ground surface and to prevent direct exposure to chromium-contaminated soil. See Figure 1-3 – Limit of Cover Installed by Removal Program.

1.2.2 Site History

The W&L chromium plating operations were performed in a 13,500 square-foot building on the property. Electroplating operations had been conducted at the property since 1940, and W&L performed chromium plating until it closed in 2007. Copper plating was also conducted at the facility until the building was remodeled in the late 1950s. Facility operations included parts degreasing using solvents, hard chrome plating, stripping with acids, aqueous rinsing, grinding, and polishing (Weston, October 2012).

Wastes typically generated from the hard chrome electroplating process include the following:

- Spent plating bath solutions
- Spent degreasing solvents
- Spent acid and alkaline cleaning/dipping solutions
- Grinding residues
- Wastewater from rinsing of parts
- Precipitated metals sludge from pretreatment of wastewater prior to discharge

From 1940 until 1970, wastewater and waste streams generated at the facility were directly discharged without treatment via an underground pipe from the plating room into the wetlands located on the southern portion of the property (RCA, 1989). The wetlands extend onto southern abutting properties. In 1970, W&L abandoned and plugged its underground discharge pipe and installed a batch wastewater treatment system for metals removal and pH adjustment. During the EPA removal action that demolished the building, effort was made to locate this pipe but it was not found. Following start-up of the treatment system, treated wastewater was discharged to a surface impoundment that was located west of the facility building. The impoundment was used to remove suspended solids remaining in the final discharge after chemical treatment (RCA, 1989). Wastewater flowing through the surface impoundment was then discharged to a storm water trench located on the west side of the facility building. The discharge from the storm water trench flowed through the wetland area, into several storm water culverts, and into the Ten Mile River (TtNUS, 2005). This practice continued until the mid-1980s. ln addition, during the period of 1970 to the mid-1980s, chromium hydroxide sludges generated by the batch wastewater treatment system were discharged into an earthen sludge lagoon south of the surface impoundment for dewatering (RCA, 1989).

In 1984, W&L was ordered by the Massachusetts Department of Environmental Protection (MassDEP) to cease discharge to both the surface impoundment and the sludge lagoon. A closure plan was prepared and was approved by MassDEP. Sludge and visibly-contaminated soil were excavated and disposed at the Stablex Canada facility (TtNUS, 2005). The impoundment and lagoon were reportedly backfilled with clean sand and

gravel and capped with a 6- to 12-inch clay cap, followed by loam and grass seed (TtNUS, 2005). The wastewater treatment system was converted to a closed-loop for process water, while chromium hydroxide sludge was accumulated and shipped off-site for disposal (approximately 4,000 gallons of sludge was shipped off-site every 90 days) (Weston, November 2013).

Two above-ground storage tanks containing TCE and 1,1,1-TCA were located on the west side of the former building and supplied solvents for internal degreasing operations. TCE was used on-site from an unknown period of time until 1983, at which time 1,1,1-TCA was determined to be a more environmentally permissible alternative. Several overflow spills of solvents reportedly occurred during the early 1980s. An abandoned dry well located on the south side of the facility was reportedly used for the disposal of waste solvents including TCE and 1,1,1-TCA (Weston, November 2013). Three underground storage tanks (USTs) were also present at the property and have all been removed (TtNUS, 2005).

The W&L property was initially investigated under the State cleanup program (i.e., the Massachusetts Contingency Plan or "MCP") and was assigned release tracking number (RTN) 4-23. W&L retained a consultant to perform MCP Phase I and Phase II investigations, but this work was not fully completed due to financial inability, and the W&L facility ceased all operations in 2007. This consultant attempted to locate the abandoned dry well as part of their activities, but was not able to find it.

The analytes that W&L's consultant identified as contaminants released to the property included metals (total chromium, hexavalent chromium, and lead), chlorinated VOCs (TCE, 1,1,1-TCA, PCE, and breakdown products), and petroleum hydrocarbons and associated PAHs. Metals and VOCs were detected in surface soil, subsurface soil, groundwater, surface water samples from Bliss Brook, and sediment samples from Bliss Brook. The investigations identified the following potential sources (RCA, 2001) (see Figure 1-2 for approximate locations):

- Historic wastewater discharge to southern wetland
- Closed surface impoundment area and lagoon
- Former outside TCE storage tank
- Outside drum storage pad
- Roof runoff
- Grinder exhaust area
- Plating tanks and plating room floor trenches
- Abandoned dry well
- Former fuel oil USTs

Subsequent investigations by EPA and MassDEP confirmed that metals (primarily chromium) and chlorinated VOCs (primarily TCE) were present in soil, groundwater, sediment, and surface water. VOCs were also detected in indoor air, likely due to vapor intrusion into buildings above or near the VOC plume. One home was equipped with a Sub-Slab Depressurization System (SSDS) as a result and two other homes were found

to have existing radon mitigation systems that appeared to be effective in addressing vapor intrusion from VOCs.

In August 2010, the EPA Emergency Planning and Response Branch ("removal program") performed a removal program preliminary assessment/site investigation (PA/SI) that documented the presence of chromic acid in on-property tanks (Weston, October 2012). In addition, high concentrations of metals were found in surface soils along the western bank of Bliss Brook, in the backyards of several residences along Paulette Lane and North Avenue. As a result of the findings of the initial phases of the PA/SI, EPA initiated a Time-Critical Removal Action in October 2010 with the objective of mitigating ongoing human health exposure to metals-impacted soil and groundwater and preventing potential future releases. Activities conducted as part of the Time-Critical Removal Action included removal of the W&L buildings and residual waste materials, excavation and off-site disposal of contaminated sediment from wetlands south of the former building where the wastewater was historically discharged, and construction of an engineered cover to isolate surficial soils adjacent to Bliss Brook (behind the North Avenue/Paulette Lane residential area) to mitigate future dermal contact risk (Figure 1-3). Chromium-contaminated soil and groundwater remain under the cover. A permeable reactive barrier (PRB) wall was constructed on the downgradient edge of the cover, with the goal of reducing hexavalent chromium to the less toxic trivalent chromium in the groundwater before it discharged to Bliss Brook.

The engineered cover was designed to serve several purposes: provide physical separation from chromium-impacted soils that remain, raise the ground surface elevation above the water table to limit influence of chromium-impacted groundwater on the near surface soils, and promote enhanced movement of groundwater beneath the cover. The existing grade in the area of the cover was excavated to the proposed grade and "hot spot" excavation was performed to remove chromium-impacted soils. The existing soil under the cover was stabilized with Portland cement for subsequent placement of cover materials and regraded to the specified preparatory grade. The soil cover is comprised of a 6-inch granular fill layer (common fill) over a woven geotextile above the regraded soils. Above the granular fill is a geocomposite drainage layer to provide a low-profile layer of high groundwater transmissivity. Above the drainage layer is a minimum 8-inch layer of crushed stone to serve as a capillary break to limit migration of impacted groundwater upward into surface soils. Overlying the crushed stone is a geotextile warning layer and then 6 inches vegetated support sand and a 4-inch topsoil layer to provide physical separation and media for vegetation (Weston, November 2013.) A typical section of the engineered cover (abstracted from the Record Drawings for the removal action) is shown in Figure 1-4.

The PRB consists of a mixture of zero-valent iron (ZVI) particles and granular fill at a ratio of 1:20 by volume. Remediation of this entire area by excavation of the contaminated soil was not a feasible option since it would have become re-contaminated via the migration of contaminated groundwater from the original source areas (Weston, November 2013).

The site was listed on the National Priorities List on May 21, 2013 (Site No. MAD001197755). Restoration activities for the removal action were completed in the summer of 2014.

1.2.3 Remedial Investigation, Phases 1 through 4

The first four phases of the RI (Phases 1, 2, and 3: June 2014 – December 2015, and Phase 4 – October 2016) consisted of activities related to the following tasks:

- Soils and Sources of Contaminants Investigation (soil borings, surficial soil sampling, upland and wetland soil sampling for toxicity testing)
- Subsurface and Hydrogeological Investigation (assessment of existing monitoring wells; installing new monitoring wells; borehole geophysics; groundwater sampling; water level measurements)
- Surface Water and Sediment Investigation (surface water, wetland soil, and sediment sampling)
- Ecological Assessment (habitat characterization)
- Site Surveys (elevation and location surveys of investigation points)
- Vapor Intrusion Assessment (sub-slab and indoor air sampling in residential homes performed by EPA's Office of Environmental Measurement and Evaluation [OEME])

Phase 1 of the remedial investigation was planned with the primary objective of filling data gaps from previous investigations regarding the nature and extent of contamination in soil, sediment, surface water, and groundwater. Phase 1 was executed in June and July 2014 and consisted of the installation of monitoring wells and the collection of samples of groundwater, surface water, soil, and sediment.

Phase 2 field activities took place in October-December 2014 and consisted of additional soil, sediment, and surface water sampling, the installation of several new monitoring wells, and sampling of the new wells along with the wells previously sampled in Phase 1.

In March of 2015, EPA's OEME performed the final Phase 2 activity consisting of sub-slab soil gas and indoor air sampling of several residences proximal to the groundwater VOC plume. The results from Phase 1 and Phase 2 groundwater sampling for VOCs (primarily TCE) were used to determine which homes would be included in this effort. The purpose of the sampling was to evaluate possible vapor intrusion of volatile contaminants from groundwater to indoor air and (if present) determine the corresponding human health risk.

In September 2016, EPA's OEME sampled one additional home that had not been sampled during the March 2015 vapor intrusion investigation because the home had been abandoned. In 2016, the home was foreclosed on and subsequently sold. Property access was granted by the new owners to EPA to perform sub-slab soil gas sampling and indoor air sampling.

The homes where indoor air sampling was conducted in 2015 and 2016 are shown on Figure 1-12. This figure also shows three homes that were not sampled due the presence of existing radon mitigation systems or in one instance, the presence of a SSDS that had been previously installed by MassDEP.

Phase 3 field activities were performed from July to October 2015, and consisted of:

- Collection of sediment samples for purposes of toxicity testing and chemical analysis

- Collection of pore water samples co-located with sediment samples for chemical analysis
- Collection of surface water samples for purposes of toxicity testing and chemical analysis
- Installation of multi-level wells to investigate vertical extent of contamination in bedrock, with well levels selected based on the results of borehole geophysical testing to identify significant water-bearing fractures
- Installation of micro-wells (piezometers) to investigate the effectiveness of the PRB
- A comprehensive groundwater sampling event that included the new wells and a subset of existing wells

Phase 4 field activities were performed in October 2016 and included the collection of 20 soil samples from two ecological exposure areas (the W&L Property & Southern Wetland, and Bliss Brook) from the vicinity of locations previously sampled, with the goal of providing a range of chromium concentrations and habitats for future toxicity testing. Twelve of the 20 samples were selected for toxicity testing after review of chemical analytical data and discussion with EPA to represent both exposure areas and a range of total chromium concentrations. The toxicity testing included: 14-day earthworm survival testing, 28-day earthworm bioaccumulation testing, and seedling germination and growth tests using rye grass. The toxicity testing was performed to reduce the uncertainty in the conclusions of the Draft BERA regarding ecological risk from soil exposure.

1.2.4 Remedial Investigation, Phase 5

As noted above, the remedial investigation has been performed in phases beginning in June 2014, leading to the completion and submission of a draft baseline Ecological Risk Assessment (submitted in April 2016), draft baseline Human Health Risk Assessment (submitted in June 2016), and draft RI Report (submitted in June 2016). During review of these documents, it was determined that additional sampling and analysis was needed as follows:

- Evaluation of the human health risk due to lead in surface soil using current EPA guidance: The current guidance requires collection of fine fraction (less than 150 µm) surface soil samples with analysis for total lead, followed by In-Vitro Bioaccessibility (IVBA) lead testing if the total fine fraction soil lead concentration (based on an average of results within an exposure point) is above 200 milligrams per kilogram (mg/kg). (The 200 mg/kg value is a screening level developed using default blood lead level modeling parameters for children and adults at a target blood lead level of 5 µg/dL for a residential exposure scenario). Because RI Phases 1 through 4 did not include sieving of soil samples and analysis of the fine fraction, it was determined that additional samples needed to be collected for sieving and analysis of the fine fraction. This additional sample collection was done for the four exposure points where the draft baseline HHRA indicated there was no actionable risk from soil exposure, but lead could be present at levels above 200 mg/kg in fine fraction soil, based on un-sieved soil lead results that occasionally exceeded this value. These exposure points are the yards in the two residential areas west and east of North Avenue, the wetland south of the W&L property and west of North Avenue known

as the Southern Wetland, and Bliss Brook. A fifth exposure point (the Walton & Lonsbury property and immediate area to the south, as far as the southern end of the fence installed by EPA along North Avenue) was determined to have actionable risk due to soil constituents other than lead that are co-located with lead. Therefore, soil remedial alternatives were already planned to be included in the FS for this exposure point, and additional data collection for fine fraction soil lead from this exposure point was deemed unnecessary. The fine fraction lead surface soil sampling was performed in early December 2017.

- Closure of data gaps in the understanding of the shallow overburden groundwater plume and its interaction with nearby surface water bodies (the ponded area south of the Walton & Lonsbury property and Bliss Brook): This effort involved installing additional piezometers and staff gauges, sampling the piezometers, surveying these new installations and also all existing wells in use for the RI, and conducting a synoptic water level round shortly after the surveying was completed. The piezometers and staff gauges were installed and the piezometers were sampled in late November 2017. Surveying and one synoptic water level round was performed in January 2018. A second synoptic water level round was performed in early April 2018 to obtain a comprehensive round including all staff gauges and piezometers, since some piezometers were frozen during the January 2018 round.

The figures in Section 2 of the RI report (AECOM, June 2019) show the RI sampling locations for Phases 1 through 5, as well as the historical sampling locations for data determined to be usable for the RI and risk assessments.

1.2.5 Treatability Studies

In 2017 AECOM conducted treatability studies with the assistance of the Attleboro Publicly Owned Treatment Works (POTW). This assistance involved allowing AECOM to utilize some of their laboratory space to perform the study. Overburden groundwater, bedrock groundwater and soil were tested with various potential treatment reagents. The treatability studies demonstrated that hexavalent chromium could be successfully treated with various reagents. Testing indicates that zero-valent iron (ZVI) and FerroBlack-H (primarily iron sulfide) were the best reagents for the Walton & Lonsbury site conditions. Calcium polysulfide and a biological amendment were also tested but were less effective.

1.2.6 Previous Investigations

The W&L property was initially investigated under the MCP [RTN 4-23], and W&L retained a consultant to perform MCP Phase I and Phase II investigations in addition to other compliance activities. The MCP disposal site, as described in the Phase IIC Comprehensive Site Assessment Report (RCA, 2001), included the area of the property itself and the land south and west of the facility, extending to the southeast up to and possibly beyond Bliss Brook. At that time, it was believed that the southern extent was at the northern edge of the Brookside Apartments, but it was acknowledged that the full extent of contamination had not been defined, either vertically (with respect to deep overburden and bedrock groundwater) or along Bliss Brook and the

Bungay River (soil, sediments, and surface water). Chromium contamination was found in sediment samples as far south as Mechanics Pond (nearly a mile south of the W&L property line) during a Site Inspection performed by EPA in 2005 (TtNUS, 2005). The MCP site was listed on the National Priorities List on May 21, 2013 (Site No. MAD001197755).

MCP Investigations by W&L's Consultant

Environmental investigations have been implemented at the property by W&L since about 1970. The property was transitioned into the MCP in 1989. A Phase I Limited Site Investigation and Phase II Interim Comprehensive Site Assessment were conducted by W&L under the MCP between 1990 and 2001 (RCA, 1990; RCA, 2001). These investigations determined that soil and groundwater at the property had been impacted by metals including trivalent chromium and hexavalent chromium and lead, as well as VOCs including TCE, 1,1,1-TCA, and their breakdown products. Groundwater contamination was documented to have migrated southeastward from the property towards Bliss Brook, passing beneath a residential area along Paulette Lane. RCA identified the potential on-property sources depicted on Figure 1-2.

EPA Remedial Program, Initial Site Inspection

In 2005, a Draft Site Inspection Report was prepared for the EPA by Tetra Tech NUS (TtNUS, 2005). This report summarized past work done, and included a reconnaissance of the W&L property and nearby residential neighborhoods, a survey of the wetlands and Bliss Brook, interviews, and collection of soil, sediment, surface water, and groundwater samples. The surface water and sediment samples were collected from Bliss Brook as well as further downstream (Bungay River, Ten Mile River, and Mechanics Pond). The soil samples were collected from residential property in areas along Bliss Brook that are subject to flooding. A well couplet was also installed on the eastern side of Bliss Brook downgradient of the known contaminated groundwater plume at that time, to determine the vertical gradient in the vicinity of the brook to assess whether the brook was a groundwater divide. The sampling confirmed that contaminants released at the W&L property were present in sediments and surface water (including downstream water bodies Bungay River and Ten Mile River/Mechanics Pond). Results from the well couplet sampling indicated that the contaminant plume discharges to Bliss Brook, but does not cross below it. The soil sampling showed elevated concentrations of chromium and hexavalent chromium.

Vapor Intrusion Evaluations

In December 2008 and again in March 2009, EPA's OEME performed air sampling at nearby residences to assess the possibility of vapor intrusion (USEPA OEME, 2008; USEPA OEME, 2009). Sub-slab soil gas samples and basement air samples were collected at 69 North Avenue. Basement air samples were collected at 73 North Avenue, which was noted to have a radon mitigation system present. TCE and other chlorinated VOCs were detected in the basement air at 69 North Avenue. An SSDS was installed at 69 North Avenue by MassDEP while the radon mitigation system already present at 73 North Avenue appeared to be effective, since TCE was not detected in the basement air.

In February 2010, MassDEP's Field Assessment and Support Team (FAST) performed a vapor intrusion study for five other homes: 27 Paulette Lane, 37 Paulette Lane, 50-52 North Avenue, 51 North Avenue, and 60 North Avenue (MassDEP, February 2010). The work consisted of sub-slab soil gas and basement indoor air sampling. The study reached the following conclusions (as stated in the MassDEP report):

1. There is no evidence or reason to believe that vapor intrusion is occurring at 27 or 37 Paulette Lane.

2. Site-related contaminants (i.e., TCE and dichloroethanes) were identified in the soil gas beneath the basements at 50-52 and 51 North Avenue, at concentrations consistent with levels of these contaminants reported in the underlying groundwater.

3. Site-related contaminants were not identified in the soil gas beneath the basement at 60 North Avenue, but there is reason to believe that detectable levels of these contaminants may exist under other areas of this structure.

4. Site-related contaminants were not identified in the basement air at any of the five homes sampled. While it is possible that site contaminants may be present in the basement air in the homes on North Avenue below the method detection limits of 10-20 $\mu g/m^3$, such concentrations would probably not represent an immediate health risk (i.e., would not be above MCP short-term metrics for cancer or non-cancer risks).

5. The homes with the highest degree of uncertainty of significant vapor intrusion impacts are 50-52 North Avenue, given the levels of site-contaminants in the sub-slab soil gas and the home condition, and 60 North Avenue, given its proximity to the Walton & Lonsbury site and the limitations of the sub-slab soil gas sampling effort. The 50-52 North Avenue home is older, with a fieldstone/brick/ mortar foundation, concrete floor, and unfinished basement. Some cracks and void spaces were observed in the foundation/floor system. Indoor air sampling via EPA Method TO-15 was recommended for these structures. (This indoor air sampling was performed by EPA OEME as part of the RI; see Section 4.8.2 of the RI Report).

In December 2010, the FAST Team conducted a vapor intrusion study that included several additional homes along Paulette Lane (5, 27, 29, 30, and 37) and North Avenue (51, 50-52, and 65) (MassDEP, December 2010). It was planned to also sample at 60 North Avenue but this could not be done due to a scheduling conflict. This study included sub-slab soil gas sampling but not indoor air sampling. Conclusions were similar to those from the earlier study.

Other MassDEP Actions

MassDEP performed an emergency removal action consisting of emptying and over-packing the contents of various containers, totes, and drums that had been left on the W&L property. All of the liquid waste from the wastewater treatment system and most of the liquid waste from plating tanks was siphoned off and disposed. In 2011 and 2012, ESM, a contractor to MassDEP, installed shallow and deep well couplets and

also installed piezometers and staff gauges in Bliss Brook (ESM, 2011; ESM, 2012). The work established that groundwater was discharging to Bliss Brook. All of the MassDEP monitoring wells and selected older wells were sampled for hexavalent chromium, lead, and VOCs in early March 2012.

EPA Removal Program PA/SI

In August 2010, the removal program performed a PA/SI that documented the presence of chromic acid in on-property tanks, despite previous attempts to remove this material (Weston, October 2012). In addition, high concentrations of metals were found in surface soils along the western bank of Bliss Brook, in the backyards of several residences along Paulette Lane and North Avenue. The contamination found in these soils is from migration of contaminated groundwater from the original on-property release areas to this area, wicking up into the unsaturated soil behind these homes and eventually discharging to Bliss Brook (Weston, November 2013). As a result of the findings of the initial phases of the PA/SI, EPA initiated a Time-Critical Removal Action in October 2010 with the objective of mitigating ongoing human health exposure to metals-impacted soil and groundwater and preventing potential future releases. Activities conducted as part of the Time-Critical Removal Action included removal of the W&L buildings and residual waste materials, excavation and off-site disposal of contaminated sediment from wetlands south of the former building where the wastewater was historically discharged, and construction of an engineered cover to isolate surficial soils adjacent to Bliss Brook (behind the North Avenue/Paulette Lane residential area) to mitigate future dermal contact risk (see Figure 1-3). Restoration activities were completed in August 2014.

EPA Remedial Program Site Reassessment

During implementation of the Time-Critical Removal Action between October 2010 and 2012, EPA also conducted additional soil, sediment and surface water sampling to further assess the extent of the chromium contamination. The EPA Site Reassessment work (Weston, April 2012) focused on the surface water pathway and included sampling of sediment and surface water in the wetlands between the W&L property and the drainage culvert beneath Deanville Road, and downstream along Bliss Brook as far as south as West Street (approximately 1,800 feet south of the W&L property). Surface and shallow soil samples were also collected from upland areas along these water courses to assess possible floodplain impacts. The results were presented in the Expanded Trip Report (Weston, April 2012) and indicated that chromium impacts from the W&L property exist as far downstream as West Street (Weston, November 2013). It had already been previously documented that chromium impacts are present as far south as the southeastern outlet of Mechanics Pond, nearly a mile downstream of the W&L property (TtNUS, 2005). The results presented in the RI report [in particular Figure 4-16, Sediment Chromium Concentrations (Total and Hexavalent) and Total Chromium Concentration Ranges] confirm that Mechanics Pond sediment is impacted by chromium in both total and hexavalent forms.

In September 2012, EPA completed the Hazardous Ranking System (HRS) evaluation and, with community and State support, the W&L site was proposed to the NPL. The W&L site was added to the Final list of NPL sites on May 21, 2013.

1.3 Physical Characteristics

The geologic, hydrologic, and hydrogeologic characteristics of the site are summarized below. Details are presented in the Remedial Investigation report (AECOM, 2019).

1.3.1 Geologic Setting

The geology in the vicinity of the study area is consistent with a filled wetland area that had developed on glacial outwash after the last glacial period. The geologic units identified are as follows (in descending order from the ground surface):

- Fill: Consists of fine to coarse sand with varying amounts of silt, gravel, cobbles, and boulders. Typically dry and well compacted (medium dense). Fill was observed in all upland boring locations at the surface and varied in thickness from about 3 to 9 feet.

- Recent Wetland Deposits: Consist of silty fine sand that was light grey with mottled orange-brown coloration. This layer was typically found near the elevation of the water table and was moist to wet and soft. This layer is believed to represent the former wetland soils upon which the fill was placed. The recent wetland deposits are not present in all locations, suggesting there were isolated areas that were excavated prior to placement of the fill. The wetland deposits vary in thickness from 0 to nearly 4 feet.

- Organic Silt and Clay: These deposits were found only in the area immediately adjacent to Bliss Brook and are believed to be recent organic deposits that formed in a depression in the glacial outwash deposits (see below) possibly related to a kettle hole. These deposits are saturated and extremely soft, with little to no bearing strength. They vary in thickness from 0 to more than 12 feet along Bliss Brook behind 27 Paulette Lane. Most were removed or buried during the removal action and placement of the engineered cover in this area.

- Fine sand and silt: Found to over lay the glacial outwash deposits and are likely of later stage deposits as the glaciers withdrew from this area. These deposits tend to contain a greater proportion of silt and are not as permeable as the coarser underlying deposits. This layer is sometimes thin or missing, likely due to anthropogenic activities.

- Glacial Outwash Deposits: Consist of very coarse to fine sand with little silt. These deposits are saturated and fairly dense, generally exhibiting an orange-brown color. They represent material deposited during the last glacial period in a fairly high-energy environment in the presence of significant amounts of water, though not far from the glacier based on the relatively angular nature of the particles. The outwash extends to a depth of about 25 to 40 feet depending on the elevation of the ground surface or depth to bedrock.

- Glacial Till: Consists of fine to coarse sand with higher amounts of silt and clay as well as angular gravel and cobbles. The contact between the till and the outwash is not distinct but rather is

transitional and can be difficult to identify. The same can also be true of the transition from till into weathered bedrock at the base. It is likely that the Site is located in an area where the terminus of the glacier advanced and retreated several times, reworking the underlying till. In general, the till is very dense and more grey to red than the overlying outwash and contains larger, more angular gravel. The till varies in thickness from about 10 to 20 feet.

- Bedrock: Consists of grey to grey-black silt/mudstone and greywacke/sandstone with some conglomerate; consistent with the Wamsutta Formation. The bedrock surface slopes gently (2 to 2.5% grade) to the southeast based on drilling refusal depths and bedrock boreholes drilled during the remedial investigation.

1.3.2 Hydrologic Setting

The study area lies within the Ten Mile River watershed, which covers approximately 54 square miles in southeastern Massachusetts and a small area of northeastern Rhode Island. Two major tributaries empty into the Ten Mile River along the way, the Seven Mile River and the Bungay River. The latter originates approximately five miles to the north in the Town of North Attleboro at the outlet of Greenwood Lake. The Bungay River flows south-southwesterly through an extensive wetland system until it joins the Ten Mile River just upstream of Mechanics Pond. Bliss Brook, which receives essentially all the drainage from the W&L property, appears to originate about 1.3 miles to the north of the W&L property, although its uppermost reaches have been significantly affected by the presence of the Exit 5 interchange on Route 95 and by commercial development to the northwest. From its headwaters, the brook flows generally south, passes approximately 500 feet east of the W&L property, and ends in the Bungay River just upstream of its confluence with the Ten Mile River. Just upstream of the W&L property, Bliss Brook flows through a large wetland area that contains a small pond. The watershed of Bliss Brook encompasses only about one square mile or less and is thus a relatively small portion of the Ten Mile River basin.

Surface drainage in the vicinity of the study area is divided by North Avenue. To the west of North Avenue, including the W&L property, surface water flows to the south through a large wetland complex (southern wetland). The primary outlet of this complex is a culvert under Deanville Road that eventually discharges into Bliss Brook near its confluence with the Bungay River. To the east of North Avenue, surface water drains into Bliss Brook.

The City of Attleboro has enacted zoning controls for the purpose of protecting future potential water supplies east of Bliss Brook within an area referred to as the "Bungay River Water Resource Protection District" (Protection District or the "District"). Figure 1-3 shows the northernmost portion of the District, which is in the vicinity of the study area.

Figure 1-5 shows the extent of the 100-year and 500-year floodplains on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map for the City of Attleboro (last revised July 16, 2015). The majority of the Southern Wetland and areas along either side of Bliss Brook are located within the 100-year floodplain. The W&L Property itself is not depicted as within a floodplain.

1.3.3 Hydrogeologic Setting

Groundwater at the study area exists as a water table aquifer under unconfined conditions in the outwash and wetland deposits (where present). The water table is generally encountered at a depth of two to 13 feet below grade. It is deepest in the residential areas adjacent to North Avenue and shallowest in the wetlands south of the W&L property and along Bliss Brook. Shallow groundwater flow is generally to the southeast across the study area toward Bliss Brook and the associated wetlands. Groundwater flow in the deeper overburden is slightly more southerly and is not as strongly influenced by Bliss Brook. The horizontal gradients range from 0.010-0.015 on the W&L property and in the residential neighborhood near Paulette Lane to 0.002-0.003 in the areas closer to Bliss Brook. Vertical gradients measured in well couplets/triplets throughout the study area show variable results that are seasonally affected at many locations. In general, to the east of North Avenue, little or no vertical gradients exist between shallow and deep overburden. Further east, along Bliss Brook, vertical gradients are non-existent to weakly upward along the northern reach of Bliss Brook but are more strongly upward in the southern reach (beyond the Attleboro housing complex called Brookside Apartments). Piezometers installed in Bliss Brook by MassDEP showed that the shallow groundwater discharges into the brook, which agrees with base-flow gauging results from Bliss Brook that show increasing flow as you move downstream (Weston, November 2013). West of North Avenue in the vicinity of the W&L property, gradients seem to be a combination of upward from shallow bedrock to deep overburden and downward from shallow overburden to deep overburden.

Hydraulic conductivity estimates made by Weston (November 2013) of the outwash deposits at the study area range from 1 to 5 feet/day, though the Weston report stated that these values appeared to be very low based on visual inspection of the soil and on pumping rates employed for dewatering during construction activities. Subsequent slug tests estimated the hydraulic conductivity of the outwash deposits near Bliss Brook to range from 20 to 440 feet/day with an average of about 140 feet/day (Weston, November 2013). Slug tests conducted for a Supplemental Phase II Comprehensive Site Assessment Report (Sage, 2016) for a property located northwest of the W&L property on Walton Street suggest that hydraulic conductivities on the W&L property are likely much lower than those along Bliss Brook. Hydraulic conductivity values measured were on the order of 0.5-3.2 feet/day (0.7 feet/day average) in the upper silty sands and 4.4-5.5 feet/day in the lower medium-coarse sands and gravel.

Based on the values reported by Sage and using an effective porosity of 22% for non-uniform sand and gravel (Fetter, 1994), the estimated velocity of groundwater west of North Avenue is about 0.34 feet/day or 124 feet/year. East of North Avenue, using an effective porosity of 30% for well sorted sands (Fetter, 1994) and a K of 140 feet/day (Weston, November 2013), the estimated groundwater velocity is 1.4 feet/day or 511 feet/year. The higher transmissivities (T=Kb, hydraulic conductivity times aquifer thickness) to the east may explain the rather abrupt decrease in the hydraulic gradient that occurs just to the east of North Avenue.

1.4 Sources of Contamination

The 1990 MCP Phase IIA report prepared by W&L's consultant for RTN 4-23 (RCA, 1990) identified nine potential sources of contamination at the W&L property – see Figure 1-2 for approximate locations:

- Original wastewater discharge to wetland area
- Closed surface impoundment area and lagoon
- Former outside TCE storage tank
- Outside drum storage pad
- Roof runoff
- Grinder exhaust area
- Plating room area
- Abandoned dry well
- Former fuel oil USTs

1.4.1 Original Wastewater Discharge to Wetland Area South of Property

The majority of contamination is believed to have occurred prior to 1970 as a result of the direct discharge of wastes to an abutting wetland on the southern side of the property. The untreated wastewater was historically discharged via an underground pipe. Standing water was historically present in this wetland in aerial photos taken prior to 1970. The pipe was abandoned and plugged in 1970, when a wastewater treatment system was constructed.

1.4.2 Closed Surface Impoundment Area and Lagoon

These areas are mostly in the portion of the W&L property now occupied by Walsh Construction Company (a tenant) and are covered by pavement (Figure 1-2). After 1970, treated wastewater was discharged to a storm water trench located on the west side of the building, after flowing through the surface impoundment, the purpose of which was to remove suspended solids remaining in the discharge after chemical treatment. Chrome hydroxide sludge generated by the wastewater treatment process was also discharged to the surface impoundment. The impoundment area and an associated lagoon were capped in place in 1985, after excavation and disposal of sludges off-site at a facility in Canada. The Phase IIA report (RCA, 1990) concluded that these areas were not significant contributors to groundwater contamination. Samples were collected from the bottom of the impoundment/lagoon area after removal of visible sludge and visibly contaminated soil and were analyzed for total chromium, lead, nickel, copper, hexavalent chromium, and VOCs (RCA, 2001). Total chromium and lead concentrations ranged from 150 to 6,900 mg/kg and 230 to 10,500 mg/kg, respectively, and no VOCs were detected (RCA, 2001). Samples for Extraction Procedure Toxicity, however, met the approved closure goal (RCA, 1990).

The soil data from the RI do not indicate the presence of significant soil contamination in this area. The hexavalent chromium groundwater plume does not originate in this area; the source of the plume appears to be in the vicinity of the former plating room area, where the plating tanks and floor trenches were located.

1.4.3 Former Outside TCE Storage Tank

The Phase IIA report states that a number of overflow spills were known to have occurred in the early 1980s. This location was identified as a major source of contamination. This area and the drum storage pad area are possible sources of the TCE groundwater plume mapped during the RI. However, historic subsurface soil sampling that was performed to attempt to locate this area did not find elevated TCE concentrations.

1.4.4 Outside Drum Storage Pad

This pad historically was used to store process chemicals and wastes. Results of the Phase IIA investigation suggested that this area was a potential source of both chlorinated VOCs and chromium.

1.4.5 Roof Runoff

Emissions from plating operations exhausted to the roof of the former plating building, and the roof was noted to be stained with chromium. Runoff from the roof discharged to the ground in several places. Roof runoff samples were found to contain significant concentrations of chromium. Roof runoff is a probable source of the surface soil chromium contamination present on the W&L property.

1.4.6 Grinder Exhaust Area

Exhaust to the roof from the area of the former building where grinding operations were performed was also suspected to be a source of metals contamination to soil, but it was concluded that this exhaust was not likely to be a significant contributor.

1.4.7 Plating Room Area

Concrete floor trenches collected drippings from plating tanks and the liquid was pumped into on-property holding tanks then shipped off site as hazardous waste. Soil and groundwater impacts were detected immediately downgradient of the plating room area (RCA, 2001). The mapping of the hexavalent chromium groundwater plume included in the RI report shows that this area is the primary source of the contamination.

1.4.8 Abandoned Dry Well

This abandoned dry well was reportedly located on the south side of the former building. A former employee stated it had been used for disposal of TCE, but the Phase II investigations did not note chlorinated VOCs in soil near this area (RCA, 1990; 2001), and the dry well itself was not located during these investigations. This area, along with the drum storage pad and former TCE storage tank areas, likely contributes to the observed TCE groundwater plume.

1.4.9 Former Fuel Oil USTs

A total of three fuel oil USTs were present at the W&L property, which have all reportedly been removed. Localized soil and groundwater contamination with petroleum hydrocarbons was detected during the 2001

Phase IIC investigation (RCA, 2001). A release of petroleum to soil was confirmed during removal of one of the tanks and the contaminated soil was removed under RTN 4-11408 in 1995.

Of the above sources, most of those associated with the former building (e.g., former tanks, drum storage pad, roof runoff, and trenches), are no longer present as they were removed by W&L or by EPA and MassDEP removal actions. Residual contamination associated with these sources remains in the subsurface. The original wetland discharge area was partially excavated by the EPA removal action, but contamination remains to the south of the immediate discharge area.

1.5 Nature and Extent of Contamination

The primary contaminant is chromium, present in both trivalent and hexavalent forms in study area surface soil, subsurface soil, sediment, and surface water, with trivalent being more prevalent. In groundwater, the chromium present is almost entirely in the hexavalent form. Figure 1-6 illustrates the extent of total chromium contamination in soil and sediment (excluding Mechanics Pond), with the extent of the hexavalent chromium bedrock groundwater plume overlaid on it. The extents of other contaminants in soil, sediment, and groundwater generally fall within the boundaries of the total chromium contamination as shown on this figure.

1.5.1 Surface and Subsurface Soil

Total chromium impacts in soil extend from the former W&L property itself, south through the Southern Wetland to Deanville Road, to the east of North Avenue as far as Bliss Brook, and south along the brook to its confluence with the Bungay River. In general, total chromium concentrations are higher in wetland soil samples from the Southern Wetland and along the brook than they are in upland soil samples from these same areas. The highest concentrations of total chromium (greater than 5,000 mg/kg) are found in soil located beneath the cover installed by the removal program and in the wetland soil in the southern wetland, based on results from samples collected in November 2010 (before the cover was designed and constructed). Soil in the area of the engineered cover was stabilized using Portland cement because the soil did not have sufficient bearing strength to support the weight of the cover. Some of this stabilized soil was also removed and consolidated on the W&L property for later off-site disposal, as necessary to grade the area to support the cover and also to remove “hot spots” of contamination. Additional sampling of the stabilized soil that underlies the engineered cover was not performed after the soil stabilization and grading/removal work was performed. Since a significant amount of stabilized soil was left in place, the RI and risk assessments are based on the assumption that pre-removal action samples are representative of the stabilized soil beneath the cover.

Along Bliss Brook south of the cover, total chromium concentrations exceed those in reference soil samples, but are less than 1,000 mg/kg with few exceptions. The highest on-property subsurface soil concentrations ranged from 1,000 to 5,000 mg/kg total chromium. The extent of soil contamination with metals other than chromium (e.g., copper, lead, and silver) is similar to that for total chromium, but concentrations are much lower overall, with very few detections greater than 500 mg/kg.

The extent of soil contamination with hexavalent chromium extends from the former W&L property to the south into the Southern Wetland and to the east of North Avenue to the cover installed by the removal program. The soil along the banks of Bliss Brook does not appear to be impacted by hexavalent chromium. Hexavalent chromium was detected in the majority of on-property surface soil and subsurface soil samples at concentrations in the range of 0.2 to 100 mg/kg, but some results exceeded 100 mg/kg. In summary, the extent of hexavalent chromium contamination in soil is smaller than that for total chromium, in that it does not extend downstream along Bliss Brook. Concentrations of hexavalent chromium in soil are also orders of magnitude lower than those for total chromium, indicating that most of the chromium present in the soil is in the trivalent form.

Petroleum releases are documented to have occurred at the W&L property from former USTs and possibly other sources. For this reason, and because total PAHs were considered to be a possible risk driver, total PAH concentrations were calculated for historic and RI surface soil samples, and the total concentrations were compared to the total PAH concentration for reference soil samples calculated in the BERA (4.87 mg/kg, rounded up to 5 mg/kg for simplicity). Results were plotted as three concentration ranges: less than 5 mg/kg, >5 to 25 mg/kg, and >25 mg/kg. Except for samples from the property itself, total PAH concentrations in soil samples exceeded 25 mg/kg in only two instances. Soil samples along Bliss Brook and in the Southern Wetland had total PAH concentrations consistent with reference soil samples, except for one sample along Deanville Road and three samples south of West Street, all of which are a considerable distance from the W&L property. Surface soil and subsurface soil samples collected from the property itself showed elevated total PAH concentrations compared to reference soil samples. Potential sources are historic petroleum releases from former USTs and historic fill. Detections of cVOCs in soil samples were limited to the property itself and the northern portion of the Southern Wetland. The most commonly detected cVOC was TCE, and with few exceptions, it was detected at every location where any cVOCs were detected.

1.5.2 Surface Soil and Fine Fraction Total Lead

Lead was identified as a possible contaminant of concern during initial MCP investigations at the site by W&L's consultant, and lead sulfate was reportedly used at the facility. During earlier RI phases and other historic sampling efforts including the EPA removal action, surface soil samples analyzed for total lead were analyzed in bulk (i.e., the samples were not sieved to create different fractions for analysis). Most of the unsieved surface soil samples with total lead concentrations above 500 mg/kg are located either on the W&L property itself, or in wetland soil of the Southern Wetland, although no clear pattern is evident. It is possible that the source of lead in the wetland soil south of the property is from former W&L facility operations, and that upland soil bordering the wetland area became contaminated with lead also due to flooding. Other contributing factors are likely, such as road runoff, historic fill, and lead paint.

Phase 5 surface soil sampling was performed in December 2017 and involved the collection of additional samples to evaluate human health risk due to lead in surface soil using current EPA guidance. This guidance involves analysis of the less than 150 µm fraction (fine fraction) for total lead, and potentially IVBA lead.

Both of these analyses were performed on all of the Phase 5 surface soil samples, and Figure 1-13 presents the fine fraction total lead results. Concentrations of fine fraction total lead are generally greater than 200 mg/kg, and are also generally greater in wetland soil samples (indicated by red symbols on Figure 1-13) than in upland soil samples (indicated by green symbols).

Table 1-1 presents the fine fraction total lead and extractable lead results and IVBA lead results from December 2017, along with bulk (not sieved) results for total lead and total chromium for the same sample locations. Results for total lead and total chromium in unsieved samples are also compared to their respective reasonable maximum exposure (RME) concentrations as found in soil samples from reference areas. There appears to be a weak correlation between elevated total lead and elevated total chromium concentrations. Nearly all samples with elevated total lead also have elevated total chromium. However, there are a significant number of samples where the total chromium concentration is elevated but the total lead concentration is consistent with background. Therefore, an elevated total chromium concentration is not necessarily indicative of a higher total lead concentration.

After evaluation of the December 2017 data, EPA determined that additional sampling for fine fraction lead should be performed for residential (upland) soil west of North Avenue to refine the extent and to provide a sufficient number of samples on each individual property so that risk could be evaluated on a property-by-property basis. Samples were located within the FEMA AE flood zone (1% annual chance of flooding) but outside of the Southern Wetland to characterize upland soil subject to flooding, as this is the mechanism by which it is believed that site-related contamination would have been deposited. This second round of fine fraction lead sampling was performed in November 2018. The results are presented on Figure 1-13. The figure also includes the previous (December 2017) results from west of North Avenue. Table 1-2 presents the fine fraction lead and bulk (unsieved sample) total lead and total chromium results for the November 2018 sampling event, along with earlier (December 2017) results for the same properties. As with the December 2017 data, there appears to be only a weak correlation between elevated levels of lead (bulk and fine fraction) and elevated levels of chromium.

The type of soil represented by the sample (residential [either in the floodplain or above it] or wetland soil) is also included in Table 1-2. Samples used for the lead risk evaluation are those of residential soil within the floodplain, as these samples represent the part of each property likely to have been impacted by flooding from the wetland and also represent residential exposure. Two soil samples within the floodplain (10-DE-10 and 28-NO-01) appear to be outliers (inconsistent with other nearby results), and the soil in these locations may be impacted by other sources. Sample 28-NO-01 is close to the road and where the property owner currently parks recreational vehicles. Sample 10-DE-10 is in the rear of the lot in an area that appears to have been a disturbed area, based on examination of historic aerial photos from before the home was built. Unlike the other properties north of Deanville Road, it appears that the lead on these two properties is localized to two areas (one on each lot) rather than being present throughout the floodplain. A technical memorandum that discusses all of the fine fraction lead results from west of North Avenue and includes a risk evaluation for each property is presented in Appendix G.

1.5.3 Sediment

The extent of sediment contamination with total chromium extends from the property through the Southern Wetland, to Bliss Brook from the section just east of the removal program cover downstream to its confluence with the Bungay River, and into Mechanics Pond. Virtually all sediment samples from these areas had total chromium concentrations greater than those found in the reference sediment samples.

The highest total chromium concentrations (greater than 5,000 mg/kg) in sediment are found in the Southern Wetland. The presence of elevated total chromium in this sediment is consistent with the fact that chromium-containing wastewater was directly discharged to the wetland prior to 1970. Chromium-contaminated surface soil also was likely transported by overland flow from the property itself to depositional areas in the Southern Wetland. Along Bliss Brook and in Mechanics Pond, the majority of sediment samples showed total chromium concentrations in the range of 23 to 1,000 mg/kg.

The extent of sediment contamination with hexavalent chromium is similar to that for total chromium, but concentrations are much lower. Detections exist in numerous samples as far south as the southern end of Mechanics Pond (SD-312), and there is no apparent correlation with respect to distance from the W&L property itself or the concentration of total chromium detected at the same location.

Sediment contamination with lead and silver is evident in the Southern Wetland, and mirrors the extent of total chromium contamination. In contrast, sediment samples from Bliss Brook do not show evidence of lead or silver contamination above the concentrations of these analytes detected in reference sediment samples. In Mechanics Pond however, there are some detections of these metals in sediment samples at levels above reference concentrations. Transport of lead and silver contamination from the Southern Wetland to the pond via overland flow or the stormwater drainage system is possible, as is the possibility of other sources impacting the Ten Mile River and the pond. Concentrations of copper in sediment samples exceed 1,000 mg/kg in multiple samples from Mechanics Pond, but are not significantly elevated in the Southern Wetland, with only one sample exceeding this value. This suggests that there may be another source of the copper contamination in Mechanics Pond sediment. Similarly, concentrations of total PAHs in Mechanics Pond and the Bungay River are generally higher than those in Southern Wetland sediment samples, suggesting that other sources are more significant contributors.

1.5.4 Groundwater

Hexavalent chromium contamination in the overburden extends east and south of the W&L property crossing under North Avenue, Paulette Lane, and eventually extending out to Bliss Brook and nearly as far as Payson Street. Migration under Bliss Brook occurs in the deep overburden and in the bedrock. The shallow overburden flow is discharging to Bliss Brook. Phase 5 of the RI included installing and sampling additional piezometers along Bliss Brook to attempt to define the extent of hexavalent chromium discharge to the brook. The results show elevated hexavalent chromium concentrations in shallow groundwater immediately west of or under the brook at PZ-10, PZ-13, and PZ-14 (Figure 1-14), demonstrating that the plume is discharging to the brook in this area.

Hexavalent chromium in bedrock appears to take a similar flow pattern as in the overburden, though with a notable extension under Bliss Brook. Although only one bedrock well exists east of Bliss Brook, the hexavalent chromium in the well indicates that the plume has traveled in bedrock under Bliss Brook. See Figure 1-8 and 1-9 for figures depicting hexavalent chromium concentrations in overburden and bedrock groundwater. The downgradient extent of hexavalent chromium in bedrock has not been defined and may potentially extend beneath a portion of the Bungay River Water Resource Protection District, which is depicted on Figure 1-3. Additional bedrock monitoring wells will need to be installed to determine if this District is impacted.

TCE in overburden (see Figure 1-10) has been detected off-property across North Avenue from the W&L property. In the overburden, the TCE plume is not as wide as the hexavalent chromium plume and does not cross under any part of Hayward Field or Paulette Lane to the northeast side of the plume. The plume does extend, however, further southwest and west of North Avenue. The overburden plume extends as far as Bliss Brook, but there is no evidence that it extends beyond the brook to any significant degree in the overburden.

Although the TCE concentrations are not as high in the bedrock (see Figure 1-11) as in the overburden, the width of the plume is wider than in the overburden, extending slightly further northeast under the corner of Hayward Field and part of Paulette Lane. The eastern most extent also appears to have traveled further under Bliss Brook, but not very significantly.

Other contaminants of note in groundwater include 1,1,1-TCA and 1,4-dioxane, which is likely associated with 1,1,1-TCA. The distribution of the two contaminants is similar, in that higher concentrations of 1,4-dioxane seem to correspond with higher concentrations of 1,1,1-TCA. The spread of 1,4-dioxane, due to its non-reactive nature and being readily soluble in water, tends to be greater than that of 1,1,1-TCA. Overall, the extent to which 1,4-dioxane is found matches that of hexavalent chromium; however, the concentrations are significantly lower.

Total (unfiltered) lead in groundwater exceeds the Safe Drinking Water Act (SDWA) action level of 15 micrograms per liter (µg/L) in three monitoring wells. However, dissolved lead results from these wells were all less than 15 µg/L except for one dissolved lead result for a monitoring well collected in August 2014, corresponding to the highest total lead result. The elevated detections of total lead in these three monitoring wells may be related to suspended particulates in the samples, rather than to dissolved lead concentrations. One monitoring well is located within the mapped hexavalent chromium plume migrating from the W&L property. This monitoring well is downgradient of the location with the highest soil concentration of lead. This monitoring well (AE-09S) was destroyed sometime between Phase 2 (October 2014) and Phase 3 (September 2015).

1.5.5 Surface Water

Total chromium and hexavalent chromium concentrations detected in surface water samples from Bliss Brook are presented in Table C-6 in Appendix C. Other contaminants were detected in surface water

samples from the brook and other locations, but hexavalent chromium is the most significant, and is clearly related to discharge of the hexavalent chromium groundwater plume to the brook. For the Phase 1 (summer 2014) samples, hexavalent chromium is first detected within the brook across from the southern end of the cover. Concentrations of hexavalent chromium rise to the 200 µg/L level for the next three locations moving downstream (SD-210, SD-211, and SD-212), indicative of the fact that the shallow groundwater hexavalent chromium plume is discharging to this area. Results were similar for the Phase 2 (fall 2014) samples, except that hexavalent chromium impacts were observed further downstream. Figure 1-7 plots the fall 2014 hexavalent chromium results. Surface water toxicity testing results showed a significant effect on survival and reproduction for some locations (SD-210 and SD-212), which is attributed to the hexavalent chromium concentrations observed in these locations.

1.6 Contaminant Fate and Transport

Hexavalent chromium [commonly abbreviated as Cr+6 or Cr(VI)] is the predominant contaminant in groundwater and has migrated to a large extent with the groundwater due to its high mobility in this medium. Hexavalent chromium is also found in surface water along a stretch of Bliss Brook where the groundwater contaminant plume discharges to it. It is also found in soil and sediment on-property and in the Southern Wetland, consistent with the conceptual site model that it was directly discharged to the Southern Wetland and also leaked from various on-site sources (see Section 1.4). Finally, it is found in saturated soil between the W&L property (the source area) and at least as far downgradient as Bliss Brook, due to the presence of hexavalent chromium-contaminated groundwater migrating from the source area towards the brook and either discharging to it or migrating under it. Hexavalent chromium is present to a much lesser extent in Bliss Brook sediments and sediments in Mechanics Pond, most likely because it is reduced to trivalent chromium in the sediments due to the presence of sulfides and organic matter acting as reducing agents.

Under certain conditions the hexavalent chromium will be reduced to the trivalent form. The reduction of hexavalent chromium to trivalent chromium is an important process because the trivalent form is both less toxic and under most conditions less mobile. Natural conditions that favor reduction of hexavalent chromium include the presence of organic carbon in soil and groundwater. This natural reductive capacity can be a key factor in limiting the spread of hexavalent chromium and in the gradual natural attenuation of hexavalent chromium. In the case of the Walton & Lonsbury site, the natural reductive capacity of the soil and groundwater may have been overwhelmed by the introduction of hexavalent chromium in some areas. With removal of the sources of hexavalent chromium a gradual restoration of the natural reductive capacity in soil and overburden groundwater is possible.

Trivalent chromium [commonly abbreviated as Cr+3 or Cr (III)] is prevalent in soil and sediment on the property, within the Southern Wetland, and east of North Avenue, along Bliss Brook, and in Mechanics Pond. In general, for off-property soil sample locations, concentrations are higher in wetland soil than in upland soil, consistent with the conceptual site model that overland flow dispersed chromium contamination from the original release areas (the W&L property and Southern Wetland) to Bliss Brook and

Mechanics Pond. As with hexavalent chromium, concentrations in surface soil are elevated east of North Avenue due to transport via groundwater. At the cover location near Bliss Brook, the concentrations of trivalent chromium in soil are higher than hexavalent chromium which indicates reduction of chromium. In groundwater, very little trivalent chromium is present, as evidenced by the fact that for both total (unfiltered) and dissolved (field-filtered) groundwater samples, total chromium and hexavalent chromium concentrations are roughly equal.

Chlorinated VOCs (TCE; 1,1,1-TCA, and their daughter products) were detected to a limited extent in soil, but are present in both overburden and bedrock groundwater, forming a plume that is of a generally smaller lateral and vertical extent than the hexavalent chromium plume, the source of which appears somewhat south of the hexavalent chromium source area. Maps of the plume are included as Figure 1-8 through 1-11 for hexavalent chromium and TCE in overburden and bedrock. The cVOCs plume is attenuated compared to the chromium plume due to mechanisms such as biodegradation (as evidenced by the presence of daughter products), adsorption to soil particles, and volatilization into soil gas. Homes overlying the cVOCs plume show evidence of vapor intrusion, based on the fact that the cVOCs found in groundwater are also detected in sub-slab soil gas samples and indoor air samples.

1,4-Dioxane is present in groundwater in low concentrations, with an approximate extent similar to that of the hexavalent chromium contamination. Similar to hexavalent chromium, its high water solubility and mobility and low biodegradability cause it to migrate quickly in groundwater. Because 1,4-dioxane is used as a stabilizer in 1,1,1-TCA, the spills/releases of 1,1,1-TCA to the property may be a source of 1,4-dioxane.

Metals other than chromium and lead are present in soil and sediment on the property and in the Southern Wetland, although concentrations are much lower than that for chromium. The sources are not known but it is known that lead and copper were used at the facility, and silver plating may also have been practiced, based on the high levels of silver found in Southern Wetland sediment that are co-incident with elevated chromium concentrations.

Lead. Surface soil samples with total bulk (unsieved) lead concentrations above 500 mg/kg (above the residential screening value of 200 mg/kg) are located either on the property itself, or in wetland soil of the Southern Wetland, although no clear pattern is evident. Few soil samples east of North Avenue (e.g., under the engineered cover) show substantially elevated lead concentrations, indicating that unlike chromium, lead has not migrated to this area via groundwater.

Because of the presence of total (unsieved) lead concentrations greater than 200 mg/kg on residential properties, fine fraction (< 150 µm) surface soil samples were collected and analyzed for total lead. Concentrations of fine fraction total lead are generally greater than 200 mg/kg for residential properties west of North Avenue that border the Southern Wetland, and are also generally greater in wetland soil samples than in upland soil samples.

There is no clear correlation of higher unsieved or fine fraction total lead results with elevated total chromium results in the same samples, but there does appear to be some association, suggesting that releases from the W&L facility may be the source of at least a portion of the fine fraction lead. It is possible that the source of lead in the wetland soil south of the property is the former W&L facility operations, and that upland soil bordering the wetland area became contaminated with lead also due to flooding. Other contributing factors are likely, such as road runoff, historic fill, and lead paint. Sediment lead concentrations show a greater likelihood of association with former W&L facility activities, because elevated concentrations are clustered in the Southern Wetland.

For unsieved samples, metals other than chromium do not appear to be significantly above reference sample concentrations for soil and sediment along Bliss Brook. This indicates that, in contrast to hexavalent chromium, other metals are not being transported to Bliss Brook via the groundwater migration pathway. Other metals are found in Mechanics Pond sediments at concentrations well above those found in reference sediment samples. In part, these metals may have been transported from the property and Southern Wetland via migration through storm water discharge from the Southern Wetland, but other sources along the Ten Mile River and the pond itself are also likely.

PAHs are present in on-property soil and in some off-property soil samples at concentrations in excess of those found in reference soil samples, but the extent is much more limited than for chromium. The source of the PAHs in on-property soil may be from historic petroleum releases as well as the presence of historic fill. PAH concentrations in soil samples collected along Bliss Brook were mostly consistent with reference soil sample concentrations. Similarly, concentrations of PAHs in sediment samples from Bliss Brook were similar to or lower than those in reference sediment samples. PAH contamination in off-property samples is not clearly associated with the property, and other sources are likely.

1.7 Baseline Risk Assessment Summary

The draft final baseline human health risk assessment (HHRA) and baseline ecological risk assessment (ERA) were both completed in May 2019. A summary of each is presented below. A separate technical memo was issued and is included (Appendix G) for the lead evaluation, as this evaluation was done primarily for FS purposes (to evaluate extent on a property-by-property basis for alternative development purposes).

1.7.1 Summary of Human Health Risk Assessment

The primary objective of the baseline HHRA is to evaluate whether chemicals detected in site soils, sediment, surface water, groundwater, and indoor air attributable to past operations, have impacted the environment at concentrations that may pose an incremental lifetime cancer risk (ILCR) or non-cancer hazard (defined by a hazard index [HI]) to human health above EPA target levels. The HHRA resulted in multiple potentially unacceptable risk scenarios.

Overall summaries of cancer risk and non-cancer hazard estimates for each of the evaluated scenarios and pathways and for each exposure point are presented in the final HHRA (AECOM, May 2019), Tables 9.1

through 9.35. Contaminants contributing to total receptor ILCRs and HIs in excess of 10^{-4} and 1, respectively, are presented in HHRA Tables 10.1 through 10.5. Risks are summarized for both the Reasonable Maximum Exposure (RME) and Central Tendency Exposure (CTE) receptors. When risks were estimated for a child and adult receptor, the child HIs are presented as the most conservative, while ILCRs are the sum of the child and adult risks (i.e., a total receptor cancer risk). The risks presented by exposure point have been summed together, as appropriate, under the assumption that each receptor is exposed to applicable media during activities.

When a receptor-specific HI for an exposure medium exceeded 1, HIs were segregated by target organ and discussed as to whether target organ-specific HIs exceed the risk management criterion. Estimated ILCRs were compared to the EPA target risk range of 10^{-6} to 10^{-4}. Risks were not summed across the exposure points since the parameter values used assume maximal exposures within each exposure point. This approach assumes that an individual would not be maximally exposed to media at more than one exposure point.

The following sections summarize the cancer and non-cancer risk contributors (HI >1, ILCR >10^{-6}) for the evaluated pathways and media for each of the exposure points for the RME and CTE scenarios. The conclusions of the lead evaluation (based on unsieved soil sample results) and the qualitative evaluations performed for covered soils at the Residential Yards East of North Avenue exposure point and the future vapor intrusion pathway on the W&L Property are also summarized.

Reasonable Maximum Exposure Risk and Hazard

The media for which RME exposures for one or more pathways were within or below EPA's target risk range for carcinogens (ILCR of 10^{-6} to 10^{-4}) and risk criterion for non-carcinogens (HI of 1) are summarized below by exposure point.

- Current and future residents exposed to site-related VOCs in indoor air at the eleven buildings along Paulette Lane and North Avenue evaluated for the vapor intrusion pathway;
- Current and future residents exposed to floodplain soil at the Residential Yards West of North Avenue and Residential Yards East of North Avenue exposure points;
- Current and future recreational users exposed to wetland/floodplain soil, sediment, and surface water at the Southern Wetland exposure point;
- Current and future recreational users exposed to sediment and surface water at the Bungay River/Mechanics Pond and Downstream of Mechanics Pond exposure points;
- Current and future recreational users exposed to wetland/floodplain soil and sediment at the Bliss Brook exposure point;
- Future commercial workers exposed to upland/floodplain surface soil and surface/subsurface soil at the W&L Property;
- Future construction workers exposed to upland/floodplain surface/subsurface soil at the W&L Property; and

- Future construction workers exposed to shallow groundwater at the Off-Property Areas.

The media for which RME exposures for one or more pathways exceeded EPA's target risk range for carcinogens (ICLR of 10^{-6} to 10^{-4}) and/or risk criterion for non-carcinogens (HI of 1) are summarized below, with the risk-contributing contaminant(s) by exposure point:

- Current and future recreational users exposed to surface water at the Bliss Brook exposure point, due to hexavalent chromium;
- Future residents exposed to upland/floodplain surface soil at the W&L Property, due to benzo(a)pyrene, benzo(b)fluoranthene, antimony, arsenic, hexavalent chromium, and thallium;
- Future residents exposed to upland/floodplain surface/subsurface soil at the W&L Property, due to benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, antimony, arsenic, hexavalent chromium, and cobalt;
- Future construction workers exposed to shallow groundwater at the W&L Property, due to hexavalent chromium; and
- Future residents exposed to Site-Wide groundwater as tap water, due to 1,1-dichloroethane, cis-1,2-dichloroethene, trichloroethene, vinyl chloride, 1,4-dioxane, arsenic, hexavalent chromium, cobalt, and manganese.

Central Tendency Exposure Risk and Hazard

The media for which CTE exposures for one or more pathways were within or below EPA's target risk range for carcinogens (ILCR of 10^{-6} to 10^{-4}) and risk criterion for non-carcinogens (HI of 1) are summarized below by exposure point.

- Current and future residents exposed to site-related VOCs in indoor air at the eleven buildings along Paulette Lane and North Avenue evaluated for the vapor intrusion pathway;
- Current and future residents exposed to floodplain soil at the Residential Yards West of North Avenue and Residential Yards East of North Avenue exposure points;
- Current and future recreational users exposed to wetland/floodplain soil, sediment, and surface water at the Southern Wetland and Bliss Brook exposure points;
- Current and future recreational users exposed to sediment and surface water at the Bungay River/Mechanics Pond and Downstream of Mechanics Pond exposure points;
- Future commercial workers exposed to upland/floodplain surface soil and surface/subsurface soil at the W&L Property;
- Future construction workers exposed to upland/floodplain surface/subsurface soil and shallow groundwater at the W&L Property; and
- Future construction workers exposed to shallow groundwater at the Off-Property Areas.

The media for which CTE exposures for one or more pathways exceeded EPA's target risk range for carcinogens (ILCR of 10^{-6} to 10^{-4}) and/or risk criterion for non-carcinogens (HI of 1) are summarized below. The risk-contributing contaminant(s) are also summarized below by exposure point:

- Future residents exposed to upland/floodplain surface soil at the W&L Property, due to antimony;
- Future residents exposed to upland/floodplain surface/subsurface soil at the W&L Property, due to cobalt; and
- Future residents exposed to Site-Wide groundwater as tap water, due to 1,1-dichloroethane, cis-1,2-dichloroethene, trichloroethene, vinyl chloride, 1,4-dioxane, arsenic, and hexavalent chromium.

Lead Evaluation Summary (based on unsieved soil sample results and groundwater results)

Lead was selected as a Chemical of Potential Concern (COPC) for soil and sediment at various exposure points. Childhood lead exposures were evaluated through use of the Integrated Exposure Uptake Biokinetic (IEUBK) model (USEPA, 1994; 2007); adult lead exposures were evaluated using the methodology provided by EPA (2003; 2009, 2017). For future adult commercial and construction-related exposures to soil on the W&L Property, the Adult Lead Model (ALM) predicts that exposure of workers to lead in surface and surface/subsurface soil on the W&L Property will result in less than 5 percent of fetal blood lead levels greater than the target of 5 micrograms per deciliter (µg/dL). Likewise, assumed childhood lead exposures to surface soil at the Residential Yards East of North Avenue and the W&L Property exposure points and wetland/floodplain soil and/or sediment at the Southern Wetland, Bliss Brook, Bungay River/Mechanics Pond, and Downstream of Mechanics Pond exposure points were not estimated to result in childhood blood lead levels exceeding the goal of 5 µg/dL. However, surface soil at the Residential Yards West of North Avenue and surface/subsurface soil at the W&L Property have a greater than 5 percent probability that children exposed will have a blood lead level that exceeds the target blood lead level of concern (5 µg/dL). The percent probabilities that the target blood lead level of concern will be exceeded are approximately 9.3 percent for Residential Yards West of North Avenue surface soil and approximately 6.1 percent for W&L Property surface/subsurface soil.

Total lead exceeded the SDWA action level of 15 µg/L in three monitoring wells. Dissolved lead results for these wells were all less than 15 µg/L except for the dissolved lead result for one monitoring well collected in August 2014, corresponding to the total lead result. That monitoring well was sampled twice more, in December 2014 and September 2015, with lower total lead results (still exceeding 15 µg/L) but dissolved lead results less than 15 µg/L. Therefore, the elevated detections of total lead in these three monitoring wells may be related to suspended particulates in the sample, rather than to dissolved lead concentrations. Of these three monitoring wells, only one (AE-09S) is located within the mapped hexavalent chromium plume migrating from the W&L Property. This monitoring well is downgradient of the location with the highest soil concentration of lead, and was destroyed sometime between December 2014 and September 2015; therefore it is not available for additional monitoring. Because the SDWA action level is exceeded,

lead in groundwater is assumed to pose an unacceptable future drinking water risk even though lead was not evaluated in the risk assessment through modeling. However, because the Groundwater Use and Value Determination developed by MassDEP determined that groundwater in the vicinity of the W&L property is unlikely to be utilized as a source of drinking water, the FS is assuming that additional sampling and possible remedial action for lead in groundwater to meet the SDWA action level will not be needed (MassDEP, 2018).

Summary of Qualitative Evaluations

A qualitative evaluation of covered soils at the Residential Yards East of North Avenue exposure point indicates that hexavalent chromium concentrations beneath the existing engineered cover would be associated with an ILCR greater than the upper bound of the target risk range (10^{-4}) if the engineered cover was disturbed and soils beneath the engineered cover were contacted.

A screening-level evaluation has been performed of soil and shallow groundwater VOC concentrations to identify those areas of the W&L property where a future vapor intrusion evaluation is warranted, should an occupied building be constructed. Based on concentrations of VOCs in shallow groundwater to the south of the former building foundation and detections of soil VOCs within and to the south of the former building footprint, it is concluded that an unacceptable future risk via the vapor intrusion pathway is possible if buildings are constructed on the W&L property in the future.

TCE and chloroform were not found at significant concentrations for residential exposure in any indoor air samples, but sub-slab soil gas concentrations of these compounds beneath Buildings M and N are above EPA soil gas screening levels (EPA, 2018) for residential properties, with the sub-slab soil gas concentrations of TCE beneath Building M being the most elevated. The presence of elevated concentrations of VOCs, in particular TCE, in sub-slab soil gas beneath Building M and N indicates a potential for future vapor intrusion to occur if building conditions were to change in such a way as to increase vapor intrusion potential (e.g., development of cracks in the floor slab, changes in the HVAC system).

Although the sub-slab soil gas and indoor air of Buildings I, J, and K were not sampled due to the presence of sub-slab vapor mitigation systems, a potential future indoor air risk may exist at these buildings if the systems were shut off. Shallow groundwater concentrations of TCE within 100 feet of these buildings exceed EPA's groundwater vapor intrusion screening levels, indicating potential impacts to indoor air that could pose a risk if the systems failed to operate.

1.7.2 Summary of Ecological Risk Assessment

A Baseline Ecological Risk Assessment (BERA) was performed to evaluate the risk to ecological receptors potentially affected by the site. Chemicals originally identified as potentially site-related contaminants released to the environment included metals (primarily total chromium, hexavalent chromium, and lead), cVOCs, and PAHs.

Three exposure areas (EA) within the areas of investigation were utilized for the purposes of the BERA based on habitat types, contaminant fate and transport pathways, and hydrogeology. These exposure areas are:

- W&L Property & Southern Wetland;
- Bliss Brook; and
- Mechanics Pond (including a short segment of Bungay River).

In addition, sample locations were identified to represent background or reference locations for each habitat and media type (surface water, sediment, and soil).

The potential receptors evaluated in the BERA included: 1) aquatic receptors (e.g., invertebrates, fish, and amphibians) living in the affected waterways; 2) benthic invertebrates in affected sediments; 3) invertebrates and plants exposed to soils affected by site contaminants; and 4) wildlife receptors (birds and mammals) exposed via the food chain to site-related contamination in the sediments or soils.

Data to support the analyses in the BERA were collected in RI Phases 1, 2 and 3, during 2014 and 2015, and RI Phase 4 (soil toxicity testing) in October 2016. In addition, selected historical data were added to the data set for soil and sediment. In support of the BERA, RI Phase 3 data included additional surface water and sediment sample collection, surface water and sediment toxicity testing, Simultaneously Extracted Metals (SEM), Acid Volatile Sulfides (AVS), and Total Organic Carbon (TOC) analyses on sediment samples, and porewater collection and analysis. RI Phase 4 data included collection of upland and wetland soil samples from the W&L Property & Southern Wetland EA and the Bliss Brook EA, for the purpose of toxicity testing and chemical analyses. The toxicity testing included earthworm survival tests, earthworm bioaccumulation tests, and seedling germination and growth tests.

The Hazard Quotient (HQ) is used to identify the COPCs most responsible for risk. The HQ method compares measured or estimated exposures to corresponding toxicity values. During risk characterization, all HQ-derived risks for each exposure area were compared to their corresponding risk at the reference areas by calculating a Residual Risk value (RR). The RR was obtained by subtracting the reference risk from the site risk. This approach allowed for a more thorough and accurate assessment of site-related impacts by factoring in reference COPC levels.

Aquatic Receptors

The potential for ecological risk to aquatic invertebrate (zooplankton), amphibian and fish populations exposed to surface water in each EA was assessed using two measurement endpoints. These included comparisons of surface water concentrations to surface water quality benchmarks and evaluation of surface water toxicity testing results.

The preponderance of the evidence indicated potential for severe ecological impairment to the aquatic invertebrates as well as potentially severe effects on amphibians and the fish community in Bliss Brook due to exposure to hexavalent chromium and potentially chronic effects of trivalent chromium. The evaluation

of endpoints for surface water indicated no significant risk to aquatic invertebrates, amphibians, or fish due exposure to surface water in the W&L Property & Southern Wetland and Mechanics Pond EAs. The reliability of this conclusion is high because it is based on multiple lines of evidence, including laboratory toxicity testing.

Benthic Invertebrates

The potential for ecological risk to the benthic community exposed to site-related contamination was assessed in all of the aquatic habitats using four measurement endpoints. These included comparison of sediment concentrations to sediment benchmarks, comparison of porewater concentrations to surface water benchmarks, evaluation of sediment toxicity testing results, and evaluation of bioavailability using SEM, AVS, and TOC evaluations of sediment.

The evidence indicated a low risk to benthic invertebrate communities based on toxicity testing, and no association of this risk related to elevated chromium concentrations in most of the sediments in Bliss Brook and W&L Property & Southern Wetland EAs. SEM, AVS, and TOC and porewater data indicated that any observed sediment toxicity measured is unlikely to be associated with divalent metals or chromium measured in sediments. In Mechanics Pond, one sediment sample collected in the deeper water at the southern end of the pond (SD-312) showed the highest toxicity to sediment invertebrates. A sheen was observed upon extraction of this sample and a gelatinous, hair-like substance was also present. The cause of toxicity in this sample is uncertain, but may be related to PAHs or pesticides in the sediment. In all other sediment locations, toxicity was low, even at high total chromium levels.

Soil Invertebrates and Plants

Risk from the direct exposure of upland and wetland plants and invertebrates to surface soils was assessed via two measurement endpoints. One end point was the comparison of bulk soil concentrations to soil benchmarks (mainly no-observed-effects concentrations). The second endpoint was to further evaluate the toxicity of site soils on invertebrate and plant receptors in laboratory toxicity tests.

Risk from direct exposure to soils was identified in Bliss Brook for antimony, chromium, selenium, and silver. The magnitude of the RR Hazard Quotients (HQs) for selenium and silver was low; the magnitude for RR HQs for chromium was high for both plants and invertebrates due to the high exposure point concentrations (EPCs) for trivalent chromium calculated for soil. Risk to plants and invertebrates exposed directly to soil in the W&L Property & Southern Wetland EA, based on comparisons to benchmarks, was identified primarily due to antimony, chromium, and silver, with high RR HQ values calculated for chromium.

Results of laboratory toxicity testing, however, indicated that site soils had no effect on the survival of soil invertebrates and no significant effects on the germination or survival of plants. The toxicity testing endpoints indicated a reduction in growth of plants on site soils as compared to laboratory controls, with no association of this risk related to elevated chromium concentrations.

Wildlife Receptors

The potential for ecological risk to piscivorous birds feeding in the three EA waterways was assessed using one endpoint. A food chain model was used to estimate the COPC concentration in fish tissue and to calculate daily doses to great blue heron for comparison to avian Toxicity Reference Values (TRVs).

The heron model results indicated possible risk to piscivorous birds feeding in the W&L Property & Southern Wetland EA, above risk levels at reference locations. The risk to piscivorous birds is related to elevated concentrations of chromium in sediments of the Southern Wetland. However, confidence in this conclusion is low.

The potential for ecological risk to insectivorous birds and mammals feeding in W&L Property & Southern Wetland and Bliss Brook EAs was assessed using one endpoint (food chain modeling). Earthworm bioaccumulation test results on site soils were used to estimate the COPC concentrations in invertebrate tissue and then to calculate daily doses to American robin and short-tailed shrew for comparison to wildlife TRVs. Risks to wildlife receptors in the Bliss Brook EA are not expected based on the evaluation of the average EPCs and the Lowest Observed Adverse Effect Levels (LOAELs) in the food chain model. Low risk was identified to short-tailed shrew and to American robin for soil exposures to trivalent chromium in the W&L Property & Southern Wetland EA. Refinement of the modeling assumptions results in the conclusion of negligible risk to receptors obtaining less than 50% of their daily food intake from the wetland soils in site areas within the W&L Property & Southern Wetland. These risks are not likely to represent significant ecological risks to wildlife populations.

The potential for ecological risk to herbivorous birds and mammals feeding in the W&L Property & Southern Wetland and Bliss Brook EAs was assessed using one endpoint (food chain modeling). Food chain models were used to estimate the COPC concentrations in plant tissue, to calculate daily doses to meadow vole and bobwhite quail for comparison to wildlife TRVs. Risks to wildlife receptors in the Bliss Brook EA are not expected based on the evaluation of the average EPCs and the LOAELs in the food chain model. Low risk was identified to bobwhite quail due to exposures to chromium in soil in the W&L Property & Southern Wetland EA. Refinement of the modeling assumptions results in the conclusion of negligible risk to receptors obtaining less than 50% of their daily food intake from the wetland soils in site areas within the W&L Property & Southern Wetland. These risks are not likely to represent a significant ecological risk to wildlife populations.

1.7.3 Supplemental Evaluations Following Risk Assessments

Homes with Existing Sub-Slab Depressurization Systems

While several residential buildings along Paulette Lane and North Avenue were evaluated for the vapor intrusion pathway as part of the HHRA, using indoor air data collected by EPA, three residences (65, 69, and

73 North Avenue) were not included in that evaluation due to the presence of existing SSDSs. The homes at 65 and 73 North Avenue (referred to as Buildings I and K) have existing radon mitigation systems that were installed by the homeowners prior to EPA's involvement. The home at 69 North Avenue (Building J) has an SSDS that was installed by MassDEP in December 2009. The locations of the homes where indoor air sampling was conducted in 2015-2016 and the three homes with existing SSDSs (Buildings I, J, and K) are shown on Figure 1-12.

A review of TCE data for shallow groundwater in monitoring wells in proximity to these residences was conducted to assess whether the groundwater data support the need to maintain the existing mitigation systems as part of the proposed remedial alternatives. Current EPA residential groundwater vapor intrusion screening levels (VISLs) for TCE are 0.52 µg/L (based on target HQ=0.1) and 1.2 µg/L (based on target cancer risk of 1E-06), as obtained from EPA's VISL online calculator (May 2018 version; https://epa-visl.ornl.gov/cgi-bin/visl_search). As shown on Figure 1-12, TCE detections of 47 µg/L, 70 µg/L, and 51 µg/L for MW-102S, MW-102D, and MW-15, respectively, exceed VISLs. These monitoring wells are located in proximity to the homes at 65 and 69 North Avenue. Also, the 5 µg/L TCE overburden groundwater contour shown on Figure 1-12 overlies the corner of the 73 North Avenue home, so it is likely that shallow overburden groundwater beneath or in close proximity to that home exceeds the groundwater VISLs for TCE. In conclusion, the available groundwater data for TCE support the need to include maintaining the SSDSs as part of the proposed remedial alternatives, until such time as future data show that they are no longer needed. Future data collection would involve monitoring of the groundwater plume near/under the homes and comparison of results to groundwater VISLs over time, or possibly the temporary shut down of the SSDSs followed by indoor air sampling to determine if the potential for risk due to vapor intrusion continues to be present.

Buildings with no SSDS in Place and No Current Actionable Risk from Exposure to Indoor Air

Similar to those homes with SSDS in place, existing buildings for which groundwater and/or sub-slab soil gas VISLs are exceeded based on RI data may need to be monitored in the future to continue to demonstrate that there is no actionable risk from exposure to indoor air contaminants resulting from vapor intrusion. This situation applies to buildings M and N, where sub-slab soil gas concentrations of TCE and chloroform as measured for the RI are greater than EPA soil gas VISLs for residential properties, with the sub-slab soil gas concentrations of TCE beneath Building M being the most elevated. The presence of elevated concentrations of VOCs, in particular TCE, in sub-slab soil gas beneath buildings M and N indicates a potential for future vapor intrusion to occur if building conditions were to change (e.g., changes to the heating and ventilation system; new penetrations in the floor slab that might increase the possibility of VI). Therefore, for these buildings, periodic building inspections (e.g. in conjunction with a five-year review of the overall remedy) are recommended to determine if conditions have changed that might indicate a need for sampling to determine if the VI potential continues to be present.

Buildings L and O also partially overlie the 5 µg/L TCE overburden groundwater contour shown on Figure 1-12, so it is possible that shallow overburden groundwater beneath or in close proximity to these homes exceed the groundwater VISLs for TCE. However, sub-slab soil gas sampling beneath these homes

performed for the RI did not show TCE levels above the EPA soil gas VISLs for residential properties. Therefore, the concern for future vapor intrusion, should building conditions change, is not believed to exist as it does for buildings M and N, and as a result, future building inspections or indoor air monitoring for buildings L and O are not being included in the FS.

Residential Irrigation Well Evaluation

As noted previously, the Groundwater Use and Value Determination developed by MassDEP (2018) determined groundwater in the vicinity of the W&L property is unlikely to be utilized as a source of drinking water. However, in order to determine if additional remedial actions need to be implemented in cases where it may be desired to install wells for uses other than drinking water (e.g., irrigation, filling of pools, etc.), an additional risk evaluation of this exposure pathway has been performed as part of this FS.

The use of an irrigation well to fill a swimming pool was evaluated as potentially the most conservative of the private well uses exclusive of drinking water. This irrigation well scenario included the evaluation of the incidental ingestion and dermal contact pathways. The following exposure assumptions were used during the irrigation well evaluation:

- Exposure duration – 20 years (adult) and 6 years (child);
- Exposure frequency – 52 days/year (adult) and 65 days/year (child);
- Exposure time – 1 hour/event (adult) and 2 hours/event (child);
- Event frequency – 1 event/day (adult and child);
- Skin surface area – 19,652 cm^2 (adult) and 6,365 cm^2 (child); and
- Water ingestion rate – 0.05 L/hr (adult) and 0.1 L/hr (child).

These parameters were utilized in EPA's Regional Screening Level (RSL) online calculator (USEPA, 2018) to develop screening levels at a cancer risk level of 1E-06 and a non-cancer hazard index of 0.1. The recreator surface water scenario in the RSL online calculator was used to calculate screening levels applicable to the irrigation water (swimming pool) scenario. Online calculator input and output for the chemicals detected in site-related groundwater are presented in Appendix A. Table A-1 of Appendix A presents the screening of maximum detections against the irrigation water screening levels. In order to simplify calculations, the screening evaluation was performed on the COPCs from the more-conservative drinking water scenario (see the HHRA). There were 12 analytes which exceeded screening levels, thus becoming COPCs. Table A-2 of Appendix A presents a cumulative risk estimate using the screening levels from the online calculator and the EPCs developed for the site-wide (center of plume) groundwater in the HHRA for each COPC. The total cancer risk (ILCR) is shown to be 8×10^{-2} and the non-cancer hazard index is shown to be 100. Both are above EPA's target risk goals discussed earlier. The cancer and non-cancer risk contributors (HI >1, ILCR $>10^{-6}$) for this exposure scenario include TCE, vinyl chloride, and hexavalent chromium.

With respect to evaluating lead for the irrigation water (swimming pool) scenario, the water ingestion rate presented above for the child was applied to the IEUBK model as an alternate source of lead along with

default input parameters utilized during the HHRA evaluations. Table A-3 in Appendix A presents IEUBK input parameters, while Table A-4 in Appendix A presents model results. Results show that the irrigation water scenario does not result in an exceedance of EPA's target blood lead level goal for residential children.

Risk Evaluation for Fine Fraction Lead in Residential Soil West of North Avenue

Samples used for the lead risk evaluation are those of residential soil within the floodplain, as these samples represent the part of each property likely to have been impacted by flooding from the wetland and also represent residential exposure.

Floodplain fine fraction lead soil data collected in December 2017 and November 2018 from seven residential properties along the western side of North Avenue were combined to evaluate the need for remedial action at the properties. Decisions concerning the need for remedial action are based on a comparison of arithmetic average lead concentrations to the 200 mg/kg residential screening value. This 200 mg/kg residential screening value is based on the default lead absolute bioavailability of 30 percent. Site-specific IVBA testing revealed that the average absolute bioavailability of lead in soil samples from the west of North Avenue exposure point (28.3 percent) is consistent with the default assumption, thus the 200 mg/kg residential screening value has been used. The following describes the results of the comparison by property. Soil data used in this evaluation are presented in Table 1-3.

- 60 North Avenue – One floodplain residential soil sample has been collected from this parcel. Although two other fine fraction lead samples were collected from the parcel, one was classified as wetland soil, and the other sample maps at the edge of the floodplain based on the FEMA map, and is likely from a higher elevation. Because the lead result for this one sample is less than 200 mg/kg, no action is indicated for this property; however, this conclusion is based on only one sample that is both from the floodplain and judged to be representative of residential exposures.
- 48 North Avenue – Five floodplain soil samples have been collected from this parcel. The average lead concentration exceeds the screening value; therefore, remedial action is required for this property. However, one of the samples collected from this property has a concentration that is less than the lead residential screening value indicating that there may be a portion of the floodplain that does not require action.
- Mass Electric Parcel – Two floodplain soil samples have been collected from this parcel. The average lead concentration exceeds the screening value; therefore, remedial action is required for this property.
- 42 North Avenue - Six floodplain soil samples have been collected from this parcel. The average lead concentration exceeds the screening value; therefore, remedial action is required for this property.
- 34 North Avenue – Five floodplain soil samples have been collected from this parcel. The average lead concentration exceeds the screening value; therefore, remedial action is required

for this property. However, one of the samples collected from this property has a concentration that is less than the lead residential screening value indicating that there may be a portion of the floodplain that does not require action.

- 10 Deanville Road – Fourteen floodplain soil samples have been collected from this parcel. One of the samples (10DE-10), as previously described in Section 1.5.2, is considered an outlier and requires removal as a lead "hot spot". The average lead concentration of the remaining 13 samples collected from this property is less than 200 mg/kg; therefore, no action other than the removal of the 10DE-10 lead hot spot is required.
- 28 North Avenue – Ten floodplain soil samples have been collected from this parcel. One of the samples (28NO-01), as previously described in Section 1.5.2, is considered an outlier and requires removal as a lead "hot spot". The average lead concentration of the remaining nine samples collected from this property is less than 200 mg/kg; therefore, no action other than the removal of the 28NO-01 lead hot spot is required.

1.7.4 Actionable Risk Summary

When the RMEs for a particular exposure point exceed EPA's target risk range for carcinogens (ILCR of 10^{-4} to 10^{-6}) and/or risk criterion for non-carcinogens (HI of 1), remedial action to reduce or eliminate the risk is warranted and the risk is considered to be "actionable." Similarly, when ecological risk to one or more receptors is estimated to exist, and the estimate is judged to have a moderate degree of certainty, remedial action to reduce the risk is warranted. Actionable risks to human and ecological receptors are summarized below.

Exposure Point and Medium	**Scenario/Receptor**	**Major Contributors to Risk (Chemicals of Concern)**
Bliss Brook Surface Water (area where plume is discharging)	**Human Health:** Current and Future Recreational Users **Ecological:** Aquatic invertebrates, amphibians, fish	Hexavalent chromium (Cr+6) Cr+6
W&L Property Surface and Subsurface Soil *	**Human Health:** Future Residents	Cr+6, PAHs, several other metals
Residential Yards West of North Avenue – Surface Soil	**Human Health:** Current and Future Residents	Lead
W&L Property Shallow Groundwater	**Human Health:** Future Construction Worker	Cr+6
Site-Wide Groundwater	**Human Health:** If groundwater is used as tap water **	Cr+6, cVOCs, 1,4-dioxane, several other metals

	Human Health: If groundwater is used for non-drinking water purposes (i.e. irrigation, filling of pools, etc.) **Human Health:** Potential for indoor air exposures in structures located above/near plume (certain areas only, if no vapor mitigation system is present to prevent vapor intrusion)***	Cr+6, TCE, vinyl chloride cVOCs

* In the HHRA, the "W&L Property" soil exposure point was evaluated in future exposure scenarios as the W&L property located at 78 North Avenue, as well as the floodplain area located immediately to the south of W&L property and current fenced area, since the area immediately to the south would likely be used as part of the property after redevelopment and the fence is removed. The future residential use is a hypothetical scenario; the property is currently zoned as industrial.
** A groundwater use and value determination completed by MassDEP indicates a low value for groundwater use as a drinking water source, except within the Bungay River Water Resource Protection District, where a medium determination has been made and action may potentially be needed to restore groundwater within that District to meet drinking water levels, if impacted above drinking water standards. Groundwater has also been assigned a high value due to its contribution to the adjacent wetlands and Bliss Brook (MassDEP, 2018).
***The risk to vapor intrusion is not actionable since no indoor air samples have been collected that confirm the presence of a risk in excess of EPA's risk criteria. However, to address this potential risk, the FS includes provisions for future building inspections, groundwater monitoring, and/or indoor air sampling to confirm that there is no actionable risk.

Remedial alternatives will be developed, screened, and evaluated to address current and potential future risks due to human health and/or ecological exposures to W&L Property surface and subsurface soil, surface soil in residential yards west of North Avenue, W&L property shallow groundwater, site-wide groundwater, and Bliss Brook surface water. Risks due to exposure to Bliss Brook surface water in the area where hexavalent chromium-contaminated groundwater discharges to the brook will be addressed by the alternatives developed to treat the hexavalent chromium in the shallow overburden groundwater plume and reduce the hexavalent chromium to the less toxic trivalent chromium before it can enter the brook. Based on MassDEP's Groundwater Use and Value Determination, it is assumed that no action will be needed as part of the remedial alternatives with respect to a drinking water scenario for groundwater outside of the Protection District. However, an action will be needed to prevent future exposure to site-wide groundwater under the non-drinking water (i.e. irrigation well) scenario.

Human health risk from exposure to cVOCs in indoor air is a potential future risk if SSDSs that are currently operating in three homes east of North Avenue were to be shut down (see evaluation in Section 1.7.3), or if a new building were constructed over the plume without a vapor mitigation system. In addition, existing buildings for which sub-slab soil gas VOC concentrations are above soil gas VISLs, but for which recently measured indoor air concentrations do not pose a risk, could potentially pose a human health risk in the future if building conditions were to change in a way that increased the potential for vapor intrusion. The FS is not evaluating other alternatives to address this potential future risk; however, Operation, Maintenance,

and Monitoring (OM&M) will be included to determine if and when the systems can be shut down in the future, or if existing buildings may have increased potential for VI due to changes in the condition of the buildings. The FS will also evaluate alternatives that have the potential to reduce VOC concentrations in groundwater while at the same time addressing the hexavalent chromium contamination. The goal of these alternatives is to potentially be able to eliminate the need for SSDSs at some future date, via a combination of treatment and monitoring to reduce VOC concentrations in groundwater.

2.0 DEVELOPMENT OF REMEDIATION CRITERIA AND SCREENING OF TECHNOLOGIES

Based on the results of the RI, COCs were identified that pose risk to human and ecological receptors. In order to best select remediation approaches, criteria are developed based on applicable regulatory requirements, guidance classified as "to be considered" (TBC), and risk-based concentrations of contaminants present at the Site. The remediation criteria are presented as Remedial Action Objectives (RAOs) supported by numeric cleanup goals called Preliminary Remediation Goals (PRGs) and regulatory requirements (ARARs). Section 2.1 identifies chemical-, location-, and action-specific ARARs. Section 2.2 provides the basis for and selection of RAOs and Section 2.3 presents site-specific PRGs for media where an actionable risk has been identified: soil on the W&L property, Site-wide groundwater, and surface water within Bliss Brook.

2.1 Identification of Preliminary of ARARs and TBCs

ARARs consist of federal and state human health and environmental requirements and guidelines (TBCs) that might affect implementation of remedial alternatives. CERCLA, as amended by the 1986 Superfund Amendments and Reauthorization Act (SARA), 42 U.S.C. § 6901 *et seq.*, and the NCP, 40 C.F.R. Part 300, require identification of all potential ARARs that must be addressed by the USEPA or parties undertaking the remedial action. Determination of ARARs is site-specific and depends on the chemical contaminants, site/location characteristics, and remedial actions being investigated for site cleanup.

CERCLA governs the liability, cleanup, financial responsibility, and response for hazardous substances released into the environment. CERCLA requires that all remedial actions be consistent with the NCP. The NCP specifies procedures, techniques, materials, equipment, and methods to be employed in identifying, removing, or remediating releases of hazardous substances. In particular, the NCP specifies procedures for determining the appropriate type and extent of remedial action at a site in order to effectively mitigate and minimize damage to, and provide adequate protection of, human health, welfare, and the environment.

The national goal of remedy selection is to protect human health and the environment, to maintain that protection over time, and to minimize untreated waste (40 CFR Part 300.430 of the NCP (55 FR 8846)). In accordance with Section 121(d) of CERCLA, 42 U.S.C. § 9621, site remediation must comply with any standard, requirement, criteria, or limitation under any Federal environmental law, except where waived. Promulgated standards, requirements, criteria, or limitations under a State environmental or facility siting law must also be attained, under Section 121(d)(2)(c) of CERCLA, 42 U.S.C. § 9621, if they are legally enforceable and consistently enforced statewide, and if the state ARAR is more stringent than the federal ARAR and has been presented to the USEPA in a timely manner. Waiver conditions that may be used, if protection of human health and the environment is to be ensured, include the following:

- The remedial action selected is only part of a total remedial action that will attain such level or standard of control when completed.
- Compliance with such requirements is technically impracticable from an engineering perspective.

- Compliance with such requirements at that facility will result in greater risk to human health and the environment than alternative options.
- The remedial action selected will attain, through use of another method or approach, a standard of performance that is equivalent to that required under the otherwise applicable standard, requirement, criteria, or limitation.
- In the case of a remedial action to be undertaken solely under Section 104 of CERCLA, 42 U.S.C. § 9604, selection of a remedial action that attains such level or standard of control will not provide a balance between the need for protection of public health and welfare and the environment at the facility under consideration, and the availability of money from the fund to respond to other sites, taking into consideration the relative immediacy of such threats.
- With respect to a state standard, requirement, criteria, or limitation, the state has not consistently applied (or demonstrated the intention to consistently apply) the standard, requirement, criteria, or limitation in similar circumstances at other remedial action sites within the state.

Section 121(e) of CERCLA, 42 U.S.C. § 9621, codified in the NCP at 40 CFR Part 300.400(e), exempts any response action conducted entirely at the site from having to obtain a federal, state, or local permit, where the action is carried out in compliance with Section 121. Remedial actions conducted on CERCLA sites need comply only with the substantive aspects of ARARs and not with the corresponding administrative requirements.

2.1.1 Definition of ARARs

As defined by the NCP, ARARs are placed into two classifications: applicable requirements and relevant and appropriate requirements. Applicable requirements are promulgated statutory or regulatory cleanup standards and environmental protection criteria that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a site. Included are federal requirements that are directly applicable, as well as those incorporated by a federally authorized state program. State standards that are more stringent than federal requirements may be applicable. Relevant and appropriate requirements are promulgated statutory or regulatory cleanup standards and environmental protection criteria that while not directly "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a site, address similar situations or problems to those encountered. Other environmental and public health guidelines which may be considered to help determine remedial alternatives, but are not ARARs, are termed TBC (to be considered). A requirement may be either "applicable" or "relevant and appropriate," but not both. Three categories of ARARs are considered: chemical-specific, location-specific, and action-specific.

2.1.2 Chemical-Specific ARARs and TBC

Chemical-specific ARARs are numeric values that provide criteria for evaluating concentrations of specific hazardous contaminants and are developed based upon protection of human health and the environment. These values establish the acceptable amount or concentration of a chemical that may be found in or discharged to the environment. The potential chemical-specific ARARs and TBCs that apply to the soils, groundwater, and surface water at Walton & Lonsbury are described in Table 2-1.

2.1.3 Location-Specific ARARs

Location-specific ARARs serve to protect individual characteristics, resources, and specific environmental features on a site, such as wetlands, water bodies, floodplains, and sensitive ecosystems. Location-specific ARARs may affect or restrict remediation and site activities. The site contains multiple wetland and open water areas and portions of the site are located within FEMA 100-year or 500-year floodplain boundaries. Southeastern Massachusetts is also within the range of the federally endangered Northern Long-Eared Bat. The potential location-specific ARARs and TBCs that apply to the soils, groundwater, surface water, and sediment at Walton & Lonsbury are described in Table 2-2.

2.1.4 Action-Specific ARARs

Action-specific ARARs are technology- or activity-based requirements of activities or processes that may be implemented on a site, including storage, transportation, and disposal methods of hazardous substances as well as construction of facilities or treatment processes. As action-specific ARARs and TBCs are defined by the components of a potential remedy, they will be discussed as appropriate for each remedial alternative during detailed evaluation of alternatives (Section 4.0).

2.2 Development of Remedial Action Objectives

RAOs consist of medium-specific goals for protecting human health and the environment and provide a basis for remedial alternative development and evaluation during the FS process. RAOs for soil, surface water, and groundwater were developed based on the results of the HHRA and ERA conducted for the site (AECOM, May 2019).

USEPA guidelines for baseline risks and hazards at a CERCLA site are generally that non-carcinogenic hazards for each target organ should not exceed a total HI of 1, and the total receptor ILCR should not exceed the target risk range of 10^{-6} to 10^{-4}. RAOs are limited to media, geographical areas, and chemicals for which estimated risks and hazards exceed the USEPA risk management criteria. Section 1.7.4 describes which current and future scenarios result in an exceedance of the USEPA risk criteria.

Future site and resource use are considered in the formulation of RAOs. Although the hypothetical future use of site-wide groundwater as tap water was evaluated in the HHRA and exceeded USEPA risk management criteria, site-wide groundwater is not a current source of drinking water. A key assumption in developing the RAOs is that the site-specific Groundwater Use and Value Determination finalized by the State for the W&L site determined that site-wide groundwater has a low use and value potential for drinking

water purposes, except for within the limits of the City's Bungay River Water Resource Protection District, where a medium use and value determination was made (MassDEP, 2018). Accordingly, a goal of preventing or minimizing further migration of Site-wide groundwater into the downgradient Bungay River Water Resource Protection District is considered in formulation of RAOs.

The RAOs for the protection of human health and environment at Walton & Lonsbury are:

- Prevent exposure to W&L Property soil containing Site contaminants that would result in a total excess lifetime cancer risk greater than the target risk range of 10^{-6} to 10^{-4}, and/or a non-cancer Hazard Index greater than 1.
- Prevent exposure by current and future residents to surface soil containing lead that would result in estimated risk of greater than 5 % of the youth population exceeding a target blood lead level of 5 µg/dL.
- Prevent exposure by future construction workers to the W&L property groundwater containing Site contaminants that would result in a total excess lifetime cancer risk greater than the target risk range of 10^{-6} to 10^{-4}, and/or a non-cancer Hazard Index greater than 1.
- Prevent or minimize further migration of Site contaminants in Source Area soil and overburden groundwater within the W&L Property into the downgradient contaminated groundwater plume, and prevent contaminated groundwater discharge into Bliss Brook.
- Prevent or minimize further migration of Site-wide groundwater containing Site contaminants, located within the compliance boundary for the defined on-Site non-drinking water aquifer, into the downgradient Bungay River Water Resource Protection District to protect its beneficial use as a potential future drinking water source.
- Prevent exposure to Site-wide groundwater containing Site contaminants that would result in a total excess lifetime cancer risk greater than the target risk range of 10^{-6} to 10^{-4}, and/or a non-cancer Hazard Index greater than 1 for non-drinking water scenarios (e.g. irrigation, swimming pools etc.).
- Prevent exposure by future building occupants to indoor air vapors, via a vapor intrusion pathway, containing Site contaminants that would result in a total excess lifetime cancer risk greater than the target risk range of 10^{-6} to 10^{-4}, and/or a non-cancer Hazard Index greater than 1.

- Prevent exposure by current and future recreational users to Bliss Brook surface water containing Site contaminants that would result in a total excess lifetime cancer risk greater than the target risk range of 10^{-6} to 10^{-4}, and/or a non-cancer Hazard Index greater than 1.[1]
- Prevent exposure by current and future ecological receptors to Bliss Brook surface water containing Site contaminants that would result in potential adverse impacts.

2.3 Development of Preliminary Remediation Goals

The following sections provide a summary of PRG development related to human and ecological exposures at W&L. PRGs were developed consistent with equations, assumptions, and methods used in the HHRA as well as the BERA.

PRGs were developed for the site to prevent exposure to soil, groundwater, and surface water with concentrations of site-related constituents that may present human health and/or ecological risks above USEPA target levels. The following text provides a summary of PRG development related to human and ecological exposures at W&L.

PRGs are developed based on an evaluation of risk-based PRGs, background concentrations, practical quantitation limits (PQLs), and other site-specific considerations (e.g., ARARs). If there are established ARARs for chemical-specific concentrations (e.g., federal Maximum Contaminant Levels, or MCLs), these are often selected as PRGs. In the absence of established ARARs, risk-based PRGs are often developed using USEPA guidance in Development of Risk-Based Preliminary Remediation Goals (USEPA, 1991), following the consideration of background/reference concentrations and PQLs.

Appendix B presents PRG development for both human and ecological receptors. Attachment A of the appendix provides the human health calculations for the derivation of risk-based soil, groundwater, and surface water PRGs and Attachment B of the appendix provides the supporting information for the derivation of ecological risk-based PRGs for surface water.

[1] Note that because the surface water in Bliss Brook is continuously receiving discharge of contaminated groundwater, it is not practical to directly address surface water. Instead, surface water exceedances will be addressed by remediating contaminated groundwater, with appropriate monitoring of surface water to evaluate achievement of RAOs.

2.3.1 Human Health PRGs

Human health risk-based PRGs were developed using the equations presented in the USEPA Risk Assessment Guidance for Superfund (RAGS), Part B: Preliminary Remediation Goals (USEPA, 1991) and the methodology used to develop the USEPA Regional Screening Levels (USEPA, 2017). Exposure factors used in the calculation of risk-based PRGs were the same as those used to estimate potential risks and hazards in the baseline HHRA. Risk-based PRGs were selected using a point of departure of an ILCR of 10^{-6} and adjusting as appropriate based on number of COCs in the exposure scenario to remain within EPA's target risk range.

Soil PRGs

Soil PRGs were developed for a hypothetical future resident exposed to soil on the W&L Property and current/future residents exposed to soil on residential yards west of North Avenue. Risk-based soil PRGs were developed for exposure scenarios with a potential future cumulative cancer risk greater than 10^{-4} or target organ HI greater than 1, considering the ingestion, dermal contact, and inhalation exposure pathways. For those soils, risk-based PRG development was required for each COC, defined as a chemical with an individual cancer risk above 10^{-6} or with a hazard quotient (HQ) above 1 (see Attachment A.1 of Appendix B, which include the HHRA RAGS Part D Table 10 appropriate for the hypothetical future resident).

PRGs were developed for the following chemicals:

- benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, antimony, arsenic, hexavalent chromium, cobalt, lead, and thallium.

The human health risk-based soil PRGs summarized in Table B-1 of Appendix B correspond to target cancer risk levels of 10^{-6}, 10^{-5}, and 10^{-4} and a target non-cancer HQ of 1. For each of the soil COCs, risk-based PRGs were calculated using equations and exposure assumptions presented in Attachment A.1 of Appendix B (the same as those used in the HHRA). Toxicity values and the dermal worksheets used in the calculation of the risk-based PRGs are presented for the hypothetical future resident in Attachment A.1 of Appendix B. Intermediate calculations for the ingestion, dermal, and particulate inhalation pathways are also presented in Attachment A.1 of Appendix B. The human health risk-based soil PRGs for each COC and pathway are summarized in Table B-1 of Appendix B. The PRGs are selected by considering the risk-based PRGs and background data. The basis for selection for each PRG is provided on the table. The selected PRGs for soil generally correspond to risk-based PRGs based on a cancer risk level of 1×10^{-5} or a non-cancer HQ of 1. For lead in soil, the IEUBK model with updated exposure parameters and a target blood lead level of 5 µg/dL provides for an acceptable residential soil concentration (fine fraction) of approximately 200 mg/kg. Refer to the HHRA for additional lead modeling discussion.

Site-specific data were utilized in the ecological risk assessment to develop reference concentrations. Table B-1 of Appendix B presents these reference concentrations, along with other background soil concentrations for reference. Per CERCLA, as amended, and the NCP, USEPA does not require cleanup to concentrations

below background or reference levels.[2] However, no site-specific reference levels were above the selected risk-based PRGs.

Table 2-3 presents a summary of soil PRGs to be used in development of remedial alternatives.

Groundwater PRGs

Groundwater PRGs were developed for a hypothetical residential scenario and future construction worker scenario with a potential future cumulative cancer risk greater than 10^{-4} or target organ HI greater than 1, considering the ingestion, dermal contact, and inhalation exposure pathways, as appropriate. Risk-based PRG development was required for each COC (in this case, only hexavalent chromium), defined for this site as a chemical with an individual cancer risk above 10^{-6} or HQ above 1 (see Attachments A.3 and A.4 of Appendix B, which includes the HHRA RAGS Part D Table 10 series of tables, as appropriate for each receptor).

The human health risk-based PRGs provided in Table B-2 of Appendix B correspond to target cancer risk levels of 10^{-6}, 10^{-5}, and 10^{-4} and a target non-cancer HQ of 1. For the groundwater COC, risk-based PRGs were calculated using equations and exposure assumptions presented in Attachment A.3 of Appendix B, Table 2, and Attachment A.4 of Appendix B, Table 2 (the same as those used in the HHRA). Toxicity values used in the calculation of the risk-based PRGs are presented in Attachment A.3 of Appendix B, Tables 3 and 4, and Attachment A.4 of Appendix B, Tables 3 through 6. Attachment A.3 of Appendix B, Tables 5 through 7, and Attachment A.4 of Appendix B, Tables 7 through 10 present intermediate PRG calculations, accounting for adult and child exposure, as appropriate. The human health risk-based groundwater PRGs for each COC are summarized in Table B-2 of Appendix B and Tables 2-4 and 2-5. Groundwater PRGs were selected by considering the ARARs and risk-based standards. There were no site-specific background wells specified for the site, therefore, reference/background data were not available for consideration. The basis for selection for each PRG is provided on the tables. For the residential drinking water scenario, seven selected PRGs (1,1,1-trichloroethane, cis-1,2-dichloroethene, TCE, vinyl chloride, arsenic, total chromium, and lead) correspond to the drinking water MCL for each chemical, while three selected PRGs (1,1-dichloroethane, 1,4-dioxane, and hexavalent chromium) correspond to a cancer risk level of 10^{-6}. The selected cobalt PRG for groundwater corresponds to an HQ of 1, while the selected manganese PRG corresponds to a health advisory value. For the construction worker scenario, the selected PRG for hexavalent chromium corresponds to a cancer risk level of 10^{-5}.

[2] It should be noted that "background" is generally considered to be without anthropogenic impacts, while "reference" may have minor impacts which are consistent to the area. For the purposes of this FS, use of the word "background" is considered to be similar to "reference."

As discussed in Section 1.7.3, a supplemental risk evaluation was performed in this FS related to use of groundwater in an irrigation scenario. The risk contributors (HI >1, ILCR >10^{-6}) for this exposure scenario include TCE, vinyl chloride, and hexavalent chromium. The human health risk-based PRGs developed for these COCs are presented in Attachment A.5 of Appendix B, and summarized in Table B-2 of Appendix B and on Table 2-5. For this scenario, the selected PRG for vinyl chloride corresponds to a cancer risk level of 1 x 10^{-4} and the selected PRG for TCE corresponds to an HQ of 1, while the selected PRG for hexavalent chromium corresponds to a cancer risk level of 3 x 10^{-4} and is also equal to the MCL for total chromium for potable water.

A qualitative screening of the selected groundwater PRGs for irrigation well scenario was performed against residential vapor intrusion exposure, using the May 2018 resident groundwater vapor intrusion screening levels (VISLs) from EPA website https://www.epa.gov/vaporintrusion/vapor-intrusion-screening-level-calculator to ensure that the selected PRGs are also protective of the vapor intrusion exposure pathway. For the irrigation well scenario, the groundwater COCs are TCE, vinyl chloride and hexavalent chromium. The selected groundwater TCE and vinyl chloride PRGs were screened for vapor intrusion against their VISLs since they are considered volatile. Hexavalent chromium was not screened since it is not considered volatile. Residential groundwater VISLs are 1.2 µg/L and 0.15 µg/L for TCE and vinyl chloride, respectively. Performing a qualitative screening, the selected TCE PRG of 98 µg/L (based on HQ = 1) would result in estimated 8 x 10^{-5} cancer risk and the selected vinyl chloride PRG of 7 µg/L (based on ILCR = 10^{-4}) would result in estimated 5 x 10^{-5} cancer risk for resident vapor intrusion pathway. These estimated risks are within EPA acceptable risk range and therefore these PRGs are protective of the vapor intrusion exposure pathway for a residential scenario.

Surface Water PRGs

Surface water PRGs were developed for a recreational user scenario with a potential cumulative cancer risk greater than 10^{-4} or target organ HI greater than 1, considering the ingestion, dermal contact, and inhalation exposure pathways, as appropriate. Risk-based PRG development was required for each COC (in this case, only hexavalent chromium), defined for this site as a chemical with an individual cancer risk above 10^{-6} or HQ above 1 (see Attachment A.2 of Appendix B, which includes the HHRA RAGS Part D Table 10 table for the exposure pathway).

The human health risk-based PRGs provided in Table B-3 of Appendix B correspond to target cancer risk levels of 10^{-6}, 10^{-5}, and 10^{-4}. Risk-based PRGs were calculated using equations and exposure assumptions presented in Attachment A.2 of Appendix B, Table 2 (the same as those used in the HHRA). Toxicity values used in the calculation of the risk-based PRGs are presented in Attachment A.2 of Appendix B, Table 3. Attachment A.2 of Appendix B, Tables 4 and 5 present intermediate PRG calculations. The human health risk-based surface water PRG for hexavalent chromium is summarized in Table B-3 of Appendix B and Table 2-6a. The basis for selection for the PRG is provided on the tables. The selected hexavalent chromium PRG corresponds to a cancer risk level of 10^{-5}.

For the ecological risk-based surface water PRG, site-specific data were utilized to develop reference concentrations. Table B-3 of Appendix B also presents the reference concentration for hexavalent chromium, which is below the selected PRG.

Human Health Residual Risks

The residual risk calculation is performed to confirm that the cumulative risk associated with the selected PRGs does not exceed EPA's risk management criteria of an incremental lifetime cancer risk of 1×10^{-4} or a target organ hazard index of 1.

Table B-4 of Appendix B presents calculations for residual human health risks associated with soils at the site. The calculation of residual risks uses the same exposure factors used in the baseline HHRA. If soils in these areas of the site were remediated to reflect an EPC equal to the selected PRG, the subsequent cumulative residual risks would be:

Human Health Residual Risks for Soil

Receptor of Concern	Residual Risk	Residual Hazard
Hypothetical Resident	6×10^{-5}	3

As shown above, the residual risk is within the USEPA target risk range of 10^{-6} to 10^{-4} for the hypothetical resident. While the residual hazard is greater than the USEPA target HI of 1, there are no individual target organ residual hazards greater than the target (see Table B-4 of Appendix B).

2.3.2 Ecological PRGs

Ecological PRGs were developed for receptors and COCs with the potential for risk based on the BERA. Ecological PRGs were developed for aquatic receptors potentially exposed to surface water. Supporting information for the derivation of the ecological PRGs is provided in Attachment B of Appendix B.

Surface Water PRGs

This section provides a summary of PRG development related to aquatic receptor ecological exposures to surface water in Bliss Brook and supporting information is provided in Attachment B of Appendix B.

The BERA concludes with high confidence there is severe risk to aquatic receptors in Bliss Brook mainly from the exposure to chromium (VI) in surface water, representing a significant ecological risk. The evidence in the BERA included comparison of the COPC levels in surface water samples to acute and chronic benchmarks which are protective of aquatic invertebrate, amphibian, and fish populations, and also utilized laboratory toxicity testing to compare toxicity of site surface water samples to reference locations using the water flea (*Ceriodaphnia dubia*).

Both chromium (III) and chromium (VI) had exceedances of reference risk at levels indicating, with high confidence, that adverse effects to aquatic receptors from exposure to surface water are possible in on-site samples in Bliss Brook. Therefore, ecological PRGs have been developed for the site to prevent exposure to surface water with site-related contaminant concentrations of chromium (III) and chromium (VI) that may present risks to ecological receptors.

Based on the site-specific calculations, using the *Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses* (USEPA, 1985), the following site-specific benchmarks were derived (Appendix D of the BERA) in comparison with National Recommended Water Quality Criteria (NRWQC):

Analyte	Site-Specific Benchmark	NRWQC
Chromium (III)	CCC = 10 µg/L	CCC = 74 µg/L (at 100 mg/L hardness)
	CMC = 609 µg/L	CMC = 570 µg/L (at 100 mg/L hardness)
Chromium (VI)	CCC = 2 µg/L	CCC=11 µg/L
	CMC = 17 µg/L	CMC=16 µg/L

The Criterion Continuous Concentration (CCC) represents the four-day average concentration that should not be exceeded more than once every three years, and the Criterion Maximum Concentration (CMC) is the one-hour average concentration that should not be exceeded once every three years on average. These site-specific CCC and CMC values were used as the chromium benchmarks in surface water to evaluate the potential risk to aquatic receptors (Tables 23 to 26 of the BERA). Although based on a similar pool of initial data, the site-specific data set (selected to represent only the conditions of hardness values on site and excluding some fish species) resulted in a smaller, yet more site-specific group of studies. There is added uncertainty in calculating the site-specific benchmarks based on a smaller group of data, but the process confirmed that even without salmonids and other sensitive species unlikely to occur on site, the protective levels of chronic (CCC) exposures with both forms of chromium are low, and possibly lower than those calculated with a broader dataset in the NRWQC for the two forms of chromium.

These site-specific benchmark data were then compared to results of the site-specific toxicity test. The only two samples showing a significant effect on survival and reproduction on *C. dubia* were samples SW-210 and SW-212 from Bliss Brook (Table 43 of the BERA). These samples, with elevated concentrations of both chromium (III) and chromium (VI), showed 100% mortality in the six-day toxicity tests. The toxicity test results are consistent with the calculated CCC and CMC for chromium (VI) of 2 µg/L and 17 µg/L, respectively. All samples with chromium (VI) less than 1 µg/L showed no toxicity in the lab, and the two samples with chromium (VI) greater than 100 µg/L (132 µg/L and 166 µg/L) were highly toxic. Ideally, samples including the range between 1 and 100 µg/L would have been tested for toxicity; however,

although samples were collected along a gradient in the affected reach of the brook, no water samples were collected with chromium (VI) concentrations in this range.

Elevated concentrations of other dissolved metals (barium and manganese) also appear not to be associated with effects on *C. dubia*. Table 43 (BERA) indicates the levels of barium and manganese observed in Bliss Brook were not toxic to *C. dubia* in site-specific toxicity tests. Therefore, the chromium (III) and chromium (VI) are identified as COCs in surface water.

The site-specific benchmark values are generally consistent with the results of the surface water toxicity tests from Bliss Brook. For chromium (III), the lower bounded value for the No Observed Effects Concentration (NOEC) was 39 µg/L in sample SW-205 (the sample-specific hardness at SW-205 was 105 mg/L, which is comparable to the NRWQC-adjusted value). The lower bounded value is the highest concentration measured among all samples that had no observed effects. The lowest concentration of chromium (III) observed in Bliss Brook with significant adverse effects was 174 µg/L; however, the effects observed in this sample are likely associated with the high concentration of chromium (VI) in the samples. Since one site sample resulted with a NOEC of 39 µg/L, the value of the CCC of 10 µg/L derived from the site-specific calculations appears to be conservative.

For chromium (VI), the lower bounded value for the NOEC was 0.5 µg/L, and was observed in all of the samples with no effects. However, the next higher concentration was 132 µg/L, which serves as the Lowest Observed Effect Concentration (LOEC) and had 100% mortality of the test organisms. The gap in observed surface water chromium (VI) between 0.5 and 132 µg/L results in a wide range in the upper and lower bounded concentrations from which a PRG can be derived.

Table 1 of Attachment B in Appendix B presents the data available to derive a PRG for the site. The NRWQC (chronic or CCC, and acute or CMC) are shown as a comparison. The site CCC and the site CMC were derived as stated above and represent conservative site-specific, protective values. In addition, using the small dataset available from the laboratory toxicity tests, the NOEC and the LOEC were identified. Although there is uncertainty surrounding each of the site NOEC and LOEC values, if the geometric mean value is used to calculate a PRG, similar values for PRGs result from the site CCC and site CMC (see Table 1 of Attachment B in Appendix B). Therefore, the recommended PRGs for the site, consistent with data presented in the BERA, are represented by the geometric mean of the site NOEC and LOEC resulting in surface water PRGs for Bliss Brook of 82 µg/L for chromium (III), and 8 µg/L for chromium (VI). These PRGs are also summarized in Table B-5 of Appendix B and Table 2-6b.

2.4 Estimation of Areas and Volumes

Comparing the available site characterization data to the RAOs and PRGs developed in this Section, estimated quantities of contaminated media (soil, groundwater, and surface water) can be quantified. The following discussion presents the basis of defining the areas and volumes of contaminated media to be addressed in this FS.

Soil on W&L Property

Appendix C presents tables (Tables C-1 and C-2) of soil samples showing Residential PRG exceedances for W&L Property soil and Figures 2-1 and 2-2 show locations and depths of PRG exceedances for PAHs and metals, respectively. General discussion of PRG exceedances is presented below.

Elevated hexavalent chromium concentrations are distributed across the property at various depths and concentrations. Elevated PAH concentrations are generally located in the central and southern portions of the property. Elevated cobalt and lead concentrations are generally located in the western half of the property. Elevated antimony and arsenic concentrations are found within or next to the former building footprint. Finally, there are a few scattered locations with elevated thallium concentrations.

While additional soil sampling would need to be performed to refine the extent of PRG exceedances, based on the existing data, in general, elevated concentrations are deeper in the northern and central portions of the property. The deeper elevated concentrations in the western portion of the property appear to be related to the former lagoon in this area. The deeper elevated concentrations in the central portion of the property appear to be related to the former building.

Figure 3-1 summarizes the estimated full extent of site soil PRG exceedances on the W&L property (for the hypothetical residential scenario). Pre-design sampling could be performed to refine horizontal and vertical extents of the soil requiring remedial action. The following area and volume estimates are based on existing data and assumptions noted.

The total impacted area (for both surface and subsurface soil) covers approximately 66,310 square feet or approximately 1.5 acres (see Figure 3-1), based on the site PRGs set for the contaminants at the site and the results of the remedial investigation. Based on observed concentrations across the site, the depth of the excavation is assumed to vary from 2 feet bgs to 10 feet bgs, or the depth of groundwater, whichever is shallower. Based on RI groundwater depth measurements (AECOM, 2019), the groundwater depth in many of the excavation areas corresponds to the excavation depths noted on Figure 3-1. Using these assumptions, the total impacted volume of soil is estimated to be approximately 15,532 cubic yards.

Soil on Residential Property

Appendix C presents a table (Table C-3) of soil samples showing Residential PRG exceedances for fine fraction lead in residential (i.e., not wetland) surface soil on five residential properties and a utility-owned lot between two residential properties. Figure 2-3 shows the locations of the PRG exceedances. Four of the affected properties border the Southern Wetland to the west of North Avenue and two of the residential properties are to the south of Deanville Road. Soil contamination on these properties within Flood Zone AE and west of North Avenue may be a result of flood waters transporting contaminated soil from the Southern Wetland to the residential yards. For the two properties south of Deanville Road, there are two sampling locations where the lead is substantially higher than for all the surrounding locations (the average of which is less than the PRG once these two locations are removed), and it is less likely that the source is transport

via flooding. However, for FS purposes it is assumed that excavation of these locations will also be conducted. Additional sampling will be needed to refine the estimates of excavation area for all properties, particularly the two properties south of Deanville Road, where use of the flood zone as an excavation boundary is not supported by the available data. Based on the existing data and the PRG for residential lead (fine fraction), the total impacted area of surface soil is estimated to cover approximately 8,310 square feet or roughly 0.2 acres (see Figure 3-3). Based on observed concentrations of lead on the residential properties in samples from 0 to 6 inches bgs, the depth of the excavation is conservatively assumed to vary from 0 to 1 feet bgs. Current samples are from 0 to 6 inches only (no deeper samples have been collected and analyzed for fine fraction lead). Based on the conceptual site model that the lead contamination was deposited to these areas due to flooding from the Southern Wetland, it is expected that the contamination would be limited to the immediate surface and that soil deeper than one foot bgs would not be impacted by the Site. Using these assumptions, the total volume of lead-impacted soil on residential property is estimated to be approximately 310 cubic yards. Pre-design sampling would be performed to refine the extent of the contamination.

Shallow Groundwater on W&L Property

Appendix C presents a table (Table C-4) of shallow groundwater samples showing PRG exceedances for the future construction worker on the W&L Property for the three phases/rounds of sampling performed during the RI in August 2014, December 2014, and September 2015. Figure 2-4 shows hexavalent chromium results and locations of PRGs exceedances for the Phase 2 sampling round, which is the most recent round for the majority of the W&L Property overburden wells. The extent of W&L Property shallow groundwater exceedances for hexavalent chromium are limited to two wells (AE-01S and MW-7) located just south and immediately downgradient of the former plating room area, which is likely the primary source of hexavalent chromium contamination. Based on this information, the estimated extent of impacts is shown on Figure 2-4 as an approximately 26,500 square foot area in the southeastern portion of the W&L Property.

Site-Wide Groundwater (Irrigation Well Scenario)

Appendix C presents a table (Table C-5) of groundwater samples showing PRG exceedances for an irrigation well scenario for the three phases/rounds of sampling performed during the RI in August 2014, December 2014, and September 2015. Figure 2-5 shows locations of PRG exceedances for TCE and/or vinyl chloride and hexavalent chromium. Hexavalent chromium in both overburden and bedrock groundwater between the W&L Property and Bliss Brook exceeds the PRG and exceedances in bedrock groundwater extend further downgradient of Bliss Brook. The extent of overburden and bedrock groundwater exceeding the PRGs for TCE and vinyl chloride is located slightly further west on the W&L Property, but does not extend as far downgradient as Bliss Brook.

Residential Groundwater (Drinking Water Scenario)

Appendix C presents a table (Table C-5) of groundwater samples showing PRG exceedances for a residential drinking water well scenario for the three phases/rounds of sampling performed during the RI in August 2014, December 2014, and September 2015. Although PRGs were developed for several VOCs and metals that are present in site groundwater at levels that would be unacceptable for a drinking water exposure, the PRGs would only need to be achieved within the Bungay River Water Resource Protection District, and would allow restoration of the groundwater to its beneficial use as a potential future drinking water source if impacted above drinking water standards. Since the current available information does not include data for any wells located within the Bungay River Water Resource Protection District, the potential extent of PRG exceedances is unknown. However, the residential drinking water PRGs for chromium and hexavalent chromium are both exceeded in the bedrock well that is closest to but upgradient from the District (well AE-20B), so it is possible that bedrock groundwater in at least a portion of the District is impacted above residential drinking water PRGs. A one-dimensional model was used to attempt to predict the extent to which hexavalent chromium is present in bedrock groundwater downgradient of the Site, in the absence of wells within the District itself. This work is summarized in Section 3.4 and the modeling assumptions and resultant figures are included in Appendix F. The modeling suggests that significant (>100 ppb) hexavalent chromium impacts to bedrock groundwater do not extend into the District, but monitoring wells would need to be installed within the District and sampled to confirm this. For the purposes of this FS, alternatives are being developed and evaluated to address the migration of contaminated bedrock groundwater into the District, should it be determined through future well installation and sampling that exceedances of the PRGs are in fact present in groundwater within the District and are attributable to the Site. As such, the drinking water PRGs are more accurately described as performance standards for compliance monitoring purposes, to evaluate the performance of remedial alternatives that may be implemented to prevent this migration from continuing. Remedial alternatives for bedrock groundwater are presented in Section 3, as are alternatives for the source area (W&L Property) and overburden groundwater, which would also reduce contamination in bedrock groundwater over time, in combination with natural attenuation.

Surface Water

Appendix C presents a table (Table C-6) of surface water samples for Bliss Brook showing human health (recreational user) and ecological PRG exceedances during Phase 1 (summer 2014) and Phase 2 (fall 2014) RI field activities. Dissolved hexavalent chromium results from the Phase 2 RI sampling event are depicted on Figure 1-7. As discussed in Section 1.0, hexavalent chromium concentrations are clearly related to discharge of the hexavalent chromium groundwater plume to the brook. Surface water location SD-208, which is located east of the cover and PRB, had total and hexavalent chromium results below PRGs during both sampling events. Moving downstream, PRGs are exceeded at locations SD-209, SD-210, SD-211, and SD-212 during both sampling events. During the Phase 2 (fall 2014) sampling event, elevated total and hexavalent chromium concentrations above PRGs extended further downstream (SD-213, SD-214, SD-215, SD-217, and SD-218). Based on available groundwater data for hexavalent chromium, the periodic detections of

hexavalent chromium at locations SD-213 and further downstream are likely related to transport in surface water from upstream rather than the discharge of contaminated groundwater, since the hexavalent chromium plume in overburden does not appear to extend that far south along Bliss Brook. Based on the "worst-case" fall 2014 surface water data, the estimated length of Bliss Brook containing elevated chromium concentrations above PRGs is 1,720 feet. This estimate is based on the mid-point between surface water locations SD-209 and SD-210 (SD-209 is the most upstream location where hexavalent chromium was detected in surface water), and continuing downstream to the point where Bliss Brook flows into the Bungay River (near SD-218, the most downstream brook sampling location where hexavalent chromium was detected).

2.5 General Response Actions

General response actions are developed to satisfy the RAOs for the site. The range of applicable general response actions for soil, overburden groundwater/surface water, and bedrock groundwater at the W&L site are as follows:

- No Action
- Limited Action
- Containment
- Removal
- Treatment (In-Situ/Ex-Situ)

No remedial activities would be implemented under the No Action response action. However, per the NCP and CERCLA RI/FS guidance, it is considered throughout the FS process as a baseline against which other alternatives can be compared.

2.6 Identification and Screening of Technology Types and Process Options

A preliminary list of potential remedial technologies has been developed for each of the general response actions listed in Section 2.5. These remedial technologies and associated process options are presented and screened in this subsection. Several factors were used to determine feasibility and, in turn, to screen out those technologies that clearly should not be considered for use at the site. The factors used in this screening process were based on the current USEPA guidance for conducting RI/FSs under CERCLA and included, but were not limited to, the following:

- Effectiveness in handling the estimated areas or volumes of media and in meeting the PRGs.
- Potential impacts to human health and the environment during construction and implementation.
- Proven effectiveness and reliability with respect to the contaminants and conditions at the site.

- Implementability in terms of both the technical and administrative feasibility.
- Relative costs as far as technologies or process options that accomplish the same result.

Tables 2-7 and 2-8 present technology and process option screening for soil and overburden groundwater/surface water and bedrock groundwater, respectively. The tables present a brief technology description and the justification for the elimination or further consideration of each technology.

In-situ treatment of soil was considered but was ultimately screened out due to high costs associated with treatment of soil containing multiple analytes. Multiple steps of treatment would be required which may not meet PRGs and would be very costly. Remaining options include removal, containment, and institutional controls.

With respect to overburden groundwater/surface water and bedrock groundwater, institutional controls, monitoring, source area soil excavation, groundwater extraction followed by certain ex-situ treatment technologies, in-situ chemical reduction, permeable reactive barriers, monitoring, and sub-slab depressurization systems were considered as part of alternative development. None of the general response options were eliminated entirely.

3.0 DEVELOPMENT AND SCREENING OF ALTERNATIVES

Remedial alternatives for soil, overburden groundwater/surface water, and bedrock groundwater at the W&L site are developed in the following sections. Remedial technologies not screened from further consideration in Section 2.6 have been used as the basis for developing potential site-specific remedial alternatives listed in this section. Feasible remedial technologies and process options have been combined into comprehensive site remedial alternatives that address the RAOs detailed in Section 2.2.

3.1 Development of W&L Property Soil Alternatives

The remedial alternatives for the impacted soil at the W&L Property are discussed below and are also summarized in Table 3-1. A pre-design investigation (PDI) may be completed prior to the Remedial Design (RD) phase in order to refine the extents of impacted soil areas as necessary to support the design for the selected alternative.

3.1.1 Alternative S-1 – No Action

This alternative is used as a baseline for comparison to the other alternatives in accordance with the NCP (USEPA, 1990) and RI/FS guidance (USEPA, 1988). There are no remedial actions involved with this alternative. Although natural processes may gradually reduce contaminant concentrations, no change is assumed under this alternative.

3.1.2 Alternative S-2 – Institutional Controls on W&L Property

This alternative would achieve the RAOs by implementing institutional controls to prevent future residential use of the W&L Property (including the floodplain soils to the immediate south), thereby preventing the direct exposure of such receptors to COCs in soil that exceed the selected PRGs. Refer to Figure 3-1 for the current estimated extent of soil impacts above PRGs. It is assumed that the entire property and the two properties to the south would receive institutional controls.

In accordance with the ROD, institutional controls would be monitored and enforced as long as contaminants are present above levels that allow for unrestricted use and unlimited exposure (UU/UE), as determined by the five-year review process.

Five-year reviews would also be required since contaminants would remain in excess of levels that allow for UU/UE.

3.1.3 Alternative S-3 – Soil Excavation on W&L Property with Off-Site Disposal

Under this alternative, soil excavation and off-site disposal would remove all soil in excess of soil PRGs for a hypothetical residential scenario on the W&L Property (including floodplain soils to the immediate south). In order to allow for removal of any soil contamination above PRGs that may exist under the remaining floor slab, it is assumed that removal of the floor slab and cobble-filled “pit” where plating tanks were formerly located, would also be required under this alternative. The underground pipe that was formerly used to

discharge wastewater to the wetland (reportedly abandoned in place), the abandoned dry well (reportedly used for solvent disposal in the past), and the former TCE tank area would also be removed if they can be located.

Excavated soil and building debris (concrete) would be transported off-site for proper disposal. Following excavation and disposal, site restoration would occur, including backfilling and grading with off-site clean soil and re-vegetation to control erosion. The leased portion of the property, which is actively used currently for commercial activities, would be restored with pavement to support continued operations.

The excavation footprint covers approximately 66,310 square feet. The excavation depth is anticipated to vary from 2 to 10 feet bgs or the depth of groundwater, whichever is shallower. A PDI would be completed to further refine the depths and lateral extent of excavation. The total impacted volume of soil is estimated to be approximately 15,532 cubic yards. See Figure 3-1 for the current estimated extent and depths of soil excavation that would be required under this alternative.

Backfill and grading would occur at the site to achieve existing elevations and grades. Erosion control measures would be required during the soil removal and until the site is stabilized.

3.1.4 Alternative S-4 – Soil Capping on W&L Property and Institutional Controls

Under this alternative, the RAOs would be achieved by physically placing 2 feet of clean soil to cap, or isolate, the impacted soils and implementing institutional controls to restrict disturbance of the soil cap. A soil cap would reduce exposure risks at the site by preventing direct contact with contaminated soil. Periodic inspections and maintenance of the cover would be needed to ensure its integrity. The soil cap footprint covers approximately 66,310 square feet. See Figure 3-2 for the current estimated extent of the soil cap.

In accordance with the ROD, institutional controls would be monitored and enforced as long as contaminants are present above levels that allow for UU/UE, as determined by the five-year review process.

Five-year reviews would also be required since contaminants would remain in excess of levels that allow for UU/UE.

3.2 Development of Soil in Residential Yards Alternatives

The remedial alternatives for the impacted soil in residential yards west of North Avenue are discussed below and are also summarized in Table 3-2. A pre-design investigation (PDI) would be completed prior to the Remedial Design (RD) phase in order to refine the extent of impacted soil areas and support the design for the selected alternative.

3.2.1 Alternative SL-1 – No Action

This alternative is used as a baseline for comparison to the other alternatives in accordance with the NCP (USEPA, 1990) and RI/FS guidance (USEPA, 1988). There are no remedial actions involved with this

alternative. Although natural processes may gradually change contaminant concentrations, conditions are assumed to remain essentially unchanged under this alternative.

3.2.2 Alternative SL-2 – Capping and Institutional Controls on Residential Properties

Under this alternative, the RAOs would be achieved by physically placing 2 feet of clean soil to cap, or isolate, the soils that exceed the PRG in residential yards west of North Avenue and south of Deanville Road and implementing institutional controls to restrict disturbance of the soil caps. A soil cap in each of these areas would reduce exposure risks by preventing direct contact with contaminated soil. Periodic inspections and maintenance of the caps would be needed to ensure their integrity. In the residential yards to the west of North Avenue, the soil cap footprint would cover approximately 7,790 square feet. In the residential yards to the south of Deanville Road the cap would cover approximately 520 square feet. A PDI would be completed to further refine the lateral extent of the soil cap. This estimate is derived from the area between the wetland boundary and the FEMA Flood Zone AE for the lots that directly border the Southern Wetland, based on the assumption that flooding of the Southern Wetland may have transported contamination to the western edges of residential yards. For the two potentially impacted lots south of Deanville Road, there is only one sample on each lot that appears to be significantly impacted, and it is not clear that the source is flooding from the Southern Wetland. For these two properties, an area around the impacted points has been drawn but there is little basis for the extent shown since the points appear to be "hot spots". Additional sampling would be needed to define the extent.

In accordance with the ROD, the institutional controls would be monitored and enforced as long as contaminants are present above levels that allow for UU/UE, as determined by the five-year review process.

Five-year reviews would also be required since contaminants would remain in excess of levels that allow for UU/UE.

3.2.3 Alternative SL-3 – Soil Excavation on Residential Properties with Off-Site Disposal

Under this alternative, excavation and off-site disposal would remove lead-contaminated surface soil with concentrations in excess of 200 mg/kg from the affected residential properties. Approximately 8,310 square feet of surface soil ranging in depth from 0 to 1 feet bgs would be excavated and disposed of off-site as non-hazardous waste.

This estimate is derived from the area between the wetland boundary and the FEMA Flood Zone AE for the lots that directly border the Southern Wetland, based on the assumption that flooding of the Southern Wetland may have transported contamination to the western edges of residential yards. For the two potentially impacted lots south of Deanville Road, there is only one sample on each lot that appears to be significantly impacted, and it is not clear that the source is flooding from the Southern Wetland. For these two properties, an area around the impacted points has been drawn but there is little basis for the extent shown since the points appear to be "hot spots". The total impacted volume is estimated to be

approximately 310 cubic yards. A PDI would be required to further refine the limits of excavation. See Figure 3-3 for the current estimated extent of surface soil excavation.

Backfill and grading would occur at each property to achieve existing elevations and grades. Erosion control measures would be required during soil removal and until the site is stabilized. Property restoration would involve landscaping to replace lawn and plantings and to repair any fencing to pre-remedial conditions.

3.3 Development of Groundwater/Surface Water Alternatives

The remedial alternatives for the impacted overburden groundwater and surface water at the W&L site are discussed below and are also summarized in Table 3-3. Overburden groundwater and surface water are evaluated together because of the interaction between these two media. Surface water impacts are a result of groundwater impacts rising to the surface. Remedial actions designed for groundwater must also result in achieving the surface water goals.

3.3.1 Alternative GW/SW-1 – No Action

This alternative is used as a baseline for comparison to the other alternatives in accordance with the NCP (USEPA, 1990) and RI/FS guidance (USEPA, 1988). This alternative does not include physical actions for treatment, institutional controls, monitoring, or associated costs. There are no remedial actions involved with this alternative.

3.3.2 Alternative GW/SW-2a – Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat

This alternative would achieve RAOs by combining soil excavation and in-situ soil treatment within the source area (former W&L facility footprint and area just to the south) with a groundwater pump and treat system to intercept and treat the hexavalent chromium groundwater plume prior to discharge to Bliss Brook; long-term groundwater and surface water monitoring and evaluation of groundwater attenuation; maintenance of existing residential SSDSs; maintenance of the existing engineered cover and existing PRB; and institutional controls.

The groundwater pump and treat system would augment the existing PRB, which appears to be partially preventing discharge of hexavalent chromium-contaminated groundwater to Bliss Brook at levels above surface water PRGs. The location and conceptual design of the pump and treat system is depicted in Figure 3-4. Hexavalent chromium has been detected in the brook just south of the existing PRB and the length of the discharge area containing hexavalent chromium appears to be 400 feet long. Either a series of extraction wells or a recovery trench would be installed in the area just south of the covered area. Recovered groundwater would be conveyed to a treatment plant and then discharged to Bliss Brook upstream from the recovery system. Thus, the remedial action would be designed to minimize changes in net flow in the stream. The treatment system would be designed to remove hexavalent chromium and cVOCs to meet surface water discharge criteria. The conceptual locations for the extraction wells or recovery trench, piping, and treatment plant are shown on Figure 3-4.

Soil excavation and in-situ treatment within the source area (former W&L facility footprint and area just to the south) would be conducted to address concentrations of both hexavalent chromium and TCE and other cVOCs that are remaining in soil and overburden groundwater in the immediate area of the former W&L facility that may be acting as an ongoing source of contamination to site-wide groundwater. The soil excavation/in-situ treatment footprint is depicted on Figure 3-4 and covers an area of approximately 14,000 square feet. This area is anticipated to be a reasonable worst case estimate that would be refined during pre-design investigations. The floor slab from the former facility would be removed, along with the cobble-filled "pit" where the plating tanks were formerly located. The soil removal/treatment would include soil above the water table and soil below the water table down to the bedrock (to the extent practical). The goal is to remove/treat soil that is a significant source of continuing impacts to groundwater. The footprint and depth of excavation/treatment would be determined as part of the pre-design investigation. As part of the pre-design investigation a specific numerical goal for soil below the water table may be developed or a mass removal goal (90% mass hexavalent chromium removed, for example) may be proposed. For the purpose of developing the approach in more detail and for cost estimation, soils above 100 mg/kg hexavalent chromium will be considered significant sources and removed or treated. Considering that overburden groundwater in the area is impacted at a level of 10 to 40 mg/L, it is reasonable to expect that soil with greater than 100 mg/kg would be potential active sources. On this basis the area and depth of excavation would encompass soil with hexavalent chromium concentrations greater than 100 mg/kg and is expected to include the plating tank area. As part of pre-design investigation, there would be an attempt to locate other potential source areas described in historic documents, but not located during past investigations (former discharge line, dry well, and TCE storage tank area). If found during the pre-design investigation or once the floor slab is removed, these areas would also be selectively removed and the soil transported off-site for proper disposal. The excavation area as shown on Figure 3-4 extends west to the fence line and the approximate location of the former TCE storage tank.

Based on available soil boring/well data, the top of bedrock is expected to be encountered between 25 to 30 feet bgs. The water table varies from approximately 6 to 10 feet bgs in the area of the building foundation. Soil, along with any remaining debris, would be excavated to a depth approximately 15 feet above the top of bedrock. Excavated soil and debris would be temporarily stockpiled and then transported off-site for proper disposal. Within the open excavation area, soil blending would be conducted down to bedrock to mix reactive media (zero-valent iron) into the subsurface soil. For these site conditions use of the excavator bucket to blend in ZVI is likely to be the best approach. Pre-blending ZVI with medium- sized sand would facilitate mixing into the till materials at this location. The deep soil mixing is best done with wet soils but removal and treatment of excess water is typically necessary. Treatability tests with soil and groundwater from the Site demonstrated that ZVI or FerroBlack-H would be effective for treating hexavalent chromium. Because ZVI is also effective for treating TCE but FerroBlack-H is not, ZVI is the most likely choice for the reactive media. The excavated soil would be transported off-site for proper disposal. The area would be backfilled with a clean sand/ZVI blend and graded with off-site clean soil as needed to match the surrounding grade and re-vegetated to control erosion.

The TCE plume appears to originate in the area to the immediate west of the soil excavation/in-situ treatment area described above. To address the TCE plume, the area of excavation and ZVI blending would be extended to the west as noted above (See Figure 3-4). It is assumed that the additional area of excavation and ZVI blending would extend to near the existing fence line and not onto the portion of the property currently used by an active commercial tenant. The intent is to encompass the area where the TCE tank was formerly located, rather than the entire width of the TCE plume. The additional area of excavation and ZVI blending would create a zone of TCE treatment that would treat TCE in the immediate area and upgradient.

Long-term surface water monitoring, groundwater monitoring, and evaluation of groundwater attenuation would occur to monitor the progress of the source area soil removal/in-situ treatment and pump and treat system towards achieving PRGs. Long-term groundwater monitoring data would also be needed to evaluate whether the site-wide groundwater plumes are stable or shrinking. Additionally, monitoring would be conducted periodically to evaluate whether the cVOCs in groundwater have attenuated such that the existing residential SSDSs are no longer needed.

This alternative would include periodic inspections and maintenance of the existing engineered cover and PRB and the existing residential SSDSs to ensure that they are functioning as intended.

Institutional controls would be implemented to:

1) Address the future construction worker risk due to hexavalent chromium in shallow groundwater on the W&L Property until shallow groundwater PRGs are achieved;

2) Prevent contact with contaminated groundwater and the installation of non-drinking water wells (i.e. irrigation wells) across the extent of the site-wide groundwater plume where non-drinking water scenario PRGs for residential groundwater are exceeded and/or which may cause migration of the contaminated plume;

3) Protect and prevent contact with existing and proposed treatment infrastructure;

4) Require either a vapor intrusion evaluation or vapor mitigation system be installed if an occupied building is to be constructed over the shallow groundwater VOC plume, within or to the south of the former building footprint on the W&L Property; and,

5) Prevent contact with soil beneath the existing engineered cover located behind the Paulette Lane residential area adjacent to Bliss Brook.

3.3.3 Alternative GW/SW-2b – Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat with Mid-Plume Treatment

As with Alternative GW/SW-2a, this alternative would achieve RAOs by combining soil excavation and in-situ soil treatment within the source area (former W&L facility footprint and area just to the south) with a

groundwater pump and treat system to intercept and treat the hexavalent chromium groundwater plume prior to discharge to Bliss Brook; long-term groundwater and surface water monitoring and evaluation of groundwater attenuation; maintenance of existing residential SSDSs; maintenance of the existing engineered cover and PRB; and institutional controls; all of which have been identified above in Section 3.3.2. However, this alternative would be augmented with the addition of a mid-plume in-situ treatment line.

In-situ soil treatment would be conducted along the west side of North Avenue (adjacent to the Southern Wetland) in a line that runs north-south along the road and approximately centered on the AE-04 well cluster, with a goal of reducing the mass of hexavalent chromium and TCE that would migrate in overburden groundwater further downgradient and need to be addressed through treatment just west of Bliss Brook. The conceptual location of the mid-plume in-situ soil treatment area is shown on Figure 3-5. For cost purposes, it is assumed that the mid-plume component would consist of a series of 10-inch augered holes down to the top of bedrock that would be filled with a ZVI/sand mixture. The highest concentration of hexavalent chromium detected in overburden groundwater based on existing data is 64,500 ppb at deep overburden well AE-04D. Based on existing groundwater data, it is anticipated that a line of in-situ treatment over a 200-foot length centered on AE-04D would intercept the most impacted portion of the overburden plume, with levels of hexavalent chromium on the order of 30,000 to 70,000 ppb. The in-situ treatment line, as placed, would also intercept the portion of the TCE plume that contains some of the most elevated concentrations (50 ppb TCE and greater) in the overburden.

3.3.4 Alternative GW/SW-3a – Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier

This alternative would achieve RAOs by combining soil excavation and in-situ treatment within the source area (former W&L facility footprint and area just to the south) with an extension of the existing PRB to reduce hexavalent chromium in groundwater to the less toxic trivalent form prior to discharge of the groundwater to Bliss Brook; long-term groundwater and surface water monitoring and evaluation of groundwater attenuation; maintenance of existing residential SSDSs; maintenance of the existing engineered cover and existing PRB; and institutional controls.

The PRB would augment the existing PRB, which appears to be partially preventing discharge of hexavalent chromium-contaminated groundwater to Bliss Brook at levels above surface water PRGs, but does not appear to extend far enough south to treat the full extent of the hexavalent chromium groundwater plume that is discharging to Bliss Brook, and does not appear to be deep enough in the portion along the edge of the engineered cover and groundwater collection pipe (where it is only 4 feet deep). The conceptual location of the extended PRB is shown on Figure 3-6. A conceptual cross section depicting the location of the reactive barrier wall and groundwater flow is provided as Figure 3-7. The location is based on hexavalent chromium results for samples collected from piezometers along the edge of the brook that were installed and sampled in December 2017 (these results are also shown on the figure), and also considers hexavalent chromium results for surface water in Bliss Brook (Figure 1-7) and the hexavalent chromium plume in the

overburden (Figure 1-8). The PRB would contain ZVI, which would work to reduce hexavalent chromium to the less toxic trivalent form.

Other components of Alternative GW/SW-3a would be the same as those previously discussed for Alternatives GW/SW-2a and GW/SW-2b. Those common components are:

- Excavation of soil above the water table in the source area and off-site disposal;
- Excavation and off-site disposal and in-situ blending of soil below the water table down to bedrock in the source area to address hexavalent chromium and TCE source areas;
- Long-term monitoring; and,
- Institutional controls.

3.3.5 Alternative GW/SW-3b – Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier with Mid-Plume Treatment

This alternative would achieve RAOs by combining soil excavation and in-situ treatment within the source area (former W&L facility footprint and area just to the south) with an extension of the existing PRB to reduce hexavalent chromium in groundwater to the less toxic trivalent form prior to discharge of the groundwater to Bliss Brook; long-term groundwater and surface water monitoring and evaluation of groundwater attenuation; maintenance of existing residential SSDSs; maintenance of the existing engineered cover and PRB; and institutional controls. However, this alternative would be augmented with the addition of a mid-plume in-situ treatment line.

Other components of Alternative GW/SW-3a would be the same as those previously discussed for Alternatives GW/SW-2a and GW/SW-2b. Those common components are:

- Excavation of soil above the water table in the source area and off-site disposal;
- Excavation and off-site disposal and in-situ blending of soil below the water table down to bedrock in the source area to address hexavalent chromium and TCE source areas;
- Long-term monitoring; and
- Institutional controls.

Extension of the existing PRB wall near Bliss Brook is the same as previously described for Alternative GW/SW-3a.

The mid-plume in-situ treatment line described in the alternative is the same as previously described under Alternative GW/SW-2b and is repeated here for convenience. In-situ treatment would be conducted along

the west side of North Avenue (adjacent to the Southern Wetland) in a line that runs north-south along the road and approximately centered on the AE-04 well cluster with a goal of reducing the mass of hexavalent chromium and TCE that would migrate further downgradient and need to be addressed through treatment just west of Bliss Brook. The conceptual location of the mid-plume in-situ soil treatment area is shown on Figure 3-8. For cost purposes, it is assumed that the component would consist of a series of 10-inch augered holes down to the top of bedrock that would be filled with a ZVI/sand mixture. The highest concentration of hexavalent chromium detected in overburden groundwater based on existing data is 64,500 ppb at deep overburden well AE-04D. Based on existing groundwater data, it is anticipated that a line of in-situ treatment over a 200-foot length centered on AE-04D would intercept the most impacted portion of the overburden plume, with levels of hexavalent chromium on the order of 30,000 to 70,000 ppb. The in-situ treatment line, as placed, would also intercept the portion of the TCE plume that contains some of the most elevated concentrations (50 ppb TCE and greater) in the overburden.

3.4 Development of Bedrock Groundwater Alternatives

The remedial alternatives for the impacted bedrock groundwater at the W&L site are discussed below and are also summarized in Table 3-4.

3.4.1 Alternative BR-1 – No Action

This alternative is used as a baseline for comparison to the other alternatives in accordance with the NCP (USEPA, 1990) and RI/FS guidance (USEPA, 1988). This alternative does not include physical actions for treatment, institutional controls, monitoring, or associated costs. There are no remedial actions involved with this alternative.

3.4.2 Alternative BR-2 – Institutional Controls

This alternative would achieve RAOs related to bedrock groundwater through institutional controls to prevent exposure of residential receptors to COCs in bedrock groundwater that exceed non-drinking water PRGs and long-term bedrock groundwater monitoring with evaluation of natural attenuation until such time as non-drinking water PRGs have been met. If pre-design investigations described below show that bedrock groundwater underlying portions of the Bungay River Resource Protection District exceeds drinking water PRGs, then additional contingency measures would be taken, including the expansion of the area to be monitored to include the impacted portion of the District and the implementation of additional institutional controls to prevent exposure of residential receptors to COCs in bedrock groundwater within the District that exceed drinking water PRGs.

Institutional controls would be implemented to prevent contact with contaminated groundwater and the installation of non-drinking water wells (i.e. irrigation wells) across the extent of the site-wide bedrock groundwater plume where non-drinking water scenario PRGs for bedrock groundwater are exceeded. As a contingency measure, institutional controls would be implemented to prevent the installation of drinking

water wells within the potentially impacted portions of the Bungay River Water Resource Protection District to prevent plume migration from the contaminated non-drinking water area into the District.

Pre-design investigations would be conducted to further refine the downgradient extent of the hexavalent chromium groundwater plume, including determining whether the plume extends into the bedrock underlying the Bungay River Water Resource Protection District. Available RI data show exceedances of the residential drinking water PRGs for total and hexavalent chromium beyond Bliss Brook in the bedrock groundwater. Pre-design investigations would also address any gaps in the estimated extent of bedrock groundwater that exceeds non-drinking water PRGs to determine where institutional controls would be needed.

Based on the available RI data, including hexavalent chromium concentrations in samples from bedrock wells and the geophysical logging data, and filling in gaps with literature sources and data from nearby similar sites, a one-dimensional model (MPNE1D) was used to predict the extent to which hexavalent chromium may be present in bedrock groundwater downgradient of the Site. The modeling assumptions, calculations, and resultant figures are included in Appendix F. Figure 3-9 shows the model-predicted extent of hexavalent chromium contamination in the bedrock overlain on the isopleths as presented in the RI report (100 ppb and 10,000 ppb isopleths) and the location of the Bungay River Water Resource Protection District. Based on this modeling, the extent of bedrock groundwater contamination at a concentration of 100 ppb is predicted to stop approximately 200 feet upgradient of the District as measured along the plume center line, suggesting bedrock groundwater in the District should not be significantly impacted by the Site plume. Lower concentrations (10 ppb and 1 ppb) were also estimated along the plume center line, and the results suggest that groundwater containing 1 ppb hexavalent chromium may be present in the westernmost portion of the District, extending into it by approximately 150 feet. The model was calibrated to three data points located at three different distances from the suspected source area. See Appendix F for further details and the limitations of the model.

Figure 3-13 shows the current estimated areas where the non-drinking water scenario and drinking water PRGs apply using a combination of the actual well sample data for hexavalent chromium in overburden and bedrock groundwater and the one-dimensional model-predicted extents for hexavalent chromium contamination in the bedrock groundwater. As stated above, the estimated extent of bedrock groundwater above the drinking water PRG within the District is based on the modeling, as no monitoring well data is currently available to define the downgradient extent of the plume. Note that because the drinking water PRG for hexavalent chromium (0.035 ppb) is well below the reporting limit for the RI groundwater data of 0.5 ppb, well data cannot be used to estimate an isopleth at the PRG. One (1) ppb (twice the reporting limit) was selected as a value that could reasonably be estimated.

Additional bedrock monitoring wells will need to be installed and sampled for hexavalent chromium to determine whether impacts extend into the District and if so, how far those impacts extend. The suggested approach is to first install additional bedrock monitoring wells along Ashton Road (this road is just upgradient of the District; see Figure 3-9). If contamination is not found to extend as far as Ashton Road, it

could be concluded that impacts to the District are not present. If bedrock groundwater contamination is found to extend as far as Ashton Road, additional wells would be needed to determine the extent of contamination within the District so that the boundaries of the institutional controls could be established.

Long-term bedrock groundwater monitoring and evaluation of groundwater attenuation would occur to monitor the progress of the remedial actions directed at soil, overburden groundwater, and surface water that would also be expected to reduce hexavalent chromium concentrations in bedrock groundwater over time. Monitoring would include the portion of the bedrock groundwater plume where non-drinking water PRGs are exceeded and as a contingency measure, if bedrock groundwater underlying portions of the District exceeds drinking water PRGs, the monitoring program would be expanded to address the impacted portions of the District.

In accordance with the ROD, institutional controls would be monitored and enforced as long as contaminants are present above levels that allow for UU/UE, as determined by the five-year review process.

Five-year reviews would be required since contaminants would remain in excess of levels that allow for UU/UE.

3.4.3 Alternative BR-3 – Institutional Controls and Contingency Remedy of Focused In-Situ Injections (West of North Avenue)

This alternative would achieve the RAOs related to bedrock groundwater through a combination of institutional controls to prevent exposure of residential receptors to COCs in bedrock groundwater that exceed non-drinking water PRGs and long-term bedrock groundwater monitoring and evaluation of groundwater attenuation until such time as non-drinking water PRGs are met and institutional controls are no longer needed. If pre-design investigations described below show that bedrock groundwater underlying portions of the Bungay River Resource Protection District exceeds drinking water PRGs, then additional contingency measures would be taken, including the design and implementation of focused in-situ treatment on the west side of North Avenue, the expansion of the area to be addressed with monitoring to include the impacted portion of the District, and the implementation of additional institutional controls to prevent exposure of residential receptors to COCs in bedrock groundwater within the District that exceed drinking water PRGs and to protect remedy infrastructure.

Institutional controls would be implemented to prevent contact with contaminated groundwater and the installation of non-drinking water wells (i.e. irrigation wells) across the extent of the site-wide bedrock groundwater plume where non-drinking water scenario PRGs for bedrock groundwater are exceeded.

As part of contingency measures, if bedrock groundwater underlying portions of the District exceeds drinking water PRGs, further institutional controls would be implemented to:

1) Prevent the installation of wells within the potentially impacted portion of the Bungay River Water Resource Protection District to prevent plume migration from the contaminated non-drinking water area into the District; and

2) Protect and prevent contact with proposed treatment infrastructure on multiple properties.

Pre-design investigations would also be conducted to further refine the downgradient extent of the hexavalent chromium groundwater plume, including where it is estimated to extend into the bedrock underlying the Bungay River Water Resource Protection District, as described for Alternative BR-2. Available RI data show exceedances of the residential drinking water PRGs for total and hexavalent chromium beyond Bliss Brook in the bedrock groundwater. The predicted extent of bedrock groundwater contamination with hexavalent chromium is shown on Figure 3-9. Based on the modeling (see Appendix F), the contamination does not extend significantly into the District; however this must be confirmed by installation and sampling of bedrock monitoring wells. The suggested approach is to first install additional bedrock monitoring wells along Ashton Road. If contamination is not found to extend as far as Ashton Road, it could be concluded that impacts to the District are not present. If bedrock groundwater contamination is found to extend as far as Ashton Road, additional wells would be needed to determine the extent of contamination within the District.

Pre-design investigations would also address any gaps in the estimated extent of bedrock groundwater that exceed non-drinking water PRGs to determine where institutional controls would be needed.

Long-term bedrock groundwater monitoring and evaluation of groundwater attenuation would be conducted to determine the effectiveness of the remedy. Monitoring would address the portion of the bedrock groundwater plume where non-drinking water PRGs are exceeded and as a contingency measure, if bedrock groundwater underlying portions of the District exceeds drinking water PRGs, the monitoring program would be expanded to address the impacted portions of the District.

As an additional contingency measure, if bedrock groundwater underlying portions of the District exceeds drinking water PRGs, focused in-situ treatment of bedrock groundwater would be conducted using ZVI or another reagent along the west side of North Avenue (adjacent to Southern Wetland). The treatment area would cover an estimated distance of approximately 200 feet, centered on the AE-04 well cluster where hexavalent chromium concentrations in bedrock are highest, and also positioned to intercept the portion of the plume with the highest TCE concentrations in bedrock. The conceptual in-situ treatment area is shown on Figure 3-10. Injection wells would be installed 10 feet into competent bedrock in this area (estimated to be approximately 30 feet bgs) and injected with a treatment solution to treat shallow bedrock groundwater before it migrates under North Avenue. These are assumptions for FS evaluation purposes; pre-design investigations would be performed to determine well locations and depths. Bench testing showed that, from a chemistry standpoint, hexavalent chromium at the site can be successfully treated with FerroBlack-H or ZVI. Other reagents may also be effective and bench-scale testing may or may not be necessary. To determine if injection into the bedrock is feasible and to allow detailed design, a pilot-scale injection test is assumed to be necessary. ZVI was found to be very effective for hexavalent chromium reduction and

precipitation in bench studies and ZVI is known to be effective for TCE. A key limitation for micro-size ZVI is that currently available formulations do not travel significant distances in groundwater. Water would be treated as it passes under North Avenue but bedrock groundwater already present downgradient of North Avenue would not be treated (other than gradual natural attenuation). Alternative ZVI types (nanoscale ZVI) or alternative reagents that can travel with the groundwater and provide faster treatment would be considered in the design phase.

In accordance with the ROD, institutional controls would be monitored and enforced as long as contaminants are present above levels that allow for UU/UE, as determined by the five-year review process.

Five-year reviews would be required since contaminants would remain in excess of levels that allow for UU/UE.

3.4.4 Alternative BR-4 – Institutional Controls and Contingency Remedy of Pump and Treat

This alternative would achieve the RAOs related to bedrock groundwater through a combination of institutional controls to prevent exposure of residential receptors to COCs in bedrock groundwater that exceed non-drinking water PRGs and long-term bedrock groundwater monitoring and evaluation of groundwater attenuation until such time as non-drinking water PRGs have been met and institutional controls are no longer needed. If pre-design investigations described below show that bedrock groundwater underlying portions of the Bungay River Resource Protection District exceeds drinking water PRGs, then additional contingency measures would be taken, including the design and implementation of a bedrock groundwater pump and treat system along Bliss Brook, the expansion of the area to be addressed with monitoring to include the impacted portion of the District, and the implementation of additional institutional controls to prevent exposure of residential receptors to COCs in bedrock groundwater within the District that exceed drinking water PRGs and to protect remedy infrastructure.

Institutional controls would be implemented to prevent the installation of non-drinking water wells (i.e. irrigation wells) across the extent of the site-wide bedrock groundwater plume where non-drinking water scenario PRGs for bedrock groundwater are exceeded.

As part of contingency measures, if bedrock groundwater underlying portions of the District exceeds drinking water PRGs, further institutional controls would be implemented to:

1) Prevent the installation of wells within the potentially impacted portion of the Bungay River Water Resource Protection District to prevent plume migration from the contaminated non-drinking water area into the District; and

2) Protect and prevent contact with proposed treatment infrastructure on multiple properties.

Pre-design investigations would also be conducted to further refine the downgradient extent of the hexavalent chromium groundwater plume, as described previously for Alternative BR-3.

Long-term bedrock groundwater monitoring and evaluation of groundwater attenuation would be conducted to determine the effectiveness of the remedy. Monitoring would address the portion of the bedrock groundwater plume where non-drinking water PRGs are exceeded and as a contingency measure, if bedrock groundwater underlying portions of the District exceeds drinking water PRGs, the monitoring program would be expanded to address the impacted portions of the District.

As an additional contingency measure, if bedrock groundwater underlying portions of the District exceeds drinking water PRGs, a groundwater pump and treat system would be installed and operated to intercept and treat the hexavalent chromium bedrock groundwater plume to prevent migration of contaminated groundwater into the bedrock underlying the District. Bedrock groundwater extraction wells would be installed along Bliss Brook to intercept the bedrock groundwater plume. The conceptual location of the extraction wells, piping, and treatment plant is shown on Figure 3-11. Pre-design investigations to include a pump test would be needed to design an extraction system that would contain the plume sufficiently to prevent continued impact to the District. Bench and/or pilot scale testing of the treatment process may be also conducted as part of pre-design work. Treated groundwater would be discharged to Bliss Brook upstream of the recovery system.

In accordance with the ROD, institutional controls would be monitored and enforced as long as contaminants are present above levels that allow for UU/UE, as determined by the five-year review process.

Five-year reviews would be required since contaminants would remain in excess of levels that allow for UU/UE.

3.4.5 Alternative BR-5 – Institutional Controls and Contingency Remedy of Enhanced (Deeper) Permeable Reactive Barrier

This alternative would achieve the RAOs related to bedrock groundwater through a combination of institutional controls to prevent exposure of residential receptors to COCs in bedrock groundwater that exceed non-drinking water PRGs, and long-term bedrock groundwater monitoring and evaluation of groundwater attenuation until such time as non-drinking water PRGs have been met and institutional controls are no longer needed. If pre-design investigations show that bedrock groundwater underlying portions of the Bungay River Resource Protection District exceeds drinking water PRGs, then additional contingency measures would be taken, including the enhancement (deepening) of the existing PRB along Bliss Brook, the expansion of the area to be addressed with monitoring to include the impacted portion of the District, and the implementation of additional institutional controls to prevent exposure of residential receptors to COCs in bedrock groundwater within the District that exceed drinking water PRGs and to protect remedy infrastructure.

Institutional controls would be implemented to prevent the installation of non-drinking water wells (i.e. irrigation wells) across the extent of the site-wide bedrock groundwater plume where non-drinking water scenario PRGs for bedrock groundwater are exceeded.

As part of contingency measures, if bedrock groundwater underlying portions of the District exceeds drinking water PRGs, further institutional controls would be implemented to:

1) Prevent the installation of wells across the extent of the bedrock groundwater plume within the potentially impacted portion of the Bungay River Water Resource Protection District to prevent plume migration from the contaminated non-drinking water area into the District; and

2) Protect and prevent contact with proposed treatment infrastructure on multiple properties.

Pre-design investigations would also be conducted to further refine the downgradient extent of the hexavalent chromium groundwater plume, as described previously for Alternative BR-3.

Long-term bedrock groundwater monitoring and evaluation of groundwater attenuation would be conducted to determine the effectiveness of the remedy. Monitoring would address the portion of the bedrock groundwater plume where non-drinking water PRGs are exceeded and as a contingency measure, if bedrock groundwater underlying portions of the District exceeds drinking water PRGs, the monitoring program would be expanded to address the impacted portions of the District.

As an additional contingency measure, if bedrock groundwater underlying portions of the District exceeds drinking water PRGs, in-situ treatment of bedrock groundwater with zero-valent iron would be conducted along Bliss Brook for a distance of approximately 300 feet. The conceptual location of the bedrock injections is shown on Figure 3-12. Injection wells would be installed 10 feet into competent bedrock in this area (estimated to be approximately 50 feet bgs) and injected with a ZVI solution to treat bedrock groundwater with concentrations of 1,000 ppb hexavalent chromium or greater before it migrates to the District. As shown in Figure 3-12, the proposed location for the bedrock ZVI injections are collocated with the existing PRB at some locations and downgradient of the existing PRB at other locations. The existing PRB is located in overburden. The ZVI injections into the bedrock would be designed to avoid damage to or adverse impact to the existing PRB and groundwater collection pipe. The bedrock injections are unlikely to lead to a significant improvement in overburden groundwater or the brook. Thus, the previously discussed remedial measures for overburden groundwater and the brook would still be necessary. These are assumptions for FS evaluation purposes; pre-design investigations would be performed to determine locations and depths. Bench and/or pilot scale testing of the treatment process may also be conducted as part of pre-design work.

In accordance with the ROD, institutional controls would be monitored and enforced as long as contaminants are present above levels that allow for UU/UE, as determined by the five-year review process.

Five-year reviews would be required since contaminants would remain in excess of levels that allow for UU/UE.

3.5 Screening of Alternatives

Initial screening of remedial alternatives developed in Sections 3.1 through 3.4 is performed in this section. The screening process is used to potentially eliminate alternatives that do not appear advantageous to carry through to the detailed evaluation in Section 4.0. This initial screening process includes an assessment of the advantages and disadvantages of each alternative on the basis of their effectiveness, implementability, and cost, in accordance with the RI/FS guidance (USEPA, 1988).

The effectiveness of each remedial alternative was assessed using the following criteria:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reductions in toxicity, mobility, or volume through treatment
- Short-term effectiveness

The implementability of each remedial alternative was assessed using the following criteria:

- Technical feasibility
- Administrative feasibility
- Applicability based on site conditions and layout

The costs were initially assessed using engineering judgment, considering capital costs for equipment and construction and operation and maintenance (O&M) estimates. Cost estimates will be developed as part of detailed evaluation.

3.5.1 Screening of W&L Property Soil Alternatives

Tables 3-5 through 3-8 present the initial screening of the remedial alternatives developed to address W&L Property soil. Based on this screening, Alternatives S-1 and S-2 were retained for detailed evaluation. Alternative S-3 – Excavation of W&L Property Soil was removed from further evaluation because future redevelopment of the property for residential uses is highly unlikely. The property is zoned for commercial/industrial use and the leased portion of the property is currently actively used by a tenant for commercial purposes. The disruption and cost of performing this alternative is not warranted when its sole purpose is to remediate it for a future use that is not reasonably likely to occur. Alternative S-4 – Capping and Institutional Controls was removed from further evaluation for similar reasons (i.e., residential use is not a reasonable anticipated future use), and also because capping would make reuse of the site for residential purposes difficult. Also, since a hypothetical future resident is the only receptor of concern for W&L

Property soils, capping is not likely to provide a benefit over institutional controls alone or a remedial alternative that would remove soil contaminants.

3.5.2 Screening of Soil in Residential Yards Alternatives

Tables 3-9 through 3-11 present the initial screening of the remedial alternatives developed to address soil in residential yards west of North Avenue. Based on this screening, Alternatives SL-1 and SL-3 were retained for detailed evaluation. Alternative SL-2 – Soil Capping and Institutional Controls on Residential Properties was removed from further evaluation because contaminants would remain on the properties above PRGs. Although SL-2 would be effective in reducing exposure, providing the ICs are adhered to, it will restrict a homeowner's use of the property. Capping may also result in net filling within the floodplain and decrease flood storage. Consequently implementation of this alternative would likely result in resistance from the owners. Based on this consideration, capping is not likely to provide a benefit over a remedial alternative that would remove soil contaminants.

3.5.3 Screening of Groundwater/Surface Water Alternatives

Tables 3-12 through 3-16 present the initial screening of the remedial alternatives developed to address impacted groundwater and surface water. Based on this screening, Alternatives GW/SW-1, GW/SW-2a, GW/SW-2b, GW/SW-3a, and GW/SW-3b have all been retained for detailed evaluation.

3.5.4 Screening of Bedrock Groundwater Alternatives

Tables 3-17 through 3-21 present the initial screening of the remedial alternatives developed to address impacted bedrock groundwater. Based on this screening, Alternatives BR-1, BR-2, BR-3, BR-4, and BR-5 have all been retained for detailed evaluation.

4.0 DETAILED ANALYSIS OF ALTERNATIVES

A detailed evaluation of candidate remedial alternatives is conducted to evaluate each of the alternatives individually, and subsequently apply the evaluation comparatively among them (refer to Section 5.0). The following seven criteria are evaluated during the FS phase of the CERCLA process. Two additional criteria, state and community acceptance, will be evaluated as part of the subsequent regulatory and community review phase.

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Detailed descriptions of each evaluation criterion are presented in Table 4-1.

4.1 W&L Property Soil

4.1.1 Alternative S-1 – No Action

The No Action alternative, as required under the NCP, would involve no remedial response activities and would provide no additional protection of human health or the environment; this alternative provides a baseline for comparison to other alternatives.

Cost – No action would be performed under this alternative, therefore no costs are presented.

Alternative Evaluation - The detailed analysis of Alternative S-1 – No Action compared against each of the FS evaluation criteria is presented in Table 4-2.

4.1.2 Alternative S-2 – Institutional Controls on W&L Property

This alternative would achieve the RAOs by implementing institutional controls to prohibit future residential use of the W&L Property (including the floodplain soils to the immediate south), thereby preventing the direct exposure of such receptors to COCs in soil that exceed the selected PRGs. It is assumed that removal of the building floor slab and cobble-filled "pit" would be implemented under the GW/SW alternatives, along with pre-design sampling focused on soil in the source area (former W&L facility footprint and area just to the south) and a combination of soil excavation and in-situ treatment within the source area. Refer to

Figure 3-1 for the current estimated extent of soil impacts above PRGs, which covers an area of approximately 66,310 square feet.

Institutional Controls – Institutional controls would be needed to prohibit future residential use of the W&L Property (including the floodplain soils to the immediate south). Based on the current estimated extent of contamination, institutional controls would be needed for the W&L property at 78 North Avenue, and the two parcels to the south along North Avenue (see Appendix H for properties with map and lot numbers). It is assumed that deed restrictions would be needed and would take the form of Activity and Use Limitations (AULs) for each parcel. A component of this deed restriction would include requirements of adhering to the guidelines of a groundwater and soil management plan (contaminated shallow groundwater is addressed separately through the GW/SW alternatives), which would be established for activities, such as construction-related activities, that could cause exposures to COCs or potential movement of soils beyond the restricted areas. In accordance with the ROD, institutional controls would be monitored and enforced as long as contaminants are present above levels that allow for UU/UE, as determined by the five-year review process.

Five-Year Reviews – Five-year reviews would also be required since contaminants would remain in excess of levels that allow for UU/UE. Additional actions may be implemented if necessary as a result of these reviews. It is assumed for cost purposes that five-year reviews would be conducted for the next 30 years.

Cost – For Alternative S-2 – Institutional Controls on W&L Property, capital costs consist of direct and indirect costs anticipated to develop, construct, and implement the remedial alternative. Periodic costs would include the preparation of the remedial action report, five-year review reports, and potential updating of institutional controls. The present worth cost of the alternative is estimated to be approximately $132,000. Cost summary sheets are provided in Appendix D.

Alternative Evaluation - The detailed analysis of Alternative S-2 – Institutional Controls on W&L Property compared against each of the FS evaluation criteria is presented in Table 4-3.

4.2 Soil in Residential Yards

4.2.1 Alternative SL-1 – No Action

The No Action alternative, as required under the NCP, would involve no remedial response activities and would provide no additional protection of human health or the environment; this alternative provides a baseline for comparison to other alternatives.

Cost – No action would be performed under this alternative, therefore no costs are presented.

Alternative Evaluation – The detailed analysis of Alternative SL-1 – No Action compared against each of the FS evaluation criteria is presented in Table 4-4.

4.2.2 Alternative SL-3 – Soil Excavation on Residential Properties with Off-Site Disposal

Under this alternative, RAOs would be achieved by soil excavation and off-site disposal to remove all soil in excess of the soil PRG for lead from the residential properties north of Deanville Road between the wetland and Flood Zone AE (48, 42, and 34 North Avenue) and the Mass Electric parcel. The alternative also includes removal of two isolated areas of soil contamination on two properties south of Deanville Road (10 Deanville Road and 28 North Avenue). The entire Flood Zone AE is not proposed for excavation on these two lots because the remaining samples (once the two "hot spots" are removed) have an average concentration below the PRG of 200 mg/kg fine fraction lead. Since the contaminated soil would be removed from the properties for off-site disposal, no institutional controls or five-year reviews are included in this alternative.

Pre-Design Investigation – Pre-design sampling would be conducted to further refine the extent of soil to be excavated. Refer to Figure 3-3 for the current estimated extent of surface soil impacts above PRGs, which covers a total area of approximately 8,310 square feet (approximately 7,790 square feet west of North Avenue and approximately 520 square feet south of Deanville Road). The focus of the pre-design sampling for this alternative would be to better define the overall horizontal and vertical extent of impacts above the Residential PRG for lead.

A primary objective of the additional sampling is to establish whether a 1 foot excavation depth is suitable. One foot is considered the smallest realistically achievable depth with excavation equipment and is also likely to be sufficiently deep. Current samples are from 0 to 6 inches only; no deeper samples have been collected and analyzed for fine fraction lead. Based on the conceptual site model that the lead contamination was deposited to these areas due to flooding from the Southern Wetland, it is expected that the contamination would be limited to the immediate surface and that soil deeper than one foot bgs would not be impacted by the Site. Additional samples from 1 to 1.5 feet bgs would be collected to confirm that soil deeper than 1 foot bgs is not impacted, and also to obtain more data on the lateral extent of the contamination. This pre-design sampling would also eliminate the need for post-excavation confirmation samples, because the excavation area would have been clearly defined before any excavation takes place. In the unlikely event that fine fraction lead contamination above the PRG is found in the 1-1.5 foot interval samples, the conceptual site model would need to be re-evaluated and more investigation done to try to establish whether the Site is in fact the source of the lead and how the lead came to be located at depth in these areas, or if there are unidentified sources that need to be investigated and understood before a new remediation plan could be developed.

For the purposes of this FS, it is estimated that soil samples would be collected from an additional 10 locations per property and would be analyzed at an off-site laboratory for fine fraction lead.

Soil Removal – The goal of the excavation is to remove all surface soils with exceedances of the PRG for lead on residential property.

Based on existing data and the conceptual site model, the excavation footprint is estimated to be approximately 8,310 square feet and the excavation depth is anticipated to be approximately 1 foot bgs as noted above. The total impacted volume of soil is estimated to be approximately 310 cubic yards. As described above, the excavation extent would be further refined through pre-design investigation.

Prior to the excavation, erosion control measures (i.e., hay bales and silt fences) would be installed around the excavation area. During the excavation, dust control and air monitoring would be performed, as necessary.

All excavated soil would be stockpiled at an approved location. Details regarding stockpile management (e.g., stormwater controls and temporary covers) would be developed during the remedial design phase.

The excavation is shallow (1 foot or less). For the purpose of cost estimation, it is assumed that excavation will not impact structures, driveways, large trees, or utilities.

Management and Disposal of Excavated Soil – Prior to disposal, waste characterization samples would be collected from the stockpiled soil. The excavated soil would be transported and disposed of at an off-site, licensed landfill. Soils are not anticipated to be classified as a hazardous waste and, although it is possible that excavated soil could be disposed of at a Massachusetts Lined Landfill, it has been assumed that the soil will be transported and disposed of at a RCRA Subtitle D facility, as the basis for the FS cost estimate.

The actual disposal classification for excavated soils will be determined through waste characterization sampling. Facilities selected for off-site disposal would need to be deemed acceptable by EPA as required under 40 CFR 300.440.

Work will include a Truck Loading and Transportation Plan. Soil will be loaded and shipped in a manner to avoid spills and tracking of soil off-site. Soil will be shipped under an appropriate manifest or bill of lading. A Traffic Plan will be implemented to ensure efficient flow of trucks to and from the site and to minimize traffic issues in the neighborhood.

Backfill and Site Restoration – Once the contaminated soil has been removed, the excavation would be backfilled with clean soil, compacted, and graded to achieve existing elevations and grades. Topsoil would be placed and each of the residential properties would be re-vegetated to conform with pre-remedial conditions as best as practicable. Erosion control measures would be required during placement of backfill and until the site is stabilized.

Cost – For Alternative SL-3 – Soil Excavation on Residential Properties with Off-Site Disposal, capital costs consist of direct and indirect costs anticipated to develop, construct, and implement the remedial alternative. No periodic costs are anticipated. The cost of the alternative is estimated to be approximately $422,000. Cost summary sheets are provided in Appendix D.

Alternative Evaluation – The detailed analysis of Alternative SL-3 – Soil Excavation on Residential Properties with Off-Site Disposal compared against each of the FS evaluation criteria is presented in Table 4-5.

4.3 Groundwater/Surface Water

4.3.1 Alternative GW/SW-1 – No Action

The No Action alternative, as required under the NCP, would involve no remedial response activities and would provide no additional protection of human health; this alternative provides a baseline for comparison to other alternatives.

Cost – No action would be performed under this alternative, therefore no costs are presented.

Alternative Evaluation – The detailed analysis of Alternative GW/SW-1 – No Action compared against each of the FS evaluation criteria is presented in Table 4-6.

4.3.2 Alternative GW/SW-2a– Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat

This alternative would achieve RAOs by combining soil excavation and in-situ treatment within the source area (former W&L facility footprint and area just to the south) with a groundwater pump and treat system to intercept and treat the hexavalent chromium groundwater plume prior to discharge to Bliss Brook; long-term monitoring of overburden groundwater, surface water in Bliss Brook, overburden groundwater attenuation and existing buildings with SSDSs or which may have the potential for vapor intrusion; maintenance of existing residential SSDSs; maintenance of the existing engineered cover and existing PRB; and institutional controls. Implementation of this alternative is described in the paragraphs that follow.

Source Area Soil (W&L Property) Pre-design Investigations – Pre-design sampling would be conducted to further refine the horizontal extent of soil that would be addressed with a combination of soil excavation and in- and ex-situ soil blending down to bedrock in the area of the former building footprint and just to the south. For the purposes of this FS, it is estimated that soil samples would be collected from up to 50 locations and would be analyzed at an off-site laboratory for hexavalent chromium, with a goal of delineating locations where soil is a continuing source of contamination to groundwater. The soil source may be defined by a specific level of hexavalent chromium in soil (in the range of 50 to 100 mg/kg, as an example) or as removal of a percent mass of hexavalent chromium (90% removal of chromium, for example). The pre-design sampling would also be conducted to determine if the excavation/soil blending area has to be extended to also address TCE in groundwater. Waste characterization sampling (including TCLP analysis) would be conducted at a subset of locations within the top 10 feet to assess whether portions of the soil to be excavated and disposed off-site may be classified as a RCRA characteristic waste. Additionally, as part of the pre-design investigation, it is assumed that test pitting would be conducted to attempt to locate other potential source areas described in historic documents, but not located during past investigations (former discharge line, dry well, and TCE storage tank area). The former discharge line was an underground pipe that was used to discharge wastewater to the wetland and was reportedly abandoned in

place and the abandoned dry well was reportedly used for solvent disposal in the past. If located, these potential sources would be removed along with any associated impacted soils as described below.

The pre-design investigation would also involve a pump test and other studies to assist in determining pumping rates, and the locations and depths of extraction wells. Water from the pump test would also be used to assist in design of the above ground water treatment components. Bench testing for the in-situ treatment has already been performed. Limited additional bench testing to refine the ZVI type and dose may also be conducted.

Source Area Soil (W&L Property) Removal/Treatment – A combination of soil excavation, in-situ soil blending and ex-situ soil blending would be conducted within the source area in the immediate area of the former W&L facility to address concentrations of both hexavalent chromium and TCE and other cVOCs that are remaining in soil and overburden groundwater in that area that may be acting as an ongoing source of contamination to site-wide groundwater.

Removal and Off-Site Disposal of Floor Slab and Cobble-Filled "Pit" – In preparation for soil excavation/soil blending, the remaining concrete floor slab and walls and the cobble-filled "pit" where plating tanks were formerly located would be removed for off-site disposal. The demolished concrete would be stockpiled for full waste characterization and any visible contaminated concrete (such as green staining from chromium) would be segregated from potential non-impacted concrete and managed separately. For cost purposes, it is assumed that approximately 730 cubic yards of concrete and rock debris would require off-site disposal and that approximately 20% of the debris would be characterized and disposed of as RCRA characteristic waste.

Soil Excavation with Soil Blending and Off-Site Disposal - The soil excavation/in-situ treatment footprint is depicted on Figure 3-4 and covers an area of approximately 14,000 square feet. The area and depth of excavation is intended to encompass soil with hexavalent chromium concentrations that are a significant continuing source to groundwater (soil over 100 mg/kg hexavalent chromium was used for preliminary estimates) and is expected to include the plating tank area. Based on pre-design data, an alternative to 100 mg/kg as the source area removal/treatment goal may be developed. As discussed above, the horizontal extent of this area would be refined during pre-design investigations.

Based on available soil boring/well data, the top of bedrock is expected to be encountered between 25 to 30 feet bgs. The water table varies from approximately 6 to 10 feet bgs in the area of the building foundation. Soil, along with any remaining debris, would be excavated to a depth approximately 15 feet above the top of bedrock. Soil from the ground surface to a depth of 15 feet bgs (estimated in-place volume of approximately 7,900 cubic yards) would be temporarily stockpiled for off-site disposal, under the assumption that this interval would be the most heavily contaminated. Within the open excavation (from 15 to 30 feet bgs), soil blending with reactive media (assumed to be 10% for cost estimating purposes) would be conducted in-situ down to bedrock. For these site conditions use of the excavator bucket to blend in ZVI is likely to be the best approach. Pre-blending ZVI with medium sized sand would facilitate mixing into the till materials at this location. The deep soil mixing is best done with wet soils but removal and treatment of excess water is

typically necessary. The excavation would be backfilled to 7.5 feet bgs or to the water table (whichever is higher) with a ZVI and clean sand blend (assumed to be 5% dose for cost estimating purposes) and the remaining excavation would be backfilled with clean sand and graded with clean topsoil from an off-site source. Treatability tests with soil and groundwater from the Site demonstrated that ZVI or FerroBlack-H would be effective for treating hexavalent chromium. Because ZVI is also effective for treating TCE but FerroBlack-H is not, ZVI is the most likely choice for the reactive media.

Prior to the excavation, erosion control measures (i.e., silt fences) would be installed around the excavation area. During the excavation, dust control and air monitoring would be performed, as necessary. Temporary shoring would also be installed during the excavation, blending, and backfilling.

Dewatering would be needed during soil excavation, in-situ soil blending, and backfilling below the water table. It is assumed that any water generated during excavation/treatment and dewatering activities would be collected in frac tanks and treated on-site as needed to meet surface water standards for discharge to surface water. Alternately, water may be collected and shipped off-site. Discharge to the POTW was also investigated as a possible option; however, it was found that discharge of groundwater to the POTW is prohibited by local ordinance and goes against the City of Attleboro's infiltration/inflow control plan, which is a requirement of their National Pollutant Discharge Elimination System (NPDES) permit. Also considered was injection or infiltration to groundwater; this option has been ruled out due to very slow infiltration of a relatively small volume of investigation-derived waste water experienced during the RI, but it could be reconsidered during design, particularly if the surface water discharge option proves to be difficult. On-site treatment with filtration and ion exchange with discharge to the open water portion of the Southern Wetland just south of the W&L property is assumed as the basis for the cost estimate. The drainage of this wetland would need to be assessed first to determine whether such a discharge could potentially cause flooding problems. Discharge criteria for other constituents present in the groundwater that are regulated under NPDES would be derived in accordance with the substantive requirements of the NPDES General Permit for Remediation Activity Discharges – the Remediation General Permit (RGP) in Massachusetts (MAG910000), effective April 8, 2017. Precipitation, reduction, and/or pH adjustment may also need to be considered in the design phase in order to meet the requirements of the RGP.

Details regarding stockpile management (e.g., stormwater controls and temporary covers) would be developed during the remedial design phase. Prior to disposal, waste characterization samples would be collected from the stockpiled soil. The excavated soil and debris would be transported and disposed of at an off-site, licensed landfill or treatment facility. The actual disposal classification for excavated soils will be determined through waste characterization sampling. Facilities selected for off-site disposal would need to be deemed acceptable by EPA as required under 40 CFR 300.440.

It is assumed for cost purposes that approximately half of the soil generated would be classified as RCRA characteristic waste, while the remainder would be non-hazardous. Also, there is the possibility that chromium and/or lead concentrations in a portion of the soil may trigger RCRA Land Disposal Restrictions and that treatment of excavated soils would be needed prior to land disposal.

Removal of Other Potential Sources – If other potential source areas (former discharge line, dry well, and TCE storage tank area) are located either during the pre-design investigation or during the slab removal and/or soil excavation, then the remedy would include removal of these features and any associated visibly contaminated soils. Removing and disposing of these features is not included in the cost estimate.

Backfill and Restoration of Excavation Area – The clean sand fill that has been blended ex-situ with ZVI would be returned to the excavation as backfill below the water table. Additional backfill will be used above the water table to achieve existing elevations and grades and re-vegetated to control erosion.

Extending Soil Excavation/Soil Blending Area to Address TCE in Groundwater – Since the TCE plume appears to originate slightly west of the hexavalent chromium plume, the area of soil removal/soil blending with ZVI will be extended to the west. Refer to Figure 3-4 for the approximate location. It is assumed that the western extension would extend to near the existing fence line and not onto the portion of the property currently used by an active tenant. The western extension would be excavated into saturated overburden soils down to bedrock and backfilled with a mixture of ZVI and washed sand (a 10% dose was assumed for cost estimating purposes). In-situ blending of soil may also be conducted instead of off-site disposal of soil. The estimated depth of soil removal or soil blending is 30 feet and extends to bedrock. Temporary shoring (trench box) would be used to facilitate excavation or blending of soil and placement of reactive media. If soil blending is chosen, the excavator bucket would be used to blend a sand/ZVI mixture into the till materials above the bedrock.

Groundwater Pump and Treatment System - The groundwater pump and treat system would augment the existing PRB, which appears to be partially preventing discharge of hexavalent chromium-contaminated groundwater to Bliss Brook at levels above the surface water PRGs. Either a series of extraction wells or a recovery trench would be installed in the area just south of the covered area. The conceptual locations for the extraction wells or recovery trench, piping, and treatment plant are shown on Figure 3-4.

Extraction wells are being used in the FS for purposes of cost estimation. Extracted groundwater would be conveyed to a treatment plant for removal of hexavalent chromium and other constituents as necessary, and then discharged to Bliss Brook upstream from the extraction system. Discharge of treated groundwater upstream of the extraction system is needed to maintain flow within the brook under dry weather conditions, because the recovery system will act to dewater the brook in the area where the hexavalent chromium plume is discharging, as its purpose is to recover contaminated groundwater before it can enter the brook. The treatment system would be designed to remove hexavalent chromium to meet the lower of the two surface water PRGs (the human health PRG of 3.4 µg/L). Discharge criteria for other constituents present in the groundwater that are regulated under NPDES would be derived in accordance with the substantive requirements of the RGP. Precipitation, reduction, and/or pH adjustment may also need to be considered in the design phase in order to meet the requirements of the RGP.

The locations and pumping rates for extraction wells would be determined by performing a pumping test to estimate the pumping rate needed to depress the water table in the vicinity of the hexavalent chromium

plume discharge zone, so that groundwater does not discharge to the brook within this zone. An extraction well would be installed and the water levels in existing monitoring wells and piezometers would be measured as the extraction well is pumped to determine the zone of influence of the extraction well at increasingly higher pumping rates. These data would then be used to decide the number and locations for additional extraction wells and the rates at which they would be pumped to capture the entire width and thickness of hexavalent chromium-contaminated groundwater that would otherwise discharge to the brook. Samples of the pumping test water would also be collected to help design the treatment equipment and confirm those constituents other than hexavalent chromium for which discharge criteria would need to be developed.

For the purposes of conceptual design and cost estimation, it is assumed that treatment would include an equalization tank, bag filtration, activated carbon (to remove TCE, if present), and ion exchange (to remove hexavalent chromium). Alternative treatment approaches (use of reduction and precipitation to remove hexavalent chromium, for example) would be considered in the detailed design phase. The treatment system would most likely be automated and remotely monitored. Weekly site visits for inspections and maintenance are anticipated. The bag filters, activated carbon and ion exchange resin would be periodically changed-out and disposed off-site. A treatment plant building (one story, approximately 900 square feet) would be required to house the system. Site work (drilling of extraction wells, installation of transfer lines, and construction of treatment building) would take three to six months.

The analytical element model GFLOW, calibrated to water level data collected in April 2018, was used for hydraulic flow modeling to estimate a pumping rate of 54 gallons per minute (gpm) (three extraction wells pumping at 18 gpm each) for capturing the shallow overburden hexavalent chromium plume before it discharges to the brook (Appendix F). The baseflow of the brook, as measured by EPA in July 2011 at a location approximately 50 feet downstream of 51 North Avenue, is 0.38 cubic feet per second (170 gpm) and was found to increase moving further downstream to West Street, confirming that groundwater discharge is occurring along this portion of the brook (Weston Solutions, November 2013). An influent hexavalent chromium concentration of 4,000 µg/L was estimated for developing a cost estimate for the ion exchange component of the treatment train. The cost estimate assumes that treatment for other constituents will not have a significant cost impact compared to the treatment requirements for hexavalent chromium.

The cost estimate also assumes that the treatment system would be housed in a pre-engineered building to be constructed in close proximity to the brook. An alternative location would be the W&L property itself, but this location is less favorable from a cost and operations perspective because it is farther from the groundwater extraction and discharge locations, and would require installing piping under North Avenue to transport influent and effluent water. Individual extraction wells would each be housed inside an underground well vault to which electrical service would be provided. Each well vault would have its own electric submersible pump and associated controls, so that the pumping rates can be adjusted to maintain the necessary draw down without pumping more water than necessary.

The treatment system would have full remote monitoring and automation, with alarms to indicate when operator attention is needed. The treatment system would be visited by operations personnel routinely to perform activities that cannot be done remotely, such as changing bag filters, regenerating or changing out ion exchange vessels, and collecting samples of influent and effluent water to demonstrate proper function and compliance with discharge criteria. One day per week is assumed for various treatment system maintenance visits. Extraction wells would also have remote monitoring and automation but would be visited on a routine basis to check operation, maintain pumps and controls as needed, and collect samples as needed (one day per month is assumed). For cost purposes, it is assumed that monthly sampling will consist of two samples per month (influent groundwater and treated groundwater prior to discharge to the brook), with analysis for hexavalent chromium, VOCs, and TAL Metals.

Time to Achieve RAOs and Cleanup Goals - The key parameter, achieving surface water PRGs in Bliss Brook, will be achieved rapidly (should be achieved within one year after the extraction wells near the brook are activated). The short delay in achieving surface water goals is to allow hexavalent chromium in saturated sediments under the stream bed to dissipate.

Institutional controls would effectively prevent exposure to groundwater immediately upon implementation.

Based on modeling, hexavalent chromium concentrations in groundwater in areas downgradient of the source area would remain above levels that could adversely impact the brook for many years (over 100 years). The pump and treat system, institutional controls and other aspects of the remedy would have to remain active until the groundwater concentrations reach levels that would not cause exceedance of surface water PRGs for Bliss Brook.

Long-Term Monitoring - Groundwater Monitoring: The overburden groundwater will need to be monitored routinely to evaluate the progress of the remedy and determine whether the groundwater extraction and treatment system is effectively preventing the overburden hexavalent chromium plume from discharging to Bliss Brook at levels causing an exceedance of surface water PRGs. The monitoring will also be used to determine if cVOC concentrations in groundwater are attenuating due to source area soil removal efforts and soil blending on the W&L property to intercept the TCE plume. The overburden monitoring network would consist of a combination of existing overburden wells throughout the site and shallow piezometers along the western edge of Bliss Brook in the plume discharge area. Samples would be analyzed for hexavalent chromium, cVOCs, or both, depending on the location of each well within the plumes. For cost purposes, 20 existing shallow overburden and deep overburden wells and 5 piezometers are assumed to be sampled annually for the duration of remedy operation.

Surface Water Monitoring: Bliss Brook would be sampled routinely to evaluate compliance with the PRG for hexavalent chromium. For cost purposes, sampling twice per year is included from a total of five locations, with analysis for hexavalent chromium. After five years, the frequency of stream sampling could be reduced.

Vapor Intrusion Monitoring: Periodic monitoring is recommended for the three existing homes with SSDSs in order to determine whether the SSDSs are functioning as designed. Annual monitoring is included in the cost estimate to determine that the system components are functioning properly and to measure the pressure differential across the floor slabs to demonstrate that the pressure within the home exceeds that under the floor slab such that vapor intrusion cannot occur. At some point, as VOC concentrations in the groundwater decline over time and approach the groundwater VISLs, indoor air sampling could be performed and a risk screening conducted on the resulting data to evaluate whether the SSDSs could be shut down. Samples would be collected after turning the SSDSs off and allowing at least a week for equilibration. For cost purposes, it is assumed that indoor air sampling would be conducted once, five years after construction completion of the remedy (for five-year review purposes), and that at that point it would be determined that the SSDSs are no longer needed for vapor intrusion prevention. This sampling may not be necessary if groundwater concentrations are found to be below VISLs and/or if the homeowners elect to keep the SSDS running for other purposes (i.e., mitigation of radon). Once groundwater VISLs are no longer exceeded, and/or indoor air sampling has shown that continued operation is no longer needed, annual inspections would also be discontinued.

Inspections are also recommended for those existing buildings with sub-slab soil gas exceedances above the VISLs, but no SSDS installed because indoor air sampling did not indicate a risk. The purpose of these inspections is to evaluate whether building conditions may have changed in a manner that could cause an increased potential for vapor intrusion. The cost estimate assumes that these inspections would occur once every five years for 30 years. The inspections would be discontinued once groundwater VISLs are no longer exceeded.

Maintenance of Existing Sub-Slab Depressurization Systems - As noted above, the SSDSs would need to be inspected at least annually to measure the differential pressure across the slab to ensure that it is sufficient to prevent vapor intrusion, and also check the system fan and piping for signs of wear. For cost purposes one technician visit to each of the three homes on a single day is included.

Maintenance of Existing Engineered Cover and Permeable Reactive Barrier - The existing cover would need to be maintained by regular mowing to prevent growth of trees and shrubs, and annual inspections to identify any animal burrows and areas of erosion so that repairs can be made. The cost estimate includes $10,000 per year for mowing, annual inspections, and minor repairs.

The ZVI media in the existing PRB is expected to require replacement at some future date (perhaps multiple times), since the reductive capacity of the ZVI will eventually be exhausted given the high flux of hexavalent chromium that has and will continue to flow through the PRB. As noted in the discussion of Time to Achieve RAOs and Cleanup Goals, modeling has shown that it could take hundreds of years for the hexavalent chromium concentration in Site groundwater just upgradient of its discharge point to Bliss Brook to drop to less than its current estimated average concentration of 4,000 µg/L, even assuming 90% of the existing source mass is removed by the Source Area Soil Removal components of this alternative (see Appendix F). The cost estimate does not consider possible replacement of ZVI media since the cost estimate time frame

ends at 30 years. Thirty years is a default duration for estimating operating costs for remedies where the duration is known to be long, but is difficult to predict based on the available information.

Institutional Controls - Institutional controls would be required to prevent exposure to groundwater contamination and protect remedy infrastructure, as follows:

1) Address the future construction worker risk due to hexavalent chromium in shallow groundwater on the W&L Property until shallow groundwater PRGs are achieved;

2) Prevent contact with contaminated groundwater and the installation of non-drinking water wells (i.e. irrigation wells) across the extent of the site-wide groundwater plume where non-drinking water scenario PRGs for residential groundwater are exceeded and/or which may cause migration of the contaminated plume;

3) Protect and prevent contact with existing and proposed treatment infrastructure on multiple properties;

4) Require a either a vapor intrusion evaluation or vapor mitigation system be installed if an occupied building is to be constructed over the shallow groundwater VOC plume, within or to the south of the former building footprint on the W&L Property; and,

5) Prevent contact with soil beneath the existing engineered cover located behind the Paulette Lane residential area adjacent to Bliss Brook.

Institutional controls in the form of AULs were assumed for a total of 9 properties for this alternative to address the issues described above. See Appendix H for a list of properties with map and lot numbers. Other IC instruments, such as a zoning ordinance or modifications to the City's permitting procedures could be also considered for certain restrictions, however, AULs are included as the basis for the cost estimate. In addition, a Groundwater Ordinance is included to restrict the use of groundwater for irrigation on properties overlying the groundwater contaminant plume plus a buffer of properties located near the contaminant plume. Figure 4-1 shows the preliminary outline of properties included in the ordinance, however, this area would be refined during the pre-design sampling phase.

Five-Year Reviews - Five-Year Reviews would be required under this alternative because hazardous substances, pollutants, or contaminants would remain at the Site above levels that allow for UU/UE. Although active source area soil removal and groundwater treatment will be employed, modeling indicates it will be hundreds of years before cleanup goals are achieved. Each five-year review would evaluate the remedy to determine if it is working as anticipated, whether the bases of the original risk assessments remain valid, and whether the remedy remains protective of human health and the environment.

Cost – For Alternative GW/SW-2a – Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat, capital costs consist of direct and indirect costs anticipated to develop, construct, and

implement the remedial alternative. Periodic costs consist of reporting and scheduled monitoring events. O&M costs will include maintenance of the pump and treat system and annual monitoring events and inspections. The present worth cost of the alternative is estimated to be approximately $18,479,000. Cost summary sheets are provided in Appendix D.

Alternative Evaluation – The detailed analysis of Alternative GW/SW-2a – Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat compared against each of the FS evaluation criteria is presented in Table 4-7.

4.3.3 Alternative GW/SW-2b– Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat with Mid-Plume Treatment

As with Alternative GW/SW-2a, this alternative would achieve RAOs by combining soil excavation and in-situ treatment within the source area (former W&L facility footprint and area just to the south) with a groundwater pump and treat system to intercept and treat the hexavalent chromium groundwater plume prior to discharge to Bliss Brook; long-term monitoring of overburden groundwater, surface water in Bliss Brook, overburden groundwater attenuation, and existing buildings with SSDSs or which may have the potential for vapor intrusion; maintenance of existing residential SSDSs; maintenance of the existing engineered cover and PRB; and institutional controls; all of which have been discussed in Section 4.3.2. However, this alternative would be augmented with the addition of a mid-plume in-situ treatment line.

Mid-Plume Treatment - The mid-plume treatment portion of this alternative involves the addition of an in-situ saturated soil treatment zone along the middle of the hexavalent chromium plume. In-situ treatment would be conducted along the west side of North Avenue, in a line that runs north-south along the road and is approximately centered on the AE-04 well cluster. The purpose of this mid-plume treatment is to reduce the mass of hexavalent chromium and TCE that is migrating further downgradient and would ultimately need to be addressed through treatment just north of Bliss Brook. The conceptual location of the mid-plume in-situ soil treatment area is shown on Figure 3-5. For cost purposes, it is assumed that this component would consist of a series of 10-inch augered holes down to the top of bedrock that would be filled with a ZVI/sand mixture at a dose of 15%. It is anticipated that the boreholes would be finished with PVC riser and screen for ease of removing spent ZVI material and replacing it, or for flexibility in using other reagents. This also provides some flexibility for future work in that a liquid ZVI solution could be injected into the wells. The highest concentration of hexavalent chromium detected in overburden groundwater based on existing data is 64.5 mg/L at deep overburden well AE-04D, which is not located at the former plating tank area, i.e. "source area" near well cluster AE-01 (well AE-04D is approximately 400 feet downgradient of the former plating tank area). The modeling effort (Appendix F) back-calculated a source area groundwater concentration of 200 mg/L based on model calibration to the AE-04D concentration of 64.5 mg/L and concentration at AE-07D of 3.12 mg/L. Based on existing groundwater data, it is anticipated that a line of in-situ treatment over a 200-foot length centered on AE-04D would intercept the most impacted portion of the overburden plume, with levels of hexavalent chromium on the order of 30 to 70 mg/L. The in-situ treatment

line, as placed, would also intercept the portion of the TCE plume that contains some of the most elevated concentrations (50 ppb TCE and greater) in the overburden.

Hexavalent chromium in groundwater flowing through the in-situ treatment line would be converted to trivalent chromium and precipitate out of solution. TCE in groundwater flowing through the in-situ treatment line would be broken down into non-toxic byproducts. As part of the detailed design, a pilot study involving installation of one or more boreholes and testing of reagents and installation methods is anticipated to be necessary. Installation of the boreholes and application of the reagent is anticipated to require one to two months to complete. Essentially all components will be below ground. Maintenance activities would be minimal but may require periodic replacement/regeneration of the reactive media. Monitoring wells in the area would be periodically tested to confirm treatment effectiveness.

Time to Achieve RAOs and Cleanup Goals - The key parameter, achieving surface water PRGs in Bliss Brook, will be achieved rapidly (should be achieved within one year after the extraction wells near the brook are activated). The short delay in achieving surface water goals is to allow hexavalent chromium in saturated sediments under the stream bed to dissipate.

Institutional controls would effectively prevent exposure to groundwater immediately upon implementation.

Based on modeling, hexavalent chromium concentrations in groundwater in areas downgradient of the source area would remain above levels that could adversely impact the brook for many years (over 100 years). The pump and treat system, institutional controls and other aspects of the remedy would have to remain active until the groundwater concentrations reach levels that would not cause exceedance of the surface water PRGs for Bliss Brook. This alternative includes mid-plume treatment of impacted groundwater near North Avenue. Compared to Alternative GW/SW-2a which does not include treatment near North Avenue, the time to achieve cleanup goals, based on modeling (see Appendix F), would be approximately 45% less under this alternative.

Institutional Controls - Institutional controls would be required to prevent exposure to groundwater contamination and to protect remedy infrastructure. AULs were assumed for 10 properties (see Appendix H), plus a groundwater ordinance would be required to restrict use of groundwater for irrigation on properties overlying the groundwater contaminant plume.

Other Alternative Components - Long-term monitoring, maintenance of existing SSDSs, maintenance of the existing engineered cover and PRB, and five-year reviews would be the same for this alternative as already described for Alternative GW/SW-2a.

Cost – For Alternative GW/SW-2b – Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat with Mid-Plume Treatment, capital costs consist of direct and indirect costs anticipated to develop, construct, and implement the remedial alternative. Periodic costs consist of reporting and scheduled monitoring events. O&M costs will include maintenance of the pump and treat system and

annual monitoring events and inspections. The present worth cost of the alternative is estimated to be approximately $19,193,000. Cost summary sheets are provided in Appendix D.

Alternative Evaluation – The detailed analysis of Alternative GW/SW-2b – Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat with Mid-Plume Treatment compared against each of the FS evaluation criteria is presented in Table 4-8.

4.3.4 Alternative GW/SW-3a – Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier

This alternative would achieve RAOs by combining soil excavation and in-situ treatment within the source area (former W&L facility footprint and area just to the south) with an extension of the existing PRB to reduce hexavalent chromium in groundwater to the less toxic trivalent form prior to discharge of the groundwater to Bliss Brook; long-term monitoring of overburden groundwater, surface water in Bliss Brook, overburden groundwater attenuation, and existing buildings with SSDSs or which may have the potential for vapor intrusion; maintenance of existing residential SSDSs; maintenance of the existing engineered cover and existing PRB; and institutional controls.

Extension of Permeable Reactive Barrier - A new PRB would be constructed to augment the existing PRB, which appears to be partially preventing discharge of hexavalent chromium-contaminated groundwater to Bliss Brook at levels above surface water PRGs, but does not appear to extend far enough south to treat the full extent of the hexavalent chromium groundwater plume that is discharging to Bliss Brook. The PRB would contain ZVI, which would work to reduce hexavalent chromium to the less toxic trivalent form.

A pre-design investigation would be required ahead of the PRB wall extension. This investigation would involve a bench test to finalize the type and dosage of the soil amendment used in the barrier, as well as a pre-design study to confirm the length of the wall based on groundwater impacts and concentrations reaching the brook. Additional flow modeling will also be required as a part of this pre-design study.

A conceptual site model of the groundwater-surface water interactions that are taking place where the hexavalent chromium plume is discharging to Bliss Brook is presented in Figure 3-7. This model is based on water level data from the RI up to and including measurements collected in April 2018 from the monitoring well network, including the new piezometers installed along the brook and sampled for hexavalent chromium in December 2017. The conceptual model suggests that overburden groundwater beneath the entire width of the brook is impacted with hexavalent chromium. The available stream flow and head data indicates that Bliss Brook is acting as a hydrogeologic boundary for overburden groundwater. However, hydrogeologic boundaries are not always centered under the exact center of a stream or river; they can vary seasonally and tend to shift back and forth across the width of the surface water body depending on the amount of recharge and runoff entering from either side. Therefore, to be conservative, it is assumed that hexavalent chromium impacts in overburden groundwater are present under the entire width of the brook.

Based on hydraulic head data, the conceptual model also suggests that the bedrock groundwater plume passes directly under the brook and does not interact with surface water in the brook.

Based on the preliminary groundwater modeling, the flow rate of water into the brook is 0.04 cubic feet per second and the hexavalent chromium concentration is estimated to be in the range of 3,000 to 4,000 µg/L. The footprint of the barrier wall and amount of ZVI would be determined during the design phase. For the purpose of cost estimation, it was assumed that the barrier wall would be 400 feet long, 20 feet wide, and 15 feet deep. The new barrier wall would not damage or otherwise impact the existing barrier wall and piping. The conceptual design includes 350 tons of ZVI which, based on preliminary estimates, would last over 30 years. The brook would be temporarily diverted to allow construction of the barrier wall. Construction of the barrier wall would require one to two months to complete. The barrier wall would not require any significant maintenance. Periodic sampling of the brook and groundwater would be conducted.

Construction of the reactive barrier wall would require excavation and off-site disposal of an estimated 4,400 cubic yards of soil. During excavation, temporary shoring and excavation dewatering are expected to be necessary. Other options for construction of the barrier wall such as narrow (five feet or less) trenching and blending existing soils in place with ZVI instead of excavation would be evaluated as part of the final design.

Time to Achieve RAOs and Cleanup Goals - The key parameter, achieving surface water PRGs in Bliss Brook, will be achieved rapidly (within one or two years). Once the barrier wall is installed, infiltration of groundwater containing hexavalent chromium into the brook will be prevented.

Institutional controls would effectively prevent exposure to groundwater immediately upon implementation.

Based on modeling, hexavalent chromium concentrations in groundwater in areas downgradient of the source area and approaching Bliss Brook would remain above levels that could adversely impact the brook for many years (over 100 years). The barrier wall, institutional controls, and other aspects of the remedy would have to remain active until the groundwater concentrations reach levels that would not cause exceedance of surface water PRGs for Bliss Brook.

Other Alternative Components - Long-term monitoring, maintenance of existing SSDSs, maintenance of the existing engineered cover and PRB, institutional controls (9 AULs and an ordinance), and five-year reviews would be the same for this alternative as already described for Alternative GW/SW-2a.

Cost – For Alternative GW/SW-3a – Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier, capital costs consist of direct and indirect costs anticipated to develop, construct, and implement the remedial alternative. Periodic costs consist of reporting and scheduled monitoring events. O&M costs will include annual monitoring events and inspections. The present worth cost of the alternative is estimated to be approximately $15,535,000. Cost summary sheets are provided in Appendix D.

Alternative Evaluation – The detailed analysis of Alternative GW/SW-3a – Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier compared against each of the FS evaluation criteria is presented in Table 4-9.

4.3.5 Alternative GW/SW-3b – Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier with Mid-Plume Treatment

This alternative would achieve RAOs by combining soil excavation and in-situ treatment within the source area (former W&L facility footprint and area just to the south) with an extension of the existing PRB to reduce hexavalent chromium in groundwater to the less toxic trivalent form prior to discharge of the groundwater to Bliss Brook; long-term monitoring of overburden groundwater, surface water in Bliss Brook, overburden groundwater attenuation, and existing buildings with SSDSs or which may have the potential for vapor intrusion; maintenance of existing residential SSDSs; maintenance of the existing engineered cover and PRB; and institutional controls. However, this alternative would be augmented with the addition of a mid-plume in-situ treatment line.

Mid-Plume Treatment - The mid-plume treatment portion of this alternative involves the addition of an in-situ saturated soil treatment zone along the middle of the chromium plume. In-situ treatment would be conducted along the west side of North Avenue, in a line that runs north-south along the road and is approximately centered on the AE-04 well cluster. The purpose of this mid-plume treatment is to reduce the mass of hexavalent chromium and TCE that is migrating further downgradient and would ultimately need to be addressed through treatment just west of Bliss Brook. The conceptual location of the mid-plume in-situ soil treatment area is shown on Figure 3-8. For cost purposes, it is assumed that the component would consist of a series of 10-inch augered holes down to the top of bedrock that would be filled with a ZVI/sand mixture at a dose of 15%. It is anticipated that the boreholes would be finished with PVC riser and screen for ease of removing spent ZVI material and replacing it, or for flexibility in using other reagents. This also provides some flexibility for future work in that a liquid ZVI solution could be injected into the wells. The highest concentration of hexavalent chromium detected in overburden groundwater based on existing data is 64,500 ppb at deep overburden well AE-04D. Based on existing groundwater data, it is anticipated that a line of in-situ treatment over a 200-foot length centered on AE-04D would capture the most impacted portion of the overburden plume, with levels of hexavalent chromium on the order of 30,000 to 70,000 ppb. The in-situ treatment line, as placed, would also intercept the portion of the TCE plume that contains some of the most elevated concentrations (50 ppb TCE and greater) in the overburden.

Hexavalent chromium in groundwater flowing through the in-situ treatment line would be converted to trivalent chromium and precipitate out of solution. TCE in groundwater flowing through the in-situ treatment line would be broken down into non-toxic byproducts. As part of the detailed design, a pilot study involving installation of one or more boreholes and testing of reagents and installation methods is anticipated to be necessary. Installation of the boreholes and application of the reagent is anticipated to require one to two months to complete. Essentially all components will be below ground. Maintenance

activities would be minimal but may require periodic replacement/regeneration of the reactive media. Monitoring wells in the area would be periodically tested to confirm treatment effectiveness.

Time to Achieve RAOs and Cleanup Goals - The key parameter, achieving surface water PRGs in Bliss Brook, will be achieved rapidly (within one or two years). Once the barrier wall is installed, infiltration of groundwater containing hexavalent chromium into the stream will be prevented.

Institutional controls would effectively prevent exposure to groundwater immediately upon implementation.

Based on modeling, hexavalent chromium concentrations in groundwater in areas downgradient of the source area and approaching Bliss Brook would remain above levels that could adversely impact the brook for many years (over 100 years). The barrier wall, institutional controls, and other aspects of the remedy would have to remain active until the groundwater concentrations reach levels that would not cause exceedance of the surface water PRGs for Bliss Brook. This alternative includes mid-plume treatment for impacted groundwater near North Avenue. Compared to Alternative GW/SW-3a which does not include treatment near North Avenue, the time to achieve cleanup goals, based on modeling (see Appendix F), would be approximately 45% less under this alternative.

Institutional Controls - Institutional controls would be required to prevent exposure to groundwater contamination and to protect remedy infrastructure. AULs were assumed for 10 properties (see Appendix H), plus a groundwater ordinance would be required to restrict use of groundwater for irrigation on properties overlying the groundwater contaminant plume.

Other Alternative Components - Long-term monitoring, maintenance of existing SSDSs, maintenance of the existing engineered cover and PRB, and five-year reviews would be the same for this alternative as already described for Alternative GW/SW-2a.

Cost – For Alternative GW/SW-3b – Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier with Mid-Plume Treatment, capital costs consist of direct and indirect costs anticipated to develop, construct, and implement the remedial alternative. Periodic costs consist of reporting and scheduled monitoring events. O&M costs will include annual monitoring events and inspections. The present worth cost of the alternative is estimated to be approximately $16,441,000. Cost summary sheets are provided in Appendix D.

Alternative Evaluation – The detailed analysis of Alternative GW/SW-3b – Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier with Mid-Plume Treatment compared against each of the FS evaluation criteria is presented in Table 4-10.

4.4 Bedrock Groundwater

4.4.1 Alternative BR-1 – No Action

The No Action alternative, as required under the NCP, would involve no remedial response activities and would provide no additional protection of human health; this alternative provides a baseline for comparison to other alternatives.

Cost – No action would be performed under this alternative, therefore no costs are presented.

Alternative Evaluation – The detailed analysis of Alternative BR-1 – No Action compared against each of the FS evaluation criteria is presented in Table 4-11.

4.4.2 Alternative BR-2 – Institutional Controls

This alternative would achieve the RAOs related to bedrock groundwater through use of institutional controls to prevent exposure of residential receptors to COCs in bedrock groundwater that exceed non-drinking water PRGs and long-term bedrock groundwater monitoring with evaluation of natural attenuation until such time as non-drinking water PRGs have been met. If pre-design investigations described below show that bedrock groundwater underlying portions of the Bungay River Resource Protection District exceeds drinking water PRGs, then additional contingency measures would be taken, including the expansion of the area to be addressed with monitoring to include the impacted portion of the District, and the implementation of additional institutional controls to prevent exposure of residential receptors to COCs in bedrock groundwater within the District that exceed drinking water PRGs and prevent plume migration into the District.

Pre-Design Investigations - Pre-design sampling would be conducted to further refine the horizontal extent of the contaminated bedrock plume so that the area requiring institutional controls can be defined. The modeling performed (see discussion in Section 3.4.2) which estimates the approximate extent of bedrock groundwater contamination, and concludes that the 100 ppb concentration contour does not extend into the District, is suggestive that bedrock groundwater within the District may not be significantly impacted by the Site (see Figure 3-9), but bedrock wells must be installed and sampled to confirm this. Additional bedrock wells are also needed in order to more accurately delineate the contamination (regardless of whether it extends into the District or not, as the extent is unknown at this time). For cost estimating purposes, 12 multi-level wells consisting of three zones each are assumed: shallow bedrock, mid-level bedrock, and deep bedrock. These multi-level wells would be similar in construction to the existing AE-ML series wells. Actual well depths would be selected in the field based on rock core observations and/or borehole geophysical investigations to identify fracture zones. It is assumed that six of these multi-level wells would be installed along Ashton Road as a first step to determine if the hexavalent chromium plume extends into the Bungay River Water Resource Protection District. The other six multi-level wells would be installed in locations on the site where further delineation is needed upon evaluating the results from the Ashton Road wells, and could include wells within the District itself and/or wells between Ashton Road and

the current known extent of the plume. These wells would also serve as compliance monitoring wells for the BR alternatives whose objective is to prevent migration of contaminated bedrock groundwater into the District. It is assumed that 39 samples will be collected during the pre-design investigation, including a selection of existing bedrock monitoring wells and new wells.

Long-Term Monitoring - Bedrock Groundwater Monitoring: The bedrock groundwater will need to be monitored routinely to evaluate the attenuation of the hexavalent chromium plume, especially near the Bungay River Water Resource Protection District. The monitoring will also be used to determine if cVOC concentrations in groundwater are attenuating naturally (as described below). The bedrock monitoring network would consist of a combination of existing shallow and deep bedrock wells throughout the site and the 12 wells installed as a part of the pre-design investigation. Samples would be analyzed for hexavalent chromium, cVOCs, or both, depending on the location of each well within the plumes. For cost purposes, 23 existing shallow bedrock and deep bedrock wells and 12 new bedrock multi-level wells (each with 3 sampling zones per well) are assumed to be sampled annually for the duration of remedy operation.

This alternative assumes the removal of the source area soil as a part of the chosen GW/SW alternative; with the primary source materials removed, COC concentrations in the bedrock are expected to gradually be reduced through natural processes. These natural processes would address the portion of the bedrock groundwater plume where non-drinking water PRGs are exceeded. As a contingency measure, if bedrock groundwater underlying portions of the District exceeds drinking water PRGs, the monitoring network would be expanded to address the impacted portions of the District. Natural attenuation relies on the physical, chemical, or biological processes that occur naturally over time to degrade or transform the contaminants. These natural processes include diffusion, reduction, dispersion, and dilution. The bedrock at the site is part of the Wamsutta Formation. This rock type is described as a conglomerate whose matrix is primarily a sandstone. Being a sedimentary rock, it has both primary (rock matrix) and secondary (fracture) porosity. Recent studies (Zhao et al., 2017) in similar sedimentary rock types with significant matrix porosity have shown that hexavalent chromium can diffuse into the primary porosity of porous sedimentary rocks and act as strong attenuation mechanism of hexavalent chromium transport. In addition, the study has shown that hexavalent chromium can be reduced to the more immobile form of trivalent chromium due to the presence of reduced iron minerals in the rock matrix. This portion of the alternative would utilize the annual sampling program as outlined above to monitor levels of hexavalent chromium and cVOCs over time.

Institutional Controls - Institutional controls would be required to prevent the installation of non-drinking water (i.e. irrigation) wells within the bedrock plume boundary as determined based on exceedances of non-drinking water PRGs. As a contingency measure, if bedrock groundwater within the Bungay River Water Resource Protection District is found to be impacted above drinking water PRGs, institutional controls would also be required to prevent the installation of drinking water wells within the potentially impacted portions of the District to prevent exposure to groundwater contamination and prevent continued plume migration into the District. It is assumed that the Institutional Controls would be in the form of a City ordinance. The need for and extent of bedrock groundwater impacts requiring institutional controls would be defined by

the pre-design investigation. The estimated extent of bedrock groundwater contamination (based on a one-dimensional modeling effort as described in Section 3) is shown on Figure 3-9. Until additional bedrock wells are installed and sampled, it is not possible to confirm the modeling or determine the need for or potential boundaries of an institutional control to prevent installation of drinking water wells. Based on the mapped overburden and bedrock plumes as they currently exist, Figure 4-1 was developed to indicate the potential boundary for restrictions on irrigation wells (with some buffer included), although the location of the downgradient edge of the bedrock plume, and whether it extends into the Bungay River Water Resource Protection District, is not currently known. The assumed approach is that a City Ordinance would be enacted that would address the no irrigation wells restriction and address both the overburden and bedrock plumes as necessary. If contingency measures are needed to restrict drinking water well installation within the District, it is further assumed that the one City Ordinance would address both types of restrictions (no irrigation wells and no drinking water wells). Irrigation well installation would need to be restricted wherever the irrigation well PRGs are exceeded. Drinking water well installation would need to be restricted in any portion of the Protection District where drinking water PRGs potentially may be exceeded. The restricted areas would be updated over the years based on the results of the long-term groundwater monitoring program, which should show decreasing trends over time due to the effects of soil and GW/SW alternatives and natural attenuation.

Time to Achieve RAOs and Cleanup Goals - Institutional controls would effectively prevent exposure to bedrock groundwater immediately upon implementation.

Natural attenuation of the bedrock groundwater plume, in conjunction with components of the GW/SW alternatives directed at the source area and overburden groundwater, would work toward reducing site-wide bedrock groundwater concentrations to below non-drinking water (irrigation well) PRGs, reducing concentrations in bedrock groundwater in the Bungay River Water Resource Protection District to below drinking water PRGs (if exceeded), and preventing potential plume migration into the District in the future. There are several factors that make it difficult to quantify the time to achieve cleanup goals in bedrock groundwater. Natural reduction of hexavalent chromium to trivalent chromium in the rock matrix is dependent on site-specific conditions (iron content and valence in the rock, pH, and presence of other minerals). The rate of natural reduction cannot be estimated at this time. Testing of groundwater over a period of time (several years) would be necessary to demonstrate that hexavalent chromium levels are declining and to determine the rate of decline. Additionally, sampling would be used to understand the mechanisms for hexavalent chromium attenuation and predict the time until the cleanup goals are achieved.

Five-Year Reviews - Five-Year Reviews would be required under this alternative because hazardous substances, pollutants, or contaminants would remain at the Site above levels that allow for UU/UE. Even under the assumption that active source area soil removal and overburden groundwater treatment are employed through one of the GW/SW alternatives, modeling indicates it will be hundreds of years before cleanup goals are achieved. Each five-year review would evaluate the remedy to determine if it is working as

anticipated, whether the bases of the original risk assessments remain valid, and whether the remedy remains protective of human health and the environment.

Cost – For Alternative BR-2 – Institutional Controls, capital costs consist of direct and indirect costs anticipated to develop, construct, and implement the remedial alternative. Periodic costs would include the preparation of the remedial action report, five-year review reports, and potential updating of institutional controls. O&M costs would consist of long-term bedrock groundwater monitoring. The present worth cost of the alternative is estimated to be approximately $4,379,000. Cost summary sheets are provided in Appendix D.

Alternative Evaluation – The detailed analysis of Alternative BR-2 – Institutional Controls compared against each of the FS evaluation criteria is presented in Table 4-12.

4.4.3 Alternative BR-3 – Institutional Controls and Contingency Remedy of Focused In-Situ Injections (West of North Avenue)

This alternative would achieve the RAOs related to bedrock groundwater through a combination of institutional controls to prevent exposure of residential receptors to COCs in bedrock groundwater that exceed non-drinking water PRGs and long-term bedrock groundwater monitoring with evaluation of groundwater attenuation until such time as non-drinking water PRGs have been met and institutional controls are no longer needed. If pre-design investigations show that bedrock groundwater underlying portions of the Bungay River Resource Protection District exceeds drinking water PRGs, then additional contingency measures would be taken, including the design and implementation of focused in-situ treatment on the west side of North Avenue, the expansion of the area to be addressed with monitoring to include the impacted portion of the District, and the implementation of additional institutional controls to prevent exposure of residential receptors to COCs in bedrock groundwater within the District that exceed drinking water PRGs, prevent further plume migration, and protect remedy infrastructure.

Pre-Design Investigations, Long-Term Monitoring, and Five-Year Reviews - Pre-design investigations, long-term monitoring, and five-year reviews would be the same for this alternative as already described for Alternative BR-2. As for BR-2, monitoring would address the portion of the bedrock groundwater plume where non-drinking water PRGs are exceeded and as a contingency measure, if bedrock groundwater underlying portions of the District exceeds drinking water PRGs, the monitoring program would be expanded to address the impacted portions of the District.

Institutional Controls - Institutional controls would be required to prevent the installation of non-drinking water wells (i.e. irrigation wells) across the extent of the site-wide bedrock groundwater plume where non-drinking water scenario PRGs for bedrock groundwater are exceeded (for more detail refer to Section 4.4.2).

As part of contingency measures, if bedrock groundwater underlying portions of the District exceeds drinking water PRGs, further institutional controls would be required to:

1) Prevent the installation of drinking water wells across the extent of the bedrock groundwater plume within the potentially impacted portion of the Bungay River Water Resource Protection District where drinking water scenario PRGs for bedrock groundwater may be exceeded (for more detail refer to Section 4.4.2); and,

2) Protect and prevent contact with proposed treatment infrastructure on multiple properties. See Appendix H for the properties that will likely have remedy infrastructure.

In-Situ Injections (West of North Avenue) – As an additional contingency measure, if bedrock groundwater underlying portions of the District exceeds drinking water PRGs, this alternative includes the addition of an in-situ bedrock treatment zone along the middle of the chromium plume. In-situ treatment would be conducted along the west side of North Avenue (adjacent to the Southern Wetland area), in a line that runs north-south along the road and is approximately centered on the AE-04 well cluster. The purpose of this mid-plume treatment is to reduce the mass of hexavalent chromium and TCE in bedrock groundwater that is migrating further downgradient. The conceptual location of the focused in-situ injections is shown on Figure 3-10. For cost purposes, it is assumed that this component would consist of 13 4-inch open borehole wells installed 10 feet into competent bedrock and approximately 15 feet apart that would be injected with 10,000 gallons of ZVI solution. High concentrations of hexavalent chromium have consistently been detected in bedrock groundwater at bedrock well AE-04B; the last sample taken there was 14,100 ppb. Based on existing groundwater data, it is anticipated that a line of in-situ treatment over a 200-foot length centered on AE-04B would intercept the contaminated bedrock groundwater coming from the source area. The in-situ treatment line, as placed, would also intercept the portion of the TCE plume coming from the same area. For cost estimating purposes, it is assumed that an additional 10,000 gallons of ZVI solution will be reinjected into the 13 wells every five years. A pre-design investigation consisting of a pilot test will be needed to determine the type, dose, depth of injection, and injection rate of ZVI solution into the bedrock. A drawback with micro-size ZVI is that it will not travel very far with the groundwater. Thus, only water entering into the area from upgradient is treated. Alternative reagents that travel with the groundwater and could provide more rapid treatment of groundwater downgradient would be considered in the design phase.

Hexavalent chromium in groundwater flowing through the in-situ treatment line would be converted to trivalent chromium and precipitate out of solution. TCE in groundwater flowing through the in-situ treatment line would be broken down into non-toxic byproducts. As part of the detailed design a pilot study involving installation of one or more wells and testing of reagents and installation methods is anticipated to be necessary. Installation of the wells and application of the reagent is anticipated to require three to six months to complete. Essentially all components will be below ground. Monitoring wells in the area would be periodically tested to confirm treatment effectiveness.

Time to Achieve RAOs and Cleanup Goals - Institutional controls would effectively prevent exposure to bedrock groundwater immediately upon implementation.

Natural attenuation of the bedrock groundwater plume, in conjunction with components of the GW/SW alternatives directed at the source area soil and overburden groundwater, would work toward reducing site-wide bedrock groundwater concentrations to below non-drinking water (irrigation well) PRGs, reducing concentrations in bedrock groundwater in the Bungay River Water Resource Protection District to below drinking water PRGs (if exceeded), and preventing potential plume migration into the Protection District in the future. If the contingency components of this alternative are implemented, the in-situ bedrock treatment zone along North Avenue would further work toward reducing site-wide bedrock groundwater concentrations of hexavalent chromium and TCE and reducing migration of hexavalent chromium toward the District. There are several factors that make it difficult to quantify the time to achieve cleanup goals in bedrock groundwater. The time to fully meet the cleanup goals in bedrock will depend on the effectiveness of natural attenuation and, if in-situ treatment is conducted, on the type and effectiveness of the treatment reagent injections. Treatment in the immediate area of the injection point would be rapid. However, impacted groundwater downgradient of the injection point will not be treated directly. Treatment downgradient will rely on flow of water from the treatment area. Treatment down gradient is expected to take a relatively long period of time (many years).

Cost – For Alternative BR-3 – Institutional Controls and Contingency Remedy of Focused In-Situ Injections (West of North Avenue), capital costs consist of direct and indirect costs anticipated to develop, construct, and implement the remedial alternative. Periodic costs consist of reporting and scheduled monitoring events as well as regular reinjections (if conducted). O&M costs would consist of long-term bedrock groundwater monitoring. The present worth cost of the alternative is estimated to be approximately $4,379,000, and the present worth cost of the contingency items for the alternative is approximately $927,000. Cost summary sheets are provided in Appendix D.

Alternative Evaluation – The detailed analysis of Alternative BR-3 – Institutional Controls and Contingency Remedy of Focused In-Situ Injections (West of North Avenue) compared against each of the FS evaluation criteria is presented in Table 4-13.

4.4.4 Alternative BR-4 – Institutional Controls and Contingency Remedy of Pump and Treat

This alternative would achieve RAOs related to bedrock groundwater through a combination of institutional controls to prevent exposure of residential receptors to COCs in bedrock groundwater that exceed non-drinking water PRGs and long-term bedrock groundwater monitoring with evaluation of groundwater attenuation until such time as non-drinking water PRGs have been met and institutional controls are no longer needed. If pre-design investigations show that bedrock groundwater underlying portions of the Bungay River Resource Protection District exceeds drinking water PRGs, then additional contingency measures would be taken, including the design and implementation of a bedrock groundwater pump and treat system along Bliss Brook, the expansion of the area to be addressed with monitoring to include the impacted portion of the District, and the implementation of additional institutional controls to prevent

exposure of residential receptors to COCs in bedrock groundwater within the District that exceed drinking water PRGs, prevent further plume migration, and protect remedy infrastructure.

Pre-Design Investigations, Long-Term Monitoring, and Five-Year Reviews - Pre-design investigations, long-term monitoring, and five-year reviews would be the same for this alternative as already described for Alternative BR-2. As for BR-2, monitoring would address the portion of the bedrock groundwater plume where non-drinking water PRGs are exceeded and as a contingency measure, if bedrock groundwater underlying portions of the District exceeds drinking water PRGs, the monitoring program would be expanded to address the impacted portions of the District.

Institutional Controls - Institutional controls would be the same for this alternative as described for Alternative BR-3, except that if the bedrock groundwater pump and treat contingency is implemented, the properties with remedy infrastructure that needs to be protected will differ.

Groundwater Pump and Treatment System - As an additional contingency measure, if bedrock groundwater underlying portions of the District exceeds drinking water PRGs, the groundwater pump and treat system would intercept and treat the hexavalent chromium bedrock groundwater plume to prevent migration of contaminated groundwater into the bedrock underlying the Bungay River Water Resource Protection District. Bedrock groundwater extraction wells would be installed along Bliss Brook to intercept the bedrock groundwater plume. The conceptual location of the extraction wells, piping, and treatment plant is shown on Figure 3-11.

Extraction wells would be drilled into the bedrock. Extracted groundwater would be conveyed to a treatment plant for removal of hexavalent chromium and other constituents as necessary, and then discharged to Bliss Brook upstream from the extraction system. The treatment system would be designed to remove hexavalent chromium to meet the lower of the two surface water PRGs (the human health PRG of 3.4 µg/L). Discharge criteria for other constituents present in the groundwater that are regulated under NPDES would be derived in accordance with the substantive requirements of the RGP. Precipitation, reduction, and/or pH adjustment may also need to be considered in the design phase in order to meet the requirements of the RGP.

The locations and pumping rates for extraction wells would be determined by performing a pumping test to estimate the pumping rate needed to capture the bedrock plume. An extraction well would be installed and the water levels in existing monitoring wells and piezometers would be measured as the extraction well is pumped to determine the zone of influence of the extraction well at increasingly higher pumping rates. These data would then be used to decide the number and locations for additional extraction wells and the rates at which they would be pumped to capture the entire width and thickness of hexavalent chromium-contaminated groundwater that may migrate further downgradient. Samples of the pumping test water would also be collected to help design the treatment equipment and confirm those constituents other than hexavalent chromium for which discharge criteria would need to be developed.

It is anticipated that the treatment train would consist of bag filters to remove suspended solids from the extracted groundwater, followed by ion exchange vessels to remove hexavalent chromium, and potentially carbon vessels or an air stripper to remove TCE and other cVOCs, if present at levels above discharge criteria.

The analytical element model GFLOW, calibrated to water level data collected in April 2018, was used for hydraulic flow modeling to estimate a pumping rate of six gallons per minute (two extraction wells pumping at three gpm each) for capturing the bedrock hexavalent chromium plume (Appendix F). An influent hexavalent chromium concentration of 1,000 µg/L was estimated for developing a cost estimate for the ion exchange component of the treatment train. The cost estimate assumes that treatment for other constituents will not have a significant cost impact compared to the treatment requirements for hexavalent chromium.

The cost estimate also assumes that the treatment system would be housed in a pre-engineered building to be constructed in close proximity to Bliss Brook. An alternative location would be the W&L property itself, but this location is less favorable from a cost and operations perspective because it is farther from the groundwater extraction and discharge locations, and would require installing piping under North Avenue to transport influent and effluent water. Individual extraction wells would each be housed inside an underground well vault to which electrical service would be provided. Each well vault would have its own electric submersible pump and associated controls, so that the pumping rates can be adjusted to maintain the necessary draw down without pumping more water than necessary.

The treatment system would have full remote monitoring and automation, with alarms to indicate when operator attention is needed. The treatment system would be visited by operations personnel routinely to perform activities that cannot be done remotely, such as changing bag filters, regenerating or changing out ion exchange vessels, and collecting samples of influent and effluent water to demonstrate proper function and compliance with discharge criteria. One day per week is assumed for various treatment system maintenance visits. Extraction wells would also have remote monitoring and automation but would be visited on a routine basis to check operation, maintain pumps and controls as needed, and collect samples as needed (one day per month is assumed). For cost purposes, it is assumed that monthly sampling will consist of two samples per month (influent groundwater and treated groundwater prior to discharge to the brook), with analysis for hexavalent chromium, VOCs, and TAL Metals.

Time to Achieve RAOs and Cleanup Goals - Institutional controls would effectively prevent exposure to bedrock groundwater immediately upon implementation.

Natural attenuation of the bedrock groundwater plume, in conjunction with components of the GW/SW alternatives directed at the source area soil and overburden groundwater, would work toward reducing site-wide bedrock groundwater concentrations to below non-drinking water (irrigation well) PRGs, reducing concentrations in bedrock groundwater in the Bungay River Water Resource Protection District to below drinking water PRGs (if exceeded), and preventing potential plume migration into the District in the future. If the contingency components of this alternative are implemented, the line of extraction wells along Bliss

Brook would prevent impacted groundwater from traveling towards the District. Some impacted water may already be present downgradient of the line of extraction wells and thus it may take time (few years) for that water to attenuate. If the District is impacted and the contingency measures are implemented, it is anticipated that remedial goals for the District would be achieved in a few years. The extraction wells will not directly treat groundwater upgradient and thus this alternative will not significantly accelerate achieving non-drinking water remedial goals in those areas.

Cost – For Alternative BR-4 – Institutional Controls and Contingency Remedy of Pump and Treat, capital costs consist of direct and indirect costs anticipated to develop, construct, and implement the remedial alternative. Periodic costs consist of reporting and scheduled monitoring events. O&M costs will include maintenance of the pump and treat system (if needed) and annual monitoring events and inspections. The present worth cost of the alternative is estimated to be approximately $4,379,000 and the present worth cost of the contingency portion is approximately $3,197,000. Cost summary sheets are provided in Appendix D.

Alternative Evaluation – The detailed analysis of Alternative BR-4 – Institutional Controls and Contingency Remedy of Pump and Treat compared against each of the FS evaluation criteria is presented in Table 4-14.

4.4.5 Alternative BR-5 – Institutional Controls and Contingency Remedy of Enhanced (Deeper) Permeable Reactive Barrier

This alternative would achieve the RAOs related to bedrock groundwater through a combination of institutional controls to prevent exposure of residential receptors to COCs in bedrock groundwater that exceed non-drinking water PRGs and long-term bedrock groundwater monitoring with evaluation of groundwater attenuation until such time as non-drinking water PRGs have been met and institutional controls are no longer needed. If pre-design investigations show that bedrock groundwater underlying portions of the Bungay River Resource Protection District exceeds drinking water PRGs, then additional contingency measures would be taken, including the enhancement (deepening) of the existing PRB along Bliss Brook, the expansion of the area to be addressed with monitoring to include the impacted portion of the District, and the implementation of additional institutional controls to prevent exposure of residential receptors to COCs in bedrock groundwater within the District that exceed drinking water PRGs, prevent further plume migration, and protect remedy infrastructure.

Pre-Design Investigations, Long-Term Monitoring, and Five-Year Reviews - Pre-design investigations, long-term monitoring, and five-year reviews would be the same for this alternative as already described for Alternative BR-2. As for BR-2, monitoring would address the portion of the bedrock groundwater plume where non-drinking water PRGs are exceeded and as a contingency measure, if bedrock groundwater underlying portions of the District exceeds drinking water PRGs, the monitoring program would be expanded to address the impacted portions of the District.

Institutional Controls - Institutional controls would be the same for this alternative as described for Alternative BR-3, except that if the enhanced PRB is implemented, the properties with remedy infrastructure that needs to be protected will differ.

Enhanced (Deeper) Permeable Reactive Barrier - As an additional contingency measure, if bedrock groundwater underlying portions of the District exceeds drinking water PRGs, an enhanced PRB would be constructed to augment the existing PRB, which appears to be partially preventing discharge of shallow hexavalent chromium-contaminated groundwater to Bliss Brook at levels above surface water PRGs. The PRB would contain ZVI, which would work to reduce hexavalent chromium to the less toxic trivalent form.

In-situ treatment of bedrock groundwater with ZVI would be conducted along Bliss Brook for a distance of approximately 300 feet. The conceptual location of the bedrock injections is shown on Figure 3-12. For cost purposes, it is assumed that this component would consist of a series of 20 4-inch open borehole wells installed 10 feet into competent bedrock that would be injected with 10,000 gallons of ZVI solution to treat bedrock groundwater with concentrations of 1,000 ppb hexavalent chromium or greater before it migrates further downgradient toward the District. These are assumptions for FS evaluation purposes; pre-design investigations would be performed to determine locations and depths. For cost estimating purposes, it is assumed that an additional 10,000 gallons of ZVI solution will be reinjected into the 20 wells every five years. A pre-design investigation consisting of a pilot test will be needed to determine the type, dose, depth of injection, and injection rate of ZVI solution into the bedrock.

Hexavalent chromium in groundwater flowing through the in-situ treatment line would be converted to trivalent chromium and precipitate out of solution. TCE in groundwater flowing through the in-situ treatment line would be broken down into non-toxic byproducts. Use of the boreholes as injection points for reagents other than ZVI is possible. As part of the detailed design a pilot study involving installation of one or more boreholes and testing of reagents and installation methods is anticipated to be necessary. Installation of the wells and application of the reagent is anticipated to require three to six months to complete. Essentially all components will be below ground. Monitoring wells in the area would be periodically tested to confirm treatment effectiveness.

Time to Achieve RAOs and Cleanup Goals - Institutional controls would effectively prevent exposure to bedrock groundwater immediately upon implementation.

The natural attenuation of the bedrock groundwater plume, in conjunction with components of the GW/SW alternatives directed at the source area soil and overburden groundwater, would work toward reducing site-wide bedrock groundwater concentrations to below non-drinking water (irrigation well) PRGs, reducing concentrations in bedrock groundwater in the Bungay River Water Resource Protection District to below drinking water PRGs (if exceeded), and preventing potential plume migration into the District in the future. If the contingency components of this alternative are implemented, the enhanced (deeper) PRB would prevent the continued flow of impacted bedrock groundwater from flowing towards the District. Over time (few years), water already present downgradient of the reactive barrier will attenuate and treatment goals

in the District would be achieved (if not already achieved). The reactive barrier will not affect the impacted groundwater in upgradient areas. Thus, the time to achieve non-drinking water remediation goals upgradient of the reactive barrier will be unchanged.

Cost – For Alternative BR-5 – Institutional Controls and Contingency Remedy of Enhanced (Deeper) Permeable Reactive Barrier, capital costs consist of direct and indirect costs anticipated to develop, construct, and implement the remedial alternative. Periodic costs consist of reporting and scheduled monitoring events as well as regular reinjections (if needed). O&M costs would consist of long-term bedrock groundwater monitoring. The present worth cost of the alternative is estimated to be approximately $4,379,000 and the present worth cost of the contingency items is approximately $1,019,000. Cost summary sheets are provided in Appendix D.

Alternative Evaluation – The detailed analysis of Alternative BR-5 – Institutional Controls and Contingency Remedy of Enhanced (Deeper) Permeable Reactive Barrier compared against each of the FS evaluation criteria is presented in Table 4-15.

5.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

In the sections that follow, a comparative analysis of the alternatives proposed for each medium/area of concern is presented. A comparative analysis of all alternatives is presented in Table 5-1, and a comparison of costs for all alternatives is presented in Table 5-2.

This comparative analysis evaluates the relative performance of each of the candidate alternatives, using the individual detailed evaluation of the specific criteria presented in Section 4.0. To organize the comparative process, the evaluation criteria are grouped into the following categories, which are sorted by the order of importance specified in CERCLA RI/FS guidance:

- Threshold criteria
- Primary balancing criteria
- Modifying criteria

Threshold criteria, according to the NCP, must be achieved by the selected site remedy. The two evaluation factors that are considered to be threshold criteria are listed below. If these criteria are not achieved by a particular remedy, then that remedy does not satisfy the minimum expectations for CERCLA response actions.

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

Primary balancing criteria are used to weigh the pros and cons of remedies that already satisfy threshold criteria. Specifically, these criteria are used to provide an assessment of the permanence of each remedial alternative, while ensuring their implementability and cost-effectiveness. Further, these criteria encourage the use of treatment technologies that reduce the toxicity, mobility, or volume of contaminants rather than technologies that solely prevent exposure. Primary balancing criteria consist of the following five NCP evaluation criteria:

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume of contaminants through treatment
- Short-term effectiveness
- Implementability
- Cost

The final category, *modifying criteria*, are not included in FS evaluations, but are essential in stakeholder discussions and selection of an ultimate site response. This final category of NCP criteria are listed below, but are not included in this FS evaluation, per CERCLA guidance (USEPA, 1988).

- State acceptance
- Community acceptance

These final two criteria are addressed in the ROD once formal comments on the proposed plan have been received.

5.1 Comparative Analysis for W&L Property Soil Alternatives

Detailed evaluation was performed for the following alternatives:

- S-1 – No Action
- S-2 – Institutional Controls on W&L Property

5.1.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment is a key threshold criterion that must be attained by an alternative to be eligible for selection in the ROD.

Alternative S-2 is expected to provide protection of human health and the environment with proper implementation by preventing unacceptable exposures by hypothetical future residents to impacted soil on the W&L Property. Alternative S-2 relies upon long-term enforcement of institutional controls, but this is not expected to be difficult. Alternative S-1 would not be protective of human health and the environment because future contact with contaminated soil would not be prevented.

5.1.2 Compliance with ARARs

Appendix E presents the ARARs for the two W&L Property soil alternatives. Potential chemical-specific ARARs are presented in Tables E-1 and E-2a for Alternative S-1 (No Action) and Alternative S-2 (ICs on W&L Property) respectively. Location-specific and action-specific ARARs for Alternative S-2 are provided in Tables E-2b and E-2c, respectively. Chemical-specific ARARs would not be met under Alternative S-1 since it does not prevent exposure to contaminated soil. No activities would be performed under Alternative S-1; therefore, action-specific and location-specific ARARs do not apply to this alternative. With proper implementation, it is anticipated that Alternative S-2 would meet chemical-specific, action-specific, and location-specific ARARs.

5.1.3 Long-Term Effectiveness and Permanence

In terms of the magnitude of residual risk under Alternative S-2, soil contamination would remain and would be reduced over time only by any natural attenuation that may occur. Alternative S-2 would rely on long-term enforcement of institutional controls and five-year reviews to assess the protectiveness of this

alternative. Alternative S-1 is not effective and does not provide permanent protection from contaminants in soil. Alternative S-2 receives a mid-level rating for long–term effectiveness because the long-term effectiveness relies on owners of the property to continue to abide by the institutional controls.

5.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

No treatment is provided under Alternatives S-1 and S-2 and thus no reduction of TMV is provided for Alternatives S-1 and S-2.

5.1.5 Short-Term Effectiveness

The effectiveness of the remedial alternatives during construction and implementation are compared to one another in the following paragraphs.

Protection of Community and Workers during Remedial Action - Short-term risks include any additional risks to the community or workers at the site from exposures to COCs in soil as a result of construction measures and implementation of remedial activities. Since no construction activities or remedial actions are proposed under Alternatives S-1 and S-2, there are no additional short-term risks to the community or workers.

Environmental Impacts - The remedial alternatives evaluated differ in the magnitude of potential impacts to natural habitats. Since no construction activities or remedial actions are proposed under Alternatives S-1 or S-2, there are no additional short-term impacts to natural habitats.

Alternative S-2 would achieve RAOs upon completing the initial implementation, while Alternative S-1 does not meet RAOs.

Based on the discussions above, Alternatives S-1 and S-2 both have low impact in the short-term.

5.1.6 Implementability

The alternatives with the highest degree of implementability would have the following characteristics from USEPA's FS guidance (USEPA, 1988):

- Require the lowest effort to construct, operate and maintain the technologies
- Include or consist only of the highest or most reliable technologies
- Require the lowest effort to undertake additional remedial actions, if necessary
- Include the fewest administrative hurdles for obtaining necessary permits, approvals and agreements
- Rely only minimally on off-site treatment, storage, and disposal facility (TSDF) services
- Require the least amount or quantity of necessary specialized equipment and/or personnel specialists
- Utilize commonly available technologies to the largest degree

Conversely, alternatives with lesser degrees of implementability will have lesser degrees of the characteristics discussed above. The first three bullets define the "technical feasibility" with regard to implementability of the alternative, the fourth bullet defines "administrative feasibility," and the remaining three bullets define the "availability of services and materials" with respect to the alternative. These three factors combine to provide the overall degree of implementability of the alternative.

In general, more complex remedial technologies are more difficult to implement and will have lesser degrees of overall implementability compared to other, less complex alternatives. As a result, the No Action alternative (S-1) is typically considered the most implementable, and any additional alternatives are less implementable. However, it should be noted that none of the alternatives presented, when applied to these areas, are considered highly complex and are commonly implemented at similar environmental restoration sites.

The following paragraphs present more detailed evaluations of the comparison on implementability characteristics of the remedial alternatives discussed in this FS.

Technical Feasibility - Implementability with regard to the technical feasibility of an alternative includes an evaluation of three factors: 1) ability to construct, operate and maintain the technologies, 2) the reliability of the technologies, and 3) the ease of undertaking additional remedial actions, if warranted by site conditions determined after implementation of the remedy.

Alternative S-2 utilizes a common technology; however, the institutional controls implemented under Alternative S-2 would rely on proper enforcement over time. Alternative S-2 would easily allow for additional remedial actions to occur, if needed, after implementation.

Administrative Feasibility - Alternative S-2 would require administrative approvals associated with five-year reviews and institutional controls, which are easily administered. There are no administrative requirements associated with S-1.

Availability of Services and Materials - Implementability with regard to the availability of services and materials includes an evaluation of three factors: 1) availability or usage of off-site TSDFs, 2) availability of necessary or specialized equipment or specialist personnel needed to implement the alternative, and 3) availability of prospective technologies required by the alternative. Each of these three factors is described for the alternatives.

Alternative S-1 would not require specialized equipment or personnel. Services need to implement Alternative S-2 would be relatively easy to obtain.

Based on the evaluations above, Alternative S-1 is considered the most implementable, followed by Alternative S-2. Both remedial alternatives can be implemented with relative ease.

5.1.7 Cost

The costs associated with the alternatives are summarized in Appendix D. For soil, Alternative S-1 is the least expensive, followed by Alternative S-2 (shown below).

Cost Component	Alternative S-1	Alternative S-2
Capital Costs[1]	$0	$65,616
O&M Costs[1]	$0	$0
Periodic Costs[1]	$0	$74,000
Total Cost[1]	$0	$132,000

[1] Rounded to the nearest $1,000, net present value

Cost Sensitivity Analysis - Cost sensitivity was also considered for this FS. However, no such analysis was performed for Alternative S-2, due to the lack of variables in that alternative; it is not sensitive to changes and cost would not be affected.

5.2 Comparative Analysis for Soil in Residential Yards Alternative

Detailed evaluation was performed for the following alternatives:

- SL-1 – No Action
- SL-3 – Soil Excavation on Residential Properties with Off-Site Disposal

5.2.1 Overall Protection of Human Health and the Environment

Alternative SL-1 (No Action) offers no protection of human health or the environment. Risks to current and future residential users from direct exposure to lead-contaminated soil would remain.

Upon completion, Alternative SL-3 (Excavation and off-Site Disposal) is expected to provide protection of human health and the environment by eliminating risks to human health from direct exposure to lead since no soil with contaminants in excess of the PRGs would remain. Alternative SL-3 could be implemented in a relatively short amount of time.

5.2.2 Compliance with ARARs

Appendix E presents the ARARs for the two Soil on Residential Property alternatives. Potential chemical-specific ARARs are presented in Tables E-3 and E-4a for Alternative SL-1 (No Action) and Alternative SL-3 (Excavation and Off-Site Disposal), respectively. Location-specific and action-specific ARARs for Alternative SL-3 are provided in Tables E-4b and E-4c, respectively. Chemical-specific ARARs would not be met under

Alternative SL-1 since it does not prevent exposure to contaminated soil. No activities would be performed under Alternative SL-1; therefore, action-specific and location-specific ARARs do not apply to this alternative. Upon completion, it is anticipated that Alternative SL-3 would meet chemical-specific, action-specific, and location specific ARARs.

5.2.3 Long-Term Effectiveness and Permanence

Alternative SL-3 removes soil with elevated lead concentrations such that the PRG for lead will not be exceeded on any of the properties, while contaminated soil will remain on-site under SL-1. Alternative SL-1 does not provide permanent protection from contaminants in soil and is not effective.

5.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

No treatment is provided in Alternative SL-1 and thus Alternative SL-1 provides no reduction in TMV. Depending on results of the waste characterization sampling, lead-impacted soil may be treated off-site to reduce mobility of lead under Alternative SL-3. With the concept of off-site treatment prior to disposal in mind, Alternative SL-3 provides better reduction in TMV compared to Alternative SL-1.

5.2.5 Short-Term Effectiveness

The effectiveness of the remedial alternatives during construction and implementation are compared to one another in the following paragraphs.

Protection of Community and Workers during Remedial Action - Short-term risks include any additional risks to the community or workers at the site from exposures to COCs in soil as a result of construction measures and implementation of remedial activities. Since no construction activities or remedial actions are proposed under Alternative SL-1, there are no additional short-term risks to the community or workers. Alternative SL-3 includes short-term risks to workers and to the community during excavation activities. Alternative SL-3 involves excavation of contaminated soil and truck traffic associated with materials entering and leaving the residential properties. These short-term community risks would be mitigated via dust control, proper traffic planning and engineering controls. The short-term worker risks associated with Alternative SL-3 can be mitigated with the use of appropriate PPE during remedial activities, dust control, and proper handling and management (i.e., engineering controls and contingency measures) of contaminated soil.

Environmental Impacts - The remedial alternatives evaluated differ in the magnitude of potential impacts to natural habitats. Since no construction activities or remedial actions are proposed under Alternative SL-1, there are no additional short-term impacts to natural habitats. Alternative SL-3 will result in several short-term impacts, including those associated with noise and exhaust from truck traffic. Alternative SL-3 will result in temporary removal of existing vegetation and possibly some trees. The SL-3 work would be designed to minimize impacts to wetland areas but given the proximity to wetland resources short-term impacts are possible.

Based on the above discussion, Alternative SL-1 would have the least detrimental effects in the short-term. Alternative SL-3 will have some short-term impacts but the scope of excavation is relatively small and thus Alternative SL-3 receives a mid-level rating for short-term effectiveness.

5.2.6 Implementability

The alternatives with the highest degree of implementability would have the following characteristics from USEPA's FS guidance (USEPA, 1988):

- Require the least effort to construct, operate and maintain the technologies
- Include or consist only of the highest or most reliable technologies
- Require the least effort to undertake additional remedial actions, if necessary
- Include the fewest administrative hurdles for obtaining necessary permits, approvals and agreements
- Require only readily available off-site treatment, storage, and disposal facilities (TSDF) services
- Require the least amount of necessary specialized equipment, resources, and/or personnel specialists
- Utilize commonly available technologies to the largest degree

Conversely, alternatives with lesser degrees of implementability will have lesser degrees of the characteristics discussed above. The first three bullets define the "technical feasibility" with regard to implementability of the alternative, the fourth bullet defines "administrative feasibility," and the remaining three bullets define the "availability of services and materials" with respect to the alternative. These three factors combine to provide the overall degree of implementability of the alternative.

In general, more complex remedial technologies are more difficult to implement and will have lesser degrees of overall implementability compared to other, less complex, alternatives. As a result, the No Action alternative (SL-1) is typically considered the most implementable, and any additional alternatives are less implementable. However, it should be noted that SL-3, the only other alternative considered for remediation of lead in residential soil, when applied to these characteristics, is not considered highly complex and has been frequently and readily implemented at similar environmental restoration sites.

The following paragraphs present more detailed evaluations of the comparison on implementability characteristics of the remedial alternatives for Soil in Residential Yards.

Technical Feasibility - Implementability with regard to the technical feasibility of an alternative includes an evaluation of three factors: 1) ability to construct, operate and maintain the technologies, 2) the reliability of the technologies, and 3) the ease of undertaking additional remedial actions, if warranted by site conditions determined after implementation of the remedy.

Alternative SL-3, which involves excavation and off-site disposal, employs a technically reliable, proven technology. With adequate planning, it is anticipated that this remedy can be completed quickly without technical problems that would result in delays. The need to conduct additional remedial actions is not anticipated since this alternative will result in the removal of soils that exceed PRGs.

Alternative SL-1, No Action, exhibits the greatest degree of technical feasibility since no equipment, technologies, or effort is required. If more action is deemed necessary in the future, this alternative allows for additional remedial actions to occur.

Administrative Feasibility - For SL-3, coordination with and approval by the off-site disposal facilities will be needed and, depending on the facility used, coordination with and approval by the state in which the TSDF is located may be needed. However, it is not expected that there will be any difficulty in obtaining these approvals. There are no administrative requirements associated with SL-1.

Availability of Services and Materials - Implementability with regard to the availability of services and materials includes an evaluation of three factors: 1) availability or usage of off-site TSDFs, 2) availability of necessary or specialized equipment or specialist personnel needed to implement the alternative, and 3) availability of prospective technologies required by the alternative. Each of these three factors is described for the alternatives.

Alternative SL-1 would not require specialized equipment or personnel. Alternative SL-3 would require off-site disposal of soil; however, all services and materials required for SL-3 would be relatively easy to obtain. Finally, special technologies (i.e., proprietary technologies or technologies with more variables affecting ultimate effectiveness) are not proposed for either of the alternatives.

Based on the evaluations above, Alternative SL-1 is considered the most implementable; however, SL-3 can be also implemented with relative ease.

5.2.7 Cost

The costs associated with Alternative SL-3 are summarized in Appendix D and shown below. There are no costs associated with SL-1; therefore it is the least costly. Table 5-2 includes a cost comparison for all alternatives that separates out pre-design and design costs from total capital costs.

Cost Component	Alternative SL-1	Alternative SL-3
Capital Costs[1]	$0	$422,000
O&M Costs[1]	$0	$0
Periodic Costs[1]	$0	$0
Total Cost[1]	$0	$422,000

[1] Rounded to the nearest $1,000, net present value, capital cost includes pre-design study and design

Cost Sensitivity Analysis - A cost sensitivity analysis was performed for Alternative SL-3 based on volume excavated from the residential properties (30% reduction and 50% increase in total soil excavated; see Appendix D). The results are shown below.

Cost Component	Alternative SL-3 (Baseline)	Alternative SL-3 (-30%)	Alternative SL-3 (+50%)
Total Cost[1]	$422,000	$382,000	$487,000

[1] Rounded to the nearest $1,000, net present value, capital cost includes pre-design study and design

5.3 Comparative Analysis for Groundwater/Surface Water Alternatives

Detailed evaluation was performed for the following alternatives:

- GW/SW-1 – No Action
- GW/SW-2a – Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat
- GW/SW-2b – Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat with Mid-Plume Treatment
- GW/SW-3a – Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier
- GW/SW-3b – Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier with Mid-Plume Treatment

5.3.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment is a key threshold criterion that must be attained by an alternative to be eligible for selection in the ROD.

Alternative GW/SW-1 (No Action) offers no protection of human health or the environment. Risks to current and future residents, construction workers, ecological receptors, and recreational users would remain.

Alternatives GW/SW-2a and GW/SW-2b are protective of human health and the environment because the full extent of impacted overburden groundwater would be contained by the pump and treat extraction wells and be under the regulation of institutional controls in addition to the source area soil removal and control on the W&L property. They are also protective of human health (recreational user) and the ecosystem of Bliss Brook because the pump and treat technology would intercept and treat the hexavalent chromium groundwater plume prior to discharge to Bliss Brook.

Alternatives GW/SW-3a and GW/SW-3b are protective of human health and the environment for overburden groundwater because the existing PRB would be extended further south to fully capture the

hexavalent chromium contaminated groundwater and reduce it to trivalent chromium before discharge into Bliss Brook in addition to the source area soil removal and control on the W&L property. They are also protective of human health (recreational user) and the ecosystem of Bliss Brook because the PRB technology would intercept and treat the hexavalent chromium groundwater plume prior to discharge to Bliss Brook.

Alternatives GW/SW-2a, GW/SW-2b, GW/SW-3a and GW/SW-3b all achieve similar levels of protection of human health and the environment.

5.3.2 Compliance with ARARs

Appendix E presents the ARARs for the five groundwater/surface water (GW/SW) alternatives. Potential chemical-specific ARARs are presented in Table E-5, E-6a, and E-7a for Alternative GW/SW-1 (No Action), Alternatives GW/SW-2a and -2b (Source Area Removal/In-Situ Treatment and Groundwater Pump and Treat with Mid-plume Treatment [GW/SW-2b only]), and Alternatives GW/SW-3a and -3b (Source Area Removal/In-Situ Treatment and Extended Permeable Reactive Barrier with Mid-plume Treatment [GW/SW-3b only]). Location-specific and action-specific ARARs are provided in Tables E-6b and E-6c, respectively, for Alternatives GW/SW-2a and -2b. Location-specific and action-specific ARARs are provided in Tables E-7b and E-7c, respectively, for Alternatives GW/SW-3a and -3b. Chemical-specific ARARs would not be met under Alternative GW/SW-1 since it does not prevent exposure to contamination in surface water and groundwater. No activities would be performed under Alternative GW/SW-1; therefore, action-specific and location-specific ARARs do not apply to this alternative. With proper implementation, it is anticipated that Alternatives GW/SW-2a, GW/SW-2b, GW/SW-3a, and GW/SW-3b would meet chemical-specific, action-specific, and location-specific ARARs.

5.3.3 Long-Term Effectiveness and Permanence

Alternative GW/SW-1 (No Action) does not include any remediation and thus is not a long-term or permanent remedy.

For Alternatives GW/SW-2a, GW/SW-2b, GW/SW-3a and GW/SW-3b, soil above the water table containing hexavalent chromium is permanently removed from the site. For soil below the water table, hexavalent chromium will be converted to the less toxic and less mobile trivalent chromium form by blending with ZVI. Although conversion of trivalent chromium back to hexavalent chromium is possible under some circumstances (presence of elevated manganese for example), the reduction of hexavalent chromium to trivalent chromium under the conditions at this site is considered to be permanent. Excavation and in-situ blending of ZVI are effective technologies.

For Alternatives GW/SW-2a and -2b, the pump and treat process near Bliss Brook would permanently remove and treat water impacted with hexavalent chromium that would enter Bliss Brook. However, the amount of hexavalent chromium in impacted water removed is small compared to the total amount of hexavalent chromium in impacted water present and thus the pump and treat system would have to continue operation for many years. For Alternatives GW/SW-2a and -2b to have long-term effectiveness, a

continuous effort to operate the pumps and treatment systems is required. If the pump and treat system stops operating for a relatively short period of time (less than two months, potentially), impacted groundwater will resume discharging to Bliss Brook and hexavalent chromium levels in Bliss Brook could exceed the PRGs.

Whereas the pump and treat alternatives permanently remove hexavalent chromium from the site, the permeable reactive barrier wall alternatives convert hexavalent chromium to the less toxic and less mobile trivalent form. Although reversion (trivalent going back to hexavalent) is theoretically possible, the conditions that would cause reversion (high levels of manganese) are not present at the W&L site. Thus, reversion is not expected. This conclusion is supported by the demonstrated long-term effectiveness of the existing PRB at the W&L site where there has been no evidence of reversion.

For Alternatives GW/SW-3a and GW/SW-3b impacted water near Bliss Brook is treated before entering Bliss Brook. Treatment reduces hexavalent chromium to trivalent chromium and is considered to be permanent. The permeable reactive barrier wall does not require any day-to-day operation or maintenance. Over time the permeable reactive barrier wall may become spent and require replacement. Under the conceptual design approach used in Alternatives GW/SW-3a and -3b, the PRB is designed to last 30 years. Groundwater near the brook and the surface water would be monitored to anticipate the timing for replenishing the reactive media.

Residual risks for GW/SW-2a, GW/SW-2b, GW/SW-3a, and GW/SW-3b would be low because incremental risks from COCs in groundwater and surface water would be mitigated through institutional controls and would decline over time as a result of the pump and treat or PRB treatment processes.

Because Alternatives GW/SW-2a and 2b rely on the effective day-to-day operations of the pumps and water treatment systems, these alternatives receive a lower rating compared to Alternatives GW/SW-3a and -3b which retain long-term effectiveness without day-to-day operational requirements.

Alternatives GW/SW-2b and GW/SW-3b include the mid-plume treatment component. The mid-plume treatment component would provide a degree of additional treatment of hexavalent chromium and TCE and would require minimal operation and maintenance. However, the added benefit of the mid-plume treatment is uncertain and has not been quantified, except to note that it should reduce the time to reach cleanup goals somewhat compared to not including mid-plume treatment. However, compared to the effectiveness of source area soil removal on the W&L property and treatment of water just before it enters Bliss Brook, the added benefits of mid-plume treatment are not great. Thus, Alternatives GW/SW-2b and GW/SW-3b do not receive better ratings compared to GW/SW-2a and GW/SW-3a.

5.3.4 Reduction of Toxicity, Mobility, or Volume through Treatment

No treatment is provided in Alternative GW/SW-1 and thus Alternative GW/SW-1 provides no reduction in TMV. For Alternatives GW/SW-2a, GW/SW-2b, GW/SW-3a, and GW/SW-3b, the TMV would be reduced by >95% on the W&L property due to the source area soil removal and introduction of a soil amendment into

the source area excavation, both of which will reduce hexavalent chromium to the less mobile trivalent chromium and treat cVOCs. Implementation of alternatives GW/SW-2a and GW/SW-2b will contain the impacted groundwater by means of extraction wells, and upon completion of treatment, impacted groundwater will have been reduced in toxicity and volume by >95%. For Alternatives GW/SW-3a and GW/SW-3b, TMV of contaminants will be inhibited downgradient of the PRB wall extension by >95% by reducing hexavalent chromium to the less mobile trivalent chromium until the ZVI amendment is exhausted. For Alternatives GW/SW-2b and GW/SW-3b, TMV will be further reduced due to the mid-plume treatment line. The amount of extra treatment provided by the mid-plume treatment is expected to be small compared to the source area soil removal component included in all alternatives. Because the added benefit to TMV for the mid-plume treatment has not been quantified but is likely to be small, the alternatives that include mid-plume treatment (GW/SW-2b and -3b) receive the same rating as the other alternatives.

5.3.5 Short-Term Effectiveness

The effectiveness of the remedial alternatives during construction and implementation are compared to one another in the following paragraphs.

Protection of Community and Workers during Remedial Action - Short-term risks include any additional risks to the community or workers at the site from exposures to COCs in groundwater or surface water as a result of construction measures and implementation of remedial activities. Since no construction activities or remedial actions are proposed under Alternative GW/SW-1, there are no additional short-term risks to the community or workers. Alternatives GW/SW-2a, GW/SW-2b, GW/SW-3a, and GW/SW-3b include short-term risks to workers and to the community during remedial activities but these risks could be easily mitigated via dust control, proper traffic planning, and engineering controls. The short-term worker risks associated with these alternatives can be mitigated with the use of appropriate PPE during remedial activities, dust control, and proper handling and management (i.e., engineering controls and contingency measures) of contaminated soil and groundwater. Transfer lines for impacted and treated water as well as electrical service would be required as part of the pump and treat alternatives (GW/SW 2a and -2b). Installation of these utilities may create temporary inconvenience to the community. Failure of the transfer lines or groundwater containment systems, although rare, creates a potential for impact to the community.

Environmental Impacts - The remedial alternatives evaluated differ in the magnitude of potential impacts to natural habitats. Since no construction activities or remedial actions are proposed under Alternative GW/SW-1, there are no additional short-term impacts to natural habitats. Alternatives GW/SW-2a and GW/SW-2b will result in some minor temporary impacts to the surrounding habitat, including those associated with noise and exhaust from truck traffic and drilling of monitoring and extraction wells.

Alternatives GW/SW-3a and GW/SW-3b will result in the same short-term impacts related to source area soil removal on the W&L property. However, short-term impacts to the community associated with the pump and treat systems will be avoided. Alternatives GW/SW-3a and -3b include more extensive work

adjacent to and in Bliss Brook. The ecosystem of Bliss Brook would be impacted during construction and would require time to recover (approximately one year).

Time to Achieve Remedial Action Objectives - The key parameter, achieving surface water PRGs in Bliss Brook, will be achieved rapidly under all alternatives besides GW/SW-1. Once the extraction wells and/or barrier wall under Bliss Brook is installed, infiltration of groundwater containing hexavalent chromium into the brook will be prevented.

Institutional controls (in all alternatives) would effectively prevent exposure to groundwater immediately upon implementation.

Based on modeling, hexavalent chromium concentrations in groundwater in areas downgradient of the source area would remain at levels that would impact the brook for many years (over 100 years). Groundwater approaching Bliss Brook would still contain elevated levels of hexavalent chromium. The long-term portions of the remedies (pump and treat or PRB wall) and institutional controls would have to remain active until the groundwater concentrations reach levels that would not cause exceedance of the surface water PRGs for Bliss Brook. The addition of the mid-plume in-situ treatment line in Alternatives GW/SW-2b and GW/SW-3b would reduce the time to achieve these levels by approximately 45% based on modeling (see Appendix F).

Based on the above discussion, Alternative GW/SW-1 would have the least detrimental effects in the short-term. The pump and treat alternatives present a slightly greater impact to the community during construction and the reactive barrier wall alternatives present a slightly greater impact to the ecosystem (Bliss Brook). On balance, short-term impacts are essentially equal.

The alternatives with mid-plume treatment will require additional work along the roadway and in proximity to the southern wetland. This additional work presents only a comparatively small increase in short-term impacts and thus was not judged to be a significant issue when comparing the alternatives.

5.3.6 Implementability

The alternatives with the highest degree of implementability would have the following characteristics from USEPA's FS guidance (USEPA, 1988):

- Require the lowest effort to construct, operate and maintain the technologies
- Include or consist only of the highest or most reliable technologies
- Require the lowest effort to undertake additional remedial actions, if necessary
- Include the fewest administrative hurdles for obtaining necessary permits, approvals and agreements
- Rely only minimally on off-site TSDF services
- Require the least amount or quantity of necessary specialized equipment and/or personnel specialists

- Utilize commonly available technologies to the largest degree

Conversely, alternatives with lesser degrees of implementability will have lesser degrees of the characteristics discussed above. The first three bullets define the "technical feasibility" with regard to implementability of the alternative, the fourth bullet defines "administrative feasibility," and the remaining three bullets define the "availability of services and materials" with respect to the alternative. These three factors combine to provide the overall degree of implementability of the alternative.

In general, more complex remedial technologies are more difficult to implement and will have lesser degrees of overall implementability compared to other, less complex, alternatives. As a result, the No Action alternative (GW/SW-1) is typically considered the most implementable, and any additional alternatives are less implementable. However, it should be noted that none of the alternatives presented, when applied to these areas, are considered highly complex and are commonly implemented at similar environmental restoration sites.

The following paragraphs present more detailed evaluations of the comparison on implementability characteristics of the remedial alternatives discussed in this FS.

Technical Feasibility - Implementability with regard to the technical feasibility of an alternative includes an evaluation of three factors: 1) ability to construct, operate and maintain the technologies, 2) the reliability of the technologies, and 3) the ease of undertaking additional remedial actions, if warranted by site conditions determined after implementation of the remedy.

Alternatives GW/SW-2a, GW/SW-2b, GW/SW-3a, and GW/SW-3b all employ technically reliable, proven technologies, including excavation, soil blending, pump and treat, and PRB walls. With adequate planning, it is anticipated that these remedies can be completed quickly without technical problems that would result in delays. The technical feasibility of ZVI was confirmed in the treatability study. However, full-scale implementation of ZVI is more complex and carries more uncertainty (relatively small) compared to pump and treat. The need to conduct additional remedial actions can be re-evaluated in the future and would be easily implementable. Additional remedial actions would include refreshing or reinjecting ZVI or undertaking other measures to accelerate treatment time.

Alternative GW/SW-1, No Action, exhibits the greatest degree of technical feasibility since no equipment, technologies, or effort is required. If more action is deemed necessary in the future, this alternative allows for additional remedial actions to occur.

Administrative Feasibility - For all alternatives besides No Action (GW/SW-1), coordination with and approval by the off-site disposal facilities will be needed and, depending on the facility used, coordination with and approval by the state in which the TSDF is located may be needed. However, it is not expected that there will be any difficulty in obtaining these approvals. There are no administrative requirements associated with GW/SW-1.

Availability of Services and Materials - Implementability with regard to the availability of services and materials includes an evaluation of three factors: 1) availability or usage of off-site TSDFs, 2) availability of necessary or specialized equipment or specialist personnel needed to implement the alternative, and 3) availability of prospective technologies required by the alternative. Each of these three factors is described for the alternatives.

Alternative GW/SW-1 would not require specialized equipment or personnel. All other alternatives would require off-site disposal of soil; however, all services and materials required for GW/SW-2a, GW/SW-2b, GW/SW-3a, and GW/SW-3b would be relatively easy to obtain. Equipment and trained personnel are readily available for the pump and treat portion of GW/SW-2a and GW/SW-2b. ZVI is required for GW/SW-3a and GW/SW-3b (or a similar reagent to ZVI could potentially be employed). ZVI is offered by several vendors and is considered easy to obtain. Finally, special technologies (i.e., proprietary technologies or technologies with more variables affecting ultimate effectiveness) are not proposed for any of the alternatives.

Based on the evaluations above, Alternative GW/SW-1 is considered the most implementable; however, all others can be also implemented with relative ease. Alternatives GW/SW-2a and GW/SW-2b are slightly easier to implement compared to GW/SW-3a and GW/SW-3b but the difference does not justify a different rating.

5.3.7 Cost

The costs (rounded to the nearest $1,000) associated with the alternatives are summarized in Appendix D and summarized below. Table 5-2 includes a cost comparison for all alternatives that separates out pre-design and design costs from total capital costs. Table 5-2 also shows the total periodic cost and the annual O&M cost for each alternative in current dollars, rather than net present value over 30 years as shown below.

Cost Component	Alternative GW/SW-1	Alternative GW/SW-2a	Alternative GW/SW-2b	Alternative GW/SW-3a	Alternative GW/SW-3b
Capital Costs[1]	$0	$9,168,000	$9,881,000	$11,085,000	$11,991,000
O&M Costs[1]	$0	$9,217,000	$9,217,000	$4,355,000	$4,355,000
Periodic Costs[1]	$0	$95,000	$95,000	$95,000	$95,000
Total Cost[1]	$0	$18,479,000	$19,193,000	$15,535,000	$16,441,000

[1] Rounded to the nearest $1,000, net present value, capital cost includes pre-design study and design

Cost Sensitivity Analysis - Cost sensitivity was also considered for this FS. For all of the GW/SW alternatives, the variables that were adjusted in the sensitivity analysis were source area soil excavation and ZVI dose in the lower 15 feet of the source area blending. Cost sensitivity was not performed for the main remedial components (pump and treat and PRB wall near Bliss Brook) due to the lack of variables for those

components; they are not sensitive to changes and costs would not be affected. For Alternatives GW/SW-2b and GW/SW-3b, the mid-plume treatment line ZVI dose was adjusted from 15% to 10% for the lower cost but was not adjusted for the higher cost because ZVI may not be effective at doses higher than 15%. It is important to note that the ZVI dose for each area will be determined during the design phase; the adjustments described above are for sensitivity analysis only. The cost sensitivity analyses are summarized in Appendix D and total costs shown below.

Cost Component	Alternative GW/SW-2a	Alternative GW/SW-2b	Alternative GW/SW-3a	Alternative GW/SW-3b
Baseline[1]	$18,479,000	$19,193,000	$15,535,000	$16,441,000
-30% Sensitivity[1]	$15,646,000	$16,343,000	$12,702,000	$13,591,000
+50% Sensitivity[1]	$24,146,000	$24,831,000	$21,202,000	$22,079,000

[1] Rounded to the nearest $1,000, net present value, capital cost includes pre-design study and design

5.4 Comparative Analysis for Bedrock Groundwater Alternatives

Detailed evaluation was performed for the following alternatives:

- BR-1 – No Action
- BR-2 – Institutional Controls
- BR-3 – Institutional Controls and Contingency Remedy of Focused In-Situ Injections (West of North Avenue)
- BR-4 – Institutional Controls and Contingency Remedy of Pump and Treat
- BR-5 – Institutional Controls and Contingency Remedy of Enhanced (Deeper) Permeable Reactive Barrier

5.4.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment is a key threshold criterion that must be attained by an alternative to be eligible for selection in the ROD.

Alternative BR-1 (No Action) offers no protection of human health or the environment. Potential risks to future users of bedrock groundwater would remain. Alternatives BR-2 through BR-5 are protective of human health and the environment because the full extent of impacted bedrock groundwater would be under the regulation of institutional controls to prevent the use of impacted water for drinking or irrigation purposes.

Alternatives BR-3 and BR-5 include contingency treatment components that would be implemented if pre-design investigations show that the bedrock groundwater plume has impacted the Bungay River Water

Resource Protection District. These contingency treatment components would provide further protection of human health because the injection of ZVI West of North Avenue (Alternative BR-3) and near Bliss Brook (Alternative BR-5) would intercept the hexavalent chromium contaminated bedrock groundwater and reduce it to trivalent chromium before it migrates further south toward the Bungay River Water Resource Protection District. Eventually the entire plume would reach cleanup goals by a combination of treatment (if determined to be needed) and natural attenuation, and in the interim, institutional controls would be in place. Similarly, Alternative BR-4 would provide further protection of human health and the environment if the contingency treatment component is implemented, because the full extent of impacted bedrock groundwater would be either contained by the pump and treat extraction wells or be under the regulation of institutional controls.

5.4.2 Compliance with ARARs

Appendix E presents the ARARs for the five bedrock groundwater alternatives. Potential chemical-specific ARARs are presented in Tables E-8, E-9a, E-10a, E-11a, and E-12a for Alternative BR-1 (No Action), Alternative BR-2 (ICs), Alternative BR-3 (ICs and Contingency Remedy of Focused In-Situ Injections), Alternative BR-4 (ICs and Contingency Remedy of Pump and Treat), and Alternative BR-5 (ICs and Contingency Remedy of Enhanced PRB). Location-specific and action-specific ARARs are provided in Tables E-9b and E-9c for Alternative BR-2, Tables E-10b and E-10c for Alternative BR-3, Tables E-11b and E-11c for Alternative BR-4, and Tables E-12b and E-12c for Alternative BR-5. Chemical-specific ARARs would not be met under Alternative BR-1 since it does not prevent exposure to contaminated bedrock groundwater. No activities would be performed under Alternative BR-1; therefore, action-specific and location-specific ARARs do not apply to this alternative. With proper implementation, it is anticipated that Alternatives BR-2, BR-3, BR-4, and BR-5 would all meet chemical-specific, action-specific, and location-specific ARARs.

5.4.3 Long-Term Effectiveness and Permanence

Alternatives BR-2, BR-3, BR-4, and BR-5 would all rely on long-term enforcement of institutional controls and five-year reviews to assess the protectiveness of the alternatives. Residual risk for these alternatives would be low because incremental risks from COCs in bedrock groundwater would be mitigated through institutional controls and would also be expected to decline over time as a result of natural attenuation.

If bedrock groundwater underlying the Bungay River Resource Protection District is found to be impacted above drinking water PRGs, the in-situ treatment contingency components of Alternatives BR-3 and BR-5 and pump and treat contingency of Alternative BR-4 would also work to reduce residual risks.

Long-term effectiveness for the pump and treat contingency for Alternative BR-4 relies on the continuous effective operation of the extraction pumps and treatment systems. Temporary shutdown of these systems would likely have minimal negative effect on overall containment of impacted groundwater and gradual improvement of groundwater downgradient. In some circumstances, pump and treat removes only a small percentage of the contamination present and thus, is not a permanent solution. If source area soil removal

is conducted (Alternatives GW/SW -2 or -3), that would improve the likelihood that pump and treat will gradually decrease hexavalent chromium concentrations in groundwater.

The in-situ treatment contingencies for Alternatives BR-3 (ZVI injection in bedrock west of North Avenue) and BR-5 (ZVI injection near Bliss Brook) propose the use of ZVI to convert hexavalent chromium to the less mobile and less toxic trivalent chromium form and to break down TCE to non-toxic components. For these site conditions, both reactions are considered to be permanent. Treatability testing, including tests with site bedrock and site groundwater, confirmed successful treatment. The challenge is placing a sufficient amount of ZVI into the bedrock to create good contact with the groundwater and to have a reasonable (30 year) period of effectiveness.

Alternative BR-1 is not effective and does not provide permanent protection from contaminants in groundwater. All other alternatives have similar levels of long-term effectiveness.

A sufficient amount of uncertainty in long-term effectiveness of the treatment contingencies for BR-3, BR-4 and BR-5 is presented that all these alternatives are rated similar. If the contingencies for these alternatives are not needed, then the alternatives would essentially be the same as BR-2 (Institutional Controls) and further support similar ratings. In theory, Alternatives BR-3, BR-4, and BR-5 should present an increase in long-term effectiveness and permanence compared to BR-2 (Institutional Controls) if the contingency treatment components are included. However, it is not certain that the active bedrock alternatives (BR-3, BR-4, and BR-5) would present a significant increase in long-term effectiveness and permanence compared to natural attenuation. The endpoints for hexavalent chromium treatment for ZVI treatment and natural attenuation are the same (trivalent chromium). The pump and treat alternative (BR-4) permanently removes hexavalent chromium from the groundwater but the amount of hexavalent chromium removed by pumping may be small compared to natural attenuation.

5.4.4 Reduction of Toxicity, Mobility, or Volume through Treatment

No treatment is provided in Alternative BR-1 and thus this alternative provides no reduction in TMV. With Alternatives BR-2, BR-3, BR-4, and BR-5, hexavalent chromium will eventually be reduced to trivalent chromium by natural processes. Compared to hexavalent chromium, trivalent chromium is less toxic and less mobile, thus TMV is reduced. Implementation of the pump and treat contingency for alternative BR-4 would contain the impacted bedrock groundwater by means of extraction wells, and upon completion of treatment, impacted groundwater downgradient of the extraction wells would gradually be reduced in volume by >95% (assuming effective design and operation). For Alternatives BR-3 and BR-5, the in-situ treatment contingencies would utilize ZVI to reduce hexavalent chromium to trivalent chromium (similar to natural reduction) and thus achieve a reduction in TMV of >95% (assuming effective distribution of ZVI in the bedrock). Natural reduction of hexavalent chromium will also occur for BR-2, BR-3, BR-4 and BR-5. The incremental improvement presented by active contingency remediation measures (BR-3, BR-4, and BR-5) is uncertain. For the purpose of comparison, the active contingency remediation measures are rated higher than BR-2.

The challenges and uncertainties in TMV reduction for the pump and treat (BR-4) and the ZVI injections (BR-3 and BR-5) contingency remedies are similar. These alternatives receive the same rating.

5.4.5 Short-Term Effectiveness

The effectiveness of the remedial alternatives during construction and implementation are compared to one another in the following paragraphs.

Protection of Community and Workers during Remedial Action - Short-term risks include any additional risks to the community or workers at the site from exposures to COCs in bedrock groundwater as a result of construction measures and implementation of remedial activities. Since no construction activities or remedial actions are proposed under Alternative BR-1, there are no additional short-term risks to the community or workers. Alternatives BR-2, BR-3, BR-4, and BR-5 include installation and sampling of monitoring wells. These activities present minimal risk or impact to the community.

If the contingency components of Alternatives BR-3, BR-4, and BR-5 are considered, Alternatives BR-3, BR-4, and BR-5 include more extensive site work compared to BR-2 and present short-term risks to workers and to the community during remedial activities. These risks could be easily mitigated via dust control, proper traffic planning, and engineering controls. The short-term worker risks associated with these alternatives can be mitigated with the use of appropriate PPE during remedial activities, dust control, and proper handling and management (i.e., engineering controls and contingency measures) of contaminated soil and groundwater. Transfer lines for impacted and treated water as well as electrical service would be required as part of the pump and treat contingency (BR-4). Installation of these utilities may create temporary inconvenience to the community. Failure of the transfer lines or groundwater containment systems, although rare, creates a potential for impact to the community. The contingency treatment component of BR-3 is somewhat less inconvenient to the community than are BR-4 and BR-5 since the work is mostly west of North Avenue on non-residential properties.

Environmental Impacts - The remedial alternatives evaluated differ in the magnitude of potential impacts to natural habitats. Since no construction activities or remedial actions are proposed under Alternative BR-1, there are no additional short-term impacts to natural habitats. Alternatives BR-2, BR-3, BR-4, and BR-5 all present minimal impact to environmental receptors as long as the contingency treatment components are not needed. The contingency components of Alternatives BR-4 and BR-5 involve drilling wells near Bliss Brook and the contingency components of Alternative BR-3 involve drilling wells near the Southern Wetland. The drilling results in some minor temporary impacts to the surrounding habitat, such as temporary destruction of bordering wetland vegetation. For Alternatives BR-3 and BR-5, the reagent and injection method must be designed to minimize the possibility of the reagent getting into the brook or wetland and adversely impacting the environment. For Alternative BR-4, the water transfer lines and treatment system must be designed to preclude spills or leaks that would affect the wetlands and brook.

Time to Achieve Remedial Action Objectives - Institutional controls (part of all alternatives besides BR-1) would effectively prevent exposure to bedrock groundwater immediately upon implementation.

Alternatives BR-2, BR-3, BR-4, and BR-5, in conjunction with components of the GW/SW alternatives directed at the source area soil and overburden groundwater, would work toward reducing site-wide bedrock groundwater concentrations to below non-drinking water (irrigation well) PRGs, reducing concentrations in bedrock groundwater in the Bungay River Water Resource Protection District to below drinking water PRGs (if exceeded), and preventing potential plume migration into the Protection District in the future. Over time (few years), water already present downgradient of the remedies will attenuate and treatment goals in the Bungay River Water Resource Protection District would be achieved (if not already achieved).

Based on the above discussion, Alternative BR-1 would have the least detrimental effects in the short-term. Alternative BR-2 includes minimal site work and would have a similarly low short-term impact. Short-term impacts for alternatives BR-3, BR-4 and BR-5 would be similar to BR-2, unless the active treatment contingencies are needed. However, the detrimental effects of the active contingencies can be mitigated.

5.4.6 Implementability

The alternatives with the highest degree of implementability would have the following characteristics from USEPA's FS guidance (USEPA, 1988):

- Require the lowest effort to construct, operate and maintain the technologies
- Include or consist only of the highest or most reliable technologies
- Require the lowest effort to undertake additional remedial actions, if necessary
- Include the fewest administrative hurdles for obtaining necessary permits, approvals and agreements
- Rely only minimally on off-site TSDF services
- Require the least amount or quantity of necessary specialized equipment and/or personnel specialists
- Utilize commonly available technologies to the largest degree

Conversely, alternatives with lesser degrees of implementability will have lesser degrees of the characteristics discussed above. The first three bullets define the "technical feasibility" with regard to implementability of the alternative, the fourth bullet defines "administrative feasibility," and the remaining three bullets define the "availability of services and materials" with respect to the alternative. These three factors combine to provide the overall degree of implementability of the alternative.

In general, more complex remedial technologies are more difficult to implement and will have lesser degrees of overall implementability compared to other, less complex, alternatives. As a result, the No Action alternative (BR-1) is typically considered the most implementable, and any additional alternatives are less implementable. The following paragraphs present more detailed evaluations of the comparison on implementability characteristics of the remedial alternatives discussed in this FS.

Technical Feasibility - Implementability with regard to the technical feasibility of an alternative includes an evaluation of three factors: 1) ability to construct, operate and maintain the technologies, 2) the reliability of the technologies, and 3) the ease of undertaking additional remedial actions, if warranted by site conditions determined after implementation of the remedy.

Alternatives BR-2, BR-3, BR-4, and BR-5 employ technically reliable, proven technologies, including institutional controls and monitoring. With adequate planning, it is anticipated that these remedies (less the contingency components) can be completed quickly without technical problems that would result in delays. The need to conduct additional remedial actions (i.e., contingency components or other actions) can be re-evaluated in the future and would be easily implementable.

If the pump and treat contingency for Alternative BR-4 is needed, implementation can be easily completed with adequate planning.

The in-situ treatment contingency for Alternative BR-3 poses some technical challenges in terms of ability to construct and reliability. Injecting reagents into bedrock can be difficult if the fractures are not sufficiently open. Hydraulic fracturing can result in uneven openings that bypass areas requiring treatment. Failure to achieve uniform and adequate delivery of reagents in bedrock adversely affects treatment reliability. Successful treatment of hexavalent chromium in bedrock is possible, however, is not routinely done and is not routinely successful. The Alternative BR-3 treatment contingency is considered to be moderately difficult to implement. Implementation of BR-3 does not adversely affect undertaking additional remedial activities.

The in-situ treatment contingency for Alternative BR-5 poses some challenges in terms of reliability. Drilling into bedrock is routinely conducted and emplacement of ZVI/sand mixture, while not commonly done, poses no major challenges. Installing enough ZVI/sand to cover the entire area for treatment is challenging. Assuring that bedrock groundwater will flow through the ZVI/sand mixture instead of around or under it is an area of uncertainty. As the ZVI rusts it is possible for the permeability to decrease and for water to flow around the reactive zone. Monitoring to ensure effective treatment may be difficult. The Alternative BR-5 treatment contingency is considered moderately difficult to implement. Implementation of BR-5 does not adversely affect undertaking additional remedial activities.

Alternative BR-1, No Action, exhibits the greatest degree of technical feasibility since no equipment, technologies, or effort is required. If more action is deemed necessary in the future, this alternative allows for additional remedial actions to occur. The Alternative BR-4 pump and treat contingency employs a proven technology for the site circumstances and has a high degree of technical feasibility. The in-situ treatment in bedrock contingencies (Alternatives BR-3 and BR-5) are challenging and not routinely successful. Alternatives BR-3 and BR-5 have a lower level of technical feasibility to BR-4 considering the treatment contingencies.

Administrative Feasibility - For all alternatives besides No Action (BR-1), coordination with and approval by the off-site disposal facilities will be needed and, depending on the facility used, coordination with and

approval by the state in which the TSDF is located may be needed. However, it is not expected that there will be any difficulty in obtaining these approvals. There are no administrative requirements associated with BR-1.

Availability of Services and Materials - Implementability with regard to the availability of services and materials includes an evaluation of three factors: 1) availability or usage of off-site TSDFs, 2) availability of necessary or specialized equipment or specialist personnel needed to implement the alternative, and 3) availability of prospective technologies required by the alternative. Each of these three factors is described for the alternatives.

Alternatives BR-1 and BR-2 and the non-contingency portions of BR-3, BR-4, and BR-5 would not require specialized equipment or personnel. All services and materials required for all other alternatives would be relatively easy to obtain. Finally, special technologies (i.e., proprietary technologies or technologies with more variables affecting ultimate effectiveness) are not proposed for any of the alternatives.

The pump and treat contingency for Alternative BR-4 is routinely implemented for bedrock. Although obtaining a uniform capture zone can be challenging, no major difficulties obtaining skilled personnel or equipment are anticipated. Designing successful in-situ treatment (contingencies for Alternatives BR-3 and BR-5) requires highly skilled personnel and specialty reagents (ZVI or other).

Based on the evaluations above, Alternatives BR-1 and BR-2 are considered the most implementable; however, all others can be also implemented with relative ease. Considering the contingency treatment components, Alternative BR-4 is more easily implemented compared to Alternatives BR-3 and BR-5.

5.4.7 Cost

The costs (rounded to the nearest $1,000) associated with the alternatives are summarized in Appendix D and summarized below. For the alternatives with contingency components (BR-3, BR-4, and BR-5), the costs presented are for the contingency portions only and do not include the Institutional Controls (BR-2) part of the cost for the particular alternative. The total cost for an alternative where the contingency is implemented would be the sum of the total cost presented for BR-2 and the total cost presented for the contingency portion in the table below.

Cost Component	Alternative BR-1	Alternatives BR-2, BR-3, BR-4, and BR-5	Alternative BR-3 (contingency)	Alternative BR-4 (contingency)	Alternative BR-5 (contingency)
Capital Costs[1]	$0	$963,000	$608,000	$569,000	$700,000
O&M Costs[1]	$0	$3,350,000	$0	$2,628,000	$0
Periodic Costs[1]	$0	$67,000	$319,000	$0	$319,000
Total Cost[1]	$0	$4,379,000	$927,000	$3,197,000	$1,019,000

[1] Rounded to the nearest $1,000, net present value, capital cost includes pre-design study and design

Table 5-2 includes a cost comparison for all alternatives that separates out pre-design and design costs from total capital costs. Table 5-2 also shows the total periodic cost and the annual O&M cost for each alternative in current dollars, rather than net present value over 30 years as shown above.

Cost Sensitivity Analysis - Cost sensitivity was also considered for this FS. The only alternatives considered in the sensitivity analysis for bedrock remediation were the contingency portions of BR-3 and BR-5. Cost sensitivity was not performed for Alternatives BR-2 or BR-4 due to the lack of variables for those alternatives; they are not sensitive to changes and costs would not be affected. For Alternatives BR-3 and BR-5, the only component that was adjusted was the volume of ZVI solution injected into the well points; it is important to note that the ZVI dose for each area will be determined during the design phase and the adjustments described above are for sensitivity analysis only. The cost sensitivity analyses are summarized in Appendix D and total costs shown below.

Cost Component	Alternative BR-3 (contingency)	Alternative BR-5 (contingency)
Baseline[1]	$927,000	$1,019,000
-30% Sensitivity[1]	$881,000	$972,000
+50% Sensitivity[1]	$1,004,000	$1,096,000

[1] Rounded to the nearest $1,000, net present value, cost includes pre-design study and design

6.0 REFERENCES

AECOM, May 2019. Revised Draft Final Baseline Human Health Risk Assessment, Walton & Lonsbury Superfund Site, Attleboro, Massachusetts. Prepared for: USEPA Region I, Boston, Massachusetts, Contract EP-S1-06-01.

AECOM, May 2019. Final Baseline Ecological Risk Assessment, Walton & Lonsbury Superfund Site, Attleboro, Massachusetts. Prepared for: USEPA Region I, Boston, Massachusetts, Contract EP-S1-06-01.

AECOM, March 2017. Treatability Test Report: Bench Testing for Hexavalent Chromium Treatment, Walton & Lonsbury Superfund Site, Attleboro, Massachusetts. Prepared for: USEPA Region I, Boston, Massachusetts, Contract EP-S1-06-01.

AECOM, June 2019. Draft Final Remedial Investigation Report, Walton & Lonsbury Superfund Site, Attleboro, Massachusetts. Prepared for: USEPA Region I, Boston, Massachusetts, Contract EP-S1-06-01.

Berry, W.J., W.S. Boothman, J.T.Serbst, and P.A. Edwards. 2004. Predicting the toxicity of chromium in sediments. Environ. Toxic. Chem. 23(12):2981-2992.

Environmental Strategies & Management, Inc. (ESM). April 2012. Limited Site Investigation Report, Former Walton and Lonsbury Site, 78 North Avenue, Attleboro, Massachusetts. MassDEP RTN 4-0000023,TAD #101535. Prepared for Massachusetts Department of Environmental Protection, Southeast Regional Office.

ESM, August 2011. Limited Site Investigation Report, Former Walton and Lonsbury Site, 78 North Avenue, Attleboro, Massachusetts. MassDEP RTN 4-0000023,TAD #101535. Prepared for Massachusetts Department of Environmental Protection, Southeast Regional Office.

Fetter, C.W., 1994. Applied Hydrogeology, Third Edition. Prentice Hall.

MassDEP, March 27, 2018. Groundwater Use and Value Determination, DEP RTN 4-00023, Walton & Lonsbury Superfund Site, Attleboro, MA.

MassDEP Field Assessment and Support Team (FAST), February 23, 2010. Vapor Intrusion Study, DEP RTN 4-00023, Attleboro – Walton and Lonsbury Site.

MassDEP Field Assessment and Support Team (FAST), December 2010. Vapor Intrusion Study II, DEP RTN 4-00023, Attleboro – Walton and Lonsbury Site.

Resource Control Associates, Inc. (RCA), 1989. Phase I – Limited Site Investigation Report. Prepared for Walton and Lonsbury, Inc., 78 North Avenue, Attleboro, MA, February 15, 1989.

RCA, 1990. Phase IIA – Preliminary Comprehensive Site Assessment Report for Property Located at: 78 North Avenue, Attleboro, MA 02703. Prepared for Walton and Lonsbury, Inc.

RCA, 2001. Phase IIC – Interim Comprehensive Site Assessment Report, Walton and Lonsbury Facility, 78 North Avenue, Attleboro, Massachusetts, RTN 4-0023. Prepared for Walton and Lonsbury, Inc.

Rifkin, E. P. Gwinn, and E. Bouwer. 2004. Chromium and Sediment Toxicity. Environ. Sci & Technol. 38(14): 267A-272A.

SAGE Environmental, Inc. (Sage), January 2016. SUPPLEMENTAL PHASE II COMPREHENSIVE SITE ASSESSMENT REPORT, 79 Walton Street, Attleboro, Massachusetts 02703, MassDEP RTN 4-012739

Tetra Tech NUS, Inc. (TtNUS), 2005. Draft Site Inspection Report for Walton and Lonsbury, Inc., Attleboro, Massachusetts. CERCLIS/RCRIS No. MAD001197755. Site Inspections, Response Action Contract (RAC), Region I. Prepared for USEPA Region 1 Office of Site Remediation and Restoration.

U.S. Environmental Protection Agency (USEPA), 2018. Regional Screening Levels (RSLs), May 2018. https://www.epa.gov/risk/regional-screening-levels-rsls

U.S. Environmental Protection Agency (USEPA). 2017. Update to the Adult Lead Methodology's Default Baseline Blood Lead Concentrations and Geometric Standard Deviation Parameters. OLEM Directive 9285.6-56. May 2017. Available at: https://semspub.epa.gov/work/HQ/196766.pdf

USEPA, 2009. *Update of the adult lead methodology's default baseline blood lead concentration and geometric standard deviation parameters.* Technical Review Workgroup for Lead. Office of Superfund Remediation and Technology Innovation. June 2009.

USEPA, 2007. *User's guide for the integrated exposure uptake biokinetic model for lead in children.* Office of Superfund Remediation and Technology Innovation. Washington, D.C. EPA 9285.7-42. May 2007.

USEPA, 2003. *Recommendations of the Technical Review Workgroup for lead for an approach to assessing risk associated with adult exposures to lead in soil.* Technical Review Workgroup for Lead. United States Environmental Protection Agency. January 2003.

USEPA, 1994. *Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children.* Office of Solid Waste and Emergency Response. Washington, D.C. EPA/540/R-93/081. February 1994.

USEPA, 1991. Risk Assessment Guidance for Superfund: Volume I – Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals), Interim, Office of Emergency and Remedial Response. EPA/540/R-92/003. December 1991.

USEPA, 1990. National Oil and Hazardous Substances Pollution Contingency Plan (National Contingency Plan; NCP). Code of Federal Regulations, Title 40, Part 300, Federal Register, Volume 55, Number 46, pp. 8666 et seq. March 9, 1990.

USEPA, 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA. EPA/540/G-89/004. OSWER Directive 9355.3-01. October 1988.

USEPA, 1985. Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses, Office of Research and Development, PB85-227049.

USEPA New England Regional Laboratory Office of Environmental Measurement and Evaluation (OEME), March 2009. Indoor Air Soil Vapor Intrusion Study Report, Walton & Lonsbury Site, Paulette Lane/North Avenue, Attleboro, MA. Prepared for MA DEP Bureau of Waste Prevention and James Chow, OSRR RCRA Corrective Action.

USEPA New England Regional Laboratory Office of Environmental Measurement and Evaluation (OEME), December 2008. Final Report: Indoor Air Soil Vapor Intrusion Study, Walton & Lonsbury, Inc. RCRA Corrective Action Site, 78 North Ave., Attleboro, MA. Prepared for MA DEP Bureau of Waste Prevention and James Chow, OSRR RCRA Corrective Action.

Weston Solutions, Inc. (Weston), November 2013. Hydrogeologic Investigation Summary Report for the Walton and Lonsbury Site, Attleboro, Bristol County, Massachusetts. Prepared for the U.S. Environmental Protection Agency, Region 1, Emergency Planning and Response Branch, Contract No. EP-W-05-042, Task Order No. 0003, DCN NO. R-7549.

Weston, November 2013. Record Drawings, Time Critical Removal Action and Site Restoration, Walton and Lonsbury Site, Attleboro, Massachusetts. Prepared for U.S. Environmental Protection Agency Region 1, Contract Number EP-W-5-04, Task Order No. 0003.

Weston, October 2012. Removal Program Preliminary Assessment/Site Investigation Report for the Walton and Lonsbury Site, Attleboro, Bristol County, Massachusetts: August 2010 through 16 June 2011. Prepared for the U.S. Environmental Protection Agency, Region I, Emergency Planning and Response Branch, Contract No. EP-W-05-042, TDD NO. 01-11-08-0002, Task No. 0737, DC NO. R-7029.

Weston, April 2012. Expanded Trip Report for Walton and Lonsbury Site Reassessment, Attleboro, Massachusetts. Prepared for the U.S. Environmental Protection Agency, Region I, Office of Site Remediation and Restoration, Contract No. EP-W-05-042, CERCLIS No. MAD001197755, State ID No. 4-0000023, TDD NO. 12-01-0003, Task No. 0773, DC NO. A-6762.

Zhao, et al. 2017. Determination of Cr(III) solids formed by reduction of Cr(VI) in a contaminated fractured bedrock aquifer: Evidence for natural attenuation of Cr(VI). Chem. Geology. 474 (2017): 1-8.

Tables

Table 1-1

December 2017 Surface Soil Sampling for Lead Risk Evaluation:

Results for Total Lead, IVBA Lead, and Total Chromium

Location\AECOM ID	Total Lead, Whole Sample (Not Sieved), dry weight (mg/Kg)		Results for Fine Fraction (< 150 µm) Samples					Total Chromium, Whole Sample (Not Sieved), dry weight (mg/Kg)	
			Total Lead, dry weight (mg/Kg)		Extractable Lead, dry weight (mg/Kg)		IVBA Lead, %		
	Result	Qualifier	Result	Qualifier	Result	Qualifier		Result	Qualifier
Exposure Point: Residential Area West of North Avenue									
WL-SO-605	57		109		73.2	J	67.2	16.9	J
WL-SO-606	163		163		107	J	65.6	72.7	J
WL-SO-612	225	J	478		364	J	76.2	42.1	J
WL-SO-611	549	J	474		384	J	81	70.1	J
WL-SO-618	74.9	J	118		84.9	J	71.9	207	J
WL-SO-617	554	J	705		432	J	61.3	882	J
WL-SO-624	73.5		149		103	J	69.1	182	J
WL-SO-622 (FD)	86.6	J	199		135	J	67.8	39.7	
WL-SO-622 (FD)	75.8		203		131	J	64.5	35.3	J
WL-SO-623	141		263		156	J	59.3	37.8	J
WL-SO-619	59.4	J	111		67	J	60.4	15.0	J
WL-SO-621	160	J	428		286	J	66.8	57.0	J
WL-SO-603	76.1		55.7		36.7	J	65.9	22.2	J
Average	185		271						
Exposure Point: Southern Wetland									
WL-SO-609	23.8	J	1820		75.3	J	4.1	96.0	J
WL-SO-613	323	J	474		277	J	58.4	10300	J
WL-SO-614	51.8	J	50.8		71.6	J	NC	99.0	J
WL-SO-616	369	J	357		220	J	61.6	14400	J
WL-SO-615	43.3	J	36.1		26.2	J	72.6	98.8	J
WL-SO-620	110	J	240		157	J	65.4	1150	J
WL-SO-610	301	J	214		163	J	76.2	3790	J
WL-SO-607	59.1	J	56.9		39.3	J	69.1	18.9	J
WL-SO-602 (FD)	207		135		85.5	J	63.3	16000	J
WL-SO-602 (FD)	138	J	144		93.4	J	64.9	35.0	J
WL-SO-601	184		220		142	J	64.5	14400	J
WL-SO-604	157		290		226	J	77.9	15.9	J
WL-SO-608	142		113		81.5	J	72.1	329	J
Average*	174		199						
Exposure Point: Residential Area East of North Avenue									
WL-SO-628	41.2		66.5		41.6		62.6	14.2	J
WL-SO-635	127	J	200		147	J	73.5	531	J
WL-SO-632	33.2		83.6		53.4	J	63.9	8.7	J
WL-SO-630	16.9		51.5		29.4	J	57.1	8.9	J
WL-SO-634	9.3	J	7.7		3.7	U	--	70.4	J
WL-SO-639	115	J	120		51.6	J	43	87.8	
WL-SO-638	133	J	259		167	J	64.5	150	
WL-SO-640	243	J	308		211		68.5	142	
WL-SO-642 (FD)	836	J	1330		1010		75.9	25.8	
WL-SO-642 (FD)	700	J	1310		1000		76.3	29.2	
WL-SO-627	40.5		64.9		38.8	J	59.8	16.5	J
WL-SO-626	51.6		76.7		55.1	J	71.8	14.9	J
WL-SO-625	54.5		69		46.8	J	67.8	16.5	J
Average	136		219						
Exposure Point: Bliss Brook									
WL-SO-643	429	J	449		276		61.5	813	J
WL-SO-645	226	J	289		203		70.2	83.7	
WL-SO-631	389		921		548	J	59.5	19.6	J
WL-SO-633	28.9		58.1		33.8	J	58.2	11.2	J
WL-SO-637	177	J	348		229		65.8	27.6	J

Table 1-1

December 2017 Surface Soil Sampling for Lead Risk Evaluation:

Results for Total Lead, IVBA Lead, and Total Chromium

Location\AECOM ID	Total Lead, Whole Sample (Not Sieved), dry weight (mg/Kg)		Results for Fine Fraction (< 150 µm) Samples					Total Chromium, Whole Sample (Not Sieved), dry weight (mg/Kg)	
			Total Lead, dry weight (mg/Kg)		Extractable Lead, dry weight (mg/Kg)		IVBA Lead, %		
	Result	Qualifier	Result	Qualifier	Result	Qualifier		Result	Qualifier
WL-SO-641	128	J	167		117		70.1	27.0	
WL-SO-648	181	J	286		262		91.6	323	J
WL-SO-646	694	J	432		356		82.4	1380	J
WL-SO-647	485	J	307		277		90.2	601	J
WL-SO-629	96.1		110		77.9		70.8	71.9	J
WL-SO-636	119	J	105		73.2		69.7	1150	J
WL-SO-644	389	J	399		303		75.9	738	
Average	279		323						

NC = Lab notation, assumed to mean that the extractable lead result > lead in soil result, therefore Not Calculated.

-- = Not determinable because extractable lead was not detected.

IVBA = In Vitro Bioaccessibility, calculated as Extractable Lead/Total Lead x 100 (expressed as a percentage)

mg/Kg = milligram per kilogram

FD = Field duplicate collected at this location.

Qualifier = qualifier applied by AECOM during data validation:

J = result is estimated due to limitations identified in the data validation memorandum

U = not detected; reported value is the reporting limit

*Average for Southern Wetland excludes SO-609. This location is evaluated separately in the HHRA.

Total lead (unsieved sample) concentration exceeds the RME concentration for soil samples from reference areas (101 mg/kg).

Total chromium (unsieved sample) concentration exceeds the RME concentration for soil samples from reference areas (16 mg/kg).

Table 1-2

December 2017 and November 2018 Surface Soil Sampling for Lead Risk Evaluation

Residential Area West of North Avenue:

Results for Total Lead, Total Chromium, and Total Fine Fraction Lead

Location/ID	Soil Sample Type	Total Lead, Whole Sample (Not Sieved), dry weight (mg/Kg)		Results for Fine Fraction (< 150 µm) Samples: Total Lead, dry weight (mg/Kg)		Total Chromium, Whole Sample (Not Sieved), dry weight (mg/Kg)	
		Result	Qualifier	Result	Qualifier	Result	Qualifier
60 North Avenue							
SO-605	residential above flood plain	57		109		16.9	J
SO-606	residential flood plain	163		163		72.7	J
SO-604	wetland	157		290		15.9	J
48 North Avenue							
48NO-01	residential flood plain	383		372		26.7	J
48NO-02	residential flood plain	153		280		16.8	J
48NO-03	residential flood plain	663		781		30	J
48NO-04	residential flood plain	191		163		47.7	J
48NO-05	residential flood plain	214	J	241		22.5	
Mass Electric Parcel							
ME-01	residential flood plain	345	J	490		21	
ME-02	residential flood plain	520	J	790		57.3	
42 North Avenue							
42NO-01	residential flood plain	192		369		33.1	J
42NO-02 (FD)	residential flood plain	228		397		23.5	J
42NO-02 (FD)	residential flood plain	178		411		17.5	J
42NO-03	residential flood plain	202		409		16.1	J
42NO-04	residential flood plain	194		511		18.8	J
SO-611	residential flood plain	549	J	474		70.1	J
SO-612	residential flood plain	225	J	478		42.1	J
SO-610	wetland	301	J	214		3,790	J
SO-613	wetland	323	J	474		10,300	J
34 North Avenue							
34NO-01	residential flood plain	318	J	471		40.1	
34NO-02 (FD)	residential flood plain	50.0		109		14.1	J
34NO-02 (FD)	residential flood plain	49.3		90.8		15	J
34NO-03	residential flood plain	200		472		104	J
34NO-04	residential flood plain	145		303		12.5	J
SO-617	residential flood plain	554	J	705		882	J
SO-618	residential above flood plain	74.9	J	118		207	J
SO-619	residential above flood plain	59.4	J	111		15.0	J
SO-621	residential above flood plain	160	J	428		57.0	J
SO-616	wetland	369	J	357		14,400	J
SO-620	wetland	110	J	240		1,150	J
10 Deanville Road							
10DE-01	residential flood plain	46.2	J	89.1		14.5	
10DE-02	residential flood plain	81.5	J	172		18.2	
10DE-03	residential flood plain	141	J	272		54.9	
10DE-04	residential flood plain	169	J	308		39.3	

Table 1-2
December 2017 and November 2018 Surface Soil Sampling for Lead Risk Evaluation
Residential Area West of North Avenue:
Results for Total Lead, Total Chromium, and Total Fine Fraction Lead

Location/ID	Soil Sample Type	Total Lead, Whole Sample (Not Sieved), dry weight (mg/Kg)		Results for Fine Fraction (< 150 µm) Samples: Total Lead, dry weight (mg/Kg)		Total Chromium, Whole Sample (Not Sieved), dry weight (mg/Kg)	
		Result	Qualifier	Result	Qualifier	Result	Qualifier
10DE-05	residential flood plain	63.5	J	142		42	
10DE-06	residential flood plain	62.9	J	136		27.4	
10DE-07	residential flood plain	59.7	J	89.8		20.9	
10DE-08	residential flood plain	101	J	172		18.9	
10DE-09	residential flood plain	98.1	J	220		17.7	
10DE-10	residential flood plain	568	J	1240		42.8	
10DE-11	residential flood plain	84.2	J	198		34.6	
10DE-12	residential flood plain	73.3	J	131		15.9	
SO-622 (FD)	residential flood plain	86.6	J	199		39.7	
SO-622 (FD)	residential flood plain	75.8		203		35.3	J
SO-623	residential flood plain	141		263		37.8	J
28 North Avenue							
28NO-01	residential flood plain	682	J	1170		35	
28NO-02	residential flood plain	90.2	J	127		22.1	
28NO-03	residential flood plain	68.3		162		11.5	J
28NO-04	residential flood plain	40.6		68.5		14.7	J
28NO-05	residential flood plain	79.9		124		40.1	J
28NO-06	residential flood plain	192		360		24.9	J
28NO-07	residential flood plain	68.9		126		23.7	J
28NO-08	residential flood plain	100		228		27.9	J
28NO-09	residential flood plain	170		358		145	J
SO-624	residential flood plain	73.5		149		182	J

mg/Kg = milligram per kilogram
FD = Field duplicate collected at this location.
Qualifier = qualifier applied by AECOM during data validation:
J = result is estimated due to limitations identified in the data validation memorandum
U = not detected; reported value is the reporting limit

Total lead (fine fraction) concentration exceeds the screening value for residential soil (200 mg/kg). Not flagged if sample is not residential soil (that is, if sample is wetland soil), as the screening value does not apply to wetland soil.

Total chromium (unsieved sample) concentration exceeds the RME exposure point concentration for soil samples from reference areas (16 mg/kg) as calculated in the BERA.

Table 1-3
Lead Risk Evaluation
Residential Area West of North Avenue

Location/ID	Soil Sample Type	Results for Fine Fraction (< 150 µm) Samples Total Lead, dry weight (mg/Kg) Result
60 North Avenue		
SO-606	residential flood plain	163
48 North Avenue		
48NO-01	residential flood plain	372
48NO-02	residential flood plain	280
48NO-03	residential flood plain	781
48NO-04	residential flood plain	163
48NO-05	residential flood plain	241
	average	**367.4**
Mass Electric Parcel		
ME-01	residential flood plain	490
ME-02	residential flood plain	790
	average	**640**
42 North Avenue		
42NO-01	residential flood plain	369
42NO-02 (combo)	residential flood plain	404
42NO-03	residential flood plain	409
42NO-04	residential flood plain	511
SO-611	residential flood plain	474
SO-612	residential flood plain	478
	average	**440.8**
34 North Avenue		
34NO-01	residential flood plain	471
34NO-02 (combo)	residential flood plain	99.9
34NO-03	residential flood plain	472
34NO-04	residential flood plain	303
SO-617	residential flood plain	705
	average	**410.2**
10 Deanville Road (outlier 10DE-10)		
10DE-10	residential flood plain	1240
10 Deanville Road		
10DE-01	residential flood plain	89.1
10DE-02	residential flood plain	172
10DE-03	residential flood plain	272
10DE-04	residential flood plain	308
10DE-05	residential flood plain	142

Table 1-3
Lead Risk Evaluation
Residential Area West of North Avenue

Location/ID	Soil Sample Type	Results for Fine Fraction (< 150 µm) Samples
		Total Lead, dry weight (mg/Kg)
		Result
10DE-06	residential flood plain	136
10DE-07	residential flood plain	89.8
10DE-08	residential flood plain	172
10DE-09	residential flood plain	220
10DE-11	residential flood plain	198
10DE-12	residential flood plain	131
SO-622 (combo)	residential flood plain	201
SO-623	residential flood plain	263
	average	**184.1**
28 North Avenue (outlier 28NO-01)		
28NO-01	residential flood plain	1170
28 North Avenue		
28NO-02	residential flood plain	127
28NO-03	residential flood plain	162
28NO-04	residential flood plain	68.5
28NO-05	residential flood plain	124
28NO-06	residential flood plain	360
28NO-07	residential flood plain	126
28NO-08	residential flood plain	228
28NO-09	residential flood plain	358
SO-624	residential flood plain	149
	average	**189.2**

mg/Kg = milligram per kilogram

combo = average of parent sample and field duplicate collected at this location.

TABLE 2-1
CHEMICAL-SPECIFIC ARARs AND TBCs
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Human Health Assessment Cancer Slope Factors (CSFs)	None	To Be Considered	CSFs are estimates of the upper-bound probability of an individual developing cancer as a result of a lifetime exposure to a particular concentration of a potential carcinogen.	Used to compute the potential carcinogenic risks caused by exposure to contaminants in site media.
EPA Risk Reference Doses (RfDs)	None	To Be Considered	Guidance used to compute human health hazard resulting from exposure to non-carcinogens in site media. RfDs are considered to be the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime.	Used to calculate potential non-carcinogenic hazards caused by exposure to contaminants in site media.
Guidelines for Carcinogenic Risk Assessment	EPA/630/P-03/001F (March 2005)	To Be Considered	These guidelines provide guidance on conducting risk assessments involving carcinogens.	Used to calculate potential carcinogenic risks caused by exposure to contaminants in site media.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F(March 2005)	To Be Considered	This provides guidance on assessing risk to children from carcinogens.	Used to calculate potential carcinogenic risks to children caused by exposure to contaminants in site media.
Updated Scientific Considerations for Lead in Soil Cleanups	OLEM Directive 9200.2-167	To Be Considered	Memorandum providing information related to blood lead levels to be considered during risk evaluations of lead.	Used to calculate potential risks caused by exposure to lead in soil.
Clean Water Act ; National Recommended Water Quality Criteria ("NRWQC")	33 U.S.C. § 1251 et seq.; 40 C.F.R. § 122.44	Relevant and Appropriate	NRWQC establish water quality standards for the protection of human health and aquatic life.	NRWQCs were used for characterizing ecological effects caused by exposure to contaminants in surface water.
Safe Drinking Water Act, National Primary Drinking Water Regulations - Maximum Contaminant Levels (MCLs)	40 Code of Federal Regulations (CFR) 141 Subpart G	Relevant and Appropriate	Establishes maximum contaminant levels (MCLs) for common organic and inorganic contaminants applicable to public drinking water supplies. Used as relevant and appropriate cleanup standards for aquifers and surface water bodies that are potential drinking water sources.	Used in the development of the PRGs for groundwater to be protective of public drinking water supplies.
Safe Drinking Water Act, National Primary Drinking Water Regulations – Maximum Contaminant Level Goals (MCLGs)	40 CFR 141 Subpart F	Relevant and Appropriate (non-zero MCLGs only)	Establishes maximum contaminant level goals (MCLGs) for public water supplies. MCLGs are health goals for drinking water sources. These unenforceable health goals are available for a number of organic and inorganic compounds.	Used in the development of the PRGs for groundwater to be protective of public drinking water supplies.
Drinking Water Health Advisory for Manganese (EPA Office of Drinking Water), 2004	None	To Be Considered	Health advisories are estimates of risk from consumption of contaminated drinking water. They consider non-carcinogenic effects only. To be considered for contaminants in groundwater that may be used for drinking water purposes, where the standard is more conservative than either federal or	The Health Advisories will be used to develop non-carcinogenic risk-based standards, particularly for manganese.

TABLE 2-1
CHEMICAL-SPECIFIC ARARs AND TBCs
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
			state statutory or regulatory standards. The Advisory standard for manganese is 0.3 mg/L.	
State				
Massachusetts Clean Water Act; MA Surface Water Quality Standards (MSWQS)	314 CMR 4.00	Relevant and Appropriate	These standards designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained, or protected. Minimum water quality criteria required to sustain the designated uses are established.	These surface water standards are used when more stringent than federal standards (NRWQC).
Massachusetts Drinking Water Regulations	310 CMR 22.00	Relevant and Appropriate	These standards establish Massachusetts Maximum Contaminant Levels (MA MCLs) for organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water supply systems.	MA MCLs were used during development of cleanup goals.

TABLE 2-2
LOCATION-SPECIFIC ARARs AND TBCs
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Protection of Wetlands (Executive Order 11990)	44 CFR Part 9	Relevant and Appropriate	Per the FEMA regulations (44 CFR Part 9; incorporating requirements under Executive Order 11990), federal agencies are required to avoid adversely impacting federal jurisdictional wetlands unless there is no practicable alternative with lesser effects and the proposed action includes all practicable measures to minimize harm to federal jurisdictional wetlands that may result from such use.	Alternatives may impact neighboring resource areas. To the extent federal jurisdictional wetlands exist within areas to be remediated, action to be taken will minimize alterations to protected resource areas. Mitigation measures, as required, will be taken to compensate for resource areas impacted by remedial actions.
Floodplain Management (Executive Order 11988)	44 CFR Part 9	Relevant and Appropriate	Per the FEMA regulations (44 CFR Part 9; incorporating requirements under Executive Order 11988), federal agencies are required to avoid long-and short-term adverse impacts associated with the occupancy and modification of federally-designated 100-year and 500-year floodplain wherever there is a practicable alternative.	Alternatives may involve modification of the floodplain. Available practicable means will be used to reduce the risk of flood loss, to minimize the impact of floods, and to restore and preserve the floodplains.
Clean Water Act, Guidelines for Specification of Disposal Sites for Dredged or Fill Material	33 U.S.C. § 1344; § 404(b)(1); 40 CFR Parts 230, 231, and 33 CFR Parts 320 - 323	Applicable	Controls discharges of dredged or fill material to protect aquatic ecosystem. Alternatives may include work to be performed in a wetland. Under this requirement no activity that adversely affects a wetland shall be permitted if a practicable alternative with lesser effects is available. If activity takes place, impacts must be minimized to the maximum extent. Sets standards for restoration and mitigation required as a result of unavoidable impacts to wetland and aquatic resources. EPA must determine which alternative is the "Least Environmentally Damaging Practicable Alternative" (LEDPA) to protect wetland and aquatic resources.	Alternatives may involve excavation and filling within federal jurisdictional wetlands. Work will be done to minimize and mitigate for any impacts to wetland resources. EPA will solicit public comment as to whether the alternative is the Least Environmentally Damaging Practicable Alternative.
Management of Undesirable Plants	7 U.S.C. § 2814	Relevant and Appropriate	Regulations calling for federal actions to contain or control undesirable plant species or group of species using all available methods, including: (A) preventive measures; (B) physical or mechanical methods; (C) biological agents; (D) herbicide methods; and (E) general land management practices.	Alternatives may involve wetlands/habitat restoration. Measures will be taken to prevent the establishment of undesirable plant species (*i.e.*, non-native and invasive species) as part of any wetlands/habitat restoration conducted.

TABLE 2-2
LOCATION-SPECIFIC ARARs AND TBCs
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Fish and Wildlife Coordination Act	16 USC Part 661 *et. seq.*	Applicable	This regulation requires that any federal agency proposing to modify a body of water must consult with the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service, and other related state agencies. That federal agency must consult with the appropriate government entity and also take action to prevent, mitigate, or compensate for project-related losses of endangered species, fish and wildlife resources.	Alternatives may modify potential, fish and wildlife habitats. All appropriate state and federal agencies, such as the USFWS, will be consulted to ensure that losses of these resources will be prevented, mitigated, or compensated.
Resource Conservation and Recovery Act; Hazardous Waste Facility Standards Within a Floodplain	43 USC § 6901 *et seq.*; 40 CFR 264.18(b)	Relevant and Appropriate	Any hazardous water facility within the 100-year floodplain must be designed, constructed, and maintained to prevent the release of hazardous waste during up to a 100-year flood event.	Alternatives involving remedial structures utilized to treat, contain, or dispose of hazardous waste with the 100-year floodplain, will be designed, constructed, and maintained to prevent a release of hazardous waste within the protected resource area.
Historic Sites Act of 1935; National Historic Landmarks	16 USC 469 *et seq.*; 36 CFR Part 65	Applicable	The purpose of the National Historic Landmarks program is to identify and designate National Historic Landmarks and encourage the long-range preservation of nationally significant properties that illustrate or commemorate the history and prehistory of the United States.	Features with potential historical/cultural significance will be evaluated during the remedial design phase. Should this alternative impact historical properties/structures determined to be protected by these standards activities will be coordinated with the Department of the Interior.
National Historical Preservation Act	16 USC 470 *et seq.*; 36 CFR Part 800	Applicable	When a federal agency finds, or is notified, that its activities may cause irreparable loss or destruction of significant scientific, pre-historical, historical, archeological data, such agency shall consult with relevant federal and State officials to address the preservation of such data or other forms of mitigation, as necessary.	If it is determined that this alternative may cause irreparable loss or destruction of significant scientific, pre-historical, historical, or archaeological data, EPA will consult with federal and State officials and implement preservation and/or mitigation measures, as necessary.
Endangered Species Act	16 USC 1531 *et seq.*; 50 CFR Part 402	Applicable	If a location contains a federal endangered or threatened species or its critical habitat, and an action may impact the species or its habitat, the U.S. Fish & Wildlife Service or the National Marine Fisheries Service must be consulted.	Southeastern Massachusetts is located within the range of the federally endangered Northern Long-Eared Bat. This requirement may be applicable if tree removal is needed during remedial activities. Consultation with the U.S. Fish & Wildlife Service will occur during the planning process to determine if the project is near known hibernacula or known maternity roost trees so that activities do not adversely impact bat populations or habitat. Tree cutting may need to be restricted to timeframes outside of the summer season.

TABLE 2-2
LOCATION-SPECIFIC ARARs AND TBCs
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
State				
Wetlands Protection Act	Mass. Gen. Laws ch. 131, §40; Wetlands Protection Regulations (310 CMR §10.00)	Applicable	Sets performance standards for dredging, filling, altering of inland wetland resource areas and sets buffer zones within 100 feet of a vegetated wetland and 200 feet from a perennial stream. The standards include mitigation requirements for alteration of regulated wetland resource areas. Resource areas at the site covered by the regulations include banks, bordering vegetated wetlands, land under bodies of water, land subject to flooding, and riverfront.	The site includes state regulated wetland resource areas. Alternatives requiring that work be completed within 100 feet of a state regulated wetland or 200 feet of a perennial waterway, will comply with these regulations. Mitigation of impacts on State wetland resource areas will be addressed.
Massachusetts Hazardous Waste Rules, Facility Location Standards	310 CMR 40.700	Relevant and Appropriate	Sets forth criteria for siting hazardous waste facilities within Land Subject to Flooding (as defined under the Massachusetts Wetlands Protection Act standards); surface water supplies; and actual, planned, or potential public water supplies.	Alternatives involving remedial structures utilized to treat, contain, or dispose of hazardous waste with the 100-year floodplain, will be designed, constructed, and maintained to prevent a release of hazardous waste within the protected resource area.
Antiquities Act and Regulation; Protection of Properties included in the State Register of Historic Places	Mass Gen. Laws ch 9 §§ 26-27; 950 CMR § 71.00	Relevant and Appropriate	Projects which are state-funded or state-licensed or which are on state property must eliminate, minimize or mitigate for adverse effects to properties that are listed in the register of historic places.	Features with potential historical/cultural significance on the state register will be evaluated during the remedial design phase. Should this alternative impact historical properties/structures determined to be protected by these standards activities will be coordinated with the Massachusetts Historical Commission.

Key:

ARAR = Applicable or Relevant and Appropriate Requirement
CFR = Code of Federal Regulations
TBC = To Be Considered
CMR = Code of Massachusetts Regulations
USC = United States Code

Table 2-3
Human Health Preliminary Remediation Goals (PRGs) for Soil

Protection of Potential Future Residents on the W&L Property

Analyte	Selected PRG (mg/kg)	Basis	Maximum Detection[1] (mg/kg)
Benzo(a)anthracene	11	ILCR = 10^{-5}	41
Benzo(a)pyrene	1.1	ILCR = 10^{-5}	34
Benzo(b)fluoranthene	11	ILCR = 10^{-5}	36
Dibenz(a,h)anthracene	1.1	ILCR = 10^{-5}	10
Antimony	31	HQ = 1	1500
Arsenic	6.8	ILCR = 10^{-5}	13
Chromium, Hexavalent	3.0	ILCR = 10^{-5}	470
Cobalt	23	HQ = 1	2700
Lead	200	Lead	3100
Thallium	0.78	HQ = 1	3.7

Protection of Current Residents – Residential Yards West of N. Avenue

Analyte	Selected PRG (mg/kg)	Basis	Maximum Detection[2] (mg/kg)
Lead	200	Lead	1240

Notes:

See Appendix B of FS for PRG development and basis.

mg/kg – Milligrams per kilogram

ILCR – Incremental Lifetime Cancer Risk

HQ – Hazard Quotient

Lead – The use of the IEUBK Model with updated parameters and a target blood lead level of 5 µg/dL provides for an acceptable residential soil concentration of approximately 200 mg/kg (see HHRA).

[1] *Maximum detections are from Table 2.1 of the HHRA.*

[2] *Maximum detection is from residential soil samples collected west of North Avenue and analyzed for fine fraction lead.*

Table 2-4
PRGs for Construction Worker Groundwater

Analyte	Selected PRG (µg/L)	Basis	Maximum Detection[1] (µg/L)
Chromium, Hexavalent	985	ILCR = 10^{-5}	83,000

Notes:
See Appendix B of FS for PRG development and basis; note that the PRG applies to a construction worker scenario.
ug/L – micrograms per liter
ILCR – Incremental Lifetime Cancer Risk

[1] *Maximum detection is from Table 2.4 of the HHRA.*

Table 2-5
PRGs for Residential Groundwater

Residential Drinking Water Scenario[1]

Analyte	Selected PRG (µg/L)	Basis	Maximum Detection[2] (µg/L)
1,1,1-Trichloroethane	200	MCL	2600
1,1-Dichloroethane	2.8	ILCR = 10^{-6}	1700
cis-1,2-Dichloroethene	70	MCL	790
Trichloroethene (TCE)	5	MCL	1300
Vinyl chloride	2	MCL	33
1,4-Dioxane	0.46	ILCR = 10^{-6}	23
Arsenic	10	MCL	13
Chromium	100	MCL	86,400
Chromium, Hexavalent	0.035	ILCR = 10^{-6}	83,000
Cobalt	6.0	HQ = 1	635
Lead	15	MCL	108
Manganese	300	Health Adv.	21,000

Irrigation Well Scenario

Analyte	Selected PRG (µg/L)	Basis	Maximum Detection[2] (µg/L)
Trichloroethene (TCE)	98	HQ = 1	1300
Vinyl chloride	7	ILCR = 10^{-4}	33
Chromium, Hexavalent	100	ILCR = 3 x 10^{-4}	83,000

Notes:
See Appendix B of FS for PRG development and basis
µg/L – micrograms per liter
HQ – Hazard Quotient
ILCR – Incremental Lifetime Cancer Risk
MCL – Maximum Contaminant Level
Health Adv. - Health Advisory on Manganese (EPA-822-R-04-003; January 2004)

[1] The PRGs for residential drinking water are more accurately described as Performance Standards rather than PRGs, as they are intended to be used to evaluate the performance of remedial alternatives that may be implemented to prevent migration of contaminated groundwater into the downgradient Bungay River Water Resource Protection District.

[2] Maximum Detections are from Table 2.4 of the HHRA.

Table 2-6a
PRGs for Surface Water – Human Health

Analyte	Selected PRG (µg/L)	Basis	Maximum Detection[1] (µg/L)
Chromium, Hexavalent	3.4	ILCR = 10^{-5}	219 (total)

Notes:
See Appendix B, Attachment A.2 of FS for PRG development and basis; note that the PRG applies to a recreational user scenario.
µg/L – micrograms per liter
ILCR – Incremental Lifetime Cancer Risk

Table 2-6b
PRGs for Surface Water – Ecological

Analyte	Selected PRG (µg/L)	Basis	Maximum Detection[2] (µg/L)
Chromium	82	Geometric Mean of LOEC and NOEC	436 (dissolved)
Chromium, Hexavalent	8	Geometric Mean of LOEC and NOEC	238 (dissolved)

Notes:
See Appendix B, Attachment B of FS for PRG development and basis
µg/L – micrograms per liter
LOEC - Lowest Observed Effect Concentration
NOEC - No Observed Effect Concentration

[1] *Maximum detection is from Table 2.3 of the HHRA and is from an unfiltered (i.e. total) sample.*
[2] *Maximum detections are from Tables 4 and 5 of the BERA and are from a filtered (i.e. dissolved) samples.*

Table 2-7
Technology & Process Option Screening for Soil

GENERAL RESPONSE ACTIONS	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	TECHNOLOGY DESCRIPTION	SCREENING
NO ACTION	NONE	NONE	No remedial or response action taken within the Site.	POTENTIALLY APPLICABLE: Required as a baseline evaluation by the NCP.
LIMITED ACTION	USE OR ACCESS RESTRICTIONS	INSTITUTIONAL CONTROLS	Administrative action using site use prohibitions to restrict future use, activities, and digging.	POTENTIALLY APPLICABLE: Effective in mitigating site risk by cutting risk pathway to receptors; however contamination will still be present at the site.
		FENCING & SECURITY MEASURES	Placement of fencing, security alarms, etc. around the site boundary to limit public exposure to surface soils.	SCREENED OUT: Not appropriate for preventing future residential land use or for use on existing residential properties.
	MONITORING	GROUNDWATER MONITORING	Analytical testing of site groundwater samples to identify migration of COCs from soil to groundwater so that other actions can be considered.	POTENTIALLY APPLICABLE: Effective in monitoring migration of contaminants and assessing future conditions.
CONTAINMENT	HORIZONTAL CONTAINMENT	NATIVE SOIL OR SINGLE BARRIER CAP	Cover area of contaminated soils with either common earth and vegetate, low permeability asphalt, soil, or geomembrane.	POTENTIALLY APPLICABLE: Effective in isolating soils that pose a risk due to potential direct contact.
		COMPOSITE / DOUBLE BARRIER CAP	Cover area of contaminated soils with a low permeability double soil and /or geomembrane cap.	SCREENED OUT: More suitable for reducing leaching, while soil risks are due to direct contact. Other covers are more cost effective.
	EXCAVATION & ON-SITE DISPOSAL	NATIVE SOIL SINGLE OR DOUBLE BARRIER CAP	Excavate soil and place under on-site protective soil cover.	SCREENED OUT: Not suitable for a current or future residential scenario. Requires using onsite space which would impact other future site uses.
REMOVAL	EXCAVATION & OFF-SITE TREATMENT/ DISPOSAL	LANDFILL OR OTHER PERMITTED RECYCLING FACILITY	Excavate soil and transport for disposal in RCRA Subtitle D landfill.	POTENTIALLY APPLICABLE: Cost-effective for small volumes of soil and for soil not determined to require disposal as a RCRA listed waste.
		RCRA RSD FACILITY	Excavate soil and transport to licensed RCRA treatment, storage, and disposal (TSD) facility for ultimate disposition of waste materials.	POTENTIALLY APPLICABLE: May be suitable for small volumes of soil determined to contain RCRA wastes.
		TREATMENT PRIOR TO LANDFILL DISPOSAL	Soil is chemically treated to reduce hexavalent chromium to trivalent chromium prior to disposal.	POTENTIALLY APPLICABLE: May be needed to reduce chromium toxicity and leachability before soil can be disposed and/or may allow for a more cost-effective disposal option.
		SOLIDIFICATION/ STABILIZATION FACILITY	Contaminants are physically bound or enclosed within a stabilized mass (solidification, i.e. asphalt batch processing), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).	POTENTIALLY APPLICABLE: May be used to reduce chromium leachability prior to placement in a landfill.
TREATMENT: IN-SITU	PHYSICAL PROCESSES	SOIL VAPOR EXTRACTION	A vacuum is applied to a network of aboveground piping to encourage volatilization of organics from the excavated media. The process includes a system for handling off-gases.	SCREENED OUT: Not effective in treating some COCs (PAHs and metals)
		ELECTROKINETIC PROCESSES	Application of a low current to electrodes in the subsurface in order to mobilize contaminants in two ways: (1) in the form of charged species (electrolysis; or (2) by causing an imbalance of charge bonds in the clayey material, which results in clay compaction and chemical desorption (electro-osmosis).	SCREENED OUT: Overly complex and not effective for treating shallow soils.
	BIOLOGICAL PROCESSES	MONITORED NATURAL ATTENUATION	Naturally occurring processes in the environment that reduce the concentrations of COCs in soil.	SCREENED OUT: Not effective for soils with multiple COCs such as metals and PAHs.
		ENHANCED BIODEGRATION	Enhancement of natural microbial breakdown by addition of nutrients, co-substrates, and oxygen sources via injection wells.	SCREENED OUT: Not effective in removing many of the site COCs (metals). Would require additional process options.
		BIOVENTING	Oxygen is delivered to contaminated unsaturated soils by forced air movement (either extraction of injection of air) to increase oxygen concentrations and stimulate biodegradation	SCREENED OUT: Not as cost-effective as other process options for treating shallow soils with the existing site COCs.
		LAND TREATMENT	Contaminated soil is treated by tilling to achieve aeration, and if necessary, by addition of amendments. Periodically tilling, to aerate the waste, enhances the biological activity.	SCREENED OUT: Not effective in removing many of the site COCs (metals). Would require additional process options.
		PHYTOREMEDIATION	Set of processes that use plants to remove, transfer, stabilize, and destroy organic/inorganic contamination.	SCREENED OUT: Limited effectiveness in treating inorganic COCs in soils. Technology is best used for organics in soils/sediments and inorganics in water.

Table 2-7
Technology & Process Option Screening for Soil

GENERAL RESPONSE ACTIONS	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	TECHNOLOGY DESCRIPTION	SCREENING
TREATMENT: IN-SITU (continued)	CHEMICAL PROCESSES	SOIL FLUSHING	Removal of contaminants from the soil by water or other suitable aqueous solutions through an injection or infiltration process.	SCREENED OUT: Not as cost-effective as other options for treating shallow soils.
		CHEMICAL REDUCTION/ OXIDATION	Reduction/oxidation chemically converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert.	SCREENED OUT: Not as cost-effective as other options for treating shallow soils with the existing mixture of site COCs.
		SOLIDIFICATION & STABILIZATION	Contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).	SCREENED OUT: Most effective for reducing leaching, which is not the primary concern at this site. Other options are more cost-effective.
	THERMAL PROCESSES	THERMALLY ENHANCED SOIL VAPOR EXTRACTION	Steam/ hot air injection or electrical resistance/ electromagnetic/ fiber optic/ radio frequency heating is used to increase the volatilization rate of semi-volatiles and facilitate extraction.	SCREENED OUT: Not as cost-effective as other options for treating shallow soils with the existing COCs. Not effective for metals.
		VITRIFICATION	Heating of soils to a molten state by electrodes which destroys organics and forms glassy matrix as soils cool.	SCREENED OUT: Not as cost-effective as other options for treating shallow soils with the existing COCs.
TREATMENT: EX-SITU	PHYSICAL PROCESSES	ELECTROKINETIC PROCESSES	Removal of contaminants through application of low-intensity direct current into the soil to mobilize charged species (ions and water) towards the electrodes.	SCREENED OUT: Effective in removal of inorganic site COCs, but at a much slower rate than other process options.
	CHEMICAL PROCESSES	CHEMICAL EXTRACTION	Waste contaminated soil and extractant are mixed in an extractor, dissolving the contaminants. The extracted solution is then placed in a separator, where the contaminants and extractant are separated for further treatment.	SCREENED OUT: Other treatment technologies are more cost effective given the presence of both organic and inorganic COCs.
		SOLIDIFICATION & STABILIZATION	Contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between the stabilizing reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).	SCREENED OUT: Most effective for reducing leaching, which is not the primary concern at this site. Other options are more cost-effective.
		CHEMICAL REDUCTION OXIDATION	Reduction/ oxidation chemically converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert.	SCREENED OUT: Other treatment technologies are more cost effective with equivalent mitigation of risks for site COCs.
		DEHALOGENATION	Reagents are added to soils contaminated with halogenated organics. The dehalogenation process is achieved by either the replacement of the halogen molecules or the decomposition and partial volatilization of the contaminants.	SCREENED OUT: Not effective in removing the primary site COCs; technology is primarily used for chlorinated compounds.
		SOIL WASHING	Contaminants sorbed onto fine soil particles are separated from bulk soil in an aqueous-based system on the basis of particle size. The wash water may be augmented with a basic leaching agent, surfactant, pH adjustment, or chelating agent to help remove organics and heavy metals.	SCREENED OUT: Other treatment technologies are more cost effective given the presence of both organic and inorganic COCs.
	BIOLOGICAL PROCESSES	SLURRY PHASE BIOLOGICAL TREATMENT	An aqueous slurry is created by combining soil, sediment, or sludge with water and other additives. The slurry is mixed to keep solids suspended and microorganisms in contact with the soil contaminants. Upon completion of the process, the slurry is dewatered and the treated soil is disposed of.	SCREENED OUT: Not effective in removing some COCs (PAHs and metals)
		COMPOSTING	Contaminated soil is excavated and mixed with bulking agents and organic amendments such as wood chips, hay, manure, and vegetative (e.g., potato) wastes. Proper amendment selection ensure adequate porosity and provides a balance of carbon and nitrogen to degradation of contaminants to non-toxic products.	SCREENED OUT: Not effective in removing the primary site COCs (PAHs and metals).
		BIOPILES	Excavated soils are mixed with soil amendments and placed in aboveground enclosures. It is an aerated static pile composting process in which compost is formed into piles and aerated with blowers or vacuum pumps.	SCREENED OUT: Not effective in removing the primary site COCs (PAHs and metals).

Table 2-7
Technology & Process Option Screening for Soil

GENERAL RESPONSE ACTIONS	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	TECHNOLOGY DESCRIPTION	SCREENING
TREATMENT: EX-SITU (continued)	BIOLOGICAL PROCESSEES (continued)	LAND TREATMENT	Treatment of contaminants through dynamic interactions of wastes with soil, climate, and biological activity. Wastes are tilled periodically to create aeration.	SCREENED OUT: Not effective in removing the primary site COCs (metals).
	THERMAL PROCESSES	PYROLYSIS	Removal of contaminants through induction of chemical decomposition in organic materials by heat in the absence of oxygen.	SCREENED OUT: Other treatment technologies are more cost-effective with equivalent mitigation of risks. Not effective in treating some primary site COCs.
		INCINERATION	High temperatures are used to combust (in the presence of oxygen) organic constituents in hazardous wastes.	SCREENED OUT: Other treatment technologies are more cost-effective with equivalent mitigation of risks.
		THERMAL DESORPTION	Wastes are heated to volatilize water and organic contaminants. A carrier gas or vacuum system transports volatilized water and organics to the gas treatment system.	SCREENED OUT: Other treatment technologies are more cost-effective with equivalent mitigation of risks. Not effective in treating some primary site COCs.
		PYRO-METALLURGICAL EXTRACTION	Utilizes elevated temperature extraction and processing for removal of metals from contaminated soils. Soils are treated in a high-temperature furnace to remove volatile metals from the solid phase. Subsequent treatment steps may include metal recovery or immobilization.	SCREENED OUT: Not effective in treating some COCs (PAHs); technology is primarily used for metals such as Hg.

Notes: [ ] Technology / Process Option screened from further evaluation

Table 2-8
Technology & Process Option Screening for Overburden Groundwater/Surface Water and Bedrock Groundwater

GENERAL RESPONSE ACTIONS	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	TECHNOLOGY DESCRIPTION	SCREENING
NO ACTION	NONE	NONE	No remedial or response action taken within the Site.	POTENTIALLY APPLICABLE: Required as a baseline evaluation by the NCP.
LIMITED ACTION	USE OR ACCESS RESTRICTIONS	INSTITUTIONAL CONTROLS	Restrictions are needed to protect future construction workers from unacceptable exposure to shallow groundwater on the W&L property and to prevent location of structures over areas of vapor intrusion risk, or add vapor mitigation, as necessary. Also, restrictions are needed to protect components of the remedy. Restrictions may include modifications to deeds, zoning, and ordinances.	POTENTIALLY APPLICABLE: Effective in mitigating site risk to human receptors by eliminating risk pathway to receptors and protecting components of the remedy; implementaton will require close co-operation between Local, State, and Federal officials.
		FENCING & SECURITY MEASURES	Placement of fencing, security alarms, etc. around the site boundary to limit public exposure to groundwater.	SCREENED OUT: Not effective in mitigating on-site risk to human receptors.
	MONITORING	GROUNDWATER AND SURFACE WATER MONITORING	Analytical testing of site monitoring wells and surface water locations to determine changes in water quality.	POTENTIALLY APPLICABLE: Effective in monitoring migration of contaminants, success of remedy, and water quality.
		SOIL VAPOR AND INDOOR AIR SAMPLING	Collection of soil vapor samples and indoor air samples periodically to monitor contaminant concentrations.	POTENTIALLY APPLICABLE: Effective in monitoring vapor-phase contaminants originating from the groundwater plume and success of existing residential SSDSs.
CONTAINMENT	VERTICAL SUBSURFACE BARRIERS	SLURRY WALL	Trenches surrounding area of contamination are filled with soil and/or cement bentonite slurry.	SCREENED OUT: While the technology may be effective in combination with a pump-and-treat scenario, a vertical barrier does not appear appropriate based on the large depth to bedrock in the area where an extraction system would be placed at this site.
		GROUT CURTAIN	Pressure injection of grout to depth of contamination in closely spaced boreholes.	SCREENED OUT: While the technology may be effective in combination with a pump-and-treat scenario, a vertical barrier does not appear appropriate based on the large depth to bedrock in the area where an extraction system would be placed at this site.
		SHEET PILING	Steel sheet piling driven to depth around the area of contamination.	SCREENED OUT: While the technology may be effective in combination with a pump-and-treat scenario, a vertical barrier does not appear appropriate based on the large depth to bedrock in the area where an extraction system would be placed at this site.
	HORIZONTAL BARRIERS (for control of vapor migration)	CONCRETE SLAB	Layer of concrete, usually a building floor slab, installed over contaminated soils/groundwater to limit potential for vapor migration indoors.	POTENTIALLY APPLICABLE: Could be considered if new construction is planned for the W&L Property and area to the south.
		GEOMEMBRANE	Polyethylene sheeting or cold-spray product (e.g. Liquid Boot) installed beneath a building slab to limit potential for vapor migration indoors.	POTENTIALLY APPLICABLE: Could be considered if new construction is planned for the W&L Property and area to the south.
	COLLECTION/ EXTRACTION (groundwater)	EXTRACTION WELLS	Series of wells to extract contaminated groundwater and form migration barrier. Typically requires ex-situ treatment to meet discharge criteria.	POTENTIALLY APPLICABLE: Effective and implementable; extraction wells can limit lateral migration of contaminated groundwater to surface water.
		COLLECTION TRENCH	High hydraulic conductivity trenches dug to intercept and collect contaminated groundwater. Typically followed by ex-situ treatment.	POTENTIALLY APPLICABLE: Effective and implementable; subsurface drains can limit lateral migration of contaminated groundwater to surface water.
		SOIL EXCAVATION	Excavate contaminated soils in source area.	POTENTIALLY APPLICABLE: Effective and implementable
	COLLECTION/ EXTRACTION (vapor)	SUB-SLAB DEPRESSURIZATION	Create a slight vacuum in the soil underlying the floor slab to withdraw vapor phase contaminants before they migrate into the building.	POTENTIALLY APPLICABLE: Effective and implementable in conjunction with inspections and monitoring. Continued maintenance of the existing SSDSs at three residences would be cost-effective.
TREATMENT: IN-SITU	PHYSICAL PROCESSES	IN-WELL AIR STRIPPING	Air is injected into double-screened well, lifting the water in the well and forcing it out the upper screen. Simultaneously, additional water is drawn in the lower screen. COCs are transferred from water to air where they are collected and treated.	SCREENED OUT: Not effective in treating hexavalent chromium, which poses a current risk to receptors in Bliss Brook where the groundwater plume is discharging.
		AIR SPARGING	Air injected into saturated matrices to remove contaminants through volatilization.	SCREENED OUT: Not effective in treating hexavalent chromium, which poses a current risk to receptors in Bliss Brook where the groundwater plume is discharging.
		HOT WATER / STEAM FLUSHING/ STRIPPING	Steam is forced into an aquifer through injection wells to vaporize volatile and semivolatile contaminants. Vaporized components rise to the unsaturated zone where they are removed by vacuum extraction and then treated.	SCREENED OUT: Not effective in treating hexavalent chromium, which poses a current risk to receptors in Bliss Brook where the groundwater plume is discharging.
		ELECTROKINETIC PROCESSES	Application of a low current to electrodes in the subsurface in order to mobilize contaminants in two ways: (1) in the form of charged species (electrolysis; or (2) by causing an imbalance of charge bonds in the clayey material, which results in clay compaction and chemical desorption (electro-osmosis).	SCREENED OUT: Technology primarily used for inorganic contaminants, but less cost effective and timely than other treatment options that would be easier to implement. Ex-situ treatment processes still required and addition of this process would only add to costs.

Table 2-8
Technology & Process Option Screening for Overburden Groundwater/Surface Water and Bedrock Groundwater

GENERAL RESPONSE ACTIONS	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	TECHNOLOGY DESCRIPTION	SCREENING
TREATMENT: IN-SITU (continued)	BIOLOGICAL PROCESSES	MONITORED NATURAL ATTENUATION	Naturally occurring processes in the environment that reduce the concentrations of COCs in groundwater	POTENTIALLY APPLICABLE: Potentially effective in reduction of site COCs over time. Easily implemented. Not appropriate without other active processes because current risks to receptors in Bliss Brook would not be addressed in a timely manner.
		ENHANCED BIODEGRATION	Enhancement of natural microbial breakdown by addition of nutrients, co-substrates, and oxygen sources via injection wells.	SCREENED OUT: Treatability studies show that other technologies are more appropriate for site COCs.
		BIOAUGMENTATION	Addition of non-native or augmented microorganisms to the subsurface suited to specific geochemistry and able to degrade specific contaminant types.	SCREENED OUT: Other technologies are more cost-effective at treating VOCs. Not effective in treating metals.
		PHYTOREMEDIATION	Set of processes that use plants to remove, transfer, stabilize, and destroy organic/ inorganic contamination in ground water.	SCREENED OUT: Not cost-effective based on depth to groundwater and the significant portion of the groundwater plume in bedrock.
	CHEMICAL PROCESSES	PERMEABLE REACTIVE BARRIERS	A barrier of reactive materials utilizing sorption, precipitation, or degradation to treat contaminants that pass through the barrier by groundwater advection.	POTENTIALLY APPLICABLE: A PRB containing zero valent iron (ZVI) was previously installed along Bliss Brook to reduce hexavalent chromium and appears to be effective, but is not long enough to fully address the hexavalent chromium groundwater plume. ZVI also worked well in bench-scale treatability studies performed on Site groundwater, and can be effective for TCE in addition to hexavalent chromium.
		SURFACTANT/COSOLVENT EXTRACTION	Surfactants/cosolvents are injected into the aquifer upgradient of the contaminant plume and proceed to solubilize either the source of contamination or the plume itself. The solvent with the dissolved COCs are then extracted downgradient.	SCREENED OUT: Not a cost-effective option for site COCs. Residual extraction and treatment increases cost of remedy.
		CHEMICAL REDUCTION/ OXIDATION	Reduction/oxidation chemically converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert.	POTENTIALLY APPLICABLE: Potentially effective in reduction of site COCs over time.
TREATMENT: EX-SITU	PHYSICAL PROCESSES	AIR STRIPPING	Air is passed through extracted groundwater to volatilize (strip) contaminants, typically organic compounds, from solution.	POTENTIALLY APPLICABLE: Potentially applicable for removal of VOCs in groundwater. May result in precipitation of metals and fouling of equipment. Pilot and bench scale testing would be required.
		ADSORPTION	Extracted groundwater is passed through sorbents, such as granular activated carbon (GAC) or activated aluminum (AA), where contaminants are removed from solution by adsorption. Most adsorption media require periodic reactivation or change-out.	POTENTIALLY APPLICABLE: Potentially applicable for removal of VOCs and to a more limited extent, some metals. Generally more appropriate as a polishing step, if needed, due to the cost and potential need for pretreatment to reduce fouling. Pilot and bench scale testing would be required. AA may be effective for hexavalent chromium and provide a better quality discharge to the river compared to ion exchange.
		ION EXCHANGE	Removal by exchange of heavy metal ions with non-toxic ions using columns containing resin beds or immobilized algal cells.	POTENTIALLY APPLICABLE: Potentially applicable for removal of metals, including chromium. Pilot testing would be required. Bench-scale testing would be required to select appropriate resin. Have to ensure that the ion exchanged for hexavalent chromium is acceptable for discharge to the brook.
	CHEMICAL PROCESSES	COAGULATION/ FLOCCULATION/CHEMICAL REDUCTION & PRECIPITATION	Removal of heavy metals as settleable solids by increasing pH and addition of flocculating agent.	SCREENED OUT: Likely to be more costly than ion exchange for removing metals and requires multiple steps. May be reconsidered if pump and treat is the selected remedy, as it is effective for hexavalent chromium, but it is more complex than ion exchange.
		ULTRA-VIOLET/ CHEMICAL OXIDATION	Oxidation using UV light in combination with oxidizing agents such as hydrogen peroxide and/or ozone (O3) to detoxify organic COCs.	SCREENED OUT: While potentially effective for treating VOCs, it is likely more costly than other process options, such as air stripping.
		SEQUESTERING	Addition of chemical binding agents to the water to prevent precipitation of inorganic COCs such as iron and manganese.	POTENTIALLY APPLICABLE: Potentially applicable as a pretreatment step if iron and/or manganese fouling is a concern.
	BIOLOGICAL PROCESSES	AEROBIC BIOREACTOR	Extracted groundwater is treated within an aerated tank containing microorganisms, which oxidize or degrade organic contaminants. Usually followed by clarification or filtration for removal of suspended solids.	SCREENED OUT: While potentially effective for treating VOCs, some chlorinated VOCs can be difficult to degrade aerobically. Also, this process option alone may not effectively reduce VOCs to below discharge criteria, and is not effective for metals.
	DISCHARGE OF TREATED WATER	TO GROUNDWATER: RECHARGE WELLS OR BASINS	Treated water is returned to the groundwater aquifer of origin using recharge wells or basins.	POTENTIALLY APPLICABLE: Pilot testing would be required. Compliance with substantive standards for recharge/injection would be required. Fouling of recharge well/basins may be a significant problem.
		TO SURFACE WATER	Treated water is discharged to a surface water body.	POTENTIALLY APPLICABLE: In a pump-and-treat scenario, discharge of treated groundwater to Bliss Brook would provide the benefit of ensuring that the groundwater pumping does not result in a net reduction of stream flow across the site. Compliance with substantative standards for surface water discharges would be required.
		POTW	Discharge of treated water to the local publicly-owned treatment works (POTW) via sewer lines or tanker truck.	SCREENED OUT: Attleboro POTW cannot accept groundwater per City ordinance.

Notes: Technology / Process Option screened from further evaluation

Table 3-1
Components of W&L Property Soil Remedial Alternatives

Alternative	Key Components
S-1: No Action	• No remedial action • Five-year reviews and periodic site status reports. • This option is included for comparison only.
S-2: Institutional Controls on W&L Property	• Implementation of institutional controls to prevent future residential use of the W&L Property and thus prevent the exposure of such receptors to COCs in soil. • Conduct five-year reviews to evaluate remedy.
S-3: Soil Excavation on W&L Property with Off-Site Disposal	• Physical removal of all impacted soils exceeding soil PRGs for a hypothetical residential scenario on the W&L Property (including floodplain soils to the immediate south) via excavation and transportation and disposal off-site. • Removal of the intact floor slab and cobble-filled "pit" where plating tanks were formerly located to allow access to hot spots of soil contamination that may exist beneath. Transportation and disposal of debris off-site. • The excavation depth will vary across the site. Based on observed concentrations of soil COCs, the depth of excavation is assumed to vary from 2 to 10 feet bgs, or the depth of groundwater, whichever is shallower. A PDI would be completed to further refine the depth of excavation and to collect data for disposal parameters. • Approximately 15,500 cubic yards of soil exceeding the selected soil PRGs would be excavated across the entire impacted area of approximately 66,300 square feet. • Following excavation, site restoration would be completed including placement of clean imported backfill to grade. The site would be re-vegetated to control erosion and the leased portion of the property, which is actively used, would be restored with pavement to support continued operations.
S-4: Soil Capping on W&L Property and Institutional Controls	• Placement of a 2 foot soil cover to prevent direct exposure to W&L Property soils by a hypothetical future resident. As a variation on this alternative, the portion of the property currently leased to a commercial tenant (and paved or covered by buildings) could remain as is. • The estimated impacted area requiring a cover based existing soil data is approximately 66,300 square feet. • Implementation of institutional controls to prevent disturbance of the cover and thus prevent the exposure of hypothetical future residents to COCs in soil. Under the variation described above, institutional controls would be required for the leased portion of the property to ensure it remains non-residential. • Periodic inspections and maintenance of the cover would be required to ensure it remains intact and is functioning as intended. • Conduct five-year reviews to evaluate remedy.

Table 3-3
Components of Groundwater/Surface Water Remedial Alternatives

Alternative	Key Components
GW/SW-1: No Action	• No remedial action • Five-year reviews and periodic site status reports. • For comparison only
GW/SW-2a: Source Area Soil Removal with In-Situ Soil Treatment (building footprint and immediate vicinity) and Groundwater Pump and Treat GW/SW-2b: Source Area Soil Removal with In-Situ Soil Treatment (expanded area to include area just west of North Avenue) and Groundwater Pump and Treat with Mid-Plume Treatment	• Soil excavation and in-situ treatment within the source area, including the former W&L facility footprint and area just to the south, to address hexavalent chromium and chlorinated VOC concentrations that may be acting as an ongoing source of contamination to groundwater. • Removal of the existing building slab, cobble-filled "pit", and former discharge line and dry well (if located); excavation of soil with hexavalent chromium concentrations greater than 100 mg/kg (to include the plating tank area at a minimum). • Soil blending to incorporate zero valent iron into saturated soils down to bedrock. • Pre-design investigation would be conducted to define the area of excavation and attempt to locate historic source areas including those noted above, as well as the former TCE storage tank area. • <u>For GW/SW-2b only (expanded area):</u> in-situ treatment with zero valent iron would also be conducted along the west side of North Avenue for a distance of approximately 200 feet, centered on the AE-04 well cluster where hexavalent chromium concentrations are highest, and also positioned to intercept the portion of the plume with the highest TCE concentrations. Holes would be augered to bedrock in this area and filled with a zero valent iron/sand mixture to treat overburden groundwater before it migrates under North Avenue. • Installation and operation of a groundwater pump and treat system to intercept and treat the hexavalent chromium groundwater plume and prevent continued discharge of contaminated groundwater to surface water above surface water PRGs. Treated groundwater would be discharged to Bliss Brook upstream of the recovery system. Bench and/or pilot scale testing of the treatment process may be conducted as part of pre-design work. • Long-term monitoring of the overburden groundwater plume, surface water in Bliss Brook, and buildings with existing SSDSs or which may have the potential for vapor intrusion. • Maintenance of any new and existing remedy infrastructure components, including the engineered cover system, PRB, existing SSDSs, and periodic replacement/regeneration of reactive media in the PRB and mid-plume treatment wells. • Institutional controls to protect the future construction worker until W&L Property shallow groundwater PRGs are

Alternative	Key Components
	achieved; to require a vapor intrusion evaluation if an occupied building is constructed over the shallow groundwater VOC plume; to prevent installation of non-drinking water wells until site-wide non-drinking water PRGs for residential groundwater are achieved; to protect remedy infrastructure; and to prevent contact with soil beneath the existing engineered cover located behind the Paulette Lane residential area. • Conduct five-year reviews to evaluate remedy.
GW/SW-3a: Source Area Soil Removal with In-Situ Soil Treatment (building footprint and immediate vicinity) and Extension of Permeable Reactive Barrier GW/SW-3b: Source Area Soil Removal with In-Situ Soil Treatment (expanded area to include area just west of North Avenue) and Extension of Permeable Reactive Barrier	• Soil excavation and in-situ treatment within the source area, including the former W&L facility footprint and area just to the south, to address hexavalent chromium and chlorinated VOC concentrations that may be acting as an ongoing source of contamination to groundwater. • Removal of the existing building slab, cobble-filled "pit", and former discharge line and dry well (if located); excavation of soil with hexavalent chromium concentrations greater than 100 mg/kg (to include the plating tank area at a minimum). • Soil blending to incorporate zero valent iron into saturated soils down to bedrock. • Pre-design investigation would be conducted to define the area of excavation and attempt to locate historic source areas including those noted above, as well as the former TCE storage tank area. • <u>For GW/SW-3b only (expanded area):</u> in-situ treatment with zero valent iron would also be conducted along the west side of North Avenue for a distance of approximately 200 feet, centered on the AE-04 well cluster where hexavalent chromium concentrations are highest, and also positioned to intercept the portion of the plume with the highest TCE concentrations. Holes would be augered to bedrock in this area and filled with a zero valent iron/sand mixture to treat overburden groundwater before it migrates under North Avenue. • Installation of a permeable reactive barrier to augment the existing permeable reactive barrier and prevent the discharge of hexavalent chromium contaminated groundwater to Bliss Brook at levels above surface water PRGs. The permeable reactive barrier would contain zero valent iron, which would work to reduce hexavalent chromium to the less toxic trivalent form. Flow modeling and other investigation work may be conducted as part of the pre-design of the reactive barrier wall. • Long-term monitoring of the overburden groundwater plume, surface water in Bliss Brook, and buildings with existing SSDSs or which may have the potential for vapor intrusion. • Maintenance of any new and existing remedy infrastructure components, including the engineered cover system, PRB, existing SSDSs, and periodic

Alternative	Key Components
	replacement/regeneration of reactive media in the PRB and mid-plume treatment wells. • Institutional controls to protect the future construction worker until W&L Property shallow groundwater PRGs are achieved; to require a vapor intrusion evaluation if an occupied building is constructed over the shallow groundwater VOC plume; to prevent installation of non-drinking water wells until site-wide non-drinking water PRGs for residential groundwater are achieved; to protect remedy infrastructure; and to prevent contact with soil beneath the existing engineered cover located behind the Paulette Lane residential area. • Conduct five-year reviews to evaluate remedy.

Table 3-4
Components of Bedrock Groundwater Remedial Alternatives

Alternative	Key Components
BR-1: No Action	• No remedial action • Conduct five-year reviews to evaluate remedy. • For comparison only
BR-2: Institutional Controls	• Additional investigation of bedrock groundwater to determine the downgradient edge of the hexavalent chromium plume boundary, including determining whether the plume extends into the bedrock underlying the Bungay River Water Resource Protection District. • Institutional controls to prevent contact with contaminated groundwater and installation of non-drinking water wells where irrigation well PRGs are exceeded. • Long-term bedrock groundwater monitoring and evaluation of groundwater attenuation to monitor the progress of remedial actions directed at soil, overburden groundwater, and surface water that would also be expected to reduce hexavalent chromium concentrations in bedrock groundwater over time. • Conduct five year reviews to evaluate remedy. • Additional Contingency Measures (if bedrock groundwater plume extends into District): - Institutional controls to prevent installation of wells within the impacted portion of the District to prevent contact with contaminated groundwater and further plume migration. - Expansion of monitoring program to include impacted portions of District.
BR-3: Institutional Controls and Contingency Remedy of Focused In-Situ Injections (West of North Avenue)	• Additional investigation of bedrock groundwater to determine the downgradient edge of the hexavalent chromium plume boundary, including determining whether the plume extends into the bedrock underlying the Bungay River Water Resource Protection District. • Institutional controls to prevent contact with contaminated groundwater and installation of non-drinking water wells where irrigation well PRGs are exceeded. • Installation of bedrock compliance groundwater monitoring wells along Ashton Road, and long-term bedrock groundwater monitoring and evaluation of groundwater attenuation to determine the effectiveness of the remedy. • Conduct five-year reviews to evaluate remedy. • Additional Contingency Measures (if bedrock groundwater plume extends into District): - Institutional controls to prevent installation of wells within the impacted portion of the District to prevent contact with contaminated groundwater and further plume migration, and to protect remedy infrastructure. - Expansion of monitoring program to include impacted portions of District. - Focused in situ treatment of bedrock groundwater

Alternative	Key Components
	with zero valent iron along the west side of North Avenue for a distance of approximately 200 feet, centered on the AE-04 well cluster where hexavalent chromium concentrations in bedrock are highest, and also positioned to intercept the portion of the plume with the highest TCE concentrations in bedrock. Holes would be drilled 10 feet into competent bedrock in this area (estimated to be approximately 50 feet below surface grade) and filled with a zero valent iron/sand mixture to treat shallow bedrock groundwater before it migrates under North Avenue. These are assumptions for FS evaluation purposes; pre-design investigations would be performed to determine well locations and depths. Pilot-scale testing of the treatment process would also be conducted as part of pre-design work.
BR-4: Institutional Controls and Contingency Remedy of Pump and Treat	• Additional investigation of bedrock groundwater to determine the downgradient edge of the hexavalent chromium plume boundary, including determining whether the plume extends into the bedrock underlying the Bungay River Water Resource Protection District. • Institutional controls to prevent contact with contaminated groundwater and installation of non-drinking water wells where irrigation well PRGs are exceeded. • Installation of bedrock compliance groundwater monitoring wells along Ashton Road, and long-term bedrock groundwater monitoring and evaluation of groundwater attenuation to determine the effectiveness of the remedy. • Conduct five-year reviews to evaluate remedy. • <u>Additional Contingency Measures</u> (if bedrock groundwater plume extends into District): - Institutional controls to prevent installation of wells within the impacted portion of the District to prevent contact with contaminated groundwater and further plume migration, and to protect remedy infrastructure. - Expansion of monitoring program to include impacted portions of District. - Installation and operation of a groundwater pump and treat system to intercept and treat the hexavalent chromium bedrock groundwater plume to prevent migration of contaminated groundwater into the bedrock underlying the Bungay River Resource Protection District. Bedrock groundwater extraction wells would be installed along Bliss Brook to intercept the bedrock groundwater plume. A line of wells approximately 300 feet long and to a depth of approximately 60 feet below surface grade is assumed for FS evaluation purposes; pre-design investigations to include a pump test would be needed to design an extraction system that would contain the plume sufficiently to prevent continued impact to the Bungay

Alternative	Key Components
	River Water Resource Protection District. Bench and/or pilot scale testing of the treatment process may be also conducted as part of pre-design work. Treated groundwater would be discharged to Bliss Brook upstream of the recovery system.
BR-5: Institutional Controls and Contingency Remedy of Enhanced [Deeper] Permeable Reactive Barrier	• Additional investigation of bedrock groundwater to determine the downgradient edge of the hexavalent chromium plume boundary, including determining whether the plume extends into the bedrock underlying the Bungay River Water Resource Protection District. • Institutional controls to prevent contact with contaminated groundwater and installation of non-drinking water wells where irrigation well PRGs are exceeded. • Installation of bedrock compliance groundwater monitoring wells along Ashton Road, and long-term bedrock groundwater monitoring and evaluation of groundwater attenuation to determine the effectiveness of the remedy. • Conduct five-year reviews to evaluate remedy. • <u>Additional Contingency Measures</u> (if bedrock groundwater plume extends into District): - Institutional controls to prevent installation of wells within the impacted portion of the District to prevent contact with contaminated groundwater and further plume migration, and to protect remedy infrastructure. - Expansion of monitoring program to include impacted portions of District. - In situ treatment of bedrock groundwater with zero valent iron along Bliss Brook for a distance of approximately 300 feet. Holes would be drilled 10 feet into competent bedrock in this area (estimated to be approximately 60 feet below surface grade) and filled with a zero valent iron/sand mixture to treat bedrock groundwater with concentrations of 1000 ppb hexavalent chromium or greater before it migrates to the Bungay River Water Resource Protection District. These are assumptions for FS evaluation purposes; pre-design investigations would be performed to determine locations and depths. Pilot-scale testing of the treatment process would also be conducted as part of pre-design work.

Table 3-5
Screening of Remedial Alternative S-1: No Action

Description: No remedial activities are included under this alternative.

	Effectiveness	Implementability	Cost
Advantages:	• None. Not effective.	• No action makes this the easiest alternative to implement	• No capital costs • No O&M costs
Disadvantages:	• Does not mitigate risk to hypothetical future residents on the W&L Property	• Additional remedial actions may be required in the future	• Additional remedial actions may be required in the future.

Conclusion: The No Action alternative would not be protective of human health and the environment. However, it is used as a baseline in comparison with other alternatives. **This alternative is retained for detailed analysis.**

Table 3-6
Screening of Remedial Alternative S-2: Institutional Controls on W&L Property

Description: This alternative would achieve the RAOs by implementing institutional controls to prevent future residential use of the W&L Property and thus prevent the exposure of such receptors to COCs in soil.

	Effectiveness	Implementability	Cost
Advantages:	• Reduces potential for exposure to impacted soil • Allows for site use equivalent to current use	• Institutional controls are a proven technology and relatively easy to implement	• Low capital costs
Disadvantages:	• Does not remove any soil contaminants from the W&L Property	• Long-term periodic inspections would be required to confirm land use	• Minimal O&M cost • Five-year Review costs

Conclusion: This alternative is protective of human health and the environment. However, inspections would be required as part of the institutional controls since contaminants remain in place. **This alternative is retained for detailed analysis.**

Table 3-7
Screening of Remedial Alternative S-3: Soil Excavation on W&L Property with Off-Site Disposal

Description: Under this alternative, soil excavation and off-site disposal would remove all impacted soils exceeding soil PRGs in order to allow for residential exposure to the W&L Property soils (including floodplain soils to the immediate south). Also included is the removal of the intact floor slab and cobble-filled "pit" where plating tanks were formerly located to allow access to hot spots of soil contamination that may exist beneath. Excavated soil and debris would be transported off-site for proper disposal. Following excavation and disposal, site restoration would occur, including backfilling and grading with offsite clean soil and re-vegetation to control erosion. The leased portion of the property would be restored with pavement to support continued operations.

	Effectiveness	**Implementability**	**Cost**
Advantages:	• Removes contaminated soil • Allows for unrestricted exposure to W&L Property soils	• Excavation is a proven technology and relatively easy to implement at this site	• O&M cost eliminated for soil
Disadvantages:	• Transportation to off-site facilities increases the potential for current and future liability	• Moderate amount of logistical considerations required during excavation	• High capital cost due to soil and debris removal volume.

Conclusion: This alternative is protective of human health and the environment and allows for unrestricted exposure to W&L Property soils. However, the future redevelopment of the property for residential uses is highly unlikely. The property is zoned for commercial/industrial use and the leased portion of the property is currently actively used by a tenant for commercial purposes. The disruption and cost of this alternative is not warranted, as the primary objective is to allow for a future use that is not reasonably anticipated. **This alternative is not retained for detailed analysis.**

Table 3-8
Screening of Remedial Alternative S-4: Soil Capping on W&L Property

Description: Under this alternative, the RAOs would be achieved by physically placing 2 feet of clean soil to cap, or isolate, the impacted soils. A soil cap would reduce exposure risks at the site by preventing direct contact with contaminated soil. Periodic inspections and maintenance of the cover would be needed to ensure its integrity. Institutional controls would be established to maintain cap protectiveness.

	Effectiveness	**Implementability**	**Cost**
Advantages:	• Reduces potential for exposure to contaminated soils	• A cap is a proven technology	• Moderate capital costs
Disadvantages:	• Does not remove all contaminants at the site • Capping would not provide an additional benefit over institutional controls alone	• Difficult to reuse the site for residential uses • Annual inspections and maintenance would be required for the cap • May interfere with source control measures included in GW/SW remedial alternatives	• Moderate O&M cost • Five-year Review costs

Conclusion: This alternative is protective of human health and the environment. However, capping would make reuse of the site for residential purposes difficult and since a hypothetical future resident is the only receptor of concern for W&L Property soils, capping is not likely to provide a benefit over institutional controls alone or remedial alternatives that would remove soil contaminants. **This alternative is not retained for detailed analysis.**

Table 3-9
Screening of Remedial Alternative SL-1: No Action

Description: No remedial activities are included under this alternative.

	Effectiveness	Implementability	Cost
Advantages:	• None. Not effective.	• No action makes this the easiest alternative to implement	• No capital costs • No O&M costs
Disadvantages:	• Does not mitigate risk to current and future residents on the North Avenue and Deanville Road properties	• Additional remedial actions may be required in the future	• Additional remedial actions may be required in the future.

Conclusion: The No Action alternative would not be protective of human health and the environment. However, it is used as a baseline in comparison with other alternatives. **This alternative is retained for detailed analysis.**

Table 3-10
Screening of Remedial Alternative SL-2: Soil Capping and Institutional Controls on Residential Properties

Description: Under this alternative, the RAOs would be achieved by physically placing 2 feet of clean soil to cap, or isolate, the impacted soils. A soil cap would reduce exposure risks by preventing direct contact with contaminated soil. Periodic inspections and maintenance of the cover would be needed to ensure its integrity. Institutional controls would be established to maintain cap protectiveness.

	Effectiveness	Implementability	Cost
Advantages:	• Reduces potential for exposure to contaminated soils	• A cap is a proven technology	• Moderate capital costs
Disadvantages:	• Does not remove contaminants on the properties • Capping could interfere with a homeowner's use of the yard.	• Not practical for residential uses. • Annual inspections and maintenance would be required for the cap • This alternative could meet resistance from landowners due to the potential to restrict a homeowner's use of the yard. • Capping in floodplain areas would decrease flood storage. This may increase the potential for flooding in the area.	• Moderate O&M cost • Five-year Review costs

Conclusion: This alternative is protective of human health and the environment. However, capping on residential property is impractical and would result in limiting or restricting an owner's use of the property. This could result in resistance from the owner. Capping is not likely to provide a benefit over a remedial alternative that would remove soil contaminants. **This alternative is not retained for detailed analysis.**

Table 3-11
Screening of Remedial Alternative SL-3: Soil Excavation on Residential Properties with Off-Site Disposal

Description: Under this alternative, soil excavation and off-site disposal would remove all impacted soils exceeding soil PRGs on residential properties bordering the Southern Wetland west of North Avenue and to the south of Deanville Road. Excavated soil would be transported off-site for proper disposal. Following excavation and disposal, site restoration would occur, including backfilling and grading with offsite clean soil and re-vegetation to replicate existing conditions and to control erosion.

	Effectiveness	**Implementability**	**Cost**
Advantages:	• Removes contaminated soil • Allows for unrestricted use of the residential property	• Excavation is a proven technology and relatively easy to implement at this site	• O&M cost eliminated for soil
Disadvantages:	• Transportation to off-site facilities increases the potential for current and future liability	• Moderate amount of logistical considerations required during excavation	• High capital cost due to soil and debris removal volume.

Conclusion: This alternative is protective of human health and the environment and allows for unrestricted exposure and use. **This alternative is retained for detailed analysis.**

Table 3-12
Screening of Remedial Alternative GW/SW-1: No Action

Description: No remedial activities are included under this alternative.

	Effectiveness	Implementability	Cost
Advantages:	• None. Not effective.	• No action makes this the easiest alternative to implement	• No capital costs • No O&M costs
Disadvantages:	• Does not mitigate risks to current/future recreational users and ecological receptors exposed to site chemicals in Bliss Brook surface water. • Does not mitigate potential risks to current/future residents to indoor air (originating from groundwater) containing site chemicals that exceed residential screening levels. • Does not mitigate risks to future construction workers exposed to site chemicals in shallow groundwater on the W&L property.	• Additional remedial actions may be required in the future	• Additional remedial actions may be required in the future.

Conclusion: The No Action alternative would not be protective of human health and the environment. However, it is used as a baseline in comparison with other alternatives. **This alternative is retained for detailed analysis.**

Table 3-13
Screening of Remedial Alternative GW/SW-2a: Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat

Description: This alternative would achieve the RAOs pertaining to overburden groundwater and surface water through 1) a combination of soil removal, removal of the existing building slab and other potential historic source areas, and in-situ soil blending with zero valent iron within the source area on the W&L property to address hexavalent chromium and chlorinated solvents that may be acting as an ongoing source of contamination to groundwater; 2) installation and operation of a groundwater pump and treat system to intercept and treat the hexavalent chromium plume and prevent continued discharge of the plume to surface water above surface water PRGs; 3) long-term surface water and groundwater monitoring and evaluation of groundwater attenuation to monitor the progress of the remedy toward achieving PRGs; 4) periodic inspections and maintenance of the existing engineered cover and permeable reactive barrier and the existing residential SSDSs to ensure they are functioning as intended; and 5) institutional controls to protect the future construction worker until W&L property shallow groundwater PRGs are achieved, to prevent installation of irrigation wells, to protect remedy infrastructure, to require a vapor intrusion evaluation if an occupied building is constructed over the shallow groundwater VOC plume, and to prevent contact with soil beneath the existing engineered cover located behind the Paulette Lane residential area. Pre-design investigations would be needed in order to design the remedy. Five-year reviews would be conducted to evaluate the effectiveness of the remedy.

	Effectiveness	**Implementability**	**Cost**
Advantages:	• Reduces source concentrations of hexavalent chromium and chlorinated VOCs. • Reduces the volume and mobility of contaminated groundwater. • Groundwater pump and treat would be expected to reduce levels of hexavalent and total chromium in Bliss Brook surface water to below PRGs relatively quickly. • Zero valent iron has already been shown to be effective as a reducing agent for hexavalent chromium based on the existing permeable reactive barrier at the site and	• It is anticipated that the groundwater pump and treat system will generally consist of well-proven technologies. • Institutional controls and long-term monitoring are proven technologies and are easy to implement	• There would be some overlap in costs with other alternatives directed at soil and bedrock groundwater, depending on which alternatives are selected.

	Effectiveness	Implementability	Cost
	the results of bench-scale treatability studies done as part of the RI.		
Disadvantages:	• The reliability of the groundwater pump and treat system for protection of surface water is dependent upon proper operation, monitoring, and maintenance of the system. Surface water monitoring will be required to evaluate the effectiveness of the system. • Inspections of the existing residential SSDSs and the existing engineered cover would be relied upon to ensure the systems are functioning as intended until such time as they are determined not to be needed.	• Moderate amount of logistical considerations required during excavation and in-situ treatment. • Installation of extraction wells, collection and discharge piping, and construction of a groundwater treatment plant, and the long-term O&M of this infrastructure, would be intrusive to residents living north and west of Bliss Brook. • O&M of the groundwater pump and treat system would be much more labor intensive compared to passive treatment systems.	• High capital and O&M costs. • Five-year review cost • Disposal costs associated with source removal activities and GWTP generated waste streams.

Conclusion: The Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat alternative is protective of human health and the environment. **This alternative is retained for detailed analysis.**

Table 3-14
Screening of Remedial Alternative GW/SW-2b: Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat with Mid-Plume Treatment

Description: This alternative would achieve the RAOs pertaining to overburden groundwater and surface water through 1) a combination of soil removal, removal of the existing building slab and other potential historic source areas, and in-situ soil blending with zero valent iron within the source area on the W&L property to address hexavalent chromium and chlorinated solvents that may be acting as an ongoing source of contamination to groundwater; 2) In-situ treatment of shallow groundwater with zero valent iron along the west side of North Avenue for a distance of approximately 200 feet to treat hexavalent chromium and TCE in overburden groundwater before it migrates under North Avenue; 3) installation and operation of a groundwater pump and treat system to intercept and treat the hexavalent chromium plume and prevent continued discharge of the plume to surface water above surface water PRGs; 4) long-term surface water and groundwater monitoring and evaluation of groundwater attenuation to monitor the progress of the remedy toward achieving PRGs; 5) periodic inspections and maintenance of the existing engineered cover and permeable reactive barrier and the existing residential SSDSs to ensure they are functioning as intended; and 6) institutional controls to protect the future construction worker until W&L property shallow groundwater PRGs are achieved, to prevent installation of irrigation wells, to protect remedy infrastructure, to require a vapor intrusion evaluation if an occupied building is constructed over the shallow groundwater VOC plume, and to prevent contact with soil beneath the existing engineered cover located behind the Paulette Lane residential area. Pre-design investigations would be needed in order to design the remedy. Five-year reviews would be conducted to evaluate the effectiveness of the remedy.

	Effectiveness	**Implementability**	**Cost**
Advantages:	• Reduces source concentrations of hexavalent chromium and chlorinated VOCs. • Reduces the volume and mobility of contaminated groundwater (This may occur more quickly under GW/SW-2b compared to GW/SW-2a due to the additional in-situ treatment that would occur west of North Avenue). • Groundwater pump and treat would be expected to reduce levels of hexavalent and total chromium in Bliss Brook surface water to below PRGs	• It is anticipated that the groundwater pump and treat system will generally consist of well-proven technologies. • Institutional controls and long-term monitoring are proven technologies and are easy to implement	• There would be some overlap in costs with other alternatives directed at soil and bedrock groundwater, depending on which alternatives are selected.

	Effectiveness	Implementability	Cost
	relatively quickly. • Zero valent iron has already been shown to be effective as a reducing agent for hexavalent chromium based on the existing permeable reactive barrier at the site and the results of bench-scale treatability studies done as part of the RI.		
Disadvantages:	• The reliability of the groundwater pump and treat system for protection of surface water is dependent upon proper operation, monitoring, and maintenance of the system. Surface water monitoring will be required to evaluate the effectiveness of the system. • Inspections of the existing residential SSDSs and the existing engineered cover would be relied upon to ensure the systems are functioning as intended until such time as they are determined not to be needed.	• Moderate amount of logistical considerations required during excavation and in-situ treatment. • Space is limited just west of North Avenue for installing an in-situ treatment wall. • Installation of extraction wells, collection and discharge piping, and construction of a groundwater treatment plant, and the long-term O&M of this infrastructure, would be intrusive to residents living north and west of Bliss Brook. • O&M of the groundwater pump and treat system would be much more labor intensive compared to passive treatment systems	• High capital and O&M costs. • Five-year review cost • Disposal costs associated with source removal activities and GWTP generated waste streams.

Conclusion: The Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat with Mid-Plume Treatment alternative is protective of human health and the environment. **This alternative is retained for detailed analysis.**

Table 3-15
Screening of Remedial Alternative GW/SW-3a: Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier

Description: This alternative would achieve the RAOs pertaining to overburden groundwater and surface water through 1) a combination of soil removal, removal of the existing building slab and other potential historic source areas, and in-situ soil blending with zero valent iron within the source area on the W&L property to address hexavalent chromium and chlorinated solvents that may be acting as an ongoing source of contamination to groundwater; 2) installation of a permeable reactive barrier to augment the existing permeable reactive barrier and prevent the discharge of hexavalent chromium contaminated groundwater to Bliss Brook at levels above surface water PRGs; 3) long-term surface water and groundwater monitoring and evaluation of groundwater attenuation to monitor the progress of the remedy toward achieving PRGs; 4) periodic inspections and maintenance of the existing engineered cover and permeable reactive barrier and the existing residential SSDSs to ensure they are functioning as intended; and 5) institutional controls to protect the future construction worker until W&L property shallow groundwater PRGs are achieved, to prevent installation of irrigation wells, to protect remedy infrastructure, to require a vapor intrusion evaluation if an occupied building is constructed over the shallow groundwater VOC plume, and to prevent contact with soil beneath the existing engineered cover located behind the Paulette Lane residential area. Pre-design investigations would be needed in order to design the remedy. Five-year reviews would be conducted to evaluate the effectiveness of the remedy.

	Effectiveness	**Implementability**	**Cost**
Advantages:	• Reduces source concentrations of hexavalent chromium and chlorinated VOCs. • The extended permeable reactive barrier would be expected to reduce levels of hexavalent and total chromium in Bliss Brook surface water to below PRGs relatively quickly. • Zero valent iron has already been shown to be effective as a reducing agent for hexavalent chromium based on the existing permeable reactive barrier at the site and the results of bench-scale treatability studies done as part	• A permeable reactive barrier has already been successfully implemented at this site. Design and construction services and materials are readily available. • Institutional controls and long-term monitoring are proven technologies and are easy to implement	• There would be some overlap in costs with other alternatives directed at soil and bedrock groundwater, depending on which alternatives are selected.

	Effectiveness	Implementability	Cost
	of the RI.		
Disadvantages:	• The effectiveness of the permeable reactive barrier for protection of surface water is somewhat dependent on modeling and other pre-design investigation work needed to prepare its design. Surface water monitoring will be required to evaluate the effectiveness of the permeable reactive barrier. • Inspections of the existing residential SSDSs and the existing engineered cover would be relied upon to ensure the systems are functioning as intended until such time as they are determined not to be needed.	• Moderate amount of logistical considerations required during excavation and in-situ treatment. • Installation of the permeable reactive barrier would be intrusive to residents living north and west of Bliss Brook. • Zero valent iron could become exhausted over time and require replacement, leading to additional intrusive activities in residential yards.	• High capital costs • Moderate O&M costs • Five-year review cost • Disposal costs associated with source removal activities.

Conclusion: The Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier alternative is protective of human health and the environment. **This alternative is retained for detailed analysis.**

Table 3-16
Screening of Remedial Alternative GW/SW-3b: Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier with Mid-Plume Treatment

Description: This alternative would achieve the RAOs pertaining to overburden groundwater and surface water through 1) a combination of soil removal, removal of the existing building slab and other potential historic source areas, and in-situ soil blending with zero valent iron within the source area on the W&L property to address hexavalent chromium and chlorinated solvents that may be acting as an ongoing source of contamination to groundwater; 2) In-situ treatment of shallow groundwater with zero valent iron along the west side of North Avenue for a distance of approximately 200 feet to treat hexavalent chromium and TCE in overburden groundwater before it migrates under North Avenue; 3) installation of a permeable reactive barrier to augment the existing permeable reactive barrier and prevent the discharge of hexavalent chromium contaminated groundwater to Bliss Brook at levels above surface water PRGs; 4) long-term surface water and groundwater monitoring and evaluation of groundwater attenuation to monitor the progress of the remedy toward achieving PRGs; 5) periodic inspections and maintenance of the existing engineered cover and permeable reactive barrier and the existing residential SSDSs to ensure they are functioning as intended; and 6) institutional controls to protect the future construction worker until W&L property shallow groundwater PRGs are achieved, to prevent installation of irrigation wells, to protect remedy infrastructure, to require a vapor intrusion evaluation if an occupied building is constructed over the shallow groundwater VOC plume, and to prevent contact with soil beneath the existing engineered cover located behind the Paulette Lane residential area. Pre-design investigations would be needed in order to design the remedy. Five-year reviews would be conducted to evaluate the effectiveness of the remedy.

	Effectiveness	**Implementability**	**Cost**
Advantages:	• Reduces source concentrations of hexavalent chromium and chlorinated VOCs. • Reduces the volume and mobility of contaminated groundwater (This may occur more quickly under GW/SW-3b compared to GW/SW-3a due to the additional in-situ treatment that would occur west of North Avenue). • The extended permeable reactive barrier would be	• A permeable reactive barrier has already been successfully implemented at this site. Design and construction services and materials are readily available. • Institutional controls and long-term monitoring are proven technologies and are easy to implement	• There would be some overlap in costs with other alternatives directed at soil and bedrock groundwater, depending on which alternatives are selected.

	Effectiveness	Implementability	Cost
	expected to reduce levels of hexavalent and total chromium in Bliss Brook surface water to below PRGs relatively quickly. • Zero valent iron has already been shown to be effective as a reducing agent for hexavalent chromium based on the existing permeable reactive barrier at the site and the results of bench-scale treatability studies done as part of the RI.		
Disadvantages:	• The effectiveness of the permeable reactive barrier for protection of surface water is somewhat dependent on modeling and other pre-design investigation work needed to prepare its design. Surface water monitoring will be required to evaluate the effectiveness of the permeable reactive barrier. • Inspections of the existing residential SSDSs and the existing engineered cover would be relied upon to ensure the systems are functioning as intended until such time as they are determined not to be needed.	• Moderate amount of logistical considerations required during excavation and in-situ treatment. • Space is limited just west of North Avenue for installing an in-situ treatment wall. • Installation of the permeable reactive barrier would be intrusive to residents living north and west of Bliss Brook. • Zero valent iron could become exhausted over time and require replacement, leading to additional intrusive activities in residential yards. (This may be less likely to occur under GW/SW-3b compared to GW/SW-3a due to the additional in-situ treatment that would occur west of North	• High capital costs • Moderate O&M costs • Five-year review cost • Disposal costs associated with source removal activities.

	Effectiveness	Implementability	Cost
		Avenue).	

Conclusion: The Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier with Mid-Plume Treatment alternative is protective of human health and the environment. **This alternative is retained for detailed analysis.**

Table 3-17
Screening of Remedial Alternative BR-1: No Action

Description: No remedial activities are included under this alternative.

	Effectiveness	Implementability	Cost
Advantages:	• None. Not effective.	• No action makes this the easiest alternative to implement	• No capital costs • No O&M costs
Disadvantages:	• Does not mitigate risks to current/future residents in the Bungay River water resource protection district from exposure to COCs in bedrock groundwater	• Additional remedial actions may be required in the future	• Additional remedial actions may be required in the future.

Conclusion: The No Action alternative would not be protective of human health and the environment. However, it is used as a baseline in comparison with other alternatives. **This alternative is retained for detailed analysis.**

Table 3-18
Screening of Remedial Alternative BR-2: Institutional Controls

Description: This alternative would achieve RAOs related to bedrock groundwater through a combination of institutional controls to prevent exposure of residential receptors to COCs in bedrock groundwater that exceed non-drinking water PRGs and long-term bedrock groundwater monitoring with evaluation of natural attenuation until such time as non-drinking water PRGs have been met. If pre-design investigations show that bedrock groundwater underlying portions of the Bungay River Resource Protection District exceeds drinking water PRGs, then additional contingency measures would be taken, including the expansion of the area to be addressed with monitoring to include the impacted portion of the District and the implementation of additional institutional controls to prevent plume migration into the District and prevent exposure of residential receptors to COCs in bedrock groundwater within the District that exceed drinking water PRGs.

	Effectiveness	**Implementability**	**Cost**
Advantages:	• Restricts use of bedrock groundwater for drinking water in the Bungay River Water Resource Protection District (if impacted). • Institutional controls can be implemented relatively quickly.	• Institutional controls and long-term monitoring are proven technologies and are easy to implement.	• Low capital costs
Disadvantages:	• The amount of time to achieve residential groundwater PRGs in the Bungay River Water Resource Protection District would likely be dependent on other remedial actions directed at soil, shallow groundwater, and surface water.	• Additional bedrock well installation and sampling will be needed to determine the downgradient extent of the hexavalent chromium plume boundary. • Long-term monitoring involves periodic sampling events to evaluate bedrock groundwater conditions.	• Moderate O&M cost • Five-year review cost

Conclusion: The Institutional Controls alternative is protective of human health. **This alternative is retained for detailed analysis.**

Table 3-19
Screening of Remedial Alternative BR-3: Institutional Controls and Contingency Remedy of Focused In-Situ Injections (West of North Avenue)

Description: This alternative would achieve the RAOs related to bedrock groundwater through a combination of institutional controls to prevent exposure of residential receptors to COCs in bedrock groundwater that exceed non-drinking water PRGs and long-term bedrock groundwater monitoring and evaluation of groundwater attenuation until such time as PRGs are met and institutional controls are no longer needed. If pre-design investigations show that bedrock groundwater underlying portions of the Bungay River Resource Protection District exceeds drinking water PRGs, then additional contingency measures would be taken, including the design and implementation of focused in-situ treatment on the west side of North Avenue, the expansion of the area to be addressed with monitoring to include the impacted portion of the District, and the implementation of additional institutional controls to prevent plume migration into the District, prevent exposure of residential receptors to COCs in bedrock groundwater within the District that exceed drinking water PRGs, and protect remedy infrastructure.

	Effectiveness	**Implementability**	**Cost**
Advantages:	• Restricts use of bedrock groundwater for drinking water in the Bungay River Water Resource Protection District (if impacted). • Institutional controls can be implemented relatively quickly. • Will likely achieve residential groundwater PRGs in a shorter time than under existing conditions. • Zero valent iron has already been shown to be effective as a reducing agent for hexavalent chromium based on the existing permeable reactive barrier at the site and the results of bench-scale treatability studies done as part of the RI.	• In-situ treatment with zero valent iron has already been successfully implemented at this site. Design and construction services and materials are readily available. • Institutional controls and long-term monitoring are proven technologies and are easy to implement. • Placement of the in-situ injections on the west side of North Avenue would minimize potential impacts to residents in the area of the site.	• If Alternatives GW/SW-2b or GW/SW-3b are also selected, there would be significant overlap in costs associated with the in-situ treatment since the injections would just be extended deeper into the shallow bedrock.

	Effectiveness	Implementability	Cost
	• Reduces the volume and mobility of contaminated groundwater.		
Disadvantages:	• The effectiveness of the focused in-situ injections at preventing migration of the hexavalent chromium plume is somewhat dependent on modeling and other pre-design investigation work needed to prepare its design. Monitoring of bedrock compliance groundwater monitoring wells will be required to evaluate the effectiveness of the focused in-situ injections.	• Space is limited just west of North Avenue for installing an in-situ treatment wall. • Installation of monitoring wells would be intrusive to residents living along Ashton Road and within the District.	• High capital costs • Moderate O&M costs • Five-year review cost • Disposal costs associated with soil and water generated during in-situ injections and compliance monitoring wells.

Conclusion: The Institutional Controls and Contingency Remedy of Focused In-Situ Injections (West of North Avenue) alternative is protective of human health and the environment. **This alternative is retained for detailed analysis.**

Table 3-20
Screening of Remedial Alternative BR-4: Institutional Controls and Contingency Remedy of Pump and Treat

Description: This alternative would achieve the RAOs related to bedrock groundwater through a combination of institutional controls to prevent exposure of residential receptors to COCs in bedrock groundwater that exceed non-drinking water PRGs and long-term bedrock groundwater monitoring and evaluation of groundwater attenuation until such time as PRGs have been met and institutional controls are no longer needed. If pre-design investigations show that bedrock groundwater underlying portions of the Bungay River Resource Protection District exceeds drinking water PRGs, then additional contingency measures would be taken, including the design and implementation of a bedrock groundwater pump and treat system along Bliss Brook, the expansion of the area to be addressed with monitoring to include the impacted portion of the District, and the implementation of additional institutional controls to prevent plume migration into the District, prevent exposure of residential receptors to COCs in bedrock groundwater within the District that exceed drinking water PRGs, and protect remedy infrastructure.

	Effectiveness	**Implementability**	**Cost**
Advantages:	• Restricts use of bedrock groundwater for drinking water in the Bungay River Water Resource Protection District (if needed). • Institutional controls can be implemented relatively quickly. • Will likely achieve residential groundwater PRGs in a shorter time than under existing conditions. • Reduces the volume and mobility of contaminated groundwater.	• It is anticipated that the groundwater pump and treat system will generally consist of well-proven technologies. • Institutional controls and long-term monitoring are proven technologies and are easy to implement.	• If Alternatives GW/SW-2a or GW/SW-2b are also selected, there would be significant overlap in costs associated with the groundwater pump and treat component.
Disadvantages:	• The effectiveness of the groundwater pump and treat system at preventing plume migration is dependent upon	• Installation of monitoring wells, extraction wells, collection and discharge piping, and construction of a	• High capital and O&M costs. • Five-year review cost • Disposal costs associated with GWTP generated

	Effectiveness	Implementability	Cost
	proper operation, monitoring, and maintenance of the system. Monitoring of bedrock compliance groundwater monitoring wells will be required to evaluate the effectiveness of the system.	groundwater treatment plant, and the long-term O&M of this infrastructure would be intrusive to residents living north and west of Bliss Brook and along Ashton Road. • O&M of the groundwater pump and treat system would be much more labor intensive compared to passive treatment systems	waste streams.

Conclusion: The Institutional Controls and Contingency Remedy of Pump and Treat alternative is protective of human health and the environment. **This alternative is retained for detailed analysis.**

Table 3-21
Screening of Remedial Alternative BR-5: Institutional Controls and Contingency Remedy of Enhanced (Deeper) Permeable Reactive Barrier

Description: This alternative would achieve the RAOs related to bedrock groundwater through a combination of institutional controls to prevent exposure of residential receptors to COCs in bedrock groundwater that exceed non-drinking water PRGs, and long-term bedrock groundwater monitoring and evaluation of groundwater attenuation until such time as PRGs have been met and institutional controls are no longer needed. If pre-design investigations show that bedrock groundwater underlying portions of the Bungay River Resource Protection District exceeds drinking water PRGs, then additional contingency measures would be taken, including the enhancement (deepening) of the existing PRB along Bliss Brook, the expansion of the area to be addressed with monitoring to include the impacted portion of the District, and the implementation of additional institutional controls to prevent plume migration into the District, prevent exposure of residential receptors to COCs in bedrock groundwater within the District that exceed drinking water PRGs, and protect remedy infrastructure.

	Effectiveness	**Implementability**	**Cost**
Advantages:	• Restricts use of bedrock groundwater for drinking water in the Bungay River Water Resource Protection District (if needed). • Institutional controls can be implemented relatively quickly. • Will likely achieve residential groundwater PRGs in a shorter time than under existing conditions. • Zero valent iron has already been shown to be effective as a reducing agent for hexavalent chromium based on the existing permeable reactive barrier at the site and the results of bench-scale treatability studies done as part of the RI.	• A permeable reactive barrier has already been successfully implemented at this site. Design and construction services and materials are readily available. • Institutional controls and long-term monitoring are proven technologies and are easy to implement	• If Alternatives GW/SW-3a or GW/SW-3b are also selected, there would be significant overlap in costs associated with the permeable reactive barrier.

	Effectiveness	Implementability	Cost
	• Reduces the volume and mobility of contaminated groundwater.		
Disadvantages:	• The effectiveness of the enhanced permeable reactive barrier at preventing migration of the hexavalent chromium plume is somewhat dependent on modeling and other pre-design investigation work needed to prepare its design. Monitoring of bedrock compliance groundwater monitoring wells will be required to evaluate the effectiveness of the enhanced permeable reactive barrier.	• Installation of the enhanced permeable reactive barrier and monitoring wells would be intrusive to residents living north and west of Bliss Brook and along Ashton Road. • Zero valent iron could become exhausted over time and require replacement, leading to additional intrusive activities in residential yards.	• High capital costs • Moderate O&M costs • Five-year review cost • Disposal costs associated with soil and water generated during installation of the permeable reactive barrier and compliance monitoring wells.

Conclusion: The Institutional Controls and Contingency Remedy of Enhanced (Deeper) Permeable Reactive Barrier alternative is protective of human health and the environment. **This alternative is retained for detailed analysis.**

Table 4-1
Nine Criteria for Detailed Evaluation of Alternatives

No.	FS Evaluation Criteria	Sub-Criteria	Additional Criteria Description [1]
1	Overall Protection of Human Health and the Environment	• Human Health Protection • Environmental (e.g., Ecological) Protection	• Final check to assess whether each alternative provides adequate protection of human health and the environment • Describe how site risks are eliminated, reduced, or controlled through the alternative's treatment, engineering, or institutional controls • This criterion draws on assessments conducted for criteria 2 (Compliance with ARARs), 3 (Long-Term Effectiveness and Permanence) and 5 (Short-Term Effectiveness).
2	Compliance with ARARs	• Compliance with Chemical-Specific ARARs • Compliance with Action-Specific ARARs • Compliance with Location-Specific ARARs	• Evaluation of this criterion also needs to include compliance with other criteria, advisories, and guidance. • This assessment needs to include both federal and state ARARs.
3	Long-Term Effectiveness and Permanence	• Magnitude of Residual Risk • Adequacy and Reliability of Controls	• The magnitude of residual risk is the assessment of risk remaining from untreated wastes or treatment residuals remaining after completion of remedial action. • The adequacy and reliability of controls is the assessment of the adequacy and suitability of controls (if any) used to manage untreated wastes or treatment residuals left on-site after completion of the remedial action.
4	Reduction of Toxicity, Mobility and Volume through Treatment	• Treatment/Recycling Processes Used • Amount of Hazardous Materials Treated or Recycled • Degree of Expected Reductions in Toxicity, Mobility, or Volume • Degree to which Treatment is Irreversible • Type and Quantity of Residuals Remaining After Treatment	• The treatment/recycling process used should address the principal threats; any special requirements should be described. • The assessment should describe the mass or volume of contaminated material destroyed/treated or recycled; the subsequent reductions in contaminant mobility should be included in the assessment. • The assessment should describe the extent to which the above treatment is irreversible. • Residuals remaining after treatment/recycling should be quantified and their characteristics described.

No.	FS Evaluation Criteria	Sub-Criteria	Additional Criteria Description [1]
5	Short-Term Effectiveness	• Protection of Community During Remedial Actions • Protection of Workers During Remedial Actions • Environmental Impacts • Time Until Remedial Action Objectives are Achieved	• The assessment should define the risks to the community and workers during implementation of the remedial action, how the risks will be mitigated and what risks, if any, cannot be readily controlled. • The assessment should define environmental impacts during implementation of the remedial action, how impacts will be mitigated and what impacts, if any, cannot be readily controlled. • The assessment should include a quantitative estimate of the time required until remedial action objectives are achieved.
6	Implementability	• Technical Feasibility • Administrative Feasibility • Availability of Services and Materials	• Technical feasibility refers to: a) ability to construct and operate the technology; b) reliability of the technology; c) ease of undertaking additional remedial actions (if required); and d) ability to monitor effectiveness of the remedy. • Administrative feasibility refers to the coordination of the remedy with other regulatory, oversight, or permitting agencies • The assessment should detail availability of the following: a) treatment, storage, and disposal services; b) any necessary equipment and specialists; and c) availability of prospective remedial technologies/process options.
7	Cost	• Capital Costs • Operation and Maintenance Costs	• Accuracy of the cost estimates should be in the range of +50% to -30%. • The assessment should include a present worth analysis with assumption detailed on discount rate and period of performance.
8	State Acceptance	--- none ---	• This assessment evaluates the technical and administrative issues and concerns the state may have regarding each of the alternatives. • Addressed after completion of the FS during the Proposed Plan public comment period.
9	Community Acceptance	--- none ---	• This assessment evaluates the issues and concerns the public may have regarding each of the alternatives • Addressed after completion of the FS during the Proposed Plan public comment period.

Notes: (1) Reference Source: U.S. EPA, 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final*, prepared by the U.S. Environmental Protection Agency Office of Emergency and Remedial Response, Washington, D.C., OSWER Directive 9355.3-01, EPA/540/G-89/004, October, 1988.

Table 4-2
Detailed Evaluation of S-1: No Action

Evaluation Criteria	Detailed Analysis
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	This alternative would not provide any protection of human health from soil risks identified for the W&L Property at the site.
Ecological Protection	No specific ecological risks were identified for W&L Property soil.
COMPLIANCE WITH ARARs	
Chemical-, Location-, and Action-Specific	Under current conditions, chemical-specific TBCs have not been met. Therefore, this alternative would not meet ARARs. Refer to Table E-1 in Appendix E for a list and evaluation of TBCs associated with this alternative.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Since this alternative includes no controls to reduce potential direct contact with contaminated W&L Property soil, the residual risk would be the same as that identified in the RI report.
Adequacy and Reliability of Controls	This alternative does not include any controls to reduce potential future exposures to W&L Property soil.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Process Used and Materials Treated	No treatment would be performed under this alternative.
Amount Destroyed or Treated	No treatment would be performed under this alternative.
Degree of Expected Reductions of TMV through treatment	No treatment would be performed under this alternative.
Degree to which Treatment is Irreversible	No treatment would be performed under this alternative.
Type and Quantity of Residuals Remaining after Treatment	No treatment would be performed under this alternative.
SHORT-TERM EFFECTIVENESS	
Protection of Community during Remedial Actions	Since this alternative involves no construction or monitoring measures, there would be no additional short-term risks to the community from the remedy.
Protection of Workers during Remedial Actions	Since this alternative involves no construction or monitoring measures, there would be no additional short-term risks to workers from the remedy.
Environmental Impacts	Since this alternative involves no construction or monitoring measures, there would be no additional short-term environmental impacts associated with the remedy.

Evaluation Criteria	Detailed Analysis
Time to Achieve Remedial Action Objectives	This alternative does not meet RAOs
IMPLEMENTABILITY	
Ability to Construct and Operate	No construction or operation would be performed under this alternative.
Reliability of the Technology	No technologies would be implemented under this alternative.
Ease of undertaking Additional Remedial Actions, if needed	If further action is deemed necessary in the future, this alternative would allow for additional remedial actions to occur.
Ability to Monitor Effectiveness	No monitoring would be conducted under this alternative. Therefore, the effectiveness would not be evaluated.
Ability to Obtain Approvals and Coordinate with Other Agencies	No approvals would likely be needed for this alternative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, or disposal services would be needed under this alternative.
Availability of Necessary Equipment and Specialists	No equipment or specialists would be needed under this alternative.
Availability of Technology	No technologies would be needed for this alternative.
COSTS	
Total Cost	$0

Table 4-3
Detailed Evaluation of S-2: Institutional Controls on W&L Property

Evaluation Criteria	Detailed Analysis
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	This alternative is protective of human health for hypothetical future residents on the W&L Property through the implementation of institutional controls to prevent future residential use of the parcels with impacted soils exceeding human health risk-based PRGs.
Ecological Protection	No specific ecological risks were identified for W&L Property soil.
COMPLIANCE WITH ARARs	
Chemical-, Location-, and Action-Specific	Under this alternative, chemical-specific, location-specific, and action-specific ARARs would be met. Therefore, this alternative would meet ARARs. Refer to Tables E-2a through E-2c in Appendix E for a list and evaluation of ARARs and TBCs associated with this alternative.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	As part of this alternative, institutional controls would be implemented to prevent future residential use and thus prevent exposure of such receptors to COCs in W&L Property soils. However, soil contamination would remain present.
Adequacy and Reliability of Controls	The adequacy of this alternative would be confirmed during the five-year reviews. Institutional controls are reliable if properly enforced.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Process Used and Materials Treated	No treatment would be performed under this alternative.
Amount Destroyed or Treated	No treatment would be performed under this alternative.
Degree of Expected Reductions of TMV through treatment	No treatment would be performed under this alternative.
Degree to which Treatment is Irreversible	No treatment would be performed under this alternative.
Type and Quantity of Residuals Remaining after Treatment	No treatment would be performed under this alternative.
SHORT-TERM EFFECTIVENESS	
Protection of Community during Remedial Actions	Under this alternative, no additional on-site activities other than surveying are anticipated. Therefore, short-term risks to the community from the remedy would be minor.
Protection of Workers during Remedial Actions	Short-term worker risks associated with surveying would be mitigated through the use of proper PPE.

Evaluation Criteria	Detailed Analysis
Environmental Impacts	Short-term impacts to habitat would be minor since on-site activities would be limited to pre-design sampling. Any impacts would be mitigated to the maximum extent practicable.
Time to Achieve Remedial Action Objectives	The RAO relevant to preventing exposure by future residents to contaminated W&L Property soils would be achieved once institutional controls are in place. It is assumed implementation of this alternative would take approximately 1 year.
IMPLEMENTABILITY	
Ability to Construct and Operate	No construction or operation would be performed under this alternative.
Reliability of the Technology	Institutional controls are a reliable technology with proper enforcement.
Ease of undertaking Additional Remedial Actions, if needed	If further action is deemed necessary in the future, this alternative would allow for additional remedial actions to occur.
Ability to Monitor Effectiveness	Five-year reviews would be conducted to monitor effectiveness.
Ability to Obtain Approvals and Coordinate with Other Agencies	Implementation of institutional controls would require coordination with MassDEP.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, or disposal services would be needed under this alternative.
Availability of Necessary Equipment and Specialists	There are many contractors available to provide the limited equipment and services required by this alternative.
Availability of Technology	No technologies would be needed for this alternative.
COSTS	
Capital Costs	$65,616
O&M Costs (Net Present Worth)	$0
Periodic Costs (Net Present Worth)	$66,719
Total Cost (Net Present Worth, rounded to nearest $1,000)	$132,000

Table 4-4
Detailed Evaluation of SL-1: No Action

Evaluation Criteria	Detailed Analysis
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	This alternative would not provide any protection of human health from risks due to lead in soil on the Residential Properties at the site.
Ecological Protection	No specific ecological risks were identified for lead in soil on residential properties.
COMPLIANCE WITH ARARs	
Chemical-, Location-, and Action-Specific	Under current conditions, chemical-specific TBCs have not been met. Therefore, this alternative would not meet ARARs. Refer to Table E-3 in Appendix E for a list and evaluation of TBCs associated with this alternative.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Since this alternative includes no controls to reduce potential direct contact with contaminated residential soil, the residual risk would be the same as that identified in the RI report.
Adequacy and Reliability of Controls	This alternative does not include any controls to reduce potential current or future exposures to lead-contaminated soil on Residential Properties.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Process Used and Materials Treated	No treatment would be performed under this alternative.
Amount Destroyed or Treated	No treatment would be performed under this alternative.
Degree of Expected Reductions of TMV through treatment	No treatment would be performed under this alternative.
Degree to which Treatment is Irreversible	No treatment would be performed under this alternative.
Type and Quantity of Residuals Remaining after Treatment	No treatment would be performed under this alternative.
SHORT-TERM EFFECTIVENESS	
Protection of Community during Remedial Actions	Since this alternative involves no construction or monitoring measures, there would be no additional short-term risks to the community from the remedy.
Protection of Workers during Remedial Actions	Since this alternative involves no construction or monitoring measures, there would be no additional short-term risks to workers from the remedy.
Environmental Impacts	Since this alternative involves no construction or monitoring measures, there would be no additional short-term environmental impacts associated with the remedy.

Evaluation Criteria	Detailed Analysis
Time to Achieve Remedial Action Objectives	This alternative does not meet RAOs
IMPLEMENTABILITY	
Ability to Construct and Operate	No construction or operation would be performed under this alternative.
Reliability of the Technology	No technologies would be implemented under this alternative.
Ease of undertaking Additional Remedial Actions, if needed	If further action is deemed necessary in the future, this alternative would allow for additional remedial actions to occur.
Ability to Monitor Effectiveness	No monitoring would be conducted under this alternative. Therefore, the effectiveness would not be evaluated.
Ability to Obtain Approvals and Coordinate with Other Agencies	No approvals would likely be needed for this alternative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, or disposal services would be needed under this alternative.
Availability of Necessary Equipment and Specialists	No equipment or specialists would be needed under this alternative.
Availability of Technology	No technologies would be needed for this alternative.
COSTS	
Total Cost	$0

Table 4-5
Detailed Evaluation of SL-3: Soil Excavation on Residential Properties with Off-Site Disposal

Evaluation Criteria	Detailed Analysis
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	This alternative would eliminate the potential for direct contact exposures with lead-contaminated soil on Residential Properties.
Ecological Protection	No specific ecological risks were identified for lead in soil on residential properties.
COMPLIANCE WITH ARARs	
Chemical-, Location-, and Action-Specific	This alternative would meet chemical, location, and action specific ARARS if properly designed and implemented. Therefore, this alternative would meet ARARs. Refer to Tables E-4a through E-4c in Appendix E for a list and evaluation of ARARs and TBCs associated with this alternative.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Since soil with lead concentrations exceeding PRGs would be removed, no residual risk will remain.
Adequacy and Reliability of Controls	Since soil with lead concentrations exceeding PRGs would be removed, no controls are necessary.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Process Used and Materials Treated	No treatment would be performed on-site under this alternative. Soil may be treated by stabilization off-site prior to off-site disposal. Stabilization for lead impacted soil would typically include blending the soil with an agent designed to reduce the leachability of the lead prior to landfill placement.
Amount Destroyed or Treated	The amount of lead impacted soil treated would depend upon the result of leaching tests conducted as part of waste characterization.
Degree of Expected Reductions of TMV through treatment	If treatment is necessary, lead mobility would be reduced to levels necessary for landfill disposal.
Degree to which Treatment is Irreversible	Stabilization is typically irreversible under most circumstances.
Type and Quantity of Residuals Remaining after Treatment	If treatment is necessary, soil blended with stabilizing agents would be generated. Stabilized soil would be disposed of in a landfill.
SHORT-TERM EFFECTIVENESS	
Protection of Community during Remedial Actions	There would be a temporary increase in dust generated during excavation; however, dust control measures would be taken and air monitoring performed to verify that there are no impacts to the community.

Evaluation Criteria	Detailed Analysis
	There would be a temporary increase in noise and truck traffic during excavation. Flagmen or a police detail would be hired to direct vehicle and pedestrian traffic when trucks are entering and exiting the properties. Temporary measures would be required to prevent access by homeowners and the public to the area on each property during remedial activities.
Protection of Workers during Remedial Actions	Construction workers would be required to have appropriate health and safety training in the area of hazardous waste management. Sufficient monitoring and worker protection would be required during remedial activities to mitigate potential risks to human health.
Environmental Impacts	Temporary impacts to the surrounding habitat during excavation would be minor. Erosion controls and silt fencing would be installed adjacent to the wetland.
Time to Achieve Remedial Action Objectives	RAOs would be met upon completion of the excavation.
IMPLEMENTABILITY	
Ability to Construct and Operate	Excavation could be accomplished relatively easily.
Reliability of the Technology	Excavation is a relatively simple, reliable technology.
Ease of undertaking Additional Remedial Actions, if needed	If further action is deemed necessary in the future, this alternative would allow for additional remedial actions to occur.
Ability to Monitor Effectiveness	Sampling would be conducted to verify achievement of the PRGs.
Ability to Obtain Approvals and Coordinate with Other Agencies	Coordination of schedules and appropriate communication will be required with other agencies. Excavated soil will be disposed off-site in licensed waste disposal facilities.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	Facilities are available to accept the contaminated soil.
Availability of Necessary Equipment and Specialists	Equipment required for this alternative is readily available.
Availability of Technology	No technologies would be needed for this alternative.
COSTS	
Capital Costs	$422,127
O&M Costs (Net Present Worth)	$0
Periodic Costs (Net Present Worth)	$0
Total Cost (Net Present Worth, rounded to nearest $1,000)	$422,000

Table 4-6
Detailed Evaluation of GW/SW-1: No Action

Evaluation Criteria	Detailed Analysis
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	This alternative would not provide any protection of human health from shallow groundwater or surface water risks identified for the site.
Ecological Protection	This alternative would not provide any protection of aquatic receptors from surface water risks identified for the site. No specific ecological risks were identified for groundwater at the site.
COMPLIANCE WITH ARARs	
Chemical-, Location-, and Action-Specific	Under current conditions, chemical-specific ARARs and TBCs have not been met. Therefore, this alternative would not meet ARARs. Refer to Table E-5 in Appendix E for a list and evaluation of ARARs and TBCs associated with this alternative.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Since this alternative includes no controls to reduce potential direct contact with contaminated shallow groundwater or surface water, the residual risk would be the same as that identified in the RI report.
Adequacy and Reliability of Controls	This alternative does not include any controls to reduce potential future exposures to shallow groundwater.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Process Used and Materials Treated	No treatment would be performed under this alternative.
Amount Destroyed or Treated	No treatment would be performed under this alternative.
Degree of Expected Reductions of TMV through treatment	No treatment would be performed under this alternative.
Degree to which Treatment is Irreversible	No treatment would be performed under this alternative.
Type and Quantity of Residuals Remaining after Treatment	No treatment would be performed under this alternative.
SHORT-TERM EFFECTIVENESS	
Protection of Community during Remedial Actions	Since this alternative involves no construction or monitoring measures, there would be no additional short-term risks to the community from the remedy.
Protection of Workers during Remedial Actions	Since this alternative involves no construction or monitoring measures, there would be no additional short-term risks to workers from the remedy.
Environmental Impacts	Since this alternative involves no construction or monitoring

Evaluation Criteria	Detailed Analysis
	measures, there would be no additional short-term environmental impacts associated with the remedy.
Time to Achieve Remedial Action Objectives	This alternative does not meet RAOs.
IMPLEMENTABILITY	
Ability to Construct and Operate	No construction or operation would be performed under this alternative.
Reliability of the Technology	No technologies would be implemented under this alternative.
Ease of undertaking Additional Remedial Actions, if needed	If further action is deemed necessary in the future, this alternative would allow for additional remedial actions to occur.
Ability to Monitor Effectiveness	No monitoring would be conducted under this alternative. Therefore, the effectiveness would not be evaluated.
Ability to Obtain Approvals and Coordinate with Other Agencies	No approvals would likely be needed for this alternative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, or disposal services would be needed under this alternative.
Availability of Necessary Equipment and Specialists	No equipment or specialists would be needed under this alternative.
Availability of Technology	No technologies would be needed for this alternative.
COSTS	
Total Cost	$0

Table 4-7
Detailed Evaluation of GW/SW-2a: Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat

Evaluation Criteria	Detailed Analysis
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	This alternative is protective of human health for a hypothetical resident and future construction worker for groundwater because the full extent of impacted groundwater would be either contained by the pump and treat extraction wells or be under the regulation of institutional controls in addition to the source removal and control on the W&L property. GW/SW-2a is also protective of human health for a recreational surface water user due to the protection of Bliss Brook as a part of the alternative.
Ecological Protection	This alternative is protective of ecological risks because it would intercept and treat the hexavalent chromium groundwater plume prior to discharge to Bliss Brook.
COMPLIANCE WITH ARARs	
Chemical-, Location-, and Action-Specific	Under this alternative, chemical-specific, location-specific, and action-specific ARARs would be met. The primary ARARs unique to this alternative relate to treatment of groundwater and discharge of treated groundwater to Bliss Brook. The conceptual design addresses ARARs compliance and no barriers to compliance have been identified. Therefore, this alternative would meet ARARs. Refer to Tables E-6a through E-6c in Appendix E for a list and evaluation of ARARs and TBCs associated with this alternative.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Residual risk would be low because incremental risks from COCs in groundwater and surface water would be mitigated through institutional controls and would decline over time as a result of the extraction and treatment process. There would be no significant residual risk at the W&L property due to the source removal and in-situ treatment.
Adequacy and Reliability of Controls	Pump and treat and ZVI are proven technologies for removal of Site COCs from groundwater. The timeframe to achieve PRGs under this alternative is uncertain; however, institutional controls would maintain protectiveness until PRGs are met.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Process Used and Materials Treated	All components of the alternative would address the principal shallow groundwater and surface water threats on site with no special or unusual requirements.

Evaluation Criteria	Detailed Analysis
Amount Destroyed or Treated	The amount of COCs in the groundwater destroyed or treated will depend on the final extraction rates and ability to flush out COCs from the groundwater and soil matrices. As pump and treat proceeds, natural attenuation should also be occurring. Approximately 8,020 CY of soil on the W&L property (100 CY test pits and 7,920 CY source area) will be excavated and disposed off-site and 9,500 CY of blended sand or soil and ZVI material will be installed in the source area.
Degree of Expected Reductions of TMV through treatment	In the source area, toxicity and volume are expected to be reduced by >95%. Installation of blended sand/ZVI in the source area excavation will inhibit toxicity, volume, and mobility of contaminants by >95% by reducing Cr+6 to the less mobile Cr+3 and treating cVOCs. Pump and treat will contain impacted groundwater by means of extraction wells, thereby reducing the mobility. Upon completion of treatment, impacted groundwater will have been reduced in toxicity and volume by >95%. These reductions in TMV of the groundwater will lead to improved water quality in Bliss Brook with respect to Cr+6 and other groundwater COCs.
Degree to which Treatment is Irreversible	Treatment of TCE by ZVI by soil blending is irreversible. TCE is broken down to non-toxic elements and will not reform. Conversion of Cr+6 to the less toxic and less mobile Cr+3 is considered irreversible under conditions observed at this site. The COCs removed by extraction (pump and treat) are permanently removed and the ex-situ treatment is irreversible. However, “rebound” is a common problem for pump and treat systems where the extraction wells are turned off and over time in-situ groundwater concentrations return to pre-pumping levels. Rebound is due to desorption of COCs from untreated areas and is not true reversal of treatment.
Type and Quantity of Residuals Remaining after Treatment	ZVI will break TCE down to non-toxic elements and compounds [hydrogen, chlorine (concentration too low to pose a risk), and carbon compounds (CO2 for example)]. ZVI will convert Cr+6 to Cr+3. Cr+3 has a low toxicity and will form complexes with iron hydroxides and sulfur naturally present in groundwater and saturated soil. Low levels of COCs will remain in groundwater, ideally at levels below the PRGs. Above ground treatment will generate spent activated carbon, spent ion exchange resin, and used bag

Evaluation Criteria	Detailed Analysis
	filters. These wastes would be generated on the order of thousands of pounds per year but can be regenerated and reused or treated and disposed readily.
SHORT-TERM EFFECTIVENESS	
Protection of Community during Remedial Actions	Short-term risks to the community from the remedy would be minor. There would be a temporary increase in dust generated during excavation; however, dust control measures would be taken and air monitoring performed to verify that there are no impacts to the community. There would be a temporary increase in noise and truck traffic during excavation. Flagmen or a police detail would be hired to direct vehicle and pedestrian traffic when trucks are entering and exiting the properties. Temporary measures would be required to prevent access by homeowners and the public to the area on each involved property during remedial activities.
Protection of Workers during Remedial Actions	Construction workers would be required to have appropriate health and safety training in the area of hazardous waste management. Sufficient monitoring and worker protection would be required during remedial activities to mitigate potential risks to human health.
Environmental Impacts	Temporary impacts to the surrounding habitat during excavation on the W&L property would be minor. Erosion controls and silt fencing would be installed adjacent to the wetland. Near Bliss Brook temporary impacts will occur to bordering stream areas from heavy equipment (drilling equipment) and trenching for transfer lines. With proper mitigation measures, the impacts will be minor.
Time to Achieve Remedial Action Objectives	RAOs in the stream are expected to be achieved within one year of activation of the pumping wells and institutional controls would effectively prevent exposure to groundwater immediately upon implementation. However, groundwater in upgradient areas will continue to contain Cr+6 at levels above PRGs for groundwater and above levels that would result in surface water PRG exceedances, in the absence of the active components of the remedy, for many years (over 100 years).

Evaluation Criteria	Detailed Analysis
IMPLEMENTABILITY	
Ability to Construct and Operate	Expected difficulties with this alternative include determining a suitable location for the treatment plant and obtaining access for extraction well sites and transfer lines. Pre-design investigations are needed to determine the extraction well yields and dosages of the ZVI in the source area on the W&L property.
Reliability of the Technology	Excavation, soil blending, containment, and ex-situ treatment and pump components are proven technologies.
Ease of undertaking Additional Remedial Actions, if needed	The pump and treat system would not inhibit additional remedial actions. Potential additional remedial actions would include expansion of the extraction system or undertaking other measures to accelerate treatment time (such as injection of treatment reagents). The addition of more soil amendment may become necessary which could be implemented with relative ease technically.
Ability to Monitor Effectiveness	Effectiveness of the components of this alternative can be monitored very easily, through sampling (for evaluating the source control, in-situ treatment, and treatment system operations), and water level measurements (for monitoring the hydraulic containment).
Ability to Obtain Approvals and Coordinate with Other Agencies	Coordination of schedules and appropriate communication will be required with other agencies.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	Facilities are available to accept (and treat if necessary) the excavated contaminated soil. Space for the groundwater treatment plant is required. Finding a suitable location in the residential area may pose some challenges.
Availability of Necessary Equipment and Specialists	Equipment and specialists required for this alternative are readily available.
Availability of Technology	Technologies for each component of this alternative are readily available for full scale implementation with multiple vendors expected to provide competitive bids.
COSTS	
Capital Costs	$9,167,597
O&M Costs (Net Present Worth)	$9,217,196
Periodic Costs (Net Present Worth)	$94,637
Total Cost (Net Present Worth, rounded to nearest $1,000)	$18,479,000

Table 4-8
Detailed Evaluation of GW/SW-2b: Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat with Mid-Plume Treatment

Evaluation Criteria	Detailed Analysis
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	This alternative is protective of human health for a hypothetical resident and future construction worker for groundwater because the full extent of impacted groundwater would be either contained by the pump and treat extraction wells or be under the regulation of institutional controls in addition to the source removal and control on the W&L property. GW/SW-2b is also protective of human health for a recreational surface water user due to the protection of Bliss Brook as a part of the alternative.
Ecological Protection	This alternative is protective of ecological risks because it would intercept and treat the hexavalent chromium groundwater plume prior to discharge to Bliss Brook.
COMPLIANCE WITH ARARs	
Chemical-, Location-, and Action-Specific	Under this alternative, chemical-specific, location-specific, and action-specific ARARs would be met. The primary ARARs unique to this alternative relate to treatment of groundwater and discharge of treated groundwater to Bliss Brook. The conceptual design addresses ARARs compliance and no barriers to compliance have been identified. Therefore, this alternative would meet ARARs. Refer to Tables E-6a through E-6c in Appendix E for a list and evaluation of ARARs and TBCs associated with this alternative.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Residual risk would be low because incremental risks from COCs in groundwater and surface water would be mitigated through institutional controls and would decline over time as a result of the extraction and treatment process. There would be no residual risk at the W&L property due to the source removal and in-situ treatment.
Adequacy and Reliability of Controls	Pump and treat and ZVI are proven technologies for removal of site COCs from groundwater. The timeframe to achieve PRGs under this alternative is uncertain; however, institutional controls would maintain protectiveness until PRGs are met. This alternative would reduce the timeline to achieve PRGs from GW/SW-2a due to the installation of the mid-plume in-situ treatment line.

Evaluation Criteria	Detailed Analysis
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Process Used and Materials Treated	All components of the alternative would address the principal shallow groundwater and surface water threats on site with no special or unusual requirements.
Amount Destroyed or Treated	The amount of COCs in the groundwater destroyed or treated will depend on the final extraction rates and ability to flush out COCs from the groundwater and soil matrices. As pump and treat proceeds, natural attenuation should also be occurring. Approximately 8,020 CY of soil on the W&L property (100 CY test pits and 7,920 CY source area) will be excavated and disposed off-site and 9,500 CY of blended sand or soil and ZVI material will be installed in the source area. An additional 133 CY of blended sand and ZVI would be installed along North Ave in a 200' long mid-plume treatment line. In addition to destruction/treatment of Cr+6 and TCE on the W&L Property and near Bliss Brook, this alternative includes a ZVI barrier wall near North Avenue. This mid-plume barrier wall will provide additional destruction of TCE and conversion of Cr+6 to Cr+3.
Degree of Expected Reductions of TMV through treatment	In the source area, toxicity and volume are expected to be reduced by >95%. Installation of blended sand/ZVI in the source area excavation, and the mid-plume line will inhibit toxicity, volume, and mobility of contaminants north of those areas by >95% by reducing Cr+6 to the less mobile Cr+3 and treating cVOCs. Pump and treat will contain impacted groundwater by means of extraction wells, thereby reducing the mobility. Upon completion of treatment, impacted groundwater will have been reduced in toxicity and volume by >95%. These reductions in TMV of the groundwater will lead to improved water quality in Bliss Brook with respect to Cr+6 and other groundwater COCs.
Degree to which Treatment is Irreversible	Treatment by ZVI amended material (reduction of Cr+6 to Cr+3) in the source area and mid-plume treatment line is irreversible. TCE is broken down to non-toxic elements and will not reform. Conversion of Cr+6 to the less toxic and less mobile Cr+3 is considered irreversible under conditions observed at this site. The COCs removed by extraction are permanently removed and the ex-situ treatment is irreversible. However, "rebound" is a common problem for pump and treat

Evaluation Criteria	Detailed Analysis
	systems where the extraction wells are turned off and over time in-situ groundwater concentrations return to pre-pumping levels. Rebound is due to desorption of COCs from untreated areas and is not true reversal of treatment.
Type and Quantity of Residuals Remaining after Treatment	ZVI will break TCE down to non-toxic elements and compounds [hydrogen, chlorine (concentration too low to pose a risk), and carbon compounds (CO2 for example)]. ZVI will convert Cr+6 to Cr+3. Cr+3 has a low toxicity and will form complexes with iron hydroxides and sulfur naturally present in groundwater and saturated soil. Low levels of COCs will remain in groundwater, ideally at levels below the PRGs. Above ground treatment will generate spent activated carbon, spent ion exchange resin, and used bag filters. These wastes would be generated on the order of thousands of pounds per year but can be regenerated and reused or treated and disposed readily.
SHORT-TERM EFFECTIVENESS	
Protection of Community during Remedial Actions	Short-term risks to the community from the remedy would be minor. There would be a temporary increase in dust generated during excavation; however, dust control measures would be taken and air monitoring performed to verify that there are no impacts to the community. There would be a temporary increase in noise and truck traffic during excavation. Flagmen or a police detail would be hired to direct vehicle and pedestrian traffic when trucks are entering and exiting the properties. Temporary measures would be required to prevent access by homeowners and the public to the area on each involved property during remedial activities.
Protection of Workers during Remedial Actions	Construction workers would be required to have appropriate health and safety training in the area of hazardous waste management. Sufficient monitoring and worker protection would be required during remedial activities to mitigate potential risks to human health.
Environmental Impacts	Temporary impacts to the surrounding habitat during excavation on the W&L property would be minor. Erosion controls and silt fencing would be installed adjacent to the wetland. Near Bliss Brook temporary impacts will occur to bordering stream areas from heavy equipment (drilling equipment) and

Evaluation Criteria	Detailed Analysis
	trenching for transfer lines. With proper mitigation measures, the impacts will be minor.
Time to Achieve Remedial Action Objectives	RAOs for the stream are expected to be achieved within one year of activation of the pumping wells and institutional controls would effectively prevent exposure to groundwater immediately upon implementation. However, groundwater in upgradient areas will continue to contain Cr+6 at levels above PRGs for groundwater and above levels that would result in surface water PRG exceedances, in the absence of the active components of the remedy, for many years (over 100 years). Modeling efforts have shown that the addition of the mid-plume treatment line will reduce time to achieve RAOs by 45%.
IMPLEMENTABILITY	
Ability to Construct and Operate	Expected difficulties with this alternative include determining a suitable location for the treatment plant and obtaining access for extraction well sites and transfer lines. Pre-design investigations are needed to determine the extraction well yields and dosages of the ZVI in the source area and mid-plume line.
Reliability of the Technology	Excavation, soil blending, containment, and ex-situ pump and treat components are proven technologies. Installation of ZVI using a conventional or sonic drill rig for the mid-plume barrier employs commonly used technology, although not commonly used for this purpose. A pilot study is recommended to determine the best method of drilling and the best method of applying the treatment reagents.
Ease of undertaking Additional Remedial Actions, if needed	The pump and treat system would not inhibit additional remedial actions. Potential additional remedial actions would include expansion of the extraction system or undertaking other measures to accelerate treatment time (such as injection of treatment reagents). The addition of more soil amendment may become necessary which could be implemented with relative ease technically. The borings in the mid-plume line would be constructed to allow potential future use to inject reagents.
Ability to Monitor Effectiveness	Effectiveness of the components of this alternative can be monitored very easily, through sampling (for evaluating the source control, in-situ treatment, mid-plume treatment line, and treatment system operations), and water level measurements (for monitoring the hydraulic containment).
Ability to Obtain Approvals and Coordinate with Other Agencies	Coordination of schedules and appropriate communication will be required with other agencies.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	Facilities are available to accept (and treat if necessary) the excavated contaminated soil. Space for the groundwater treatment plant is required. Finding a suitable location in the

Evaluation Criteria	Detailed Analysis
	residential area may pose some challenges.
Availability of Necessary Equipment and Specialists	Equipment and specialists required for this alternative are readily available.
Availability of Technology	Technologies for each component of this alternative are readily available for full scale implementation with multiple vendors expected to provide competitive bids.
COSTS	
Capital Costs	$9,881,067
O&M Costs (Net Present Worth)	$9,217,196
Periodic Costs (Net Present Worth)	$94,637
Total Cost (Net Present Worth, rounded to nearest $1,000)	$19,193,000

Table 4-9
Detailed Evaluation of GW/SW-3a: Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier

Evaluation Criteria	Detailed Analysis
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	This alternative is protective of human health for a hypothetical resident and future construction worker for groundwater because the existing PRB would be extended further south to fully capture the Cr+6 contaminated groundwater and reduce it to Cr+3 before discharge into Bliss Brook in addition to the source removal and control on the W&L property. GW/SW-3a is also protective of human health for a recreational surface water user due to the protection of Bliss Brook as a part of the alternative.
Ecological Protection	This alternative is protective of ecological risks because it would intercept and treat the hexavalent chromium groundwater plume prior to discharge to Bliss Brook.
COMPLIANCE WITH ARARs	
Chemical-, Location-, and Action-Specific	Under this alternative, chemical-specific, location-specific, and action-specific ARARs would be met. Refer to Tables E-7a through E-7c in Appendix E for a list and evaluation of ARARs and TBCs associated with this alternative.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Residual risk would be low because incremental risks from COCs in groundwater and surface water would be mitigated through institutional controls and would decline over time as a result of the PRB treatment process. There would be no residual risk at the W&L property due to the source removal and in-situ treatment.
Adequacy and Reliability of Controls	Zero valent iron is a material proven to be effective at treating cVOCs and reducing Cr+6 to Cr+3. The timeframe to achieve PRGs under this alternative is uncertain; however, institutional controls would maintain protectiveness until PRGs are met.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Process Used and Materials Treated	All components of the alternative would address the principal shallow groundwater and surface water threats on site with no special or unusual requirements.
Amount Destroyed or Treated	The amount of COCs in the groundwater destroyed or treated will depend on the groundwater flow rate and dose of ZVI installed in the PRB. As ZVI treatment proceeds, natural attenuation should also be occurring. Approximately 4,400 CY of soil will be excavated and disposed off-site and 3,900 CY of

Evaluation Criteria	Detailed Analysis
	blended sand and ZVI material will be installed in the PRB extension. Approximately 8,020 CY of soil on the W&L property (100 CY test pits and 7,920 CY source area) will be excavated and disposed off-site and 9,500 CY of blended sand or soil and ZVI material will be installed in the source area.
Degree of Expected Reductions of TMV through treatment	In the source area, toxicity and volume are expected to be reduced by >95%. Installation of blended sand/ZVI in the source area excavation and barrier wall will inhibit toxicity, volume, and mobility of contaminants >95% by reducing Cr+6 to the less mobile Cr+3 and treating cVOCs. Downgradient of the PRB extension, toxicity, mobility, and volume of contaminants will be inhibited by >95% by reducing Cr+6 to the less mobile Cr+3 until the ZVI amendment is exhausted. These reductions in TMV of the groundwater will lead to improved water quality in Bliss Brook with respect to Cr+6 and other groundwater COCs.
Degree to which Treatment is Irreversible	Treatment by ZVI amended material (reduction of Cr+6 to Cr+3) in the source area and PRB extension is irreversible. TCE is broken down to non-toxic elements and will not reform. Conversion of Cr+6 to the less toxic and less mobile Cr+3 is considered irreversible under conditions observed at this site.
Type and Quantity of Residuals Remaining after Treatment	ZVI will break TCE down to non-toxic elements and compounds [hydrogen, chlorine (concentration too low to pose a risk), and carbon compounds (CO2 for example)]. ZVI will convert Cr+6 to Cr+3. Cr+3 has a low toxicity and will form complexes with iron hydroxides and sulfur naturally present in groundwater and saturated soil. Low levels of COCs will remain in groundwater, ideally at levels below the PRGs.
SHORT-TERM EFFECTIVENESS	
Protection of Community during Remedial Actions	Short-term risks to the community from the remedy would be minor. There would be a temporary increase in dust generated during excavation; however, dust control measures would be taken and air monitoring performed to verify that there are no impacts to the community. There would be a temporary increase in noise and truck traffic during excavation. Flagmen or a police detail would be hired to direct vehicle and pedestrian traffic when trucks are entering and exiting the properties.

Evaluation Criteria	Detailed Analysis
	Temporary measures would be required to prevent access by homeowners and the public to the area on each involved property during remedial activities.
Protection of Workers during Remedial Actions	Construction workers would be required to have appropriate health and safety training in the area of hazardous waste management. Sufficient monitoring and worker protection would be required during remedial activities to mitigate potential risks to human health.
Environmental Impacts	Temporary impacts to the surrounding habitat during excavation would be minor for the source removal and control portion of the alternative. However, implementation of the PRB extension wall would significantly disrupt the ecosystem of Bliss Brook as the brook would need to be rerouted during excavation and installation of the PRB.
Time to Achieve Remedial Action Objectives	RAOs in the stream are expected to be achieved rapidly once the barrier wall under Bliss Brook is installed and institutional controls would effectively prevent exposure to groundwater immediately upon implementation. However, groundwater in upgradient areas will continue to contain Cr+6 at levels above PRGs for groundwater and above levels that would result in surface water PRG exceedances, in the absence of the active components of the remedy, for many years (over 100 years).
	IMPLEMENTABILITY
Ability to Construct and Operate	All components of GW/SW-3a are relatively easy to construct and require minimal operation. Pre-design investigations are needed to determine the doses of ZVI in the source area on the W&L property and the PRB extension wall.
Reliability of the Technology	Excavation and soil blending are proven technologies.
Ease of undertaking Additional Remedial Actions, if needed	Potential additional remedial actions would include expansion of the PRB wall or undertaking other measures to accelerate treatment time, which could be implemented with low difficulty. The addition of more soil amendment may become necessary which could be implemented with relative ease technically.
Ability to Monitor Effectiveness	Effectiveness of the components of this alternative can be monitored very easily through groundwater and surface water sampling (for evaluating the source control, in-situ treatment, and PRB wall).
Ability to Obtain Approvals and Coordinate with Other Agencies	Coordination of schedules and appropriate communication will be required with other agencies.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	Facilities are available to accept (and treat if necessary) the excavated contaminated soil.

Evaluation Criteria	Detailed Analysis
Availability of Necessary Equipment and Specialists	Equipment and specialists required for this alternative are readily available.
Availability of Technology	Technologies for each component of this alternative are readily available for full scale implementation with multiple vendors expected to provide competitive bids.
COSTS	
Capital Costs	$11,085,151
O&M Costs (Net Present Worth)	$4,355,326
Periodic Costs (Net Present Worth)	$94,637
Total Cost (Net Present Worth, rounded to nearest $1,000)	$15,535,000

Table 4-10
Detailed Evaluation of GW/SW-3b: Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier with Mid-Plume Treatment

Evaluation Criteria	Detailed Analysis
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	This alternative is protective of human health for a hypothetical resident and future construction worker for groundwater because the existing PRB would be extended further south to fully capture the Cr+6 contaminated groundwater and reduce it to Cr+3 before discharge into Bliss Brook in addition to the source removal and control on the W&L property. GW/SW-3b is also protective of human health for a recreational surface water user due to the protection of Bliss Brook as a part of the alternative.
Ecological Protection	This alternative is protective of ecological risks because it would intercept and treat the hexavalent chromium groundwater plume prior to discharge to Bliss Brook.
COMPLIANCE WITH ARARs	
Chemical-, Location-, and Action-Specific	Under this alternative, chemical-specific, location-specific, and action-specific ARARs would be met. Refer to Tables E-7a through E-7c in Appendix E for a list and evaluation of ARARs and TBCs associated with this alternative.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Residual risk would be low because incremental risks from COCs in groundwater and surface water would be mitigated through institutional controls and would decline over time as a result of the PRB treatment process. There would be no residual risk at the W&L property due to the source removal and in-situ treatment.
Adequacy and Reliability of Controls	Zero valent iron is a material proven to be effective at treating cVOCs and reducing Cr+6 to Cr+3. The timeframe to achieve PRGs under this alternative is uncertain; however, institutional controls would maintain protectiveness until PRGs are met. This alternative would reduce the timeline to achieve PRGs from GW/SW-3a due to the installation of the mid-plume in-situ treatment line.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Process Used and Materials Treated	All components of the alternative would address the principal shallow groundwater and surface water threats on site with no special or unusual requirements.

Evaluation Criteria	Detailed Analysis
Amount Destroyed or Treated	The amount of COCs in the groundwater destroyed or treated will depend on the groundwater flow rate and dose of ZVI installed in the PRB. As ZVI treatment proceeds, natural attenuation should also be occurring. Approximately 4,400 CY of soil will be excavated and disposed off-site and 3,900 CY of blended sand and ZVI material will be installed in the PRB extension. Approximately 8,020 CY of soil on the W&L property (100 CY test pits and 7,920 CY source area) will be excavated and disposed off-site and 9,500 CY of blended sand or soil and ZVI material will be installed in the source area. An additional 133 CY of blended sand and ZVI would be installed along North Ave in a 200' long mid-plume treatment line. In addition to destruction/treatment of Cr+6 and TCE on the W&L Property and near Bliss Brook, this alternative includes a ZVI barrier wall near North Avenue. This mid-plume treatment line will provide additional destruction of TCE and conversion of Cr+6 to Cr+3.
Degree of Expected Reductions of TMV through treatment	In the source area, toxicity and volume are expected to be reduced by >95%. Installation of blended sand/ZVI in the source area excavation, and mid-plume line will inhibit toxicity, volume, and mobility of contaminants by >95% by reducing Cr+6 to the less mobile Cr+3 and treating cVOCs. Downgradient of the PRB extension, toxicity, mobility, and volume of contaminants will be inhibited by >95% by reducing Cr+6 to the less mobile Cr+3 until the ZVI amendment is exhausted. These reductions in TMV of the groundwater will lead to improved water quality in Bliss Brook with respect to Cr+6 and other groundwater COCs.
Degree to which Treatment is Irreversible	Treatment by ZVI amended material (reduction of Cr+6 to Cr+3) in the source area, mid-plume treatment line, and PRB extension is irreversible. TCE is broken down to non-toxic elements and will not reform. Conversion of Cr+6 to the less toxic and less mobile Cr+3 is considered irreversible under conditions observed at this site.
Type and Quantity of Residuals Remaining after Treatment	ZVI will break TCE down to non-toxic elements and compounds [hydrogen, chlorine (concentration too low to pose a risk), and carbon compounds (CO2 for example)]. ZVI will convert Cr+6 to Cr+3. Cr+3 has a low toxicity and will form complexes with

Evaluation Criteria	Detailed Analysis
	iron hydroxides and sulfur naturally present in groundwater and saturated soil. Low levels of COCs will remain in groundwater, ideally at levels below the PRGs.
SHORT-TERM EFFECTIVENESS	
Protection of Community during Remedial Actions	There would be a temporary increase in dust generated during excavation; however, dust control measures would be taken and air monitoring performed to verify that there are no impacts to the community. There would be a temporary increase in noise and truck traffic during excavation. Flagmen or a police detail would be hired to direct vehicle and pedestrian traffic when trucks are entering and exiting the properties. Temporary measures would be required to prevent access by homeowners and the public to the area on each involved property during remedial activities.
Protection of Workers during Remedial Actions	Construction workers would be required to have appropriate health and safety training in the area of hazardous waste management. Sufficient monitoring and worker protection would be required during remedial activities to mitigate potential risks to human health.
Environmental Impacts	Temporary impacts to the surrounding habitat during excavation would be minor for the source removal and control portion of the alternative. However, implementation of the PRB extension wall would significantly disrupt the ecosystem of Bliss Brook as the brook would need to be rerouted during excavation and installation of the PRB.
Time to Achieve Remedial Action Objectives	RAOs in the stream are expected to be achieved rapidly once the barrier wall under Bliss Brook is installed and institutional controls would effectively prevent exposure to groundwater immediately upon implementation. However, groundwater in upgradient areas will continue to contain Cr+6 at levels above PRGs for groundwater and above levels that would result in surface water PRG exceedances, in the absence of the active components of the remedy, for many years (over 100 years). Modeling efforts have shown that the addition of the mid-plume treatment line will reduce time to achieve RAOs by 45%.
IMPLEMENTABILITY	
Ability to Construct and Operate	All components of GW/SW-3b are relatively easy to construct and require minimal operation. Pre-design investigations are needed to determine the doses of ZVI in the source area and mid-plume line on the W&L property and the PRB extension wall.

Evaluation Criteria	Detailed Analysis
Reliability of the Technology	Excavation and soil blending are proven technologies. Installation of ZVI using a conventional or sonic drill rig for the mid-plume barrier employs commonly used technology, although not commonly used for this purpose. A pilot study is recommended to determine the best method of drilling and the best method of applying the treatment reagents.
Ease of undertaking Additional Remedial Actions, if needed	Potential additional remedial actions would include expansion of the PRB wall or undertaking other measures to accelerate treatment time, which could be implemented with low difficulty. The addition of more soil amendment may become necessary which could be implemented with relative ease technically. The borings in the mid-plume line would be constructed to allow potential future use to inject reagents.
Ability to Monitor Effectiveness	Effectiveness of the components of this alternative can be monitored very easily through groundwater and surface water sampling (for evaluating the source control, in-situ treatment, mid-plume treatment line, and PRB wall).
Ability to Obtain Approvals and Coordinate with Other Agencies	Coordination of schedules and appropriate communication will be required with other agencies.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	Facilities are available to accept (and treat if necessary) the excavated contaminated soil.
Availability of Necessary Equipment and Specialists	Equipment and specialists required for this alternative are readily available.
Availability of Technology	Technologies for each component of this alternative are readily available for full scale implementation with multiple vendors expected to provide competitive bids.
COSTS	
Capital Costs	$11,991,192
O&M Costs (Net Present Worth)	$4,355,326
Periodic Costs (Net Present Worth)	$94,637
Total Cost (Net Present Worth, rounded to nearest $1,000)	$16,441,000

Table 4-11
Detailed Evaluation of BR-1: No Action

Evaluation Criteria	Detailed Analysis
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	This alternative would not provide any protection of human health from groundwater risks identified for the site.
Ecological Protection	No specific ecological risks were identified for groundwater at the site.
COMPLIANCE WITH ARARs	
Chemical-, Location-, and Action-Specific	Under current conditions, chemical-specific ARARs and TBCs have not been met. Therefore, this alternative would not meet ARARs. Refer to Table E-8 in Appendix E for a list and evaluation of ARARs and TBCs associated with this alternative.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Since this alternative includes no controls to reduce potential direct contact with contaminated bedrock groundwater, the residual risk would be the same as that identified in the RI report.
Adequacy and Reliability of Controls	This alternative does not include any controls to reduce potential future exposures to bedrock groundwater.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Process Used and Materials Treated	No treatment would be performed under this alternative.
Amount Destroyed or Treated	No treatment would be performed under this alternative.
Degree of Expected Reductions of TMV through treatment	No treatment would be performed under this alternative.
Degree to which Treatment is Irreversible	No treatment would be performed under this alternative.
Type and Quantity of Residuals Remaining after Treatment	No treatment would be performed under this alternative.
SHORT-TERM EFFECTIVENESS	
Protection of Community during Remedial Actions	Since this alternative involves no construction or monitoring measures, there would be no additional short-term risks to the community from the remedy.
Protection of Workers during Remedial Actions	Since this alternative involves no construction or monitoring measures, there would be no additional short-term risks to workers from the remedy.
Environmental Impacts	Since this alternative involves no construction or monitoring measures, there would be no additional short-term environmental impacts associated with the remedy.
Time to Achieve Remedial Action Objectives	This alternative does not meet RAOs.
IMPLEMENTABILITY	
Ability to Construct and Operate	No construction or operation would be performed under this alternative.

Evaluation Criteria	Detailed Analysis
Reliability of the Technology	No technologies would be implemented under this alternative.
Ease of undertaking Additional Remedial Actions, if needed	If further action is deemed necessary in the future, this alternative would allow for additional remedial actions to occur.
Ability to Monitor Effectiveness	No monitoring would be conducted under this alternative. Therefore, the effectiveness would not be evaluated.
Ability to Obtain Approvals and Coordinate with Other Agencies	No approvals would likely be needed for this alternative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, or disposal services would be needed under this alternative.
Availability of Necessary Equipment and Specialists	No equipment or specialists would be needed under this alternative.
Availability of Technology	No technologies would be needed for this alternative.
COSTS	
Total Cost	$0

Table 4-12
Detailed Evaluation of BR-2: Institutional Controls

Evaluation Criteria	Detailed Analysis
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	This alternative is protective of human health through the implementation of institutional controls to prevent future non-potable (irrigation) use of Site groundwater, and if needed, to prevent installation of drinking water wells in potentially impacted areas of the Bungay River Resource Protection District.
Ecological Protection	No specific ecological risks were identified for groundwater at the site.
COMPLIANCE WITH ARARs	
Chemical-, Location-, and Action-Specific	Under this alternative, chemical-specific ARARs and TBCs would be met. Therefore, this alternative would meet ARARs. Refer to Table E-9a through E-9c in Appendix E for a list and evaluation of ARARs and TBCs associated with this alternative.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	As part of this alternative, institutional controls would be implemented to prevent future use of bedrock groundwater, and thus prevent exposure to COCs in bedrock groundwater. However, contamination will still be present. It is anticipated that there will be some degree of natural attenuation, as well as benefit from remedial actions for other areas of concern (soil, source areas, and overburden groundwater), which will reduce COC concentrations over time and prevent potential plume migration to the Bungay River Resource Protection District, thereby reducing residual risk.
Adequacy and Reliability of Controls	The adequacy of this alternative would be confirmed during the five-year reviews. Institutional controls are reliable if properly enforced.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Process Used and Materials Treated	No treatment would be performed under this alternative.
Amount Destroyed or Treated	No treatment would be performed under this alternative.
Degree of Expected Reductions of TMV through treatment	No treatment would be performed under this alternative.
Degree to which Treatment is Irreversible	No treatment would be performed under this alternative.
Type and Quantity of Residuals Remaining after Treatment	No treatment would be performed under this alternative.

Evaluation Criteria	Detailed Analysis
SHORT-TERM EFFECTIVENESS	
Protection of Community during Remedial Actions	Under this alternative, on-site activities would be limited to well installation, and pre-design and long-term sampling. Short-term risks to the community from the remedy would be minor.
Protection of Workers during Remedial Actions	Short-term worker risks associated with well installation, pre-design and long-term sampling would be mitigated through the use of proper PPE and adherence to a health and safety program.
Environmental Impacts	Short-term impacts to habitat would be minor since on-site activities would be limited to installation of monitoring wells and to pre-design and long-term sampling. Any impacts would be mitigated to the maximum extent practicable.
Time to Achieve Remedial Action Objectives	Institutional controls would effectively prevent exposure to bedrock groundwater immediately upon implementation. Natural attenuation is expected to reduce COC concentrations in bedrock groundwater over time to prevent potential plume migration into the Bungay River Resource Protection District and to reduce site-wide bedrock groundwater concentrations to below non-drinking water (irrigation well) PRGs. If bedrock groundwater within the District is determined to be impacted above drinking water PRGs, natural attenuation would also work to reduce COC concentrations within the impacted area.
IMPLEMENTABILITY	
Ability to Construct and Operate	Monitoring wells are easily constructed and maintained.
Reliability of the Technology	Well installation uses proven, reliable technology.
Ease of undertaking Additional Remedial Actions, if needed	If further action is deemed necessary in the future, this alternative would allow for additional remedial actions to occur.
Ability to Monitor Effectiveness	Effectiveness of this alternative can be easily monitored.
Ability to Obtain Approvals and Coordinate with Other Agencies	Approval for well installation would be required from property owners. Specific well locations are to be determined and may depend on where access is provided. Implementation of institutional controls would require coordination with local and state agencies.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, or disposal services would be needed under this alternative.
Availability of Necessary Equipment and Specialists	Equipment and specialists for this alternative are readily available.
Availability of Technology	No technologies other than well drilling would be needed for this alternative.

Evaluation Criteria	Detailed Analysis
COSTS	
Capital Costs	$962,529
O&M Costs (Net Present Worth)	$3,350,251
Periodic Costs (Net Present Worth)	$66,719
Total Cost (Net Present Worth, rounded to nearest $1,000)	$4,379,000

Table 4-13
Detailed Evaluation of BR-3: Institutional Controls and Contingency Remedy of Focused In-Situ Injections (West of North Avenue)

Evaluation Criteria	Detailed Analysis
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	This alternative is protective of human health through the implementation of institutional controls to prevent future non-potable (irrigation) use of Site groundwater, and if needed, to prevent installation of drinking water wells in potentially impacted areas of the Bungay River Resource Protection District. Natural attenuation would also continue to occur downgradient of the source area, reducing COC concentrations over time. If bedrock groundwater underlying the District is determined to be impacted, contingency measures (in-situ treatment of bedrock groundwater along North Ave and expansion of the monitoring program area to include impacted portion of the District) would further work to reduce COC concentrations over time.
Ecological Protection	No specific ecological risks were identified for groundwater at the site.
COMPLIANCE WITH ARARs	
Chemical-, Location-, and Action-Specific	Under this alternative, chemical-specific, location-specific, and action-specific ARARs would be met. Therefore, this alternative would meet ARARs. Refer to Tables E-10a through E-10c in Appendix E for a list and evaluation of ARARs and TBCs associated with this alternative.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	As part of this alternative, institutional controls would be implemented to prevent future use of bedrock groundwater, and thus prevent exposure to COCs in bedrock groundwater. Natural attenuation and remedial actions for other areas of concern are expected to reduce COC concentrations over time to prevent potential plume migration to the Bungay River Resource Protection District, thereby reducing residual risk. Residual risk would be further reduced by focused in-situ treatment if contingency measures are implemented due to bedrock groundwater impacts within the District.
Adequacy and Reliability of Controls	The timeframe to achieve PRGs under this alternative is uncertain; however, institutional controls would maintain protectiveness until PRGs are met. Institutional controls are reliable if properly enforced.

Evaluation Criteria	Detailed Analysis
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Process Used and Materials Treated	All components of the alternative would address the principal bedrock groundwater threats on site with no special or unusual requirements.
Amount Destroyed or Treated	If the contingency portion of this alternative is performed, 10,000 gallons of ZVI would be injected into bedrock along North Ave in a 200' long mid-plume treatment line.
Degree of Expected Reductions of TMV through treatment	If the contingency portion of this alternative is performed, ZVI injection will inhibit toxicity, volume, and mobility of contaminants upgradient of the treatment area by >95% by reducing Cr+6 to the less mobile Cr+3 and treating cVOCs.
Degree to which Treatment is Irreversible	Treatment of TCE by ZVI is irreversible. TCE is broken down to non-toxic elements and will not reform. Conversion of Cr+6 to the less toxic and less mobile Cr+3 is considered irreversible under conditions observed at this site.
Type and Quantity of Residuals Remaining after Treatment	If in-situ treatment is conducted, ZVI will break TCE down to non-toxic elements and compounds [hydrogen, chlorine (concentration too low to pose a risk), and carbon compounds (CO2 for example)]. ZVI will convert Cr+6 to Cr+3. Cr+3 has a low toxicity and will form complexes with iron hydroxides and sulfur naturally present in groundwater.
SHORT-TERM EFFECTIVENESS	
Protection of Community during Remedial Actions	Temporary measures would be required to prevent access by homeowners and the public to the area on each involved property during remedial activities.
Protection of Workers during Remedial Actions	Construction workers would be required to have appropriate health and safety training in the area of hazardous waste management. Sufficient monitoring and worker protection would be required during remedial activities to mitigate potential risks to human health.
Environmental Impacts	Temporary impacts to the surrounding habitat during remedial activities would be minor. Erosion control and silt fencing would be installed adjacent to the wetland.
Time to Achieve Remedial Action Objectives	Institutional controls would effectively prevent exposure to bedrock groundwater immediately upon implementation. Natural attenuation is expected to reduce COC concentrations in bedrock groundwater over time to prevent potential plume migration into the Bungay River Resource Protection District and to reduce site-wide bedrock groundwater concentrations to below non-drinking water (irrigation well) PRGs. If bedrock groundwater within the District is determined to be impacted above drinking water PRGs, natural attenuation and in-situ injections would also work to reduce COC concentrations within

Evaluation Criteria	Detailed Analysis
	the impacted area over time.
IMPLEMENTABILITY	
Ability to Construct and Operate	If the in-situ treatment contingency is determined to be needed, a pre-design investigation would be needed to determine the type, dose, depth of injection, and injection rate of ZVI solution into the bedrock.
Reliability of the Technology	Institutional controls are reliable with proper enforcement. ZVI is a proven technology for reduction of Cr+6 to Cr+3.
Ease of undertaking Additional Remedial Actions, if needed	If further action is deemed necessary in the future, this alternative would allow for additional remedial actions to occur.
Ability to Monitor Effectiveness	Effectiveness of the components of this alternative can be monitored very easily, through sampling. Five-year reviews would be conducted to monitor effectiveness.
Ability to Obtain Approvals and Coordinate with Other Agencies	Implementation of institutional controls would require coordination with local agencies and the MassDEP. Coordination of schedules and appropriate communication will be required with other agencies.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	Facilities are available to accept (and treat if necessary) the IDW generated during well installation and sampling activities.
Availability of Necessary Equipment and Specialists	Equipment and specialists required for this alternative are readily available.
Availability of Technology	Technologies required for this alternative are readily available for full scale implementation with multiple vendors expected to provide competitive bids.
INITIAL COSTS	
Capital Costs	$962,529
O&M Costs (Net Present Worth)	$3,350,251
Periodic Costs (Net Present Worth)	$66,719
Total Initial Cost (Net Present Worth, rounded to nearest $1,000)	$4,379,000
CONTINGENCY COSTS	
Capital Costs	$607,829
O&M Costs (Net Present Worth)	$0
Periodic Costs (Net Present Worth)	$319,196
Total Contingency Cost (Net Present Worth, rounded to nearest $1,000)	$927,000

Table 4-14
Detailed Evaluation of BR-4: Institutional Controls and Contingency Remedy of Pump and Treat

Evaluation Criteria	Detailed Analysis
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	This alternative is protective of human health through the implementation of institutional controls to prevent future non-potable (irrigation) use of Site groundwater and if needed, to prevent installation of drinking water wells in potentially impacted areas of the Bungay River Resource Protection District. If bedrock groundwater underlying the District is determined to be impacted and the contingency measures are implemented, the full extent of impacted bedrock groundwater would be contained by the pump and treat extraction wells and it is assumed that natural attenuation would then occur downgradient.
Ecological Protection	No specific ecological risks were identified for groundwater at the site.
COMPLIANCE WITH ARARs	
Chemical-, Location-, and Action-Specific	Under this alternative, chemical-specific, location-specific, and action-specific ARARs would be met. Therefore, this alternative would meet ARARs. Refer to Tables E-11a through E-11c in Appendix E for a list and evaluation of ARARs and TBCs associated with this alternative.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Residual risk is expected to be reduced over time through natural attenuation and remedial actions for other areas of concern, which are expected to reduce COC concentrations over time. Residual risk would be further reduced if the bedrock groundwater pump and treat contingency measures were implemented due to bedrock groundwater impacts within the Bungay River Resource Protection District. Institutional controls would be implemented to prevent future use of bedrock groundwater, and thus prevent exposure to COCs.
Adequacy and Reliability of Controls	The timeframe to achieve PRGs under this alternative is uncertain; however, institutional controls would maintain protectiveness until PRGs are met.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Process Used and Materials Treated	All components of the alternative would address the principal groundwater threats on site with no special or unusual requirements.
Amount Destroyed or Treated	If the contingency portion of this alternative is performed, the

Evaluation Criteria	Detailed Analysis
	amount of COCs in the groundwater destroyed or treated will depend on the final extraction rates and ability to flush out COCs from the groundwater and soil matrices. As pump and treat proceeds, natural attenuation should also be occurring.
Degree of Expected Reductions of TMV through treatment	If the contingency portion of this alternative is performed, pump and treat will contain impacted groundwater by means of extraction wells, thereby reducing the mobility. Upon completion of treatment, impacted groundwater will have been reduced in toxicity and volume by >95%.
Degree to which Treatment is Irreversible	If the contingency portion of this alternative is performed, the COCs removed by extraction are permanently removed and the ex-situ treatment is irreversible. However, "rebound" is a common problem for pump and treat systems where the extraction wells are turned off and over time in-situ groundwater concentrations return to pre-pumping levels. Rebound is due to desorption of COCs from untreated areas and not true reversal of treatment.
Type and Quantity of Residuals Remaining after Treatment	If the contingency portion of this alternative is performed, low levels of COCs will remain in groundwater, ideally at levels below the PRGs. Above ground treatment will generate spent activated carbon, spent ion exchange resin, and used bag filters. These wastes would be generated on the order of thousands of pounds per year but can be regenerated and reused or treated and disposed readily.
SHORT-TERM EFFECTIVENESS	
Protection of Community during Remedial Actions	Temporary measures would be required to prevent access by homeowners and the public to the area on each involved property during remedial activities.
Protection of Workers during Remedial Actions	Construction workers would be required to have appropriate health and safety training in the area of hazardous waste management. Sufficient monitoring and worker protection would be required during remedial activities to mitigate potential risks to human health.
Environmental Impacts	Temporary impacts to the surrounding habitat during remedial activities would be minor. Erosion control and silt fencing would be installed adjacent to the wetland.
Time to Achieve Remedial Action Objectives	Institutional controls would effectively prevent exposure to bedrock groundwater immediately upon implementation. Natural attenuation is expected to reduce COC concentrations in bedrock groundwater over time to prevent potential plume migration into the Bungay River Resource Protection District and to reduce site-wide bedrock groundwater concentrations to below non-drinking water (irrigation well) PRGs. If bedrock groundwater within the District is determined to be impacted

Evaluation Criteria	Detailed Analysis
	above drinking water PRGs, natural attenuation and bedrock groundwater pump and treat would also work to reduce COC concentrations within the impacted area over time.
IMPLEMENTABILITY	
Ability to Construct and Operate	If the bedrock groundwater pump and treat contingency is determined to be needed, expected difficulties include determining a suitable location for the treatment plant and obtaining access for extraction well sites and transfer lines. Pre-design investigations are needed to determine the extraction well yields and finalize the treatment processes to be applied.
Reliability of the Technology	Pump and treat is a reliable technology and institutional controls are reliable with proper enforcement.
Ease of undertaking Additional Remedial Actions, if needed	Potential additional remedial actions would include expansion of the extraction system or undertaking other measures to accelerate treatment time, which could be implemented with low difficulty.
Ability to Monitor Effectiveness	Effectiveness of the components of this alternative can be monitored very easily, through sampling (for natural attenuation and for evaluating the treatment system operations if needed), and water level measurements (for monitoring the hydraulic containment if needed for the contingency treatment component).
Ability to Obtain Approvals and Coordinate with Other Agencies	Implementation of institutional controls would require coordination with local agencies and the MassDEP. Coordination of schedules and appropriate communication will be required with other agencies.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	Facilities are available to accept (and treat if necessary) any excavated contaminated soil. If the contingency treatment component is needed, space for the groundwater treatment plant is required. Finding a suitable location in the residential area may pose some challenges.
Availability of Necessary Equipment and Specialists	Equipment and specialists required for this alternative are readily available.
Availability of Technology	Technologies required for this alternative are readily available for full scale implementation with multiple vendors expected to provide competitive bids.
INITIAL COSTS	
Capital Costs	$962,529
O&M Costs (Net Present Worth)	$3,350,251
Periodic Costs (Net Present Worth)	$66,719
Total Initial Cost (Net Present Worth, rounded to nearest $1,000)	$4,379,000

Evaluation Criteria	Detailed Analysis
CONTINGENCY COSTS	
Capital Costs	$568,927
O&M Costs (Net Present Worth)	$2,627,762
Periodic Costs (Net Present Worth)	$0
Total Contingency Cost (Net Present Worth, rounded to nearest $1,000)	$3,197,000

Table 4-15
Detailed Evaluation of BR-5: Institutional Controls and Contingency Remedy of Enhanced (Deeper) Permeable Reactive Barrier

Evaluation Criteria	Detailed Analysis
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	This alternative is protective of human health through the implementation of institutional controls to prevent future non-potable (irrigation) use of Site groundwater and if needed, to prevent installation of drinking water wells in potentially impacted areas of the Bungay River Resource Protection District. If bedrock groundwater underlying the District is determined to be impacted and the contingency measures are implemented, the bedrock plume would be treated by the injection of ZVI along Bliss Brook, reducing Cr+6 to Cr+3 And it is assumed that natural attenuation would then occur downgradient, reducing COC concentrations over time.
Ecological Protection	No specific ecological risks were identified for groundwater at the site.
COMPLIANCE WITH ARARs	
Chemical-, Location-, and Action-Specific	Under this alternative, chemical-specific, location-specific, and action-specific ARARs would be met. Therefore, this alternative would meet ARARs. Refer to Tables E-12a through E-12c in Appendix E for a list and evaluation of ARARs and TBCs associated with this alternative.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Residual risk is expected to be reduced over time through natural attenuation and remedial actions for other areas of concern, which are expected to reduce COC concentrations over time. Residual risk would be further reduced if the ZVI injections along Bliss Brook are implemented as a contingency measure due to bedrock groundwater impacts within the Bungay River Resource Protection District. Institutional controls would be implemented to prevent future use of bedrock groundwater, and thus prevent exposure to COCs in the bedrock groundwater.
Adequacy and Reliability of Controls	The timeframe to achieve PRGs under this alternative is uncertain; however, institutional controls would maintain protectiveness until PRGs are met. Institutional controls are reliable if properly enforced.

Evaluation Criteria	Detailed Analysis
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Process Used and Materials Treated	All components of the alternative would address the principal bedrock groundwater threats on site with no special or unusual requirements.
Amount Destroyed or Treated	If the contingency portion of this alternative is performed, 10,000 gallons of ZVI would be injected into bedrock along Bliss Brook in a 300' long treatment line.
Degree of Expected Reductions of TMV through treatment	If the contingency portion of this alternative is performed, ZVI injection will inhibit toxicity, volume, and mobility of contaminants by >95% by reducing Cr+6 to the less mobile Cr+3 and treating cVOCs.
Degree to which Treatment is Irreversible	Treatment of TCE by ZVI is irreversible. TCE is broken down to non-toxic elements and will not reform. Conversion of Cr+6 to the less toxic and less mobile Cr+3 is considered irreversible under conditions observed at this site.
Type and Quantity of Residuals Remaining after Treatment	If in-situ treatment is conducted, ZVI will break TCE down to non-toxic elements and compounds (hydrogen, chlorine (concentration too low to pose a risk), and carbon compounds CO2 for example). ZVI will convert Cr+6 to Cr+3. Cr+3 has a low toxicity and will form complexes with iron hydroxides and sulfur naturally present in groundwater.
SHORT-TERM EFFECTIVENESS	
Protection of Community during Remedial Actions	Temporary measures would be required to prevent access by homeowners and the public to the area on each involved property during remedial activities.
Protection of Workers during Remedial Actions	Construction workers would be required to have appropriate health and safety training in the area of hazardous waste management. Sufficient monitoring and worker protection would be required during remedial activities to mitigate potential risks to human health.
Environmental Impacts	Temporary impacts to the surrounding habitat during remedial activities would be minor. Erosion control and silt fencing would be installed adjacent to the wetland.
Time to Achieve Remedial Action Objectives	Institutional controls would effectively prevent exposure to bedrock groundwater immediately upon implementation. Natural attenuation is expected to reduce COC concentrations in bedrock groundwater over time to prevent potential plume migration into the Bungay River Resource Protection District and to reduce site-wide bedrock groundwater concentrations to below non-drinking water (irrigation well) PRGs. If bedrock groundwater within the District is determined to be impacted above drinking water PRGs, natural attenuation and the enhanced (deeper) PRB would also work to reduce COC

Evaluation Criteria	Detailed Analysis
	concentrations within the impacted area over time.
IMPLEMENTABILITY	
Ability to Construct and Operate	If the enhanced (deeper) PRB contingency is determined to be needed, a pre-design investigation would be needed to determine the type, dose, depth of injection, and injection rate of ZVI solution into the bedrock.
Reliability of the Technology	Institutional controls are reliable with proper enforcement. ZVI is a proven technology for reduction of Cr+6 to Cr+3.
Ease of undertaking Additional Remedial Actions, if needed	If further action is deemed necessary in the future, this alternative would allow for additional remedial actions to occur.
Ability to Monitor Effectiveness	Effectiveness of the components of this alternative can be monitored very easily, through sampling. Five-year reviews would be conducted to monitor effectiveness.
Ability to Obtain Approvals and Coordinate with Other Agencies	Implementation of institutional controls would require coordination with local agencies and MassDEP. Coordination of schedules and appropriate communication will be required with other agencies.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	Facilities are available to accept (and treat if necessary) the IDW generated during well installation and sampling activities.
Availability of Necessary Equipment and Specialists	Equipment and specialists required for this alternative are readily available.
Availability of Technology	Technologies required for this alternative are readily available for full scale implementation with multiple vendors expected to provide competitive bids.
INITIAL COSTS	
Capital Costs	$962,529
O&M Costs (Net Present Worth)	$3,350,251
Periodic Costs (Net Present Worth)	$66,719
Total Initial Cost (Net Present Worth, rounded to nearest $1,000)	$4,379,000
CONTINGENCY COSTS	
Capital Costs	$699,679
O&M Costs (Net Present Worth)	$0
Periodic Costs (Net Present Worth)	$319,196
Total Contingency Cost (Net Present Worth, rounded to nearest $1,000)	$1,019,000

Table 5-1
Comparative Analyses of Remedial Alternatives

ALTERNATIVES BY MEDIUM	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effectiveness	Implementability	COSTS[1]			
							Capital Cost	Periodic Cost	Annual O&M Cost	Total (Net Present Value)
SOIL										
Alternative S-1: No Action	□	□	♦	N/A	♦♦♦	♦♦♦	$0	$0	$0	$0
Alternative S-2: Institutional Controls on W&L Property	■	■	♦♦	N/A	♦♦♦	♦♦	$66,000	$74,000	$0	$132,000
SOIL IN RESIDENTIAL YARDS										
Alternative SL-1: No Action	□	□	♦	N/A	♦♦♦	♦♦♦	$0	$0	$0	$0
Alternative SL-3: Soil Excavation on Residential Properties with Off-Site Disposal	■	■	♦♦♦	♦♦♦	♦♦	♦♦	$422,000	$0	$0	$422,000
GROUNDWATER AND SURFACE WATER										
Alternative GW/SW-1: No Action	□	□	♦	N/A	♦♦♦	♦♦♦	$0	$0	$0	$0
Alternative GW/SW-2a: Source Area Source Removal with In-Situ Soil Treatment and Groundwater Pump and Treat	■	■	♦♦	♦♦♦	♦♦	♦♦	$9,168,000	$103,000	$342,000	$18,479,000
Alternative GW/SW-2b: Source Area Source Removal with In-Situ Soil Treatment and Groundwater Pump and Treat with Mid-Plume Treatment	■	■	♦♦	♦♦♦	♦♦	♦♦	$9,881,000	$103,000	$342,000	$19,193,000
Alternative GW/SW-3a: Source Area Source Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier	■	■	♦♦♦	♦♦♦	♦♦	♦♦	$11,085,000	$103,000	$161,000	$15,535,000
Alternative GW/SW-3b: Source Area Source Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier with Mid-Plume Treatment	■	■	♦♦♦	♦♦♦	♦♦	♦♦	$11,991,000	$103,000	$161,000	$16,441,000
BEDROCK										
Alternative BR-1: No Action	□	□	♦	N/A	♦♦♦	♦♦♦	$0	$0	$0	$0
Alternative BR-2: Institutional Controls	■	■	♦♦	♦	♦♦♦	♦♦♦	$963,000	$74,000	$124,000	$4,379,000
Alternative BR-3: Institutional Controls (with Contingency for Focused In-Situ Injections West of North Avenue)[2]	■	■	♦♦	♦♦♦	♦♦	♦	$963,000	$74,000	$124,000	$4,379,000
							$608,000	$360,000	$0	$927,000
Alternative BR-4: Institutional Controls (with Contingency for Pump and Treat)[2]	■	■	♦♦	♦♦♦	♦♦	♦♦	$963,000	$74,000	$124,000	$4,379,000
							$569,000	$0	$97,000	$3,197,000
Alternative BR-5: Institutional Controls (with Contingency for Enhanced [Deeper] Permeable Reactive Barrier)[2]	■	■	♦♦	♦♦♦	♦♦	♦	$963,000	$74,000	$124,000	$4,379,000
							$700,000	$360,000	$0	$1,019,000

Notes:

□ Fails
■ Passes

♦ Lowest (least favorable)
♦♦ Medium
♦♦♦ Highest (most favorable)

[1] rounded to the nearest $1,000. Periodic cost presented is total, not Net Present Value (NPV). Annual O&M cost presented is total O&M cost for one year, not NPV. Total (NPV) cost presented is the sum of capital cost, NPV of periodic cost for 30 years, and NPV of annual O&M cost for 30 years. See Appendix D for details.

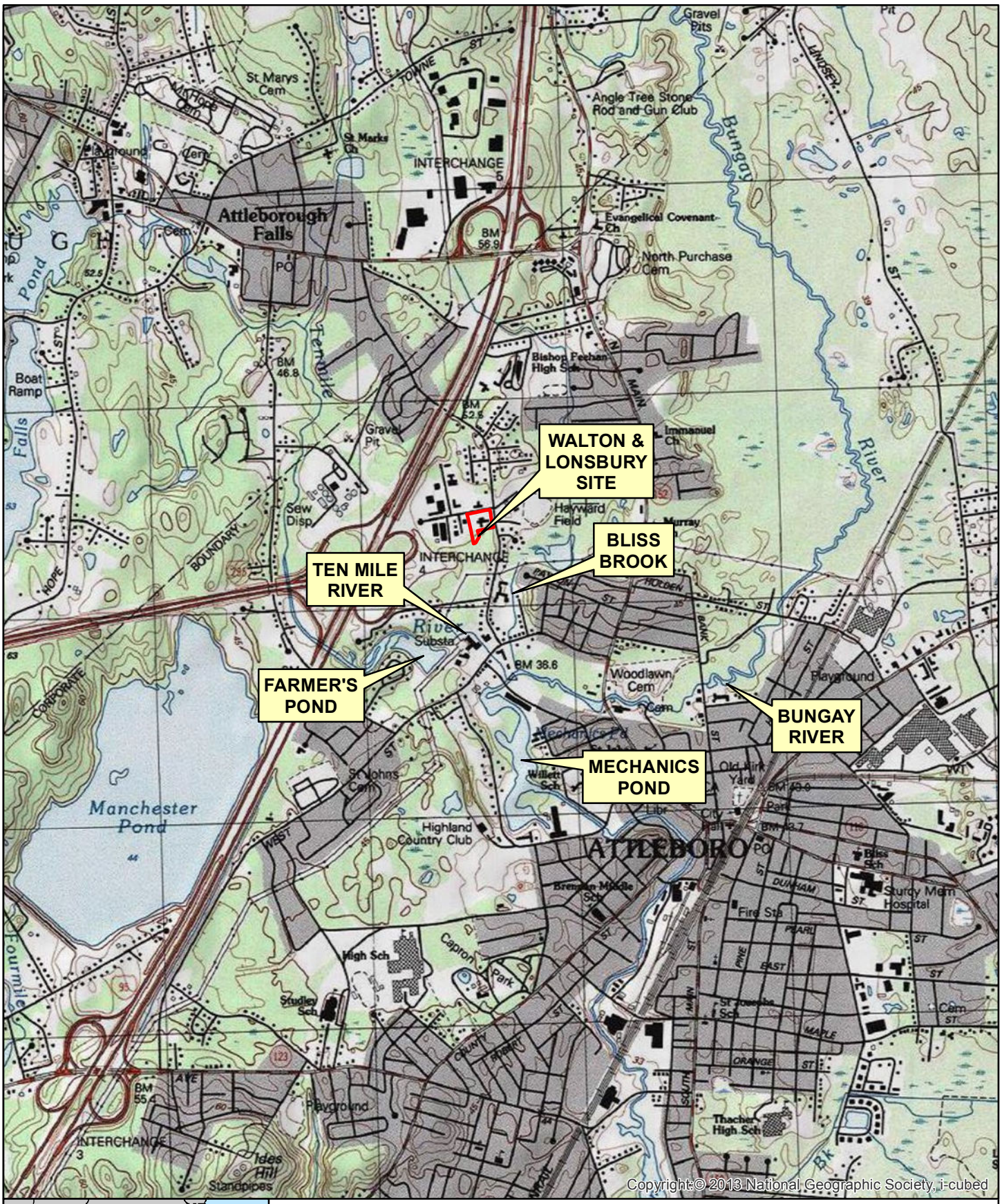
[2] costs for the initial and contingency portions of Alternatives BR-3, BR-4, and BR-5 are presented separately.

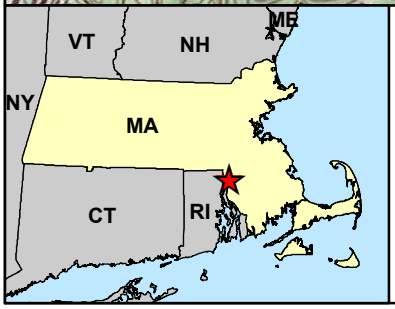
Table 5-2
Cost Comparative Analysis of Remedial Alternatives

ALTERNATIVES BY MEDIUM	COSTS[1]					
	Capital Cost			Periodic Cost	Annual O&M Cost	Total (Net Present Value)
	Pre-Design Investigation[2]	Remedial Design[3]	Total Capital Cost			
SOIL						
Alternative S-1: No Action	$0	$0	$0	$0	$0	$0
Alternative S-2: Institutional Controls on W&L Property	$0	$0	$66,000	$74,000	$0	$132,000
SOIL IN RESIDENTIAL YARDS						
Alternative SL-1: No Action	$0	$0	$0	$0	$0	$0
Alternative SL-3: Soil Excavation on Residential Properties with Off-Site Disposal	$64,000	$48,000	$422,000	$0	$0	$422,000
GROUNDWATER AND SURFACE WATER						
Alternative GW/SW-1: No Action	$0	$0	$0	$0	$0	$0
Alternative GW/SW-2a: Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat	$183,000	$608,000	$9,168,000	$103,000	$342,000	$18,479,000
Alternative GW/SW-2b: Source Area Soil Removal with In-Situ Soil Treatment and Groundwater Pump and Treat with Mid-Plume Treatment	$183,000	$655,000	$9,881,000	$103,000	$342,000	$19,193,000
Alternative GW/SW-3a: Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier	$158,000	$736,000	$11,085,000	$103,000	$161,000	$15,535,000
Alternative GW/SW-3b: Source Area Soil Removal with In-Situ Soil Treatment and Extension of Permeable Reactive Barrier with Mid-Plume Treatment	$158,000	$797,000	$11,991,000	$103,000	$161,000	$16,441,000
BEDROCK						
Alternative BR-1: No Action	$0	$0	$0	$0	$0	$0
Alternatives BR-2, BR-3, BR-4, BR-5: Institutional Controls	$692,000	$64,000	$963,000	$74,000	$124,000	$4,379,000
Alternative BR-3 Contingency: Focused In-Situ Injections West of North Avenue	$100,000	$38,000	$608,000	$360,000	$0	$927,000
Alternative BR-4 Contingency: Pump and Treat	$50,000	$35,000	$569,000	$0	$97,000	$3,197,000
Alternative BR-5 Contingency: Enhanced (Deeper) Permeable Reactive Barrier	$100,000	$44,000	$700,000	$360,000	$0	$1,019,000

[1] rounded to the nearest $1,000
[2] includes pre-design investigative sampling, pilot tests, bench tests, and/or pump tests
[3] RD calculated as a percentage of total capital cost; see Appendix D for details

Figures





1:25,000

0 1,250 2,500 Feet

AECOM

FIGURE 1-1.

SITE LOCUS MAP

G:\Projects\HAZWASTE\60308115\WALI\Maps\RI\Fig1-1_SiteLocus.mxd

WALTON STREET

NORTH AVENUE

Grinder Exhaust Area

Vertical Tank

Shed

Stack

Former Plating Room

Outside Drum Storage Pad

Surface Impoundment Area and Lagoon

Fuel Oil UST Area

Former Outside TCE Tank

Stack

Abandoned Dry Well

Historic Wastewater Discharge Line

FIGURE 1-2.

HISTORIC SITE FEATURES (FROM RCA, 1989)

Legend

- Property
- Former Building Footprint
- Leased Portion of Property
- Limit of Closed Lagoon Area

NOTE: All locations approximate; not all were actually found during EPA or earlier investigations.

AECOM

0 20 40 80 Feet

G:\Projects\HAZWASTE\60308115WAL\Maps\FS\Fig1-2_SiteFeatures.mxd

89_12
89_11
89_10
89_9
89_8
89_7
89_6A
89_6_A01
89_6_I
89_5
89_4
89_3
89_2
89_2_A
89_2_C
89_2D
89_1
89_6F
89_6_H
89_6G
59_233
59_233_A
50_4
50_5
59_236
59_237
59_238
59_239
PAULETTE LANE
59_245
59_234
59_240
59_242
59_241
59_243
59_244
59_190_A
59_190
59_228
59_227
59_225
59_142
59_135
59_136
59_137
59_137A
59_139A
59_140
59_141
59_138
59_139
59_142_B
59_142_C
59_220
DEANVILLE ROAD
NORTH AVENUE
49_112
49_111
49_110
49_109
49_108
49_107
49_106
49_105
49_104
49_103
49_102_A
49_102
49_101A
49_101
49_100
49_99
49_98A
49_98
49_97
49_97_A
49_96
49_95
49_94
49_94_A
49_93
49_93_A
49_92
49_91
49_61
49_60
49_58
49_58_A
49_56
49_157_D
49_158
49_157_C
49_157E
49_1_B
49_1A
49_1
49_1F
49_1E
49_1_D
49_1_C
49_2A
49_2
49_157_B
49_157F
49_157A
49_157
49_155
49_15_A
PAYSON STREET
50_4_J
50_41
50_40
50_38
50_39
50_37
50_35
49_3
49_4
49_6
49_7
BLISS BROOK
49_113
49_114
49_114A
49_114_B
49_115
49_115A
49_116
49_117_A
49_117
49_118
49_118_A
49_119
51_6_A
51_6_B
51_6
51_7_B
51_7_A
51_7
FARMERS POND
TEN MILE RIVER
BUNGAY RIVER
MECHANICS POND
WEST STREET
MILK STREET
WATER STREET
ELIZABETH STREET
STATE STREET
JOHN STREET
WATSON AVENUE
RIVERBANK ROAD
SD-11
SD-12
SD-13
SD-14
DETAIL - SOUTHERN PORTION OF MECHANICS POND
SEE DETAIL FOR SOUTHERN PORTION OF MECHANICS POND

FIGURE 1-3.

SITE FEATURES AND LIMITS OF REMOVAL ACTION

Legend

- Drainage Pipe Trunk Line
- Groundwater Collection Pipe
- PRB Trench
- Fence Installed by Removal Program
- Pre-1970 Standing Water Area
- Limit of Cover Installed by Removal Program
- Parcel Boundary
- Former Building Footprint
- Leased Portion of Walton Property
- Limit of Closed Lagoon Area
- Bungay River Water Resource Protection District

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water
- Stream Channel
- Area of Excavation by Removal Program
- Approximate Limit of Work for Removal Action and Site Restoration

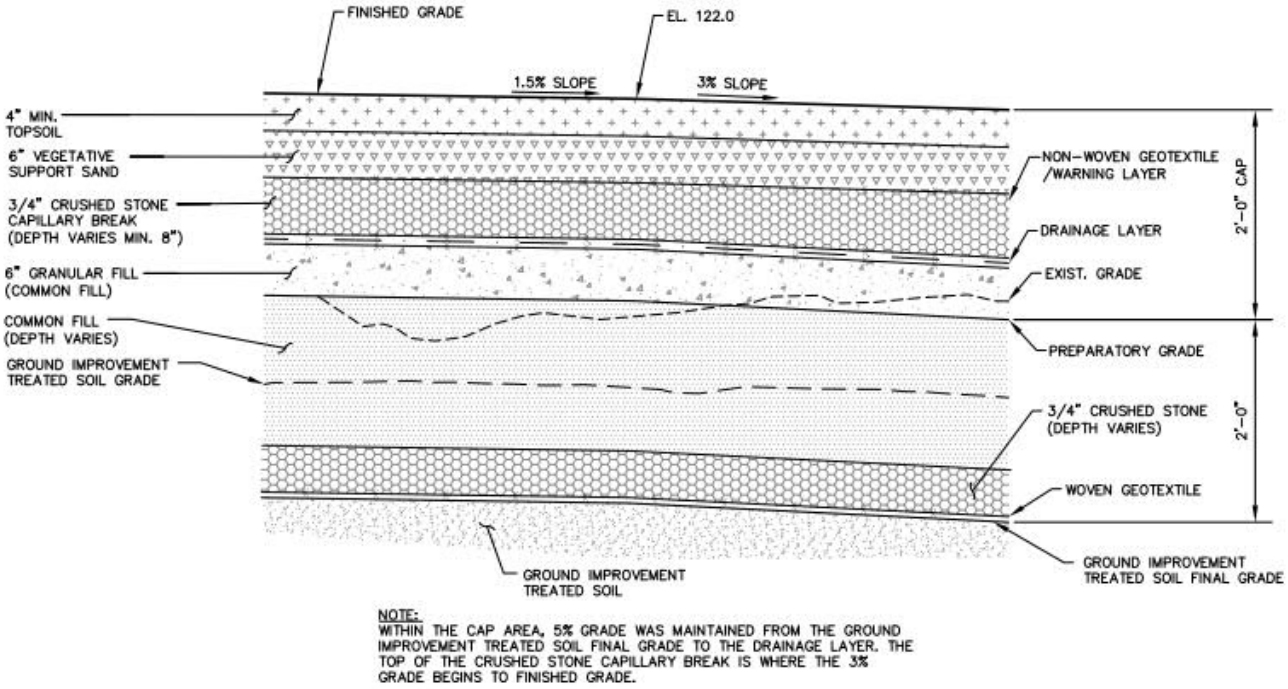
N

1:3,200

AECOM

0 125 250 500 Feet

G:\Projects\HAZWASTE\60308115WAL\Maps\FS\Fig1-3_SiteFeatures.mxd



Note: Above detail is from Drawing C-8 of Plans for: Time Critical Removal Action and Site Restoration, Walton and Lonsbury Site, Attleboro, Massachusetts: Record Drawings. Prepared by Weston Solutions for US EPA Region 1, Contract Number EP-W-05-04, Task Order Number 0003, November 2013

FIGURE 1-4. TYPICAL SECTION – ENGINEERED COVER

PAULETTE LANE

PAYSON STREET

BLISS BROOK

NORTH AVENUE

DEANVILLE ROAD

TEN MILE RIVER

WEST STREET

FARMERS POND

BUNGAY RIVER

MECHANICS POND

SEE DETAIL FOR SOUTHERN PORTION OF MECHANICS POND

DETAIL - SOUTHERN PORTION OF MECHANICS POND

MILK STREET

WATER STREET

ELIZABETH STREET

STATE STREET

JOHN STREET

WATSON AVENUE

RIVERBANK ROAD

SD-11

SD-12

SD-13

SD-14

FIGURE 1-5.

SITE FEATURES AND FEMA FLOOD HAZARD AREAS

Legend

- Drainage Pipe Trunk Line
- Groundwater Collection Pipe
- PRB Trench
- Limit of Cover Installed by Removal Program
- Parcel Boundary
- Former Building Footprint
- Limit of Closed Lagoon Area

FEMA Flood Zone Designations

- A: 1% Annual Chance of Flooding, no BFE
- AE: 1% Annual Chance of Flooding, with BFE
- AE: Regulatory Floodway
- X: 0.2% Annual Chance of Flooding

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water
- Stream Channel

N

1:3,200

0 125 250 500 Feet

AECOM

G:\Projects\HAZWASTE\60308115\WAL\Maps\FSIFig1-4_FEMA.mxd

FIGURE 1-6.

GENERALIZED EXTENT OF TOTAL CHROMIUM IN SOIL AND SEDIMENT AND HEXAVALENT CHROMIUM IN GROUNDWATER

Legend

Total Chromium Concentration Ranges in Surface Soil and Sediment (mg/kg)

- Not Analyzed for Total Cr
- <=RME Reference Sample Concentration
- >RME Reference Sample Concentration - 1000
- >1000 - 5000
- >5000

- Hexavalent Chromium Concentration, µg/L
- Streams

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water
- Former Building Footprint
- Excavation Extent
- Limit of Cover Installed by Removal Program

1:2,500

0 100 200 400 Feet

AECOM

G:\Projects\HAZWASTE\60308115\WAL\Maps\FSIFig1-5_GeneralizedChromium.mxd

100

TEN MILE RIVER

BLISS BROOK

BUNGAY RIVER

FARMERS POND

MECHANICS POND

FIGURE 1-7.
HEXAVALENT CHROMIUM IN BLISS BROOK SURFACE WATER

Legend

- AECOM Surface Water Sample
- Limit of Cover Installed by Removal Program
- Streams
- PRB Groundwater Treatment Trench
- Groundwater Collection Pipe

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water
- Former Building Footprint

NOTES:
1. Hexavalent chromium results from the Phase 2 (Fall 2014) RI are presented. Results are for field-filtered samples.
2. Units are µg/L.
3. Locations with asterisks showed 0% survival during July 2015 toxicity testing.

AECOM

0 75 150 300 Feet

G:\Projects\HAZWASTE\60308115WAL\Maps\FS\Fig1-6_HexCrBlissBrook.mxd

WALTON ST
NORTH AVENUE
WEST STREET
TEN MILE RIVER
BLISS BROOK
BUNGAY RIVER
SD-208 <0.5
SD-209 0.90
SD-211 181
SD-210* 158
SD-212* 163
SD-213 31.0
SD-214 79.5
SD-215 82.4
SD-217 38.9
SD-218 27.6
SD-219 <0.5
SD-305 <0.5

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

DEP-5S 6.75J+
DEP-5D 0.50U
DEP-8S 0.50U
DEP-8D 0.50U
MW-7 11,300
MW-10S 2.70J+
MW-10D 6.90J+
MW-9S 0.50U
MW-9D 2.60J+
AE-01S 36,800
AE-01D 2.90J+
AE-15S 1,800J
AE-15D 12,300
100
1,000
10,000
MW-12S 0.90J+
MW-12D 0.50U
MW-5S 0.50U
MW-5D 0.50U
MW-6D 0.50U
MW-6S 0.50U
PAULETTE LANE
MW-14 121
MW-13 470
MW-100D 0.50U
MW-100S 0.50U
DEP-4S 0.50U
DEP-4D 0.50U
AE-04D 64,500
AE-04S 0.50U
MW-101S 0.50U
MW-101D 3,480
PZ-01S 0.50U
PZ-01D 0.50U
PZ-02S
PZ-02D 3.70J+
MW-102S 5,610
MW-102D 16,400
MW-15 14.1J+
AE-08D 34.3
AE-09S 0.50U
PRB-01W
PRB-01E
PRB-02W
PRB-02E
AE-10S 0.50U
RCA-19 9,410
PRB-03WD
PRB-03WS
PRB-03ED
PRB-03ES
PRB-04W
PRB-04E
BLISS BROOK
DEP-7D 1.10J+
DEP-7S 0.50U
AE-19S 1.7J+
MW-103S 3,000
MW-103D 664
AE-12B
AE-18S 0.50U
DEP-1S 0.50U
DEP-1D 0.50U
NORTH AVENUE
PAYSON STREET
AE-14D 27.7
MW-16 102
AE-07D 3,120
AE-16S 0.50U
AE-17S 0.50U
DEP-3D 0.50U
DEP-3S 0.50U
DEANVILLE ROAD
DEP-2S 0.50U
DEP-2D 0.50U

FIGURE 1-8.

PHASE 3 GROUNDWATER RESULTS FOR HEXAVALENT CHROMIUM* IN OVERBURDEN

Legend

- Hexavalent Chromium Concentration (maximum regardless of depth), in µg/L
- Monitoring Well Installed by AECOM
- Monitoring Well Installed in Previous Investigation
- Bliss Brook
- PRB Groundwater Treatment Trench
- Groundwater Collection Pipe
- Former Building Footprint

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water

* Unfiltered results, label units are µg/L
red text indicates Phase 2
blue text indicates Phase 3

1:1,200

AECOM

0 50 100 200 Feet

G:\Projects\HAZWASTE\60308115\WAL\Maps\FS\Fig1-7_HexCrOverburdenPh3.mxd

DEP-5D
DEP-5S
MW-10S
MW-10D
MW-9S
MW-9D
AE-02B
0.50
MW-7
AE-01S
AE-01B
10.3J+
AE-01D
AE-ML-01
A 0.50U
B 0.50U
C 0.50U
MW-12S
MW-12D
MW-5S
MW-5D
MW-6D
MW-6S
AE-03B
0.50U
DEP-4S
DEP-4D
AE-15S
AE-15B
11,500
AE-15D
AE-11B
57.4
PAULETTE LANE
MW-14
AE-05B
8,130
MW-13
MW-100S
MW-100D
AE-04B
14,100
AE-04D
AE-ML-02
0.50U
AE-04S
100
1,000
10,000
MW-101S
MW-101D
PZ-01D
PZ-01S
PZ-02S
PZ-02D
AE-ML-04
E 4,670
A 17,700
B 0.50U
C 0.05U
MW-102S
MW-102D
MW-15
AE-06B
16,300
AE-08D
AE-08B
719
PRB-01W
PRB-01E
AE-09S
PRB-02W
PRB-02E
AE-10S
PRB-03WD
PRB-03WS
PRB-03ED
PRB-03ES
RCA-19
PRB-04W
PRB-04E
BLISS BROOK
DEP-7D
DEP-7S
MW-103D
MW-103S
AE-ML-03
0.50U
AE-12B
3,170
AE-19S
AE-18S
NORTH AVENUE
DEP-1S
DEP-1D
AE-20B
1,270
PAYSON STREET
AE-14D
AE-14B
0.5U
MW-16
AE-07B
335
AE-07D
AE-16S
AE-17S
DEP-3D
DEP-3S
DEANVILLE ROAD
DEP-2S
DEP-2D
AE-13B
0.50U

FIGURE 1-9.

PHASE 3 GROUNDWATER RESULTS FOR HEXAVALENT CHROMIUM* IN BEDROCK

Legend

- Monitoring Well Installed by AECOM, Phase 1 or Phase 2
- Monitoring Well Installed by AECOM, Phase 3
- Monitoring Well Installed in Previous Investigation
- Hexavalent Chromium Concentration (maximum regardless of depth), in µg/L
- Bliss Brook
- PRB Groundwater Treatment Trench
- Groundwater Collection Pipe
- Former Building Footprint

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water

* Unfiltered results, label units are µg/L
red text indicates Phase 2
blue text indicates Phase 3

1:1,200

AECOM

0 50 100 200 Feet

G:\Projects\HAZWASTE\60308115\WALI\Maps\FS\Fig1-8_HexCrBedrockPh3.mxd

DEP-5S 0.50U
DEP-5D 0.50U
DEP-8S 0.50U
DEP-8D 0.50U
MW-7 0.50U
MW-10S 8.1
MW-10D 16
MW-9S 0.21J
MW-9D 6.9
AE-01S 0.84
AE-01D 6.9
AE-15S 0.50U
AE-15D 2.2
MW-12S 5.9
MW-12D 26
MW-5S 380
MW-5D 91
MW-6D 4.2
MW-6S 390
DEP-4S 5.4
DEP-4D 4.4
PAULETTE LANE
MW-14 0.16J
MW-13 0.50U
MW-100D 0.50U
MW-100S 0.50U
AE-04D 62
AE-04S 0.50U
5
50
PZ-01S 0.50U
PZ-01D 0.50U
MW-101S 0.50U
MW-101D 1.0
PZ-02S
PZ-02D 0.50U
MW-102S 47
MW-102D 70
MW-15 51
AE-08D 0.50U
AE-09S 4.7
PRB-01W
PRB-01E
AE-10S 8.6
PRB-02W
PRB-02E
PRB-03WD
PRB-03WS
PRB-03ED
PRB-03ES
PRB-04W
PRB-04E
RCA-19 20
BLISS BROOK
DEP-7D 0.50U
DEP-7S 0.50U
AE-19S 7.6
MW-103S 20
MW-103D 9.9
AE-12B
AE-18S 0.50U
DEP-1S 0.50U
DEP-1D 0.50U
NORTH AVENUE
AE-14D 7.5
PAYSON STREET
MW-16 7.8
AE-07D 22
AE-16S 0.30J
AE-17S 0.50U
DEP-3D 0.50U
DEP-3S 0.50U
DEANVILLE ROAD
DEP-2S 0.50U
DEP-2D 0.50U

FIGURE 1-10.

PHASE 3 GROUNDWATER RESULTS FOR TCE* IN OVERBURDEN

Legend

- TCE Concentration (maximum regardless of depth), in µg/L
- Monitoring Well Installed by AECOM
- Monitoring Well Installed in Previous Investigation
- Bliss Brook
- PRB Groundwater Treatment Trench
- Groundwater Collection Pipe
- Former Building Footprint

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water

* Unfiltered results, label units are µg/L
red text indicates Phase 2
blue text indicates Phase 3

1:1,200

AECOM

0 50 100 200 Feet

G:\Projects\HAZWASTE\60308115\WAL\Maps\FS\Fig1-9_TCEOverburdenPh3.mxd

DEP-5D
DEP-5S
MW-10S
MW-10D
MW-9S
MW-9D
MW-7
AE-01S
AE-01B
6.2
AE-01D
AE-02B
5.5
AE-ML-01
A 6.3
B 6.2
C 4.0
MW-12S
MW-12D
MW-5S
MW-5D
MW-6D
MW-6S
AE-03B
5.9
DEP-4S
DEP-4D
AE-15S
AE-15B
2.8
AE-15D
AE-11B
0.50U
PAULETTE LANE
MW-14
AE-05B
1.8
MW-13
MW-100S
MW-100D
AE-04B
17
AE-ML-02
6.2
AE-04D
AE-04S
2
10
20
MW-101S
MW-101D
PZ-01D
PZ-01S
PZ-02S
PZ-02D
AE-ML-04
A 19
B 2.0
C 0.5U
E 9.6
MW-102S
MW-102D
MW-15
AE-06B
20D
AE-08D
AE-08B
0.50U
PRB-01W
PRB-01E
AE-09S
PRB-02W
PRB-02E
AE-10S
PRB-03WD
PRB-03WS
PRB-03ED
PRB-03ES
RCA-19
PRB-04W
PRB-04E
BLISS BROOK
DEP-7D
DEP-7S
MW-103D
MW-103S
AE-12B
4.8
AE-ML-03
0.50U
AE-19S
AE-18S
NORTH AVENUE
DEP-1S
DEP-1D
AE-20B
1.1
PAYSON STREET
AE-14D
AE-14B
1.7
MW-16
AE-07B
4.8
AE-07D
AE-16S
AE-17S
DEP-3D
DEP-3S
DEANVILLE ROAD
DEP-2S
DEP-2D
AE-13B
0.50U

FIGURE 1-11.

PHASE 3 GROUNDWATER RESULTS FOR TCE* IN BEDROCK

Legend

- Monitoring Well Installed by AECOM, Phase 1 or Phase 2
- Monitoring Well Installed by AECOM, Phase 3
- Monitoring Well Installed in Previous Investigation
- TCE Concentration (maximum regardless of depth), in µg/L
- Bliss Brook
- PRB Groundwater Treatment Trench
- Groundwater Collection Pipe
- Former Building Footprint

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water

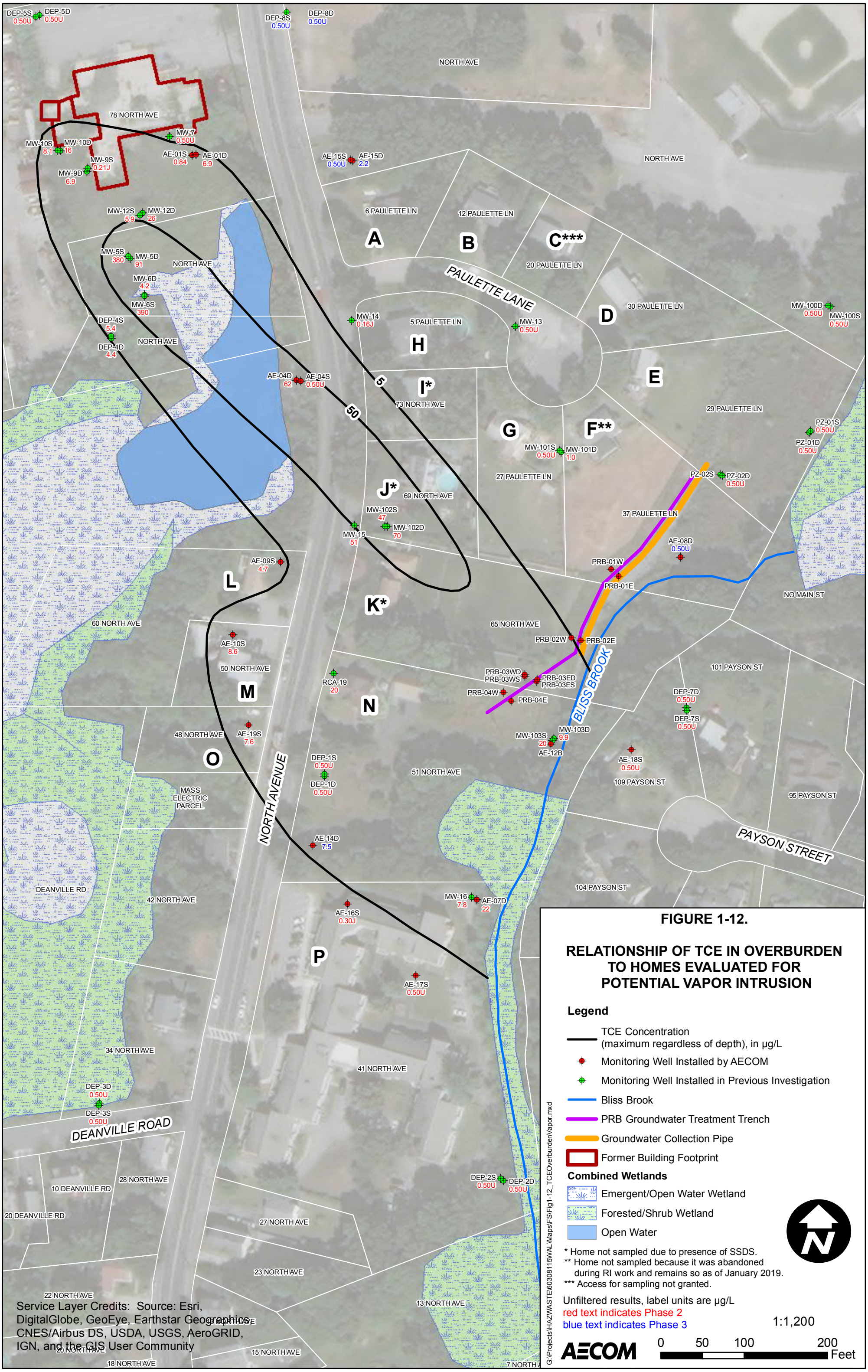
* Unfiltered results, label units are µg/L
red text indicates Phase 2
blue text indicates Phase 3

1:1,200

AECOM

0 50 100 200 Feet

G:\Projects\HAZWASTE\60308115WAL\Maps\FS\Fig1-10_TCEBedrockPh3.mxd



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FIGURE 1-12.

RELATIONSHIP OF TCE IN OVERBURDEN TO HOMES EVALUATED FOR POTENTIAL VAPOR INTRUSION

Legend

- TCE Concentration (maximum regardless of depth), in µg/L
- Monitoring Well Installed by AECOM
- Monitoring Well Installed in Previous Investigation
- Bliss Brook
- PRB Groundwater Treatment Trench
- Groundwater Collection Pipe
- Former Building Footprint

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water

* Home not sampled due to presence of SSDS.
** Home not sampled because it was abandoned during RI work and remains so as of January 2019.
*** Access for sampling not granted.

Unfiltered results, label units are µg/L
red text indicates Phase 2
blue text indicates Phase 3

1:1,200

AECOM

0 50 100 200 Feet

G:\Projects\HAZWASTE\60308115\WAL\Maps\FS\Fig1-12_TCEOverburdenVapor.mxd

FIGURE 1-13

FINE FRACTION TOTAL LEAD RESULTS FOR SURFACE SOIL SAMPLES (0-6 INCHES): WEST OF NORTH AVENUE 2017 AND 2018

Exposure Areas/Sampling Locations
- Residential Soil
- Wetland Soil
- Approximate Location of Drainage Pipe
- Streams
- Former Building Footprint
- Limit of Closed Lagoon Area

Combined Wetlands
- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water

FEMA Flood Zone Designations
- AE: 1% Annual Chance of Flooding, with BFE
- X: 0.2% Annual Chance of Flooding

48NO-01 2018 Sample Location ID
SO-601: 2017 Sample Location ID
Total Lead in Soil, Fine Fraction (< 150µm):
>200 mg/kg
<200 mg/kg

AECOM

0 60 120 Feet

G:\Projects\HAZWASTE\60308115\WAL\Maps\Fig1-13_Alternative_SI_3.mxd

79 WALTON ST
WALTON STREET
40 WALTON ST
32 WALTON ST
50 WALTON ST
36 WALTON ST
60 WALTON ST
78 NORTH AVE
NORTH AVE
NORTH AVE
NORTH AVE
NORTH AVE
6 PAULETTE LN
12 PAULETTE LN
5 PAULETTE LN
73 NORTH AVE
69 NORTH AVE
65 NORTH AVE
60 NORTH AVE
50 NORTH AVE
48 NORTH AVE
51 NORTH AVE
41 NORTH AVE
42 NORTH AVE
34 NORTH AVE
27 NORTH AVE
23 NORTH AVE
22 NORTH AVE
20 NORTH AVE
19 NORTH AVE
18 NORTH AVE
15 NORTH AVE
13 NORTH AVE
7 NORTH AVE
NORTH AVENUE
MASS ELECTRIC PARCEL
DEANVILLE RD
28 DEANVILLE RD
160
150
140
130
120

SO-601	220
SO-602	139.5
SO-603	55.7
SO-604	290
SO-605	109
SO-606	163
SO-607	56.9
SO-608	113
SO-609	1,820
SO-610	214
SO-611	474
SO-612	478
SO-613	474
SO-614	50.8
SO-615	36.1
SO-616	357
SO-617	705
SO-618	118
SO-619	111
SO-620	240
SO-621	428
SO-622	201
SO-623	263
SO-624	149
48NO-01	372
48NO-02	280
48NO-03	781
48NO-04	163
48NO-05	241
ME-01	490
ME-02	790
42NO-01	369
42NO-02	404
42NO-03	409
42NO-04	511
34NO-01	471
34NO-02	100
34NO-03	472
34NO-04	303
28NO-01	1,170
28NO-02	127
28NO-03	162
28NO-04	68.5
28NO-05	124
28NO-06	360
28NO-07	126
28NO-08	228
28NO-09	358
10DE-01	89.1
10DE-02	172
10DE-03	272
10DE-04	308
10DE-05	142
10DE-06	136
10DE-07	89.8
10DE-08	172
10DE-09	220
10DE-10	1,240
10DE-11	198
10DE-12	131

WALTON STREET

PAULETTE LANE

NORTH AVENUE

BLISS BROOK

PAYSON STREET

DEANVILLE ROAD

DEP-5D
DEP-5S
129.32

DEP-8S
128.40
DEP-8D

MW-7
126.52

MW-10S
MW-10D

MW-9S
127.81
MW-9D

AE-01D
AE-01S
125.57
AE-01B

AE-02B

AE-ML-01

AE-15S
123.13
AE-15B
AE-15D

AE-11B

MW-12S
125.77
MW-12D

MW-5S
124.96
MW-5D

MW-6D
MW-6S
124.96

DEP-4S
124.25
AE-03B
DEP-4D

MW-14
124.17

AE-05B
MW-13
121.65

MW-100D
MW-100S
121.02

AE-04B
AE-04D
AE-ML-02
AE-04S
124.23

PZ-02
0.037
0.019 (FD)
0.11
0.079 (FD)

SG-1
PZ-01
0.0090
0.016

PZ-07
1.7
0.20

PZ-01S
PZ-01D

MW-101S
121.20
MW-101D

PZ-02S
PZ-02D

MW-102S
120.82
MW-102D

MW-15*

AE-ML-04
AE-06B

AE-08D
AE-08B

PRB-01W
120.17
PRB-01E
119.10

PZ-06
0.0060
0.02

SG-6

PZ-09
0.72
0.65

AE-09S
123.73

AE-10S
123.53

PRB-02W
120.01
PRB-02E
119.14

PZ-10
1,350
1,300

PRB-03Wd
PRB-03Ws
120.36
PRB-03Ed
PRB-03Es
120.32
PRB-04W
120.35
PRB-04E
120.34

PZ-11
0.11
0.026

PZ-08
3.5
0.15

AE-19S*

RCA-19
120.26

DEP-7D
DEP-7S
120.56

MW-103S
119.05
MW-103D
AE-12B
AE-ML-03

PZ-12
0.043
0.017

AE-18S
120.31

DEP-1S
120.61
DEP-1D

PZ-13
834
864

AE-20B

AE-14D
AE-14B

PZ-14
6,870
6,880

SG-4

MW-16
119.48
AE-07B
AE-07D

AE-16S
120.31

PZ-04
0.10
<0.025

AE-17S

PZ-15
0.029
0.020

SG-3
DEP-3D
DEP-3S
122.22

PZ-03
0.44
0.19

DEP-12S
120.21

PZ-05
0.31
0.14

DEP-2S
118.70
DEP-2D
AE-13B
SG-5

129
128
127
126
125
124
123
122
121
120
119

* Well damaged and/or not found and presumed destroyed; therefore no water level measurements for this location.

FIGURE 1-14.

HEXAVALENT CHROMIUM RESULTS: DECEMBER 2017 PIEZOMETER SAMPLES

Legend

- Water Table Contour, in ft NAVD88 (dashed where inferred), January 2018
- Monitoring Well Installed by AECOM
- Monitoring Well Installed in Previous Investigation
- Stream Gauge
- Phase 5 Piezometer
- Bliss Brook
- PRB Groundwater Treatment Trench
- Groundwater Collection Pipe
- Parcel Boundary
- Former Building Footprint
- Limit of Cover Installed by Removal Program

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water

Green = Hexavalent Cr, unfiltered sample, µg/L
Red = Hexavalent Cr,field-filtered sample, µg/L

1:1,440

0 60 120 240 Feet

AECOM

G:\Projects\HAZWASTE\60308115WAL\Maps\FS\Fig1-14_HexCrResults_Jan2018.mxd

FIGURE 2-1.

SOIL PRG EXCEEDANCES FOR PAHS

Legend

- One or More PAHs Exceeds Soil PRG(s) - Impacted Sample Depth (ft bgs) Shown in Red
- PAHs not Detected Above Soil PRGs - Associated Sample Depths (ft bgs) Shown in Black
- Excavation Extent
- Limit of Closed Lagoon Area
- Former Building Footprint

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water

NOTES:
ft bgs = Feet below the ground surface
PAHs = Polycyclic aromatic hydrocarbons
PRGs = Preliminary Remediation Goals

PAHs with Soil PRGs include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene

1:600

0 20 40 80 Feet

AECOM

G:\Projects\HAZWASTE\60308115\WAL\Maps\FS\Fig2-1_SoilPRGExceedancePAHs.mxd

SO-101 5.1-6.1
SO-149 5-6
SO-150 5.4-6.4
SO-106 0.5-1.5
PASI_SB-01 0-1,2-3,6-7
SO-107 0.5-1.5, 5.2-6.2
ISB-02 0-1
ISB-01 0-2.58
SO-148 0.5-1.5
PASI_SB-08 0-1 2-3 6-7
SO-104 3.7-4.7
PASI_SB-07 0-1 2-3 5-6
SO-108 0.5-1.5 8-10
SO-105 0.5-1.5 9-10
SO-147 0-1,9-10
PASI_SB-02 0-1 2-3 4-5
PASI_SB-06 0-1 2-3 7-8
PASI_SB-03 0-1 2-3 6-7
PASI_SB-14 0-1
PASI_SB-20 0-1 2-3 8-9
PASI_SB-16 0-1 2-3
PASI_SB-18 0-1 2-3
PASI_SB-11 0-1 2-3
PASI_SB-17 0-1 2-3
P-78-SB-01 0-2
P-78-SB-02 0-2
PASI_SB-12 0-1 2-3
PASI_SB-15 0-1 2-3
SO-102 0.7-1.7
PASI_SB-10 0-1 2-3 3-4
PASI_SB-05 0-1 2-3 4-5
P-78-SB-03 0-2
PASI_SB-04 0-1 2-3 4-5
P-78-SB-04 0-0.5 0.75-2
SO-103 4.8-5.8
P-78-SB-05 0-2
PASI_SB-09 0-1,2-3,4-5
P-78-SB-09 0-2
P-78-SB-10 0-2
SO-113 0-1
P-78-SB-14 0-2
P-78-SB-15 0-2
P-78-SB-19 0-2
P-78-SB-20 0-2
P-78-SB-24 0-2
P-78-SB-25 0-2
P-78-SB-29 0-2

78 NORTH AVE
NORTH AVE
NORTH AVE
NORTH AVENUE
NORTH AVE
NORTH AVE
32 WALTON ST
60 NORTH AVE
50 NORTH AVE
48 NORTH AVE
51 NORTH AVE
LE RD

FIGURE 2-2.

SOIL PRG EXCEEDANCES FOR METALS

Legend

Hexavalent Chromium

- Hex chromium exceeds soil PRG - Impacted sample depth (ft bgs) shown in red
- Hex chromium not detected above soil PRG
- Hex chromium not analyzed

Other Metals

- One or more other metals exceed soil PRG(s) - Impacted sample depth (ft bgs) shown in green
- Other metals not detected above soil PRG(s)
- Excavation Extent
- Limit of Closed Lagoon Area
- Former Building Footprint

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water

NOTES:
ft bgs = Feet below the ground surface
PRGs = Preliminary Remediation Goals

Metals with Soil PRGs include arsenic, antimony, hexavalent chromium, cobalt, lead, and thallium.

1:600

0 20 40 80 Feet

AECOM

G:\Projects\HAZWASTE\60308115WAL\Maps\FS\Fig2-2_SoilPRGExceedanceMetals.mxd

SO-101 5-6
SO-149 4.8-5.8 4.8-5.8
SO-150 5.9-6.9 5.9-6.9
SO-106 0.5-1.5 0.5-1.5
PASI_SB-01 0-1 0-1 2-3 6-7
PASI_SB-02 0-1 0-1 2-3 2-3 4-5 4-5
SO-108 0.5-1.5 0.5-1.5 8-10
PASI_SB-03 0-1 0-1 2-3 2-3 6-7 6-7
ISB-02 0-1
SO-148 0.5-1.5 0.5-1.5
ISB-01 1.1 0-2.58 1.25 0-1.7
SO-107 0.5-1.5 0.5-1.5 5-6
PASI_SB-06 2-3 2-3 7-8 7-8
PASI_SB-07 0-1 0-1 2-3 5-6
PASI_SB-08 2-3 6-7
SO-104 4-5
SO-105 0.5-1.5 9-10
SB-21 0-4
SO-147 0.5-1.5 9-10
PASI_SB-14 0-1
PASI_SB-20 8-9 8-9
PASI_SB-16 0-1 2-3
PASI_SB-18 0-1 2-3
PASI_SB-13 0-1
PASI_SB-11 0-1
PASI_SB-17 0-1 2-3
P-78-SB-02 0.75-1.25 1.5-2
P-78-SB-01 0-0.5 0-0.5 1.5-2
PASI_SB-15 0-1 2-3
PASI_SB-12 2-3
SO-102 0.5-1.5
PASI_SB-05 4-5
P-78-SB-03 0-2
PASI_SB-10 0-1 0-1 2-3 2-3 3-4 3-4
PASI_SB-04 0-1 0-1 2-3 4-5
P-78-SB-04 0-2
SO-103 4.4-5.4
P-78-SB-05 1.5-2
PASI_SB-09 0-1 0-1
P-78-SB-10 0-2
P-78-SB-09 0.75-1.25
SO-113 0-1
P-78-SB-15 0-2
P-78-SB-14 0.75-1.25 1.5-2
P-78-SB-20 0-2
P-78-SB-19 0.75-1.25
P-78-SB-24 0-2
P-78-SB-25 0-2
P-78-SB-29 0-2

78 NORTH AVE
32 WALTON ST
NORTH AVE
NORTH AVE
NORTH AVENUE
NORTH AVE
NORTH AVE
60 NORTH AVE
50 NORTH AVE
48 NORTH AVE
51 NORTH AVE
LE RD

FIGURE 2-3

SURFACE SOIL PRG EXCEEDANCES LEAD IN RESIDENTIAL YARDS WEST OF NORTH AVENUE

Exposure Areas
- Residential Soil
- Wetland Soil
- Streams
- Former Building Footprint
- Excavation Extent (Removal Program)
- Limit of Cap Installed by Removal Program
- Limit of Closed Lagoon Area

Combined Wetlands
- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water

FEMA Flood Zone Designations
- AE: 1% Annual Chance of Flooding, with BFE
- X: 0.2% Annual Chance of Flooding

SO-601: Phase 4 Sample LocationID
Total Lead in Soil, Fine Fraction (< 150µm):
>200 mg/kg
<200 mg/kg

AECOM

0 60 120 Feet

G:\Projects\HAZWASTE\60308115\WAI\Maps\FS\Fig2-3_SoilPRGExceedances.mxd

WALTON STREET
NORTH AVE
NORTH AVENUE
DEANVILLE ROAD
79 WALTON ST
41 WALTON ST
82 NORTH AVE
40 WALTON ST
32 WALTON ST
50 WALTON ST
36 WALTON ST
60 WALTON ST
78 NORTH AVE
6 PAULETTE LN
12 PAULETTE LN
5 PAULETTE LN
73 NORTH AVE
69 NORTH AVE
65 NORTH AVE
60 NORTH AVE
50 NORTH AVE
48 NORTH AVE
51 NORTH AVE
42 NORTH AVE
34 NORTH AVE
41 NORTH AVE
10 DEANVILLE RD
20 DEANVILLE RD
28 DEANVILLE RD
28 NORTH AVE
27 NORTH AVE
23 NORTH AVE
22 NORTH AVE
20 NORTH AVE
19 NORTH AVE
18 NORTH AVE
15 NORTH AVE
13 NORTH AVE
150
160
140
130
120

SO-601 220
SO-602 139.5
SO-603 55.7
SO-604 290
SO-605 109
SO-606 163
SO-607 56.9
SO-608 113
SO-609 1,820
SO-610 214
SO-611 474
SO-612 478
SO-613 474
SO-614 50.8
SO-615 36.1
SO-616 357
SO-617 705
SO-618 118
SO-619 111
SO-620 240
SO-621 428
SO-622 201
SO-623 263
SO-624 149
SO-630 51.5

82 NORTH AVE

WALTON STREET

NORTH AVE

NORTH AVE

DEP-8D
0.50U

DEP-8S
0.50U

DEP-5S
6.75J+

DEP-5D
0.50U

ESTIMATED IMPACT AREA
FOR FUTURE CONSTRUCTION
WORKER - W&L PROPERTY

NORTH AVENUE

NORTH AVE

78 NORTH AVE

MW-7
11,300

MW-10S
2.70J+>

MW-10D
6.90J+

AE-01S
36,800

AE-01D
2.90J+

MW-9S
0.50U

MW-9D
2.60J+

MW-12D
0.50U

MW-12S
0.90J+

MW-5S
0.50U

MW-5D
0.50U

NORTH AVE

MW-6D
0.50U

MW-6S
0.50U

DEP-4S
0.50U

DEP-4D
0.50U

NORTH AV

32 WALTON ST

G:\Projects\HAZWASTE\60308115\WAL\Maps\FS\Fig2-4_PRGExceedancesShallowGW.mxd

FIGURE 2-4.

PRG EXCEEDANCES FOR HEXAVALENT CHROMIUM* IN SHALLOW GROUNDWATER ON W&L PROPERTY

Legend

- Monitoring Well Installed by AECOM
- Monitoring Well Installed in Previous Investigation
- Former Building Footprint
- Estimated Impact Area

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water

N

* Unfiltered results from Phase 2 (December 2014),
Label units are µg/L.
red text indicates hex chromium results
above construction worker PRG

1:480

AECOM

0 20 40 80
Feet

DEP-5S DEP-5D DEP-8S DEP-8D
AE-ML-01
MW-7
AE-01B, AE-01D, AE-01S
MW-9D
AE-15D AE-15B
AE-11B
AE-02B
MW-12S
MW-5S MW-5D
MW-6S
MW-6D
AE-03B
DEP-4D
PAULETTE LANE
AE-05B
MW-100D
MW-100S
MW-14
AE-04B, AE-04D, AE-04S
AE-ML-02
PZ-01D PZ-01S
MW-101S
PZ-02S PZ-02D
MW-101D
MW-15
AE-06B
AE-09S
MW-102D
AE-ML-04
AE-08D
AE-08B
AE-10S
PRB-03WD, WS
PRB-03ED, ES
RCA-19
PRB-04W
PRB-04E
DEP-7D
AE-19S
AE-12B
AE-18S
DEP-7S
DEP-1S
DEP-1D
AE-ML-03
AE-20B
AE-14B
AE-14D
PAYSON STREET
AE-16S
AE-07B
AE-07D
BLISS BROOK
AE-17S
DEP-3S DEP-3D
DEP-2S DEP-2D
DEANVILLE ROAD
AE-13B
TEN MILE RIVER
NORTH AVENUE
WEST STREET
FARMERS POND
BUNGAY RIVER
MECHANICS POND
SEE DETAIL FOR SOUTHERN PORTION OF MECHANICS POND
MILK STREET
WATER STREET
ELIZABETH STREET
STATE STREET
JOHN STREET
WATSON AVENUE
RIVERBANK ROAD
SD-11
SD-12
SD-13
SD-14
DETAIL - SOUTHERN PORTION OF MECHANICS POND

FIGURE 2-5.

GROUNDWATER PRG EXCEEDANCES FOR IRRIGATION SCENARIO

Legend

- TCE or VC exceeds groundwater PRG
- No VOCs detected above groundwater PRG
- VOCs not analyzed
- Hex Cr detected above groundwater PRG
- No metals detected above groundwater PRG(s)
- Parcel Boundary
- Former Building Footprint
- Limit of Closed Lagoon Area
- Bungay River Water Resource Protection District

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water
- Stream Channel
- Area of Excavation by Removal Program
- Approximate Limit of Work for Removal Action and Site Restoration

N

1:3,200

AECOM

0 125 250 500 Feet

G:\Projects\HAZWASTE\60308115WAL\Maps\FS\Fig2-5_PRGExceedanceIrrigation.mxd

EXCAVATE TO 8 FT

EXCAVATE TO 4 FT

EXCAVATE TO 7 FT

EXCAVATE TO 4 FT

EXCAVATE TO 9 FT

EXCAVATE TO 10 FT

EXCAVATE TO 6 FT

EXCAVATE TO 5 FT

EXCAVATE TO 7 FT

EXCAVATE TO 2 FT

EXCAVATE TO 4 FT

EXCAVATE TO 2 FT

NORTH AVE

NORTH AVE

78 NORTH AVE

NORTH AVENUE

32 WALTON ST

NORTH AVE

NORTH AVE

60 NORTH AVE

50 NORTH AVE

NORTH AVE

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FIGURE 3-1.

CONCEPTUAL PLAN FOR ALTERNATIVE S-3: SOIL EXCAVATION ON W&L PROPERTY

Legend

- Soil Excavation Area
- Previous Excavation
- Limit of Closed Lagoon Area
- Former Building Footprint

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water

NOTE:
The soil excavation depths and lateral extents shown are considered approximate and will be refined with pre-design sampling.

1:600

0 20 40 80 Feet

AECOM

G:\Projects\HAZWASTE\60308115\WAL\Maps\FS\Fig3-1_ConceptualPlan_S-3.mxd

NORTH AVE

NORTH AVE

78 NORTH AVE

NORTH AVENUE

32 WALTON ST

NORTH AVE

NORTH AVE

60 NORTH AVE

50 NORTH AVE

NORTH AVE

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FIGURE 3-2.

CONCEPTUAL PLAN FOR ALTERNATIVE S-4: SOIL CAPPING ON W&L PROPERTY

Legend

- Soil Capping Area
- Previous Excavation
- Limit of Closed Lagoon Area
- Former Building Footprint

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water

NOTE:
The lateral extent of the cap is considered approximate and will be refined with pre-design sampling.

1:600

0 20 40 80 Feet

AECOM

G:\Projects\HAZWASTE\60308115\WAL\Maps\FS\Fig3-2_ConceptualPlan_S-4.mxd

Excavate Surface Soil (0 to 1 ft.)
Between Wetland Boundary and
Flood Zone AE
Area = 2,245 sq. ft.
Volume = 83 cu. yds.

Excavate Surface Soil (0 to 1 ft.)
Between Wetland Boundary and
Flood Zone AE
Area = 301 sq. ft.
Volume = 11 cu. yds.

Excavate Surface Soil (0 to 1 ft.)
Between Wetland Boundary and
Flood Zone AE
Area = 100 sq. ft.
Volume = 4 cu. yds.

Excavate Surface Soil (0 to 1 ft.)
Between Wetland Boundary and
Flood Zone AE
Area = 2,759 sq. ft.
Volume = 102 cu. yds.

Excavate Surface Soil (0 to 1 ft.)
Between Wetland Boundary and
Flood Zone AE
Area = 2,387 sq. ft.
Volume = 88 cu. yds.

Excavate Surface Soil (0 to 1 ft.)
Extent to be Determined by
Additional Sampling
Total Area Shown = 211 sq. ft.
Volume = 8 cu. yds.

Excavate Surface Soil (0 to 1 ft.)
Extent to be Determined by
Additional Sampling
Total Area Shown = 310 sq. ft.
Volume = 11 cu. yds.

48NO-01 372
48NO-02 280
48NO-03 781
48NO-04 163
48NO-05 241
SO-608 113
ME-01 490
ME-02 790
SO-611 474
42NO-01 369
42NO-02 404
42NO-03 409
42NO-04 511
SO-610 214
SO-612 478
SO-613 474
SO-617 705
34NO-01 471
SO-616 357
SO-618 118
34NO-02 100
SO-619 111
SO-620 240
SO-621 428
34NO-04 303
34NO-03 472
10DE-03 272
SO-622 201
28NO-01 1,170
10DE-02 172
10DE-01 89.1
28NO-02 127
10DE-04 308
28NO-03 162
SO-623 263
28NO-04 68.5
10DE-06 136
10DE-05 142
SO-624 149
10DE-07 89.8
28NO-05 124
28NO-07 126
10DE-11 198
10DE-09 220
28NO-09 358
28NO-06 360
10DE-12 131
10DE-10 1,240
28NO-08 228
10DE-08 172

65 NORTH AVE
50 NORTH AVE
48 NORTH AVE
MASS ELECTRIC PARCEL
DEANVILLE RD
42 NORTH AVE
34 NORTH AVE
NORTH AVENUE
130
41 NORTH AVE
DEANVILLE ROAD
10 DEANVILLE RD
28 NORTH AVE
20 DEANVILLE RD
28 DEANVILLE RD
20 NORTH AVE

FIGURE 3-3.

CONCEPTUAL PLAN FOR ALTERNATIVE SL-3: SURFACE SOIL EXCAVATION FOR RESIDENTIAL YARDS WEST OF NORTH AVENUE

Exposure Areas/Sampling Locations
- Residential Soil
- Wetland Soil
- Estimated Extent of Surface Soil Excavation for Lead
- Approximate Location of Drainage Pipe
- Streams

Combined Wetlands
- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water

FEMA Flood Zone Designations
- AE: 1% Annual Chance of Flooding, with BFE
- X: 0.2% Annual Chance of Flooding

48NO-01: 2018 Sample Location ID
SO-601: 2017 Sample LocationID
Total Lead in Soil, Fine Fraction (< 150µm):
>200 mg/kg
<200 mg/kg

1 inch = 50 feet
0 25 50 Feet

AECOM

G:\Projects\HAZWASTE\60308115\WAL\Maps\Fig3-3_Excavate.mxd

WALTON STREET

ENTIRE FLOOR SLAB AND COBBLE-FILLED PIT TO BE REMOVED

ESTIMATED AREA OF SOURCE AREA SOIL REMOVAL AND IN-SITU TREATMENT*

FORMER OUTSIDE TCE TANK

100

1,000

10,000

5

PAULETTE LANE

TREATMENT PLANT

TREATED WATER DISCHARGE LINE

I*

J*

K*

F**

INFLUENT TRANSFER LINE

AREA OF EXTRACTION WELL NETWORK OR RECOVERY TRENCH

5

NORTH AVENUE

PAYSON STREET

BLISS BROOK

DEANVILLE ROAD

G:\Projects\HAZWASTE\60308115\WAL\Maps\Fig3-4_Alternative_GWSW-2A.mxd

FIGURE 3-4.

CONCEPTUAL PLAN FOR ALTERNATIVE GW/SW-2A: SOURCE AREA SOIL REMOVAL WITH IN-SITU TREATMENT AND GROUNDWATER PUMP AND TREAT

Legend

- Former Outside TCE Tank
- Drainage Pipe Trunk Line
- Groundwater Collection Pipe
- PRB Trench
- Site Fence
- Residential Privacy Fence
- Hexavalent Chromium, Overburden (dashed where inferred)
- TCE Concentration (maximum regardless of depth), in µg/L
- Limit of Cover Installed by Removal Program
- Parcel Boundary
- Former Building Footprint
- Leased Portion of Walton Property (paved and occupied)
- Limit of Closed Lagoon Area

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water
- Stream Channel
- Area of Excavation by Removal Program

I*, J*, K* - Home has operating SSDS.
F** - Home is abandoned.

* Includes removal of former discharge line to southern wetlands, dry well, and TCE storage tank area if located

1 inch = 150 feet

AECOM

0 75 150 300 Feet

WALTON STREET

ENTIRE FLOOR SLAB AND COBBLE-FILLED PIT TO BE REMOVED

ESTIMATED AREA OF SOURCE AREA SOIL REMOVAL AND IN-SITU TREATMENT*

FORMER OUTSIDE TCE TANK

100

1,000

10,000

5

PAULETTE LANE

LOCATION OF MID-PLUME IN-SITU TREATMENT LINE

TREATMENT PLANT

TREATED WATER DISCHARGE LINE

I*

J*

K*

F**

INFLUENT TRANSFER LINE

AREA OF EXTRACTION WELL NETWORK OR RECOVERY TRENCH

5

NORTH AVENUE

PAYSON STREET

BLISS BROOK

DEANVILLE ROAD

G:\Projects\HAZWASTE\60308115\WAL\Maps\Fig3-5_Alternative_GWSW-2B.mxd

FIGURE 3-5.

CONCEPTUAL PLAN FOR ALTERNATIVE GW/SW-2B: SOURCE AREA SOIL REMOVAL WITH IN-SITU TREATMENT AND GROUNDWATER PUMP AND TREAT WITH MID-PLUME TREATMENT

Legend

- Former Outside TCE Tank
- Drainage Pipe Trunk Line
- Groundwater Collection Pipe
- PRB Trench
- Site Fence
- Residential Privacy Fence
- Hexavalent Chromium, Overburden (dashed where inferred)
- TCE Concentration (maximum regardless of depth), in µg/L
- Limit of Cover Installed by Removal Program
- Parcel Boundary
- Former Building Footprint
- Leased Portion of Walton Property (paved and occupied)
- Limit of Closed Lagoon Area

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water
- Stream Channel
- Area of Excavation by Removal Program
- Mid-Plume In-Situ Treatment Line

I*, J*, K* - Home has operating SSDS.
F** - Home is abandoned.

* Includes removal of former discharge line to southern wetlands, dry well, and TCE storage tank area if located

1 inch = 150 feet

AECOM

0 75 150 300 Feet

WALTON STREET

ENTIRE FLOOR SLAB AND COBBLE-FILLED PIT TO BE REMOVED

ESTIMATED AREA OF SOURCE AREA SOIL REMOVAL AND IN-SITU TREATMENT*

FORMER OUTSIDE TCE TANK

100

1,000

10,000

5

PAULETTE LANE

I*

J*

K*

F**

PZ-06
0.0060

PZ-09
0.72

PZ-10
1,350

PZ-11
0.11

PZ-12
0.043

PZ-13
834

PZ-14
6,870

PAYSON STREET

EXTENDED PERMEABLE REACTIVE BARRIER

PZ-04
0.10

NORTH AVENUE

BLISS BROOK

PZ-15
0.029

PZ-05
0.31

DEANVILLE ROAD

G:\Projects\HAZWASTE\60308115\WAL\Maps\Fig3-6_Alternative_GWSW-3A.mxd

FIGURE 3-6.

CONCEPTUAL PLAN FOR ALTERNATIVE GW/SW-3A: SOURCE AREA SOIL REMOVAL WITH IN-SITU TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER

Legend

- Piezometer with Sampling Results, December 2017
  Hexavalent Cr, unfiltered sample, µg/L
- Former Outside TCE Tank
- Drainage Pipe Trunk Line
- Groundwater Collection Pipe
- PRB Trench
- Site Fence
- Residential Privacy Fence
- Hexavalent Chromium, Overburden (dashed where inferred)
- TCE Concentration (maximum regardless of depth), in µg/L
- Limit of Cover Installed by Removal Program
- Parcel Boundary
- Former Building Footprint
- Leased Portion of Walton Property (paved and occupied)
- Limit of Closed Lagoon Area

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water
- Stream Channel
- Area of Excavation by Removal Program

I*, J*, K* - Home has operating SSDS.
F** - Home is abandoned.

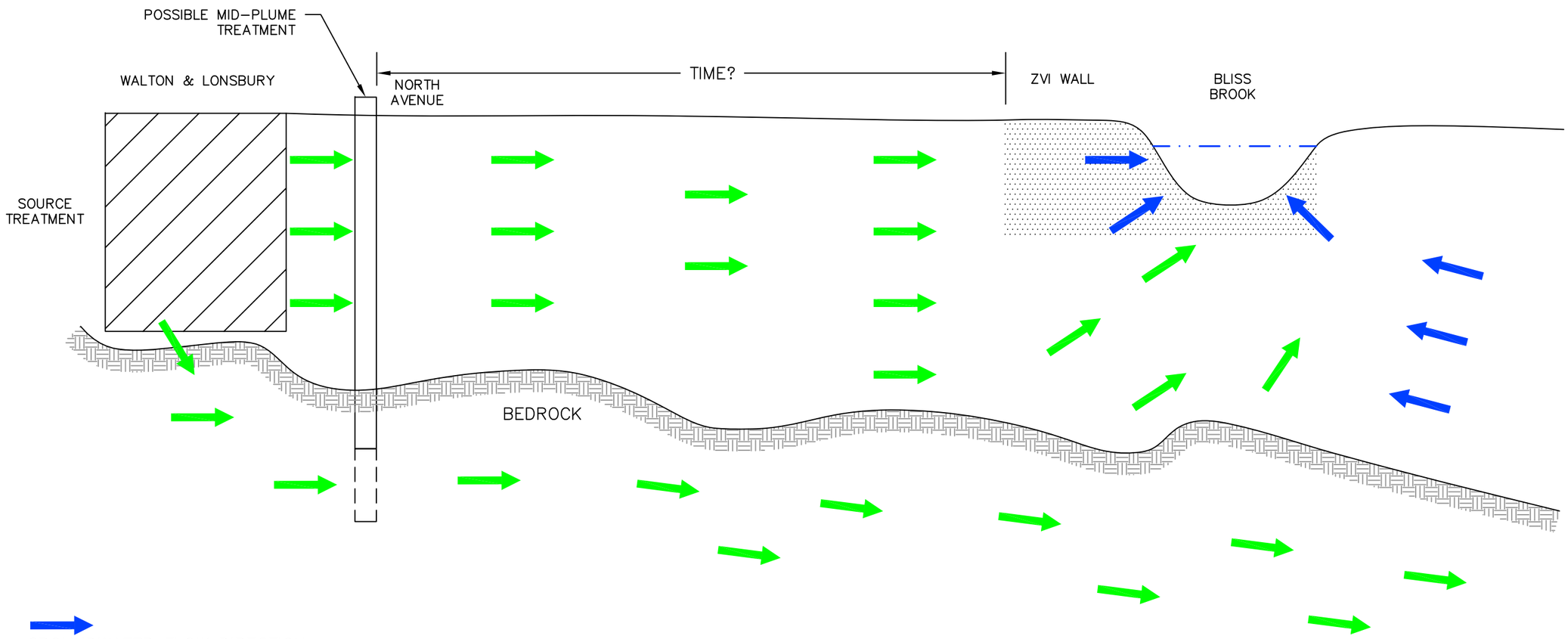
* Includes removal of former discharge line to southern wetlands, dry well, and TCE storage tank area if located

1 inch = 150 feet

AECOM

0 75 150 300 Feet

File: \\vsch11fp002\data\Library\GISData\Projects\HAZWASTE\60308115WAL\Maps\Site_Model\Site_Model.dwg Layout: Layout1 User: Bourdeaul Plotted: Mar 29, 2019 - 10:18am Xref's:



LEGEND

- GROUNDWATER CONTAINING CR+6
- GROUNDWATER NOT CONTAINING CR+6
- ZVI TREATMENT ZONE

AECOM

WALTON & LONSBURY 78 NORTH AVENUE, ATTLEBORO, MA			**CONCEPTUAL SITE MODEL**
DATE: 07/24/2018	DRWN:		**FIGURE 3-7**

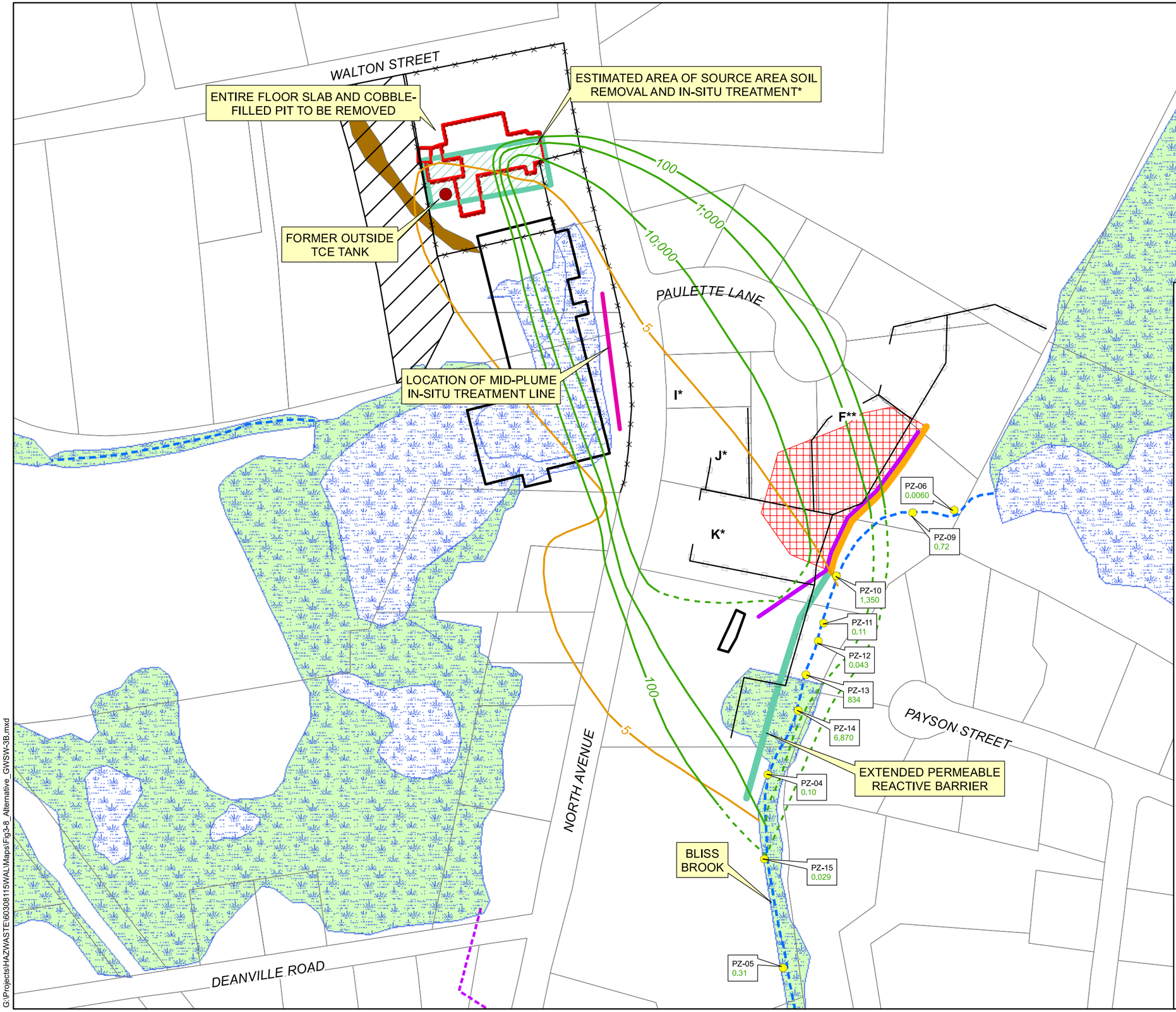


FIGURE 3-8.

CONCEPTUAL PLAN FOR ALTERNATIVE GW/SW-3B: SOURCE AREA SOIL REMOVAL WITH IN-SITU TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER WITH MID-PLUME TREATMENT

Legend

- Former Outside TCE Tank
- Drainage Pipe Trunk Line
- Groundwater Collection Pipe
- PRB Trench
- Site Fence
- Residential Privacy Fence
- Hexavalent Chromium, Overburden (dashed where inferred)
- TCE Concentration (maximum regardless of depth), in µg/L
- Limit of Cover Installed by Removal Program
- Parcel Boundary
- Former Building Footprint
- Leased Portion of Walton Property (paved and occupied)
- Limit of Closed Lagoon Area

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water
- Stream Channel
- Area of Excavation by Removal Program
- Mid-Plume In-Situ Treatment Line

I*, J*, K* - Home has operating SSDS.
F** - Home is abandoned.

* Includes removal of former discharge line to southern wetlands, dry well, and TCE storage tank area if located

1 inch = 150 feet

AECOM

0 75 150 300 Feet

G:\Projects\HAZWASTE\60308115\WAL\Maps\Fig3-8_Alternative_GWSW-3B.mxd

FIGURE 3-9

SIMULATED BEDROCK HEXAVALENT CHROMIUM PLUME EXTENT

Legend

- Bedrock Monitoring Well
- Bedrock Solute Transport Model Simulated Results
- Existing PRB Trench
- Fence Installed by Removal Program
- Hexavalent Chromium Concentration Contour (from Figure 1-9: Phase 3 Groundwater Results for Hexavalent Chromium in Bedrock)
- (Dashed Where Inferred)
- Former Building Footprint

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water
- Stream Channel
- Bungay River Water Resource Protection District

Stereoplots showing bedrock fracture orientations from borehole geophysics

1 inch equals 150 feet

0 75 150 300 Feet

AECOM

G:\Projects\HAZWASTE\60308115WAL\Maps\BedrockSolute.mxd

AE-01B
AE-ML-01
AE-02B
AE-15B
AE-11B
AE-03B
AE-ML-02
AE-04B
AE-05B
PAULETTE LANE
1 µg/L
100 µg/L
10,000 µg/L
1,000 µg/L
AE-ML-04
AE-06B
AE-08B
AE-12B
AE-ML-03
AE-20B
PAYSON STREET
AE-14B
AE-07B
NORTH AVENUE
100 µg/L
10 µg/L
1 µg/L
AE-13B
BLISS BROOK
WEST STREET

WALTON ST

LOCATION OF ZVI INJECTIONS INTO BEDROCK

100

1

10,000

1,000

10

PAULETTE LN

I*

J*

K*

F**

AE-20B
Cr+6 = 1270 µg/L

PAYSON ST

NORTH AVE

BLISS BROOK

DEANVILLE RD

ASHTON RD

ROUNDS PL

WEST ST

COMPLIANCE MONITORING WELLS

G:\Projects\HAZWASTE\60308115WAL\Maps\FS\Fig3-10_Alternative_BR-3.mxd

FIGURE 3-10.

CONCEPTUAL PLAN FOR CONTINGENCY FOCUSED IN-SITU INJECTION COMPONENT OF ALTERNATIVE BR-3

Legend

- Monitoring Well Location
- Drainage Pipe Trunk Line
- Compliance Monitoring Wells (Locations TBD)
- Groundwater Collection Pipe
- PRB Trench
- Site Fence
- Residential Privacy Fence
- Hexavalent Chromium, Bedrock (dashed where inferred)
- TCE 10 ppb Isopleth, Bedrock
- Limit of Cover Installed by Removal Program
- Parcel Boundary
- Former Building Footprint
- Leased Portion of Walton Property (paved and occupied)
- Limit of Closed Lagoon Area

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water
- Stream Channel
- Area of Excavation by Removal Program
- Bungay River Water Resource Protection District

I*, J*, K* - Home has operating SSDS.
F** - Home is abandoned.

N

AECOM

0 125 250 500 Feet

WALTON ST
PAULETTE LN
NORTH AVE
DEANVILLE RD
PAYSON ST
ASHTON RD
ROUNDS PL
WEST ST
1,000
100
1
10
10,000
I*
J*
K*
F**
TREATMENT PLANT
TREATED WATER DISCHARGE LINE
INFLUENT TRANSFER LINE
AREAS OF BEDROCK EXTRACTION WELL NETWORK
AE-20B Cr+6 = 1270 µg/L
BLISS BROOK
COMPLIANCE MONITORING WELLS

FIGURE 3-11.

CONCEPTUAL PLAN FOR CONTINGENCY PUMP AND TREAT COMPONENT OF ALTERNATIVE BR-4

Legend

- Monitoring Well Location
- Drainage Pipe Trunk Line
- Compliance Monitoring Wells (Locations TBD)
- Groundwater Collection Pipe
- PRB Trench
- Site Fence
- Residential Privacy Fence
- Hexavalent Chromium, Bedrock (dashed where inferred)
- TCE 10 ppb Isopleth, Bedrock
- Limit of Cover Installed by Removal Program
- Parcel Boundary
- Former Building Footprint
- Leased Portion of Walton Property (paved and occupied)
- Limit of Closed Lagoon Area

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water
- Stream Channel
- Area of Excavation by Removal Program
- Bungay River Water Resource Protection District

I*, J*, K* - Home has operating SSDS.
F** - Home is abandoned.

AECOM

0 130 260 520 Feet

G:\Projects\HAZWASTE\60308115WAL\Maps\FS\Fig3-11_Alternative_BR-4.mxd

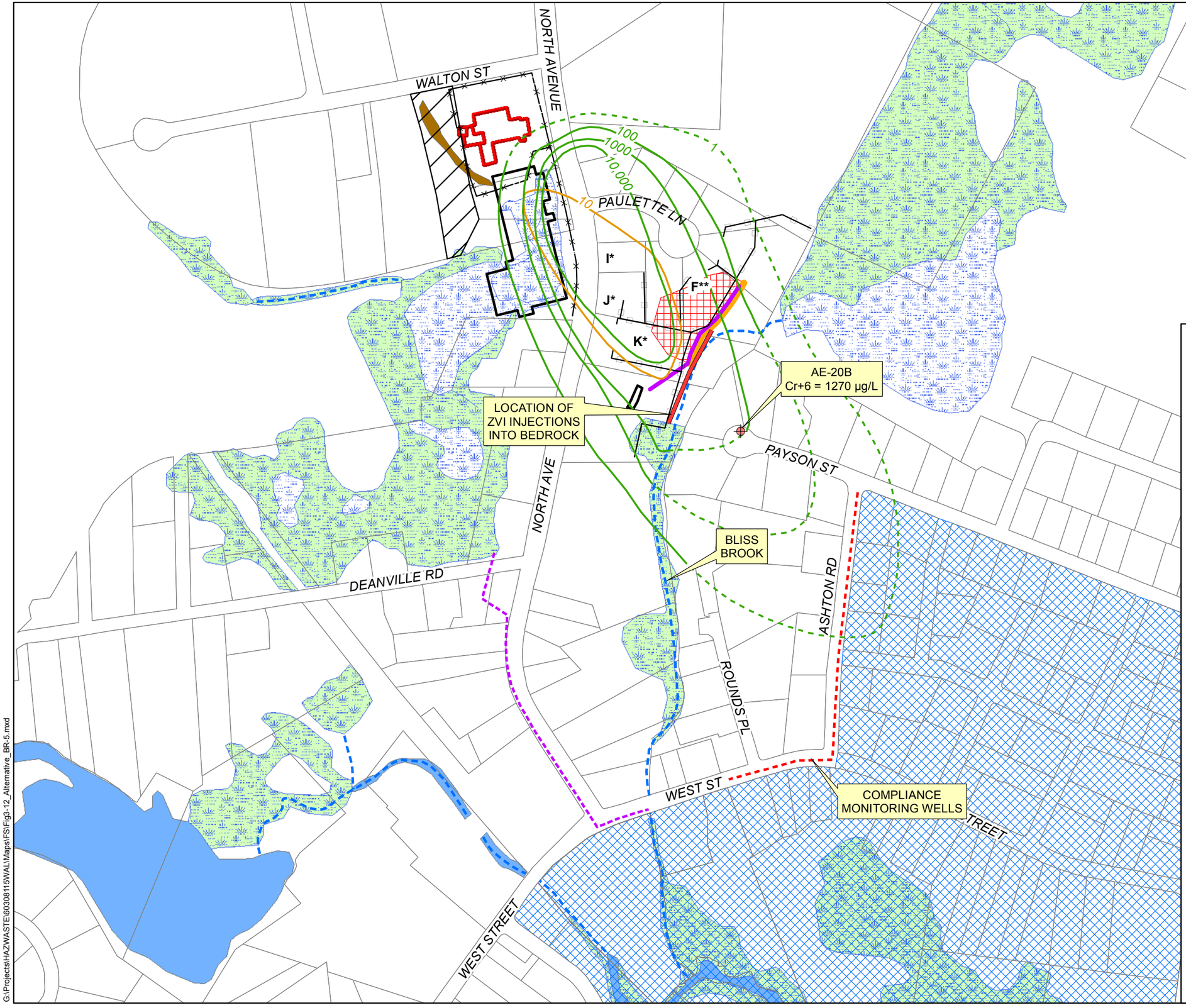


FIGURE 3-12.

CONCEPTUAL PLAN FOR CONTINGENCY ENHANCED (DEEPER) PRB COMPONENT OF ALTERNATIVE BR-5

Legend

- Monitoring Well Location
- Drainage Pipe Trunk Line
- Compliance Monitoring Wells (Locations TBD)
- Groundwater Collection Pipe
- PRB Trench
- Site Fence
- Residential Privacy Fence
- Hexavalent Chromium, Bedrock (dashed where inferred)
- TCE 10 ppb Isopleth, Bedrock
- Limit of Cover Installed by Removal Program
- Parcel Boundary
- Former Building Footprint
- Leased Portion of Walton Property (paved and occupied)
- Limit of Closed Lagoon Area

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water
- Stream Channel
- Area of Excavation by Removal Program
- Bungay River Water Resource Protection District

I*, J*, K* - Home has operating SSDS.
F** - Home is abandoned.

AECOM

0 130 260 520 Feet

G:\Projects\HAZWASTE\60308115\WAL\Maps\FS\Fig3-12_Alternative_BR-5.mxd

FIGURE 3-13

ESTIMATED EXTENTS OF HEXAVALENT CHROMIUM IN GROUNDWATER ABOVE IRRIGATION AND DRINKING WATER PRGs

Legend

- Overburden Monitoring Well
- Bedrock Monitoring Well
- Existing PRB Trench
- Fence Installed by Removal Program
- Hexavalent Chromium Concentration Contour Based on Phase 3 Bedrock Groundwater Results
- (Dashed Where Inferred or Estimated Based on Modeling)
- Hexavalent Chromium Concentration Contour Based on Phase 3 Overburden Groundwater Results
- (Dashed Where Inferred or Estimated Based on Modeling)
- Former Building Footprint

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water
- Stream Channel
- Bungay River Water Resource Protection District

1 inch equals 150 feet

0 75 150 300 Feet

AECOM

G:\Projects\HAZWASTE\60308115WAL\Maps\Fig3-13_BedrockSolute.mxd

DEP-5S DEP-5D DEP-8D DEP-8S MW-7 MW-10S MW-10D AE-01S AE-01B AE-01D MW-9S MW-9D AE-02B AE-ML-01 AE-15S AE-15B AE-15D 1 µg/L 100 µg/L AE-11B MW-12S MW-12D MW-5S MW-5D MW-6D MW-6S AE-03B MW-4S MW-4D PAULETTE LANE MW-14 AE-05B MW-13 AE-ML-02 AE-04B AE-04D AE-04S MW-100D MW-100S PZ-01S PZ-01D MW-101S MW-101D PZ-02S PZ-02D MW-15 MW-102D MW-102S AE-ML-04 AE-06B AE-08D AE-08B AE-09S AE-10S RCA-19 AE-19S DEP-7D DEP-7S MW-103S MW-103D AE-12B AE-ML-03 AE-18S DEP-1S DEP-1D AE-20B AE-14D AE-14B PAYSON STREET MW-16 AE-07B AE-07D AE-16S AE-17S NORTH AVENUE DEP-3D DEP-3S DEP-2S DEP-2D AE-13B

ESTIMATED EXTENT OF GROUNDWATER ABOVE IRRIGATION WELL PRG FOR HEXAVALENT CHROMIUM (BASED ON WELL DATA AND MODELING)

BLISS BROOK

ESTIMATED EXTENT OF GROUNDWATER ABOVE DRINKING WATER PRG FOR HEXAVALENT CHROMIUM WITHIN DISTRICT (BASED ON MODELING TO ESTIMATE 1 µg/L CONCENTRATION CONTOUR: SEE NOTE)

WEST STREET

Note: Because the drinking water PRG for hexavalent chromium (0.035 µg/L) is well below the reporting limit for RI groundwater data of 0.5 µg/L, well data cannot be used to estimate a concentration contour line at the PRG. 1 µg/L (twice the reporting limit) was selected as a value that could reasonably be estimated.

FIGURE 4-1.

CONCEPTUAL LIMITS FOR GROUNDWATER RESTRICTIONS FOR IRRIGATION WELLS

Legend

- TCE or VC exceeds groundwater PRG
- No VOCs detected above groundwater PRG
- VOCs not analyzed
- Hex Cr detected above groundwater PRG
- No metals detected above groundwater PRG(s)
- Proposed Limit of Groundwater Restriction
- Parcel Boundary
- Former Building Footprint
- Limit of Closed Lagoon Area
- Bungay River Water Resource Protection District

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water
- Stream Channel
- Area of Excavation by Removal Program
- Approximate Limit of Work for Removal Action and Site Restoration

1:3,200

AECOM

0 125 250 500 Feet

DETAIL - SOUTHERN PORTION OF MECHANICS POND

SEE DETAIL FOR SOUTHERN PORTION OF MECHANICS POND

G:\Projects\HAZWASTE\60308115WAL\Maps\FSFig4-1_GroundwaterOrdinance.mxd

APPENDIX A – ADDITIONAL RISK EVALUATION

TABLE A-1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
WALTON & LONSBURY SUPERFUND SITE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
All Samples Combined															
	71-55-6	1,1,1-Trichloroethane	0.11 J	2600	ug/L	MW-5S (Ph. 1)	58 / 129	0.5	2600	N/A	37300 N	N/A	N/A	N	BSL
	79-00-5	1,1,2-Trichloroethane	0.52	0.52	ug/L	MW-9S (Ph. 2)	1 / 129	0.5 - 10	0.52	N/A	41.400 N	N/A	N/A	N	BSL
	75-34-3	1,1-Dichloroethane	0.11 J	1700	ug/L	MW-5S (Ph. 1)	77 / 128	0.5	1700	N/A	391.0 C	N/A	N/A	Y	ASL
	75-35-4	1,1-Dichloroethene	0.25 J	450	ug/L	MW-5S (Ph. 1)	51 / 128	0.5 - 0.96	450	N/A	1050 N	N/A	N/A	N	BSL
	96-12-8	1,2-Dibromo-3-chloropropane	0.11 J	0.11 J	ug/L	AE-04B (Ph. 1)	1 / 127	0.5 - 10	0.11	N/A	0.44000 C	N/A	N/A	N	BSL
	107-06-2	1,2-Dichloroethane	0.38 J	0.38 J	ug/L	AE-08D (Ph. 3)	1 / 127	0.5 - 10	0.38	N/A	30.00 C	N/A	N/A	N	BSL
	71-43-2	Benzene	0.10 J	0.49 J	ug/L	MW-102D (Ph. 1)	10 / 129	0.5 - 10	0.49	N/A	27.30 C	N/A	N/A	N	BSL
	75-27-4	Bromodichloromethane	0.55	0.55	ug/L	MW-14 (Ph. 3)	1 / 116	0.5 - 10	0.55	N/A	38.60 C	N/A	N/A	N	BSL
	67-66-3	Chloroform	1.0	4.9	ug/L	DEP-4S (Ph. 2)	3 / 128	0.5 - 10	4.9	N/A	67.60 C	N/A	N/A	N	BSL
	156-59-2	cis-1,2-Dichloroethene	0.12 J	790	ug/L	MW-5S (Ph. 1)	76 / 128	0.5	790	N/A	43.4 N	N/A	N/A	Y	ASL
	127-18-4	Tetrachloroethene	0.10 J	19	ug/L	MW-5S (Ph. 1)	46 / 129	0.5	19	N/A	51.3 N	N/A	N/A	N	BSL
	79-01-6	Trichloroethene	0.069 J	1300	ug/L	MW-5S (Ph. 1)	91 / 129	0.15 - 0.5	1300	N/A	9.81 N	N/A	N/A	Y	ASL
	75-01-4	Vinyl chloride	0.0077 J	33 J	ug/L	MW-12S (Ph. 1)	61 / 129	0.015 - 0.5	33	N/A	0.070 C	N/A	N/A	Y	ASL
	123-91-1	1,4-Dioxane	0.026 J	23	ug/L	AE-06B (Ph. 1)	49 / 65	0.1 - 0.23	23	N/A	41.80 C	N/A	N/A	N	BSL
	7429-90-5	Aluminum	21	26400	ug/L	AE-09S (Ph. 2)	115 / 128	20 - 65.8	26400	N/A	39600 N	N/A	N/A	N	BSL
	7440-36-0	Antimony	0.070 J	2.7	ug/L	DEP-5S (Ph. 3)	16 / 128	2 - 4	2.7	N/A	11.80 N	N/A	N/A	N	BSL
	7440-38-2	Arsenic	0.076 J	13	ug/L	MW-102D (Ph. 1)	97 / 128	1	13	N/A	2.670 C	N/A	N/A	Y	ASL
	7440-39-3	Barium	8.6 J	552	ug/L	DEP-4D (Ph. 1)	122 / 128	10	552	N/A	4410 N	N/A	N/A	N	BSL
	7440-43-9	Cadmium	0.011 J	2.9	ug/L	MW-5S (Ph. 2)	68 / 128	0.04 - 1	2.9	N/A	9.26 N	N/A	N/A	N	BSL
	7440-47-3	Chromium	0.14 J-	86400	ug/L	AE-04D (Ph. 1)	103 / 128	2 - 7.4	86400	N/A	10700 N	N/A	N/A	Y	ASL
	18540-29-9	Chromium, Hexavalent	0.60	83000	ug/L	AE-04D (Ph. 1)	72 / 127	0.5	83000	N/A	0.307 C	N/A	N/A	Y	ASL
	7440-48-4	Cobalt	0.140 J	635 J	ug/L	MW-9S (Ph. 2)	99 / 128	1	635	N/A	12.30 N	N/A	N/A	Y	ASL
	7440-50-8	Copper	0.16 J	777	ug/L	AE-04D (Ph. 1)	69 / 128	2	777	N/A	1580 N	N/A	N/A	N	BSL
	57-12-5	Cyanide	1.4 J	36	ug/L	MW-5S (Ph. 2)	89 / 128	2.5 - 10	36	N/A	23.80 N	N/A	N/A	Y	ASL
	7439-89-6	Iron	66 J	48700	ug/L	MW-5S (Ph. 2)	115 / 128	200	48700	N/A	27700 N	N/A	N/A	Y	ASL
	7439-96-5	Manganese	3.0 J	21000	ug/L	DEP-4S (Ph. 1)	128 / 128	N/A	21000	N/A	390 N	N/A	N/A	Y	ASL
	7439-97-6	Mercury	0.023 J	0.33	ug/L	DEP-4D (Ph. 2)	11 / 128	0.2	0.33	N/A	6.620 N	N/A	N/A	N	BSL
	7440-02-0	Nickel	0.63 J	42	ug/L	AE-04D (Ph. 1)	124 / 128	1	42	N/A	639 N	N/A	N/A	N	BSL
	7440-62-2	Vanadium	0.50 J-	68	ug/L	DEP-3D (Ph. 2)	18 / 118	5	68	N/A	61.6 N	N/A	N/A	Y	ASL

TABLE A-1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
WALTON & LONSBURY SUPERFUND SITE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)

Notes:
Refer to Attachment A of HHRA for samples included in data set. Only analytes which were COPCs resulting from the HHRA tapwater screening have been included in this evaluation. Lead exposures have been evaluated separately.
COPCs - Chemicals of Potential Concern
N/A = Not Applicable or Not Available

[1] **Organic Data Qualifiers**
J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.
Inorganic Data Qualifiers
J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.

[2] The maximum detected concentration was used. Duplicate samples were averaged prior to the identification of maxima.

[3] Background values were not used for COPC screening purposes.

[4] Screening toxicity values are the USEPA (May 2018) Regional Screening Levels (RSLs) for irrigation well exposures (see FS text for details) using the online RSL calculator (see attached calculator output).
C = Carcinogen
N = Noncarcinogen (adjusted to a hazard quotient of 0.1)
L = Lead
The RSL values for noted analytes are as follows:
RSL for chromium (III), Insoluble Salts used for chromium.
RSL for mercuric chloride used for mercury.

[5] Codes used for rationale are as follows:
Selection Reason: Above Screening Levels (ASL)
Deletion Reason: Below Screening Level (BSL)

Table A-2. Risk Estimate for Irrigation Well Scenario

CAS number	Chemical of Potential Concern [1]	EPC (ug/L) [2]	Cancer RSL (ug/L) [3]	Non-cancer RSL (ug/L) [3]	Cancer Risk [4]	Non-cancer Hazard [4]	Target Organ [5]
75-34-3	1,1-Dichloroethane	467.5	391	5310	1E-06	9E-03	Kidney
156-59-2	cis-1,2-Dichloroethene	306.1	-	43.4	-	7E-01	Kidney
79-01-6	Trichloroethene	398.9	20.4	9.81	2E-05	4E+00	Cardiovascular/ Developmental/ Immune System
75-01-4	Vinyl chloride	11.1	0.0702	76.6	2E-04	1E-02	Liver
7440-38-2	Arsenic	3.793	2.67	11.9	1E-06	3E-02	Skin
7440-47-3	Chromium	26068	-	10700	-	2E-01	Liver
18540-29-9	Chromium, Hexavalent	25874	0.307	20.7	8E-02	1E+02	Gastrointestinal
7440-48-4	Cobalt	12.34	-	12.3	-	1E-01	Endocrine
57-12-5	Cyanide	3.669	-	23.8	-	2E-02	Reproductive
7439-89-6	Iron	9085	-	27700	-	3E-02	Gastrointestinal
7439-96-5	Manganese	729.9	-	390	-	2E-01	Nervous System
7440-62-2	Vanadium	ND	-	61.6	-		Skin
				Total Risk/Hazard:	8E-02	1E+02	

Notes

1. See Table A-1
2. Exposure Point Concentrations (EPCs) taken from HHRA, Site-Wide (center of plume) groundwater.
3. See RSL calculator output attached. Cancer RSL at risk level of 1E-06; non-cancer RSL set at a hazard quotient of 0.1.
4. Determined proportionally using the maximum detection and the appropriate RSL.
5. See HHRA

RSL - Regional Screening Level

HI - Hazard Index

ND - Not Detected in center of plume

Total Cardiovascular HI =	4E+00
Total Developmental HI =	4E+00
Total Endocrine HI =	1E-01
Total Gastrointestinal HI =	1E+02
Total Immune System HI =	4E+00
Total Kidney HI =	7E-01
Total Liver HI =	3E-01
Total Nervous System HI =	2E-01
Total Reproductive HI =	2E-02
Total Skin HI =	3E-02

Table A-3. Summary of Parameter Values Used in the Integrated Exposure Uptake Biokinetic (IEUBK) Model for Evaluation of Lead Risks Associated with Site Groundwater via an Irrigation Well
Baseline Human Health Risk Assessment
Walton & Lonsbury Superfund Site

Receptor Scenario: Young Child [1,2] (Resident)

Parameter		Value	Units
Indoor air lead concentration (% of outdoor)		30 [a]	%
AIR (by year)			
Air Concentration			
Age (years) =	0 - 1	0.10 [a]	µg/m^3
	1 - 2	0.10 [a]	µg/m^3
	2 - 3	0.10 [a]	µg/m^3
	3 - 4	0.10 [a]	µg/m^3
	4 - 5	0.10 [a]	µg/m^3
	5 - 6	0.10 [a]	µg/m^3
	6 - 7	0.10 [a]	µg/m^3
Time Outdoors			
Age (years) =	0 - 1	1 [a]	hours/day
	1 - 2	2 [a]	hours/day
	2 - 3	3 [a]	hours/day
	3 - 7	4 [a]	hours/day
Ventilation Rate			
Age (years) =	0 - 1	3.22 [b]	m^3/day
	1 - 2	4.97 [b]	m^3/day
	2 - 3	6.09 [b]	m^3/day
	3 - 4	6.95 [b]	m^3/day
	4 - 5	7.68 [b]	m^3/day
	5 - 6	8.32 [b]	m^3/day
	6 - 7	8.89 [b]	m^3/day
Lung Absorption		32 [a]	%
DIET (by year)			
Dietary Lead Intake			
Age (years) =	0 - 1	2.66 [b]	µg Pb/day
	1 - 2	5.03 [b]	µg Pb/day
	2 - 3	5.21 [b]	µg Pb/day
	3 - 4	5.58 [b]	µg Pb/day
	4 - 5	5.64 [b]	µg Pb/day
	5 - 6	6.04 [b]	µg Pb/day
	6 - 7	5.95 [b]	µg Pb/day
ALTERNATE DIET SOURCES (by food class)			
Concentration:			
	home-grown fruits	0 [a]	µg Pb/g
	home-grown vegetables	0 [a]	µg Pb/g
	fish from fishing	0 [a]	µg Pb/g
	game animals from hunting	0 [a]	µg Pb/g

Table A-3. Summary of Parameter Values Used in the Integrated Exposure Uptake Biokinetic (IEUBK) Model for Evaluation of Lead Risks Associated with Site Groundwater via an Irrigation Well
Baseline Human Health Risk Assessment
Walton & Lonsbury Superfund Site

Receptor Scenario: Young Child [1,2] (Resident)

Parameter		Value	Units
Percent of food class:			
	home-grown fruits	0 [a]	%
	home-grown vegetables	0 [a]	%
	fish from fishing	0 [a]	%
	game animals from hunting	0 [a]	%
ALTERNATE INTAKE - Not Applicable			
Ingestion rate:			
Age (years) =	0 - 1	0 [a]	µg Pb/day
	1 - 2	0 [a]	µg Pb/day
	2 - 3	0 [a]	µg Pb/day
	3 - 4	0 [a]	µg Pb/day
	4 - 5	0 [a]	µg Pb/day
	5 - 6	0 [a]	µg Pb/day
	6 - 7	0 [a]	µg Pb/day
DRINKING WATER			
Lead Concentration in drinking water		0.9 [b]	µg/L
Ingestion rate:			
Age (years) =	0 - 1	0.40 [b]	L/day
	1 - 2	0.43 [b]	L/day
	2 - 3	0.51 [b]	L/day
	3 - 4	0.54 [b]	L/day
	4 - 5	0.57 [b]	L/day
	5 - 6	0.6 [b]	L/day
	6 - 7	0.63 [b]	L/day
SOIL/DUST INGESTION			
Concentration:			
	soil	100 [c]	µg/g
	dust	Calculated	µg/g
Soil/dust ingestion weighting factor (% soil)		45 [a]	%
Soil/dust ingestion:			
Age (years) =	0 - 1	0.096 [b]	g/day
	1 - 2	0.094 [b]	g/day
	2 - 3	0.067 [b]	g/day
	3 - 4	0.063 [b]	g/day
	4 - 5	0.067 [b]	g/day
	5 - 6	0.052 [b]	g/day
	6 - 7	0.055 [b]	g/day
SOIL/DUST MULTIPLE SOURCE ANALYSIS			
Fraction of indoor dust lead attributable to soil		0.70 [a]	unitless
Ratio of dust lead concentration to outdoor air lead concentration		100 [a]	µg Pb/g dust per µg Pb/m^3 air

Table A-3. Summary of Parameter Values Used in the Integrated Exposure Uptake Biokinetic (IEUBK) Model for Evaluation of Lead Risks Associated with Site Groundwater via an Irrigation Well
Baseline Human Health Risk Assessment
Walton & Lonsbury Superfund Site

Receptor Scenario: Young Child [1,2] (Resident)

Parameter	Value	Units
BIOAVAILABILITY FOR GUT ABSORPTION PATHWAYS		
Total lead absorption (at low intake):		
diet	50 [a]	%
drinking water	50 [a]	%
soil	30 [a]	%
dust	30 [a]	%
alternate source	50 [e]	%
BIOAVAILABILITY FOR GUT ABSORPTION PATHWAYS (continued)		
Fraction of total net absorption at low intake rate that is attributable to non-saturable (passive) processes	0.2 [a]	unitless
ALTERNATE SOURCES OF LEAD - Not Applicable		
Total lead intake:		
Age (years) = 0 - 1	0.26 [d]	µg/day
1 - 2	0.26 [d]	µg/day
2 - 3	0.26 [d]	µg/day
3 - 4	0.26 [d]	µg/day
4 - 5	0.26 [d]	µg/day
5 - 6	0.26 [d]	µg/day
6 - 7	0.26 [d]	µg/day
MATERNAL-TO-NEWBORN LEAD EXPOSURE		
Mothers blood lead concentration at childbirth	0.6 [f]	µg/dL
PLOTTING AND RISK ESTIMATION		
Geometric standard deviation (GSD) for blood lead	1.6 [a]	unitless
Blood lead level of concern	5 [b]	µg/dL
COMPUTATION OPTIONS		
Iteration time step for numerical integration	4 [a]	hours

Table A-3. Summary of Parameter Values Used in the Integrated Exposure Uptake Biokinetic (IEUBK) Model for Evaluation of Lead Risks Associated with Site Groundwater via an Irrigation Well
Baseline Human Health Risk Assessment
Walton & Lonsbury Superfund Site

Receptor Scenario: Young Child [1,2] (Resident)

Parameter	Value	Units

Notes:

[1] Young child = 0 - 7 years of age (0 - 84 months)

[2] Assumes exposure to lead via a swimming pool, filled using an irrigation well impacted by site groundwater.

[a] Default value (USEPA, 2007).

[b] Provided by the EPA Lead Workgroup, March 2017

[c] Consistent with the HHRA, background concentration assumed to be 100 mg/kg.

[d] For the swimming scenario described in Section 1.7.3 of the FS, the ingestion rate of a child is 0.1 L/hr, with an exposure of 2 hrs/day. The average groundwater concentration (from Table 3.10 of the HHRA) is 1.3 ug/L. This results in 0.26 ug/day.

[e] Assumed the same as the default for drinking water ingestion.

[f] USEPA. 2017b. Update of the Adult Lead Methodology's Default Baseline Blood Lead Concentration and Geometric Standard Deviation Parameters. OLEM Directive 9285.6-56. May 2017. Available at: https://semspub.epa.gov/work/HQ/196766.pdf

L/day = liters per day

$\mu g/m^3$ = micrograms per cubic meter

µg/dL = micrograms per deciliter

µg/g = micrograms per gram

References:

USEPA. 2007. User's Guide for the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK). Office of Superfund Remediation and Technology Innovation. EPA-540-K-01-005. OSWER #9285.7-42. May 2007.

Table A-4. IEUBK Output – Walton & Lonsbury Superfund Site
F Irrigation Exposure

LEAD MODEL FOR WINDOWS Version 1.1

==========

Model Version: 1.1 Build11
User Name:
Date:
Site Name:
Operable Unit:
Run Mode: Research

==========

******** Air ********

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (µg Pb/m^3)
.5-1	1.000	3.220	32.000	0.100
1-2	2.000	4.970	32.000	0.100
2-3	3.000	6.090	32.000	0.100
3-4	4.000	6.950	32.000	0.100
4-5	4.000	7.680	32.000	0.100
5-6	4.000	8.320	32.000	0.100
6-7	4.000	8.890	32.000	0.100

******** Diet ********

Age	Diet Intake(µg/day)
.5-1	2.660
1-2	5.030
2-3	5.210
3-4	5.580
4-5	5.640
5-6	6.040
6-7	5.950

******** Drinking Water ********

Water Consumption:

Age	Water (L/day)
.5-1	0.400
1-2	0.430
2-3	0.510
3-4	0.540
4-5	0.570
5-6	0.600
6-7	0.630

Drinking Water Concentration: 0.900 µg Pb/L

******** Soil & Dust ********

Multiple Source Analysis Used
Average multiple source concentration: 80.000 µg/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (µg Pb/g)	House Dust (µg Pb/g)
.5-1	100.000	80.000
1-2	100.000	80.000
2-3	100.000	80.000
3-4	100.000	80.000
4-5	100.000	80.000
5-6	100.000	80.000
6-7	100.000	80.000

******** Alternate Intake ********

Age	Alternate (µg Pb/day)
.5-1	0.260
1-2	0.260
2-3	0.260
3-4	0.260
4-5	0.260
5-6	0.260
6-7	0.260

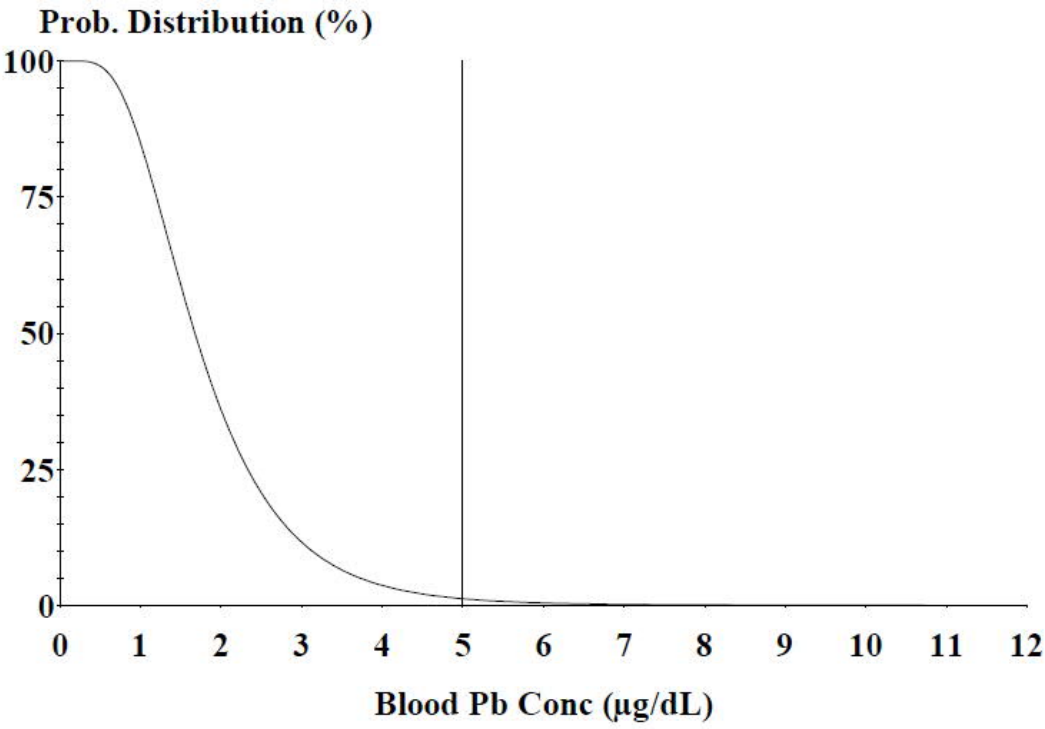
******** Maternal Contribution: Infant Model ********

Maternal Blood Concentration: 0.600 µg Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (µg/day)	Diet (µg/day)	Alternate (µg/day)	Water (µg/day)
.5-1	0.034	1.271	0.124	0.172
1-2	0.057	2.405	0.124	0.185
2-3	0.076	2.518	0.126	0.222
3-4	0.093	2.708	0.126	0.236
4-5	0.102	2.746	0.127	0.250
5-6	0.111	2.952	0.127	0.264
6-7	0.119	2.913	0.127	0.278

Year	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
.5-1	2.449	4.050	2.2
1-2	2.400	5.172	2.2
2-3	1.729	4.670	1.8
3-4	1.633	4.796	1.7
4-5	1.742	4.967	1.6
5-6	1.357	4.811	1.5
6-7	1.438	4.874	1.4



Cutoff = 5.000 µg/dl
Geo Mean = 1.757
GSD = 1.600
% Above = 1.303

Age Range = 0 to 84 months

Run Mode = Research

APPENDIX B – CALCULATION OF PRELIMINARY REMEDIATION GOALS

This appendix presents PRG development summary tables followed by receptor-specific attachments.

- **Summary tables B-1 through B-5**
- **Attachment A – Human Health PRG Calculations**
  - **A.1 – Soil - Resident**
  - **A.2 – Surface Water – Recreational User**
  - **A.3 – Groundwater – Construction Worker**
  - **A.4 – Groundwater – Resident**
  - **A.5 – Groundwater – Irrigation Scenario**
- **Attachment B – Ecological PRG Calculations**

TABLES

TABLE B-1. HUMAN HEALTH PRELIMINARY REMEDIATION GOALS (PRGs) FOR SOIL - WALTON & LONSBURY

Media/ Scenario	Contaminant	Risk-Based PRGs[1]					Additional Information				Selected PRG	Basis
		ILCR			HQ = 1	Lead [2]	Site-specific Reference Levels[3]	U.S. Background[5]	MA Background - Natural[4]	MA Background - Fill[4]		
		10^{-6}	10^{-5}	10^{-4}								
Walton & Lonsbury Property Soil - mg/kg (Hypothetical Residential Scenario)												
	Benzo(a)anthracene	1.1	11	110	NA	NA	0.25	- -	2	9	11	ILCR = 10^{-5}
	Benzo(a)pyrene	0.11	1.1	11	NA	NA	0.28	- -	2	7	1.1	ILCR = 10^{-5}
	Benzo(b)fluoranthene	1.1	11	110	NA	NA	0.45	- -	2	8	11	ILCR = 10^{-5}
	Dibenz(a,h)anthracene	0.11	1.1	11	NA	NA	- -	- -	0.5	1	1.1	ILCR = 10^{-5}
	Antimony	NA	NA	NA	31	NA	0.34	0.52	1	7	31	HQ = 1
	Arsenic	0.68	6.8	68	NA	NA	- -	4.8	20	20	6.8	ILCR = 10^{-5}
	Chromium, Hexavalent	0.30	3.0	30	NA	NA	14	33	30	40	3.0	ILCR = 10^{-5}
	Cobalt	NA	NA	NA	23	NA	2.8	5.9	4	4	23	HQ = 1
	Lead	NA	NA	NA	NA	200	75	14	100	600	200	Lead
	Thallium	NA	NA	NA	0.78	NA	- -	- -	0.6	5	0.78	HQ = 1
Residential Yards-West of N. Avenue Soil - mg/kg (Residential Scenario)												
	Lead	NA	NA	NA	NA	200	75	14	100	600	200	Lead

Notes
ILCR - Incremental Lifetime Cancer Risk
HQ - Hazard Quotient
NA - Not carcinogenic, or a carcinogen was not evaluated for potential non-carcinogenic effects; not applicable

1. Risk-based PRGs are developed based on risk results from the human health risk assessment and consider the ingestion, dermal and inhalation routes of exposure, as applicable.
   The only PRGs included were for those analytes which were concluded to be primary risk drivers; if the cancer or non-cancer effects were not shown to be primary risk drivers, a PRG was not presented (NA).
2. The use of the IEUBK Model with updated parameters and a target blood lead level of 5 ug/dL provides for an acceptable residential soil concentration of approximately 200 mg/kg (see HHRA).
3. Site-specific reference values from Table 12 of BERA - CTE concentration; note that the value presented for Chromium, Hexavalent is actually total chromium.
   - - = not detected
4. Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil - Technical Update; MassDEP, May 2002.
5. USGS, 1984. Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States. Eastern US mean concentrations; note that the value presented for Chromium, Hexavalent is actually total chromium.

TABLE B-2. HUMAN HEALTH PRELIMINARY REMEDIATION GOALS (PRGs) FOR GROUNDWATER - WALTON & LONSBURY

Media/ Scenario	Contaminant	Regulatory Criteria		Risk-Based PRGs - Ingestion/Dermal/Inhalation				Additional Information					Selected PRG	Basis
		Federal MCLs	MMCLs	ILCR 10^{-6}	ILCR 10^{-5}	ILCR 10^{-4}	HQ = 1	Site-specific Background Levels[1]	MassDEP Background[2]	Health Advisory[3]	ORSG	Non-zero MCLGs		
Groundwater - ug/L Site-wide (Residential Scenario)														
	1,1,1-Trichloroethane[5]	200	200	- -	- -	- -	- -	- -	- -	- -	- -	- -	200	MCL
	1,1-Dichloroethane	- -	- -	2.8	28	275	3753	- -	- -	- -	70	- -	2.8	ILCR = 10^{-6}
	cis-1,2-Dichloroethene	70	70	N/A	N/A	N/A	36	- -	- -	- -	- -	70	70	MCL
	Trichloroethene	5	5	0.49	4.9	49	2.8	- -	- -	- -	- -	- -	5	MCL
	Vinyl chloride	2	2	0.019	0.19	1.9	44	- -	- -	- -	- -	- -	2	MCL
	1,4-Dioxane	- -	- -	0.46	5	46	57	- -	- -	- -	0.3	- -	0.46	ILCR = 10^{-6}
	Arsenic	10	10	0.052	0.52	5.2	6.0	- -	5.5	- -	- -	- -	10	MCL
	Chromium[5]	100	100	- -	- -	- -	- -	- -	4.9	- -	- -	- -	100	MCL
	Chromium, Hexavalent	- -	- -	0.035	0.35	3.5	44	- -	- -	- -	- -	- -	0.035	ILCR = 10^{-6}
	Cobalt	- -	- -	N/A	N/A	N/A	6.0	- -	- -	- -	- -	- -	6.0	HQ = 1
	Lead[4]	15	15	N/A	N/A	N/A	N/A	- -	8.8	- -			15	MCL
	Manganese	- -	- -	N/A	N/A	N/A	434	- -	- -	300	300	- -	300	Health Adv.
Groundwater - ug/L Site-wide (Irrigation Well Scenario)														
	Trichloroethene	5	5	20	204	2040	98	- -	- -	- -	- -	- -	98	HQ = 1
	Vinyl chloride	2	2	0.070	0.70	7.0	766	- -	- -	- -	- -	- -	7.0	ILCR = 10^{-4}
	Chromium, Hexavalent	- -	- -	0.31	3.1	31	207	- -	- -	- -	- -	- -	100	ILCR = 3 x 10^{-4}
Groundwater - ug/L W&L Property (Const. Worker Scenario)														
	Chromium, Hexavalent	- -	- -	98	985	9846	3520	- -	- -	- -	- -	- -	985	ILCR = 10^{-5}

Notes

MCL - Maximum Contaminant Level. National Primary Drinking Water Regulations accessible at http://www.epa.gov/safewater/contaminants/index.html

MCLG - Maximum Contaminant Level Goal. National Primary Drinking Water Regulations accessible at http://www.epa.gov/safewater/contaminants/index.html

MMCL - Massachusetts Maximum Contaminant Level (310 CMR 22.00); accessible at http://www.mass.gov/eea/agencies/massdep/water/drinking/standards/standards-and-guidelines-for-drinking-water-contaminants.html#InorganicandOrganicChemicals

ORSG - Massachusetts Office of Research and Standards Guidelines accessible at http://www.mass.gov/eea/agencies/massdep/water/drinking/standards/standards-and-guidelines-for-drinking-water-contaminants.html#MassachusettsDrinkingWaterGuidelines; - - = no guideline

ILCR - Incremental Lifetime Cancer Risk

HQ - Hazard Quotient

N/A - Not carcinogenic, or a carcinogen was not evaluated for potential non-carcinogenic effects

1. No site-specific background wells have yet been specified; - - = not applicable
2. From *Background Documentation for the Development of the Massachusetts Contingency Plan (MCP) Numerical Standards* (MassDEP, 1994); - - = not applicable
3. Health Advisory on Manganese (EPA-822-R-04-003; January 2004)
4. Lead was identified in the HHRA as a risk-driver, however, it was not quantitatively evaluated. Lead is regulated by a Treatment Technique that requires systems to control the corrosiveness of their water. If more than 10% of tap water samples exceed the action level, water systems must take additional steps to correct that.
5. Analyte included only due to detections in exceedance of Regulatory Criteria. As this analyte was not determined to be a risk driver in the Baseline Human Health Risk Assessment (BHHRA), risk-based PRG calculations are not included for this analyte/exposure scenario.

TABLE B-3. HUMAN HEALTH PRELIMINARY REMEDIATION GOALS (PRGs) FOR SURFACE WATER - WALTON & LONSBURY

Media/ Scenario	Contaminant	Regulatory Criteria	Risk-Based PRGs - Ingestion/Dermal/Inhalation				Additional Information	Selected PRG	Basis
			ILCR						
		NRWQC	10^{-6}	10^{-5}	10^{-4}	HQ = 1	Site-specific Reference Levels[1]		
Surface water - ug/L Bliss Brook (Recreational User Scenario)	Chromium, Hexavalent	- -	0.34	3.4	34	- -	0.21	3.4	ILCR = 10^{-5}

Notes

NRWQC - National Recommended Water Quality Criteria for human health consumption of water and organism, 2015 - current values accessible at https://www.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table; - - = no value

ILCR - Incremental Lifetime Cancer Risk

HQ - Hazard Quotient

1. Central Tendency Exposure (CTE) concentration from Table 26 of Baseline Ecological Risk Assessment (BERA)

TABLE B-4. RESIDUAL RISK ASSOCIATED WITH HUMAN HEALTH PRGs FOR SOIL - WALTON & LONSBURY

Media/ Scenario	Contaminant	Risk-Based PRGs[1] ILCR 10^{-6}	ILCR 10^{-5}	ILCR 10^{-4}	HQ = 1	Lead[2]	Additional Information: Site-specific Reference Levels[3]	U.S. Background[5]	MA Background - Natural[4]	MA Background - Fill[4]	Selected PRG	Basis	Residual Risk At PRG[6]: Estimated ILCR	Estimated HQ	Target Organ
Walton & Lonsbury Property Soil - mg/kg (Hypothetical Residential Scenario)															
	Benzo(a)anthracene	1.1	11	110	NA	NA	0.25	- -	2	9	11	ILCR = 10^{-5}	1E-05	NA	
	Benzo(a)pyrene	0.11	1.1	11	NA	NA	0.28	- -	2	7	1.1	ILCR = 10^{-5}	1E-05	6E-02	Developmental
	Benzo(b)fluoranthene	1.1	11	110	NA	NA	0.45	- -	2	8	11	ILCR = 10^{-5}	1E-05	NA	
	Dibenz(a,h)anthracene	0.11	1.1	11	NA	NA	- -	- -	0.5	1	1.1	ILCR = 10^{-5}	1E-05	NA	
	Antimony	NA	NA	NA	31	NA	0.34	0.52	1	7	31	HQ = 1	NA	1E+00	Blood
	Arsenic	0.68	6.8	68	NA	NA	- -	4.8	20	20	6.8	ILCR = 10^{-5}	1E-05	2E-01	Skin
	Chromium, Hexavalent	0.30	3.0	30	NA	NA	14	33	30	40	3.0	ILCR = 10^{-5}	1E-05	1E-02	Gastrointestinal
	Cobalt	NA	NA	NA	23	NA	2.8	5.9	4	4	23	HQ = 1	1E-08	1E+00	Endocrine
	Lead	NA	NA	NA	NA	200	75	14	100	600	200	Lead			
	Thallium	NA	NA	NA	0.78	NA	- -	- -	0.6	5	0.78	HQ = 1	NA	1E+00	Skin
													6E-05	**3E+00**	

Notes

ILCR - Incremental Lifetime Cancer Risk

HQ - Hazard Quotient

NA - Not carcinogenic, or a carcinogen was not evaluated for potential non-carcinogenic effects; not applicable

Total Blood HI =	1E+00
Total Skin HI =	1E+00
Total Developmental HI =	6E-02
Total Endocrine HI =	1E+00
Total Gastrointestinal HI =	1E-02

1. Risk-based PRGs are developed based on risk results from the human health risk assessment and consider the ingestion, dermal and inhalation routes of exposure, as applicable. The only PRGs included were for those analytes which were concluded to be primary risk drivers; if the cancer or non-cancer effects were not shown to be primary risk drivers, a PRG was not presented (NA).
2. The use of the IEUBK Model with updated parameters and a target blood lead level of 5 ug/dL provides for an acceptable residential soil concentration of approximately 200 mg/kg (see HHRA).
3. Site-specific reference values from Table 12 of BERA - CTE concentration; note that the value presented for Chromium, Hexavalent is actually total chromium.
   - - = not detected
4. Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil - Technical Update; MassDEP, May 2002.
5. USGS, 1984. Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States. Eastern US mean concentrations; note that the value presented for Chromium, Hexavalent is actually total chromium.
6. Residual risk calculations developed by utilizing calculated risk results from the HHRA and the corresponding exposure point concentrations to proportionally determine the risk for the selected PRG.

TABLE B-5. ECOLOGICAL PRELIMINARY REMEDIATION GOALS (PRGs) FOR SURFACE WATER - WALTON & LONSBURY

Analyte	Ecological PRG [1]	Additional Information: Site-Specific Reference Concentrations[2]	Selected Ecological PRG	Basis
Inorganics				
Chromium	82	0.5	82	Geometric Mean of LOEC and NOEC
Chromium, Hexavalent	8	0.21	8	Geometric Mean of LOEC and NOEC

Notes:
All units - ug/L
BERA - Baseline Ecological Risk Assessment.
LOEC - Lowest Observed Effect Concentration
NOEC - No Observed Effect Concentration
PRG - Preliminary Remediation Goal.

1. See Attachment B
2. Central Tendency Exposure (CTE) concentration from Table 26 of BERA

ATTACHMENT A – HUMAN HEALTH PRG CALCULATIONS

A.1 – SOIL – RESIDENT

TABLE 1a

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

WALTON & LONSBURY SUPERFUND SITE

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Upland/Floodplain Surface Soil (0-2 ft)	Walton & Lonsbury Property											
			Benzo(a)pyrene	9E-06	1E-10	3E-06	- -	1E-05					
			Benzo(b)fluoranthene	6E-06	8E-12	2E-06	- -	8E-06					
			Antimony						Blood	4E+00	N/A	N/A	4E+00
			Arsenic	4E-06	7E-10	6E-07	- -	5E-06					
			Chromium, Hexavalent	2E-04	7E-07	N/A	- -	2E-04					
			Thallium						Skin	3E+00	N/A	N/A	3E+00
			Chemical Total	2E-04	7E-07	6E-06	- -	2E-04		7E+00	- -	- -	7E+00
			Radionuclide Total										
		Exposure Point Total						2E-04					7E+00
	Exposure Medium Total							2E-04					7E+00
Medium Total								2E-04					7E+00
Receptor Total								2E-04					7E+00

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 2E-04

Total Hazard Across All Media: 7E+00

Total Blood HI =	4E+00
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total Endocrine HI =	N/A
Total Gastrointestinal HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	N/A
Total Nervous System HI =	N/A
Total Reproductive HI =	N/A
Total Respiratory HI =	N/A
Total Muscoluskeletal HI =	N/A
Total Skin HI =	3E+00

TABLE 1b

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

WALTON & LONSBURY SUPERFUND SITE

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Upland/Floodplain Surface/ Subsurface Soil (0-10 ft)	Walton & Lonsbury Property	Benzo(a)anthracene	2E-06	2E-11	6E-07	- -	2E-06					
			Benzo(a)pyrene	1E-05	2E-10	5E-06	- -	2E-05					
			Benzo(b)fluoranthene	2E-05	2E-11	5E-06	- -	2E-05					
			Dibenz(a,h)anthracene	4E-06	5E-11	1E-06	- -	5E-06					
			Antimony						Blood	3E+00	N/A	N/A	3E+00
			Arsenic	4E-06	7E-10	6E-07	- -	5E-06					
			Chromium, Hexavalent	3E-04	1E-06	N/A	- -	3E-04					
			Cobalt						Endocrine	6E+00	4E-03	N/A	6E+00
			Chemical Total	4E-04	1E-06	1E-05	- -	4E-04		9E+00	4E-03	- -	9E+00
			Radionuclide Total										
		Exposure Point Total						4E-04					9E+00
	Exposure Medium Total							4E-04					9E+00
Medium Total								4E-04					9E+00
Receptor Total								4E-04					9E+00

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 4E-04

Total Hazard Across All Media: 9E+00

Total Blood HI =	3E+00
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total Endocrine HI =	6E+00
Total Gastrointestinal HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	N/A
Total Nervous System HI =	N/A
Total Reproductive HI =	N/A
Total Respiratory HI =	N/A
Total Muscoluskeletal HI =	N/A
Total Skin HI =	N/A

TABLE 2

VALUES USED FOR DAILY INTAKE CALCULATIONS - RESIDENT

REASONABLE MAXIMUM EXPOSURE

WALTON & LONSBURY SUPERFUND SITE

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface/Subsurface Soil

Exposure Route	Receptor Population	Receptor Age	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion/Dermal/ Inhalation	Resident	Young Child/Adult					See HHRA	See attached
			THQ	Target Hazard Quotient	1	- -		
			$AT\text{-}N_C$	Averaging Time (Non-Cancer) - child	2,190	days		
			ED_C	Exposure Duration - child	6	years		
			BW_C	Body Weight - child	15	kg		
			EF_C	Exposure Frequency - child	350	days/year		
			IR_C	Ingestion Rate of Soil - child	200	mg/day		
			CF	Conversion Factor	0.000001	kg/mg		
			SA_C	Surface Area - child	2,373	cm^2		
			AF_C	Adherence Factor - child	0.2	mg/cm^2-day		
			ABS	Dermal Absorption Fraction	see Table 7	- -		
			$AT\text{-}N_A$	Averaging Time (Non-Cancer) - adult	7,300	days		
			ED_A	Exposure Duration - adult	20	years		
			BW_A	Body Weight - adult	80	kg		
			EF_A	Exposure Frequency - adult	350	days/year		
			IR_A	Ingestion Rate of Soil - adult	100	mg/day		
			SA_A	Surface Area - adult	6,032	cm^2		
			AF_A	Adherence Factor - adult	0.07	mg/cm^2-day		
			RBA	Relative Bioavailability	0.6 for Arsenic/1 for all other analytes	- -		
			TR	Target ILCR	10^{-6} to 10^{-4}	- -		
			AT-C	Averaging Time (Cancer)	25,550	days		
			PEF	Particulate Emission Factor	1.36E+09	m^3/kg		
			VF	Volatilization Factor	see Table 10	m^3/kg	(a)	
			CF2	Conversion Factor 2	1000	ug/mg		
			RfD_O	Oral Reference Dose	see Table 3	mg/kg-day		
			RfD_D	Dermal Reference Dose	see Table 3	mg/kg-day		
			RfC	Reference Concentration	see Table 4	ug/m^3		
			SF_O	Oral Slope Factor	see Table 5	$(mg/kg\text{-}day)^{-1}$		
			SF_D	Dermal Slope Factor	see Table 5	$(mg/kg\text{-}day)^{-1}$		
			UR	Unit Risk	see Table 6	$(ug/m^3)^{-1}$		
			$ED_{0\text{-}2}$	Exposure Duration - 0-2 yrs	2	years		
			$ED_{2\text{-}6}$	Exposure Duration - 2-6 yrs	4	years		
			$ED_{6\text{-}16}$	Exposure Duration - 6-16 yrs	10	years		
			$ED_{16\text{-}26}$	Exposure Duration - 16-26 yrs+	10	years		

Notes:

(a) - The volatilization factor (VF) applies to those COCs considered volatile. The November 2017 update of EPA's Regional Screening Levels (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm) defines benzo(a)anthracene as volatile and provides chemical-specific VFs which have been applied during the PRG development process.

Intake Equation/
Model Name

Preliminary Remediation Goal (PRG) non-cancer:

Ingestion - child

$$PRG_{nc\text{-}ing}\ (mg/kg) = \frac{THQ \times AT\text{-}N_C \times RfD_o \times BW_C}{EF_C \times ED_C \times IR_C \times CF \times RBA}$$

Dermal - child

$$PRG_{nc\text{-}derm}\ (mg/kg) = \frac{THQ \times AT\text{-}N_C \times RfD_D \times BW_C}{EF_C \times ED_C \times SA_C \times AF_C \times ABS \times CF}$$

Inhalation - child

$$PRG_{nc\text{-}inh}\ (mg/kg) = \frac{THQ \times AT\text{-}N_C \times RfC}{EF_C \times (1/PEF + 1/VF) \times ED_C \times CF2}$$

Total - child

$$PRG_{nc\text{-}tot}\ (mg/kg) = \frac{1}{1/PRG_{nc\text{-}ing} + 1/PRG_{nc\text{-}derm} + 1/PRG_{nc\text{-}inh}}$$

Ingestion - adult

$$PRG_{nc\text{-}ing}\ (mg/kg) = \frac{THQ \times AT\text{-}N_A \times RfD_o \times BW_A}{EF_A \times ED_A \times IR_A \times CF \times RBA}$$

Dermal - adult

$$PRG_{nc\text{-}derm}\ (mg/kg) = \frac{THQ \times AT\text{-}N_A \times RfD_D \times BW_A}{EF_A \times ED_A \times SA_A \times AF_A \times ABS \times CF}$$

Inhalation - adult

$$PRG_{nc\text{-}inh}\ (mg/kg) = \frac{THQ \times AT\text{-}N_A \times RfC}{EF_A \times (1/PEF + 1/VF) \times ED_A \times CF2}$$

Total - adult

$$PRG_{nc\text{-}tot}\ (mg/kg) = \frac{1}{1/PRG_{nc\text{-}ing} + 1/PRG_{nc\text{-}derm} + 1/PRG_{nc\text{-}inh}}$$

Preliminary Remediation Goal (PRG) cancer:

Ingestion

$$PRG_{ca\text{-}ing}\ (mg/kg) = \frac{TR \times AT\text{-}C}{SF_o \times IFS_{adj} \times CF \times RBA}$$

$$IFS_{adj}\ (mg/kg) = \frac{ED_C \times EF_C \times IR_C}{BW_C} + \frac{ED_A \times EF_A \times IR_A}{BW_A}$$

Dermal

$$PRG_{ca\text{-}derm}\ (mg/kg) = \frac{TR \times AT\text{-}C}{SF_D \times DFS_{adj} \times ABS \times CF}$$

$$DFS_{adj}\ (mg/kg) = \frac{ED_C \times EF_C \times SA_C \times AF_C}{BW_C} + \frac{ED_A \times EF_A \times SA_A \times AF_A}{BW_A}$$

Inhalation

$$PRG_{ca\text{-}inh}\ (mg/kg) = \frac{TR \times AT\text{-}C}{UR \times CF2 \times EF_A \times (1/PEF + 1/VF) \times (ED_A + ED_C)}$$

Total

$$PRG_{ca\text{-}tot}\ (mg/kg) = \frac{1}{1/PRG_{ca\text{-}ing} + 1/PRG_{ca\text{-}derm} + 1/PRG_{ca\text{-}inh}}$$

Preliminary Remediation Goal (PRG) mutagenic:

Ingestion

$$PRG_{mu\text{-}ing}\ (mg/kg) = \frac{TR \times AT\text{-}C}{SF_o \times IFSM_{adj} \times CF \times RBA}$$

$$IFSM_{adj}\ (mg/kg) = \frac{ED_{0\text{-}2} \times EF_C \times IR_C \times 10}{BW_C} + \frac{ED_{2\text{-}6} \times EF_C \times IR_C \times 3}{BW_C} + \frac{ED_{6\text{-}16} \times EF_A \times IR_A \times 3}{BW_A} + \frac{ED_{16\text{-}26} \times EF_A \times IR_A}{BW_A}$$

Dermal

$$PRG_{mu\text{-}derm}\ (mg/kg) = \frac{TR \times AT\text{-}C}{SF_D \times DFSM_{adj} \times ABS \times CF}$$

$$DFSM_{adj}\ (mg/kg) = \frac{ED_{0\text{-}2} \times EF_C \times AF_C \times SA_C \times 10}{BW_C} + \frac{ED_{2\text{-}6} \times EF_C \times AF_C \times SA_C \times 3}{BW_C} + \frac{ED_{6\text{-}16} \times EF_A \times AF_A \times SA_A \times 3}{BW_A} + \frac{ED_{16\text{-}26} \times EF_A \times AF_A \times SA_A}{BW_A}$$

Inhalation

$$PRG_{mu\text{-}inh}\ (mg/kg) = \frac{TR \times AT\text{-}C}{CF2 \times EF_A \times (1/PEF + 1/VF) \times INFM_{adj}}$$

$$INFM_{adj} = ED_{0\text{-}2} \times UR \times 10 + ED_{2\text{-}6} \times UR \times 3 + ED_{6\text{-}16} \times UR \times 3 + ED_{16\text{-}30} \times UR$$

Total

$$PRG_{mu\text{-}tot}\ (mg/kg) = \frac{1}{1/PRG_{mu\text{-}ing} + 1/PRG_{mu\text{-}derm} + 1/PRG_{mu\text{-}inh}}$$

Notes

IFS_{adj} - age-adjusted soil ingestion factor

DFS_{adj} - age-adjusted soil dermal factor

$IFSM_{adj}$ - mutagenic age-adjusted soil ingestion factor

$DFSM_{adj}$ - mutagenic age-adjusted soil dermal factor

$INFM_{adj}$ - mutagenic age-adjusted inhalation factor

TABLE 3

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

WALTON & LONSBURY SUPERFUND SITE

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)anthracene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(a)pyrene	Chronic	3E-04	mg/kg-day	N/A	3E-04	mg/kg-day	Developmental	N/A	IRIS	06/01/18
Benzo(b)fluoranthene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dibenz(a,h)anthracene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Antimony	Chronic	4E-04	mg/kg-day	0.15	6.0E-05	mg/kg-day	Blood	1000	IRIS	06/01/18
Arsenic	Chronic	3E-04	mg/kg-day	(4)	3E-04	mg/kg-day	Skin	3	IRIS	06/01/18
Chromium, Hexavalent	Chronic	3E-03	mg/kg-day	0.025	7.5E-05	mg/kg-day	Gastrointestinal	900	IRIS	06/01/18
Cobalt	Chronic	3E-04	mg/kg-day	(4)	3E-04	mg/kg-day	Endocrine	3000	PPRTV	06/01/18
Thallium	Chronic	1E-05	mg/kg-day	(4)	1E-05	mg/kg-day	Skin	3000	PPRTV	06/01/18

(1) Oral Absorption Efficiencies from Exhibit 4-1, RAGS Part E, USEPA 2004b.

Oral absorption efficiency for cobalt obtained from ATSDR Toxicological Profile.

(2) Calculated as: (oral RfD) x (oral to dermal adjustment factor).

(4) Oral absorption efficiency exceeds 50%. Therefore, no adjustment of the oral reference dose is necessary (USEPA, 2001).

RfD for thallium is based on thallium (soluble salts)

IRIS = Integrated Risk Information System

N/A = Not Applicable/Not Available

PPRTV = Provisional Peer Reviewed Toxicity Value

TABLE 4

NON-CANCER TOXICITY DATA -- INHALATION

WALTON & LONSBURY SUPERFUND SITE

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)anthracene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(a)pyrene	Chronic	2.0E-03	ug/m^3	N/A	N/A	Developmental	3000	IRIS	06/01/18
Benzo(b)fluoranthene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dibenz(a,h)anthracene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Antimony	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	Chronic	1.5E-02	ug/m^3	N/A	N/A	Developmental	30	CalEPA	06/01/18
Chromium, Hexavalent	Chronic	1.0E-01	ug/m^3	N/A	N/A	Respiratory	300	IRIS	06/01/18
Cobalt	Chronic	6.0E-03	ug/m^3	N/A	N/A	Respiratory	300	PPRTV	06/01/18
Thallium	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

IRIS = Integrated Risk Information System

CalEPA = California Environmental Protection Agency, Office of Environmental Health Hazard Assessment

N/A = Not Applicable or Not Available

PPRTV = Provisional Peer Reviewed Toxicity Value

TABLE 5

CANCER TOXICITY DATA -- ORAL/DERMAL

WALTON & LONSBURY SUPERFUND SITE

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal (2)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)anthracene	1.0E-01	$(mg/kg\text{-}day)^{-1}$	(1)	1.0E-01	$(mg/kg\text{-}day)^{-1}$	Carcinogenic to humans	IRIS	06/01/18
Benzo(a)pyrene	1.0E+00	$(mg/kg\text{-}day)^{-1}$	(1)	1.0E+00	$(mg/kg\text{-}day)^{-1}$	Carcinogenic to humans	IRIS	06/01/18
Benzo(b)fluoranthene	1.0E+00	$(mg/kg\text{-}day)^{-1}$	(1)	1.0E+00	$(mg/kg\text{-}day)^{-1}$	Carcinogenic to humans	IRIS	06/01/18
Dibenz(a,h)anthracene	1.0E+00	$(mg/kg\text{-}day)^{-1}$	(1)	1.0E+00	$(mg/kg\text{-}day)^{-1}$	Carcinogenic to humans	IRIS	06/01/18
Antimony	N/A	N/A	0.15	N/A	N/A	Inadequate	PPRTV	06/01/18
Arsenic	1.5E+00	$(mg/kg\text{-}day)^{-1}$	(1)	1.5E+00	$(mg/kg\text{-}day)^{-1}$	A	IRIS	06/01/18
Chromium, Hexavalent	5.0E-01	$(mg/kg\text{-}day)^{-1}$	0.025	2.0E+01	$(mg/kg\text{-}day)^{-1}$	NA	NJDEP	06/01/18
Cobalt	N/A	N/A	(1)	N/A	N/A	Likely	PPRTV	06/01/18
Thallium	N/A	N/A	(1)	N/A	N/A	Inadequate	IRIS	06/01/18

IRIS = Integrated Risk Information System

PPRTV = Provisional Peer Reviewed Toxicity Value

NJDEP = New Jersey Department of Environmental Protection

Slope factor for benzo(a)pyrene, along with the appropriate relative potency factor (USEPA, 1993), used for the other carcinogenic PAHs.

(1) Oral absorption efficiency exceeds 50%. Therefore, no adjustment of the oral slope factor is necessary.

(2) Calculated as: (oral slope factor) / (oral to dermal adjustment factor)

N/A = Not Applicable/Not Available

EPA Group:

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen (by the oral route)

E - Evidence of noncarcinogenicity

TABLE 6

CANCER TOXICITY DATA -- INHALATION

WALTON & LONSBURY SUPERFUND SITE

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)anthracene	6.0E-05	$(ug/m^3)^{-1}$	N/A	N/A	Carcinogenic to humans	IRIS	06/01/18
Benzo(a)pyrene	6.0E-04	$(ug/m^3)^{-1}$	N/A	N/A	Carcinogenic to humans	IRIS	06/01/18
Benzo(b)fluoranthene	6.0E-05	$(ug/m^3)^{-1}$	N/A	N/A	Carcinogenic to humans	IRIS	06/01/18
Dibenz(a,h)anthracene	6.0E-04	$(ug/m^3)^{-1}$	N/A	N/A	Carcinogenic to humans	IRIS	06/01/18
Antimony	N/A	N/A	N/A	N/A	Inadequate	PPRTV	06/01/18
Arsenic	4.3E-03	$(ug/m^3)^{-1}$	N/A	N/A	A	IRIS	06/01/18
Chromium, Hexavalent	8.4E-02	$(ug/m^3)^{-1}$	N/A	N/A	NA	NJDEP	06/01/18
Cobalt	9.0E-03	$(ug/m^3)^{-1}$	N/A	N/A	Likely	PPRTV	06/01/18
Thallium	N/A	N/A	N/A	N/A	Inadequate	IRIS	06/01/18

IRIS = Integrated Risk Information System

PPRTV = Provisional Peer Reviewed Toxicity Values

NJDEP = New Jersey Department of Environmental Protection

N/A = Not Applicable

EPA Group:

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen (by the oral route)

Table 7. Dermal Worksheet
Intermediate Variables for Calculating DA(event)
POINT - S WALTON & LONSBURY SUPERFUND SITE

Timeframe	Receptor	Exposure Point	Chemical of Potential Concern	Media	Dermal Absorption Fraction (soil)	FA	Kp		T(event)		Tau		T*		B
						Value	Value	Units	Value	Units	Value	Units	Value	Units	Value
All	All	All													
			Benzo(a)anthracene	Soil	0.13	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
			Benzo(a)pyrene	Soil	0.13	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
			Benzo(b)fluoranthene	Soil	0.13	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
			Dibenz(a,h)anthracene	Soil	0.13	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
			Antimony	Soil	NA	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
			Arsenic	Soil	0.03	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
			Chromium, Hexavalent	Soil	NA	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
			Cobalt	Soil	NA	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
			Thallium	Soil	NA	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data

FA = Fraction Absorbed Water
Kp = Dermal Permeability Coefficient of Compound in Water
NA = Not Applicable/Available

T(event) = Event Duration
Tau = Lag Time

T* = Time to Reach Steady-State
B = Dimensionless Ratio of the Permeability Coefficient of a Compound Through the Stratum Corneum Relative to its Permeability Coefficient Across the Viable Epidermis

TABLE 8. INTERMEDIATE RESIDENT SOIL PRG CALCULATIONS - INGESTION

Chemical	Mutagenic?	THQ	$AT\text{-}N_C$ days	$AT\text{-}N_A$ days	RfD_o mg/kg-day	BW_C kg	BW_A kg	EF_C days/yr	EF_A days/yr	ED_C yrs	ED_A yrs	IR_C mg/day	IR_A mg/day	CF kg/mg	RBA	TR	AT-C days	SF_o $(mg/kg\text{-}day)^{-1}$	IFS_{adj} mg/kg	$IFSM_{adj}$ mg/kg	$PRG_{ca\text{-}ing}$ mg/kg	$PRG_{nc\text{-}ing\text{-}child}$ mg/kg	$PRG_{nc\text{-}ing\text{-}adult}$ mg/kg
Benzo(a)anthracene	Y	1	2190	7300	N/A	15	80	350	350	6	20	200	100	0.000001	1	1E-06	25550	1.0E-01	36750	166833.333	**1.5E+00**	**N/A**	**N/A**
Benzo(a)pyrene	Y	1	2190	7300	3E-04	15	80	350	350	6	20	200	100	0.000001	1	1E-06	25550	1.0E+00	36750	166833.333	**1.5E-01**	**2.3E+01**	**2.5E+02**
Benzo(b)fluoranthene	Y	1	2190	7300	N/A	15	80	350	350	6	20	200	100	0.000001	1	1E-06	25550	1.0E-01	36750	166833.333	**1.5E+00**	**N/A**	**N/A**
Dibenz(a,h)anthracene	Y	1	2190	7300	N/A	15	80	350	350	6	20	200	100	0.000001	1	1E-06	25550	1.0E+00	36750	166833.333	**1.5E-01**	**N/A**	**N/A**
Antimony		1	2190	7300	4E-04	15	80	350	350	6	20	200	100	0.000001	1	1E-06	25550	N/A	36750	166833.333	**N/A**	**3.1E+01**	**3.3E+02**
Arsenic		1	2190	7300	3E-04	15	80	350	350	6	20	200	100	0.000001	0.6	1E-06	25550	1.5E+00	36750	166833.333	**7.7E-01**	**3.9E+01**	**4.2E+02**
Chromium, Hexavalent	Y	1	2190	7300	3E-03	15	80	350	350	6	20	200	100	0.000001	1	1E-06	25550	5.0E-01	36750	166833.333	**3.1E-01**	**2.3E+02**	**2.5E+03**
Cobalt		1	2190	7300	3E-04	15	80	350	350	6	20	200	100	0.000001	1	1E-06	25550	N/A	36750	166833.333	**N/A**	**2.3E+01**	**2.5E+02**
Thallium		1	2190	7300	1E-05	15	80	350	350	6	20	200	100	0.000001	1	1E-06	25550	N/A	36750	166833.333	**N/A**	**7.8E-01**	**8.3E+00**

Notes

See Table 2 for input parameters and equations

N/A - Not applicable or not available.

TABLE 9. INTERMEDIATE RESIDENT SOIL PRG CALCULATIONS - DERMAL

Chemical	Mutagenic?	THQ	AT-N_C days	AT-N_A days	RfD_D mg/kg-day	BW_C kg	BW_A kg	EF_C days/yr	EF_A days/yr	ED_C yrs	ED_A yrs	SA_C cm^2	SA_A cm^2	AF_C mg/cm^2-day	AF_A mg/cm^2-day	ABS	CF kg/mg	TR	AT-C days	SF_D $(mg/kg\text{-}day)^{-1}$	DFS_{adj} mg/kg	$DFSM_{adj}$ mg/kg	$PRG_{ca\text{-}derm}$ mg/kg	$PRG_{nc\text{-}derm\text{-}child}$ mg/kg	$PRG_{nc\text{-}derm\text{-}adult}$ mg/kg
Benzo(a)anthracene	Y	1	2190	7300	N/A	15	80	350	350	6	20	2373	6032	0.2	0.07	0.13	0.000001	1E-06	25550	1.0E-01	103390	428260	**4.6E+00**	**N/A**	**N/A**
Benzo(a)pyrene	Y	1	2190	7300	3E-04	15	80	350	350	6	20	2373	6032	0.2	0.07	0.13	0.000001	1E-06	25550	1.0E+00	103390	428260	**4.6E-01**	**7.6E+01**	**4.6E+02**
Benzo(b)fluoranthene	Y	1	2190	7300	N/A	15	80	350	350	6	20	2373	6032	0.2	0.07	0.13	0.000001	1E-06	25550	1.0E-01	103390	428260	**4.6E+00**	**N/A**	**N/A**
Dibenz(a,h)anthracene	Y	1	2190	7300	N/A	15	80	350	350	6	20	2373	6032	0.2	0.07	0.13	0.000001	1E-06	25550	1.0E+00	103390	428260	**4.6E-01**	**N/A**	**N/A**
Antimony		1	2190	7300	6E-05	15	80	350	350	6	20	2373	6032	0.2	0.07	NA	0.000001	1E-06	25550	N/A	103390	428260	**N/A**	**N/A**	**N/A**
Arsenic		1	2190	7300	3E-04	15	80	350	350	6	20	2373	6032	0.2	0.07	0.03	0.000001	1E-06	25550	1.5E+00	103390	428260	**5.5E+00**	**3.3E+02**	**2.0E+03**
Chromium, Hexavalent	Y	1	2190	7300	8E-05	15	80	350	350	6	20	2373	6032	0.2	0.07	NA	0.000001	1E-06	25550	2.0E+01	103390	428260	**N/A**	**N/A**	**N/A**
Cobalt		1	2190	7300	3E-04	15	80	350	350	6	20	2373	6032	0.2	0.07	NA	0.000001	1E-06	25550	N/A	103390	428260	**N/A**	**N/A**	**N/A**
Thallium		1	2190	7300	1E-05	15	80	350	350	6	20	2373	6032	0.2	0.07	NA	0.000001	1E-06	25550	N/A	103390	428260	**N/A**	**N/A**	**N/A**

Notes

See Table 2 for input parameters and equations

N/A - Not applicable or not available.

TABLE 10. INTERMEDIATE RESIDENT SOIL PRG CALCULATIONS - PARTICULATE INHALATION

Chemical	Mutagenic?	EF_A days/yr	EF_C days/yr	ED_C yrs	ED_A yrs	PEF m^3/kg	VF m^3/kg	AT-N_C days	AT-N_A days	AT-C days	UR $(ug/m^3)^{-1}$	RfC ug/m^3	CF2 ug/mg	THQ	TR	$INFM_{adj}$ yr-ug/m^3	$PRG_{ca\text{-}inh}$ mg/kg	$PRG_{nc\text{-}inh\text{-}child}$ mg/kg	$PRG_{nc\text{-}inh\text{-}adult}$ mg/kg
Benzo(a)anthracene	Y	350	350	6	20	1.36E+09	4.41E+06	2190	7300	25550	6.0E-05	N/A	1E+03	1	1E-06	4.3E-03	**7.4E+01**	**N/A**	**N/A**
Benzo(a)pyrene	Y	350	350	6	20	1.36E+09	N/A	2190	7300	25550	6.0E-04	2E-03	1E+03	1	1E-06	4.3E-02	**2.3E+03**	**2.8E+03**	**2.8E+03**
Benzo(b)fluoranthene	Y	350	350	6	20	1.36E+09	N/A	2190	7300	25550	6.0E-05	N/A	1E+03	1	1E-06	4.3E-03	**2.3E+04**	**N/A**	**N/A**
Dibenz(a,h)anthracene	Y	350	350	6	20	1.36E+09	N/A	2190	7300	25550	6.0E-04	N/A	1E+03	1	1E-06	4.3E-02	**2.3E+03**	**N/A**	**N/A**
Antimony		350	350	6	20	1.36E+09	N/A	2190	7300	25550	N/A	N/A	1E+03	1	1E-06	N/A	**N/A**	**N/A**	**N/A**
Arsenic		350	350	6	20	1.36E+09	N/A	2190	7300	25550	4.3E-03	2E-02	1E+03	1	1E-06	3.1E-01	**8.9E+02**	**2.1E+04**	**2.1E+04**
Chromium, Hexavalent	Y	350	350	6	20	1.36E+09	N/A	2190	7300	25550	8.4E-02	1E-01	1E+03	1	1E-06	6.0E+00	**1.6E+01**	**1.4E+05**	**1.4E+05**
Cobalt		350	350	6	20	1.36E+09	N/A	2190	7300	25550	9.0E-03	6E-03	1E+03	1	1E-06	6.5E-01	**4.2E+02**	**8.5E+03**	**8.5E+03**
Thallium		350	350	6	20	1.36E+09	N/A	2190	7300	25550	N/A	N/A	1E+03	1	1E-06	N/A	**N/A**	**N/A**	**N/A**

Notes

See Table 4 for input parameters and equations N/A - Not applicable or not available.

PRGs shown as "N/A" are due to either lack of inhalation toxicity values or because the analyte is non-volatile.

VF applied to volatile chemicals: benzo(a)anthracene

TABLE 11. INTERMEDIATE RESIDENT SOIL PRG CALCULATIONS - RESULTS

Chemical	Carcinogenic Risk Level = 1E-06				Non-Cancer HQ = 1 - Child				Non-Cancer HQ = 1 - Adult			
	$PRG_{ca\text{-}ing}$ mg/kg	$PRG_{ca\text{-}derm}$ mg/kg	$PRG_{ca\text{-}inh}$ mg/kg	Result mg/kg	$PRG_{nc\text{-}ing}$ mg/kg	$PRG_{nc\text{-}derm}$ mg/kg	$PRG_{nc\text{-}inh}$ mg/kg	Result mg/kg	$PRG_{nc\text{-}ing}$ mg/kg	$PRG_{nc\text{-}derm}$ mg/kg	$PRG_{nc\text{-}inh}$ mg/kg	Result mg/kg
Benzo(a)anthracene	1.5E+00	4.6E+00	7.4E+01	**1.1E+00**	N/A	N/A	N/A	**N/A**	N/A	N/A	N/A	**N/A**
Benzo(a)pyrene	1.5E-01	4.6E-01	2.3E+03	**1.1E-01**	2.3E+01	7.6E+01	2.8E+03	**1.8E+01**	2.5E+02	4.6E+02	2.8E+03	**1.5E+02**
Benzo(b)fluoranthene	1.5E+00	4.6E+00	2.3E+04	**1.1E+00**	N/A	N/A	N/A	**N/A**	N/A	N/A	N/A	**N/A**
Dibenz(a,h)anthracene	1.5E-01	4.6E-01	2.3E+03	**1.1E-01**	N/A	N/A	N/A	**N/A**	N/A	N/A	N/A	**N/A**
Antimony	N/A	N/A	N/A	**N/A**	3.1E+01	N/A	N/A	**3.1E+01**	3.3E+02	N/A	N/A	**3.3E+02**
Arsenic	7.7E-01	5.5E+00	8.9E+02	**6.8E-01**	3.9E+01	3.3E+02	2.1E+04	**3.5E+01**	4.2E+02	2.0E+03	2.1E+04	**3.4E+02**
Chromium, Hexavalent	3.1E-01	N/A	1.6E+01	**3.0E-01**	2.3E+02	N/A	1.4E+05	**2.3E+02**	2.5E+03	N/A	1.4E+05	**2.5E+03**
Cobalt	N/A	N/A	4.2E+02	**4.2E+02**	2.3E+01	N/A	8.5E+03	**2.3E+01**	2.5E+02	N/A	8.5E+03	**2.4E+02**
Thallium	N/A	N/A	N/A	**N/A**	7.8E-01	N/A	N/A	**7.8E-01**	8.3E+00	N/A	N/A	**8.3E+00**

Notes

See Table 2 for equations

HQ = Hazard Quotient

The lowest non-cancer PRG between the child and adult is used as the non-cancer PRG.

N/A - Not applicable or not available.

A.2 – SURFACE WATER – RECREATIONAL USER

TABLE 1

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

WALTON & LONSBURY SUPERFUND SITE

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Bliss Brook	Chromium, Hexavalent	- -	- -	3E-04	- -	3E-04					
			Chemical Total	- -	- -	3E-04	- -	3E-04		- -	- -	- -	N/A
			Radionuclide Total										
		Exposure Point Total						3E-04					N/A
	Exposure Medium Total							3E-04					N/A
Medium Total								3E-04					N/A
Receptor Total								3E-04					N/A

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 3E-04

Total Hazard Across All Media: N/A

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total Endocrine HI =	N/A
Total Gastrointestinal HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	N/A
Total Nervous System HI =	N/A
Total Reproductive HI =	N/A
Total Respiratory HI =	N/A
Total Muscoluskeletal HI =	N/A
Total Skin HI =	N/A

TABLE 2

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

WALTON & LONSBURY SUPERFUND SITE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal	Resident	Adult/Young Child					See RI Appendix X	See attached
			EF	Exposure Frequency	78	days/year		
			ED_A	Exposure Duration - adult	20	years		
			BW_A	Body Weight - adult	80	kg		
			AT-C	Averaging Time (Cancer)	25550	days		
			CF1	Conversion Factor 1	0.001	mg/ug		
			BW_C	Body Weight - child	15	kg		
			CF2	Conversion Factor 2	0.001	cm^3/mg		
			CF3	Conversion Factor 3	0.001	$liters/cm^3$		
			EV	Event Frequency	1	events/day		
			ED_C	Exposure Duration - child	6	years		
			TR	Target ILCR	10^{-6} to 10^{-4}	- -		
			SF_d	Dermal Slope Factor	see Table 3	$(mg/kg\text{-}day)^{-1}$		
			DA_{event}	Dose Absorbed per Unit Area per Event	see Table 4	mg/cm^2-event		
			ET_C	Exposure Time - child	3	hr/event		
			ET_A	Exposure Time - adult	3	hr/event		
			GIABS	Gastrointestinal absorption	see Table 4	- -		
			FA	Fraction Absorbed Water	see Table 4	- -		
			MW	Molecular Weight	see Table 4	g/mol		
			SA_A	Skin Surface Area Available for Contact - adult	6032	cm^2		
			SA_C	Skin Surface Area Available for Contact - child	2373	cm^2		

Intake Equation/
Model Name

Preliminary Remediation Goal (PRG) mutagenic:

Dermal - inorganics

$$PRG_{mu\text{-}derm}\ (ug/L) = \frac{DA_{event}}{Kp \times ET_{madj} \times CF3}$$

where

$$ET_{madj} = \frac{ET_C \times ED_{0\text{-}2} + ET_C \times ED_{2\text{-}6} + ET_A \times ED_{6\text{-}16} + ET_A \times ED_{16\text{-}26}}{ED_{0\text{-}2} + ED_{2\text{-}6} + ED_{6\text{-}16} + ED_{16\text{-}26}}$$

$$DA_{event}\ (ug/cm2\text{-}event) = \frac{TR \times AT\text{-}C \times GIABS}{SF_o \times CF1 \times EF \times DFWM_{adj}}$$

$$DFWM_{adj} = \frac{ED_{0\text{-}2} \times SA_C \times 10}{BW_C} + \frac{ED_{2\text{-}6} \times SA_C \times 3}{BW_C} + \frac{ED_{6\text{-}16} \times SA_A \times 3}{BW_A} + \frac{ED_{16\text{-}26} \times SA_A}{BW_A}$$

TABLE 3

CANCER TOXICITY DATA -- ORAL/DERMAL

WALTON & LONSBURY SUPERFUND SITE

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal	Absorbed Cancer Slope Factor for Dermal (1)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Chromium, Hexavalent	5.0E-01	$(mg/kg\text{-}day)^{-1}$	0.025	2.0E+01	$(mg/kg\text{-}day)^{-1}$	NA	NJDEP	06/01/18

NJDEP = New Jersey Department of Environmental Protection

(1) Calculated as: (oral slope factor) / (oral to dermal adjustment factor)

N/A = Not Applicable/Not Available

TABLE 4. INTERMEDIATE SURFACE WATER PRG CALCULATIONS - DERMAL

Chemical	MWT g/mol	logKow	Kp (cm/hr) predicted	B	Isc cm	Dsc cm^2/hr	tau (hr)	c	b	t_star1 B>0.6	t_star3 B<=0.6	t_star (hr)	GIABS	Mutagenic?	FA for tau>3	ET_C hr/event	ET_A hr/event	ET_{adj} hr/event	ET_{madj} hr/event	EV event/day	EF days	ED_C yrs	ED_A yrs	BW_C kg	BW_A kg	SA_C cm^2	SA_A cm^2	AT-C days	CF1 mg/ug	CF3 L/cm^3	SF_o $(mg/kg\text{-}day)^{-1}$	TR	DFW_{adj} cm^2-evt-day/kg	$DFWM_{adj}$ evt-cm^2/kg	DA_{event} - ca ug/cm^2-evt	$PRG_{ca\text{-}derm}$ ug/L
Chromium, Hexavalent	--	--	2.0E-03	--	1.0E-03	--	--	--	--	--	--	--	0.025	Y	1	3	3.00	3.000	3.000	1	78	6	20	15	80	2373	6032	25550	0.001	0.001	5.0E-01	1E-06	2457	8078	2.0E-06	**3.4E-01**

Notes

See Table 2 for input parameters and equations N/A - Not applicable or not available.

log Kow, GIABS, and FA - From Regional Screening Level (May 2018) tables

Kp - Inorganics: Rags Part E, Exhibit 3-1; Final - EPA/540/R/99/005, July 2004

TABLE 5. INTERMEDIATE SURFACE WATER PRG CALCULATIONS - RESULTS

	Carcinogenic Risk Level = 1E-06	
Chemical	$PRG_{ca\text{-}derm}$ ug/L	Result ug/L
Chromium, Hexavalent	3.4E-01	**3.4E-01**

Notes

See Table 2 for equations

N/A - Not applicable or not available.

A.3 – GROUNDWATER – CONSTRUCTION WORKER

TABLE 1

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

WALTON & LONSBURY SUPERFUND SITE

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Shallow Groundwater	Walton & Lonsbury Property	Chromium, Hexavalent	6E-05	- -	3E-04	- -	4E-04	Blood	2E+00	- -	9E+00	1E+01
			Chemical Total	6E-05	- -	3E-04	- -	4E-04		2E+00	- -	9E+00	1E+01
			Radionuclide Total										
		Exposure Point Total						4E-04					1E+01
	Exposure Medium Total							4E-04					1E+01
Medium Total								4E-04					1E+01
Receptor Total								4E-04					1E+01

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 4E-04

Total Hazard Across All Media: 1E+01

Total Blood HI =	1E+01
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total Endocrine HI =	N/A
Total Gastrointestinal HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	N/A
Total Nervous System HI =	N/A
Total Reproductive HI =	N/A
Total Respiratory HI =	N/A
Total Muscoluskeletal HI =	N/A
Total Skin HI =	N/A

TABLE 2

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

WALTON & LONSBURY SUPERFUND SITE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Shallow Groundwater

Exposure Route	Receptor Population	Receptor Age	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion/Dermal	Construction Worker	Adult					See RI Appendix X	
			IR_A	Ingestion Rate of Water - adult	0.05	liters/day		See attached
			EF	Exposure Frequency	125	days/year		
			ED_A	Exposure Duration - adult	1	years		
			BW_A	Body Weight - adult	80	kg		
			AT-C	Averaging Time (Cancer)	25550	days		
			AT-N	Averaging Time (Non-Cancer)	365	days		
			CF1	Conversion Factor 1	0.001	mg/ug		
			RfD_o	Oral Reference Dose	see Table 3	mg/kg-day		
			RfD_d	Dermal Reference Dose	see Table 3	mg/kg-day		
			CF2	Conversion Factor 2	0.001	cm^3/mg		
			CF3	Conversion Factor 3	0.001	liters/cm^3		
			EV	Event Frequency	1	events/day		
			THQ	Target Hazard Quotient	1	- -		
			SF_o	Oral Slope Factor	see Table 5	$(mg/kg\text{-}day)^{-1}$		
			TR	Target ILCR	10^{-6} to 10^{-4}	- -		
			SF_d	Dermal Slope Factor	see Table 4	$(mg/kg\text{-}day)^{-1}$		
			DA_{event}	Dose Absorbed per Unit Area per Event	see Table 6	mg/cm^2-event		
			ET_A	Exposure Time - adult	1	hr/event		
			GIABS	Gastrointestinal absorption	see Table 6	- -		
			FA	Fraction Absorbed Water	see Table 6	- -		
			MW	Molecular Weight	see Table 6	g/mol		
			SA_A	Skin Surface Area Available for Contact - adult	3527	cm^2		

Intake Equation/
Model Name

Preliminary Remediation Goal (PRG) non-cancer:

Ingestion

$$PRG_{nc\text{-}ing}\ (ug/L) = \frac{THQ \times AT\text{-}N \times RfD_o \times BW_A}{EF \times CF1 \times ED_A \times IR_A}$$

Dermal - inorganics

$$PRG_{nc\text{-}derm}\ (ug/L) = \frac{DA_{event}}{Kp \times ET_C \times CF3}$$

where

$$DA_{event}\ (ug/cm2\text{-}event) = \frac{THQ \times AT\text{-}N \times RfD_o \times GIABS \times BW_A}{EV \times CF1 \times ED_A \times EF \times SA_A}$$

Total

$$PRG_{nc\text{-}tot}\ (ug/L) = \frac{1}{1/PRG_{nc\text{-}ing} + 1/PRG_{nc\text{-}derm}}$$

Preliminary Remediation Goal (PRG) cancer:

Ingestion

$$PRG_{ca\text{-}ing}\ (ug/L) = \frac{TR \times AT\text{-}C}{EF \times CF1 \times SF_o \times IFW_{adj}}$$

$$IFW_{adj} = \frac{ED_A \times IR_A}{BW_A}$$

Dermal - inorganics

$$PRG_{ca\text{-}derm}\ (ug/L) = \frac{DA_{event}}{Kp \times ET_A \times CF3}$$

$$DA_{event}\ (ug/cm2\text{-}event) = \frac{TR \times AT\text{-}C \times GIABS}{SF_o \times CF1 \times EF \times DFW_{adj}}$$

$$DFW_{adj} = \frac{EV \times ED_A \times SA_A}{BW_A}$$

Total

$$PRG_{ca\text{-}tot}\ (ug/L) = \frac{1}{1/PRG_{ca\text{-}ing} + 1/PRG_{ca\text{-}derm}}$$

TABLE 3

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

WALTON & LONSBURY SUPERFUND SITE

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Chromium, Hexavalent	Subchronic	5E-03	mg/kg-day	0.025	1.3E-04	mg/kg-day	Blood	100	ATSDR	06/01/18

(1) Oral Absorption Efficiencies from Exhibit 4-1, RAGS Part E, USEPA 2004b.

ATSDR = Agency for Toxic Substances and Disease Registry

(2) Calculated as: (oral RfD) x (oral to dermal adjustment factor).

(3) Oral absorption efficiency exceeds 50%. Therefore, no adjustment of the oral reference dose is necessary (USEPA, 2001).

(4) Permeability constants (Kp) used for water absorption calculations: 2E-03 cm/hr for chromium (VI) (USEPA, 2004).

TABLE 4

CANCER TOXICITY DATA -- ORAL/DERMAL

WALTON & LONSBURY SUPERFUND SITE

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal (2)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Chromium, Hexavalent	5.0E-01	$(mg/kg\text{-}day)^{-1}$	0.025	2.0E+01	$(mg/kg\text{-}day)^{-1}$	NA	NJDEP	06/01/18

NJDEP = New Jersey Department of Environmental Protection

(1) Oral absorption efficiency exceeds 50%. Therefore, no adjustment of the oral slope factor is necessary.

(2) Calculated as: (oral slope factor) / (oral to dermal adjustment factor)

N/A = Not Applicable/Not Available

EPA Group:

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen (by the oral route)

E - Evidence of noncarcinogenicity

TABLE 5. INTERMEDIATE GROUNDWATER PRG CALCULATIONS - INGESTION

Chemical	EF days	ED_A yrs	BW_A kg	IR_A L/day	AT-N days	AT-C days	CF1 mg/ug	SF_o $(mg/kg\text{-}day)^{-1}$	RfD_o mg/kg-day	THQ	TR	IFW_{adj} (L-yr/kg-day)	$PRG_{ca\text{-}ing}$ ug/L	$PRG_{nc\text{-}ing}$ ug/L
Chromium, Hexavalent	125	1	80	0.05	365	25550	0.001	5.0E-01	5E-03	1	1E-06	0.000625	**6.5E+02**	**2.3E+04**

Notes

See Table 2 for input parameters and equations

TABLE 6. INTERMEDIATE GROUNDWATER PRG CALCULATIONS - DERMAL

Chemical	MWT g/mol	logKow	Kp (cm/hr) predicted	B	Isc cm	Dsc cm^2/hr	tau (hr)	c	b	t_star1 B>0.6	t_star3 B<=0.6	t_star (hr)	GIABS	FA for tau>3	ET_A hr/event	EV event/day	EF days	ED_A yrs	BW_A kg	SA_A cm^2	AT-N days	AT-C days	CF1 mg/ug	CF3 L/cm^3	SF_o $(mg/kg\text{-}day)^{-1}$	RfD_o mg/kg-day	THQ	TR	DFW_{adj} cm^2-evt-day/kg	DA_{event} - ca ug/cm^2-evt	DA_{event} - nc ug/cm^2-evt	$PRG_{ca\text{-}derm}$ ug/L	$PRG_{nc\text{-}derm}$ ug/L
Chromium, Hexavalent	--	--	2.0E-03	--	1.0E-03	--	--	--	--	--	--	--	0.025	1	1	1	125	1	80	3527	365	25550	0.001	0.001	5.0E-01	5E-03	1	1E-06	44	2.3E-04	8.3E-03	**1.2E+02**	**4.1E+03**

Notes

See Table 2 for input parameters and equations N/A - Not applicable or not available.

log Kow, GIABS, and FA - From Regional Screening Level (May 2018) tables

Kp - predicted values utilize formula from RAGs part E Eq. 3.8: log Kp = -2.805603 + 0.6645865 log Kow - 0.0056118 MW (Equation more accurate in spreadsheet than in report) (Final - EPA/540/R/99/005, July 2004)

NA: Outside of Effective Predictive Domain (EPD). Calculated based on RAGS Part E criteria for MW and log Kow.

Inorganics: Rags Part E, Exhibit 3-1; Final - EPA/540/R/99/005, July 2004

TABLE 7. INTERMEDIATE GROUNDWATER PRG CALCULATIONS - RESULTS

	Carcinogenic Risk Level = 1E-06				Non-Cancer Hazard Quotient = 1			
Chemical	$PRG_{ca\text{-}ing}$ ug/L	$PRG_{ca\text{-}derm}$ ug/L	$PRG_{ca\text{-}inh}$ ug/L	Result ug/L	$PRG_{nc\text{-}ing}$ ug/L	$PRG_{nc\text{-}derm}$ ug/L	$PRG_{nc\text{-}inh}$ ug/L	Result ug/L
Chromium, Hexavalent	6.5E+02	1.2E+02	N/A	**9.8E+01**	2.3E+04	4.1E+03	N/A	**3.5E+03**

Notes

See Table 2 for equations

N/A - Not applicable or not available.

A.4 – GROUNDWATER – RESIDENT

TABLE 1

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

WALTON & LONSBURY SUPERFUND SITE

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Site-Wide (center of the plume)	1,1-Dichloroethane	3E-05	1E-04	N/A	- -	2E-04					
			cis-1,2-Dichloroethene						Kidney	8E+00	N/A	1E+00	9E+00
			Trichloroethene	3E-04	4E-04	5E-05	- -	8E-04	Cardiovascular/ Developmental/ Immune System	4E+01	1E+02	6E+00	1E+02
			Vinyl chloride	5E-04	3E-05	N/A	- -	6E-04					
			1,4-Dioxane	2E-05	1E-05	N/A	- -	3E-05					
			Arsenic	7E-05	N/A	N/A	- -	7E-05					
			Chromium, Hexavalent	5E-01	N/A	2E-01	- -	7E-01	Gastrointestinal	4E+02	N/A	2E+02	6E+02
			Cobalt						Endocrine	2E+00	N/A	N/A	2E+00
			Manganese						Nervous System	2E+00	N/A	2E-01	2E+00
			Chemical Total	5E-01	6E-04	2E-01	- -	7E-01		5E+02	1E+02	2E+02	7E+02
			Radionuclide Total										
		Exposure Point Total						7E-01					7E+02
	Exposure Medium Total							7E-01					7E+02
Medium Total								7E-01					7E+02
Receptor Total								7E-01					7E+02

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 7E-01

Total Hazard Across All Media: 7E+02

Total Blood HI =	N/A
Total Cardiovascular HI =	1E+02
Total Developmental HI =	1E+02
Total Endocrine HI =	2E+00
Total Gastrointestinal HI =	6E+02
Total Immune System HI =	1E+02
Total Kidney HI =	9E+00
Total Liver HI =	N/A
Total Nervous System HI =	2E+00
Total Reproductive HI =	N/A
Total Respiratory HI =	N/A
Total Muscoluskeletal HI =	N/A
Total Skin HI =	N/A

TABLE 2

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

WALTON & LONSBURY SUPERFUND SITE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion/Dermal/ Inhalation	Resident	Adult/Young Child					See RI Appendix X	
			IR_A	Ingestion Rate of Water - adult	2.5	liters/day		See attached
			EF	Exposure Frequency	350	days/year		
			ED_A	Exposure Duration - adult	20	years		
			BW_A	Body Weight - adult	80	kg		
			AT-C	Averaging Time (Cancer)	25550	days		
			AT-N	Averaging Time (Non-Cancer)	2190	days		
			CF1	Conversion Factor 1	0.001	mg/ug		
			BW_C	Body Weight - child	15	kg		
			IR_C	Ingestion Rate of Water - child	0.78	liters/day		
			RfD_o	Oral Reference Dose	see Table 3	mg/kg-day		
			RfD_d	Dermal Reference Dose	see Table 3	mg/kg-day		
			RfC	Inhalation Reference Concentration	see Table 4	ug/m^3		
			CF2	Conversion Factor 2	0.001	cm^3/mg		
			CF3	Conversion Factor 3	0.001	$liters/cm^3$		
			K	Volatilization Factor	0.5	L/m^3		
			EV	Event Frequency	1	events/day		
			THQ	Target Hazard Quotient	1	- -		
			ED_C	Exposure Duration - child	6	years		
			SF_o	Oral Slope Factor	see Table 5	$(mg/kg\text{-}day)^{-1}$		
			TR	Target ILCR	10^{-6} to 10^{-4}	- -		
			SF_d	Dermal Slope Factor	see Table 5	$(mg/kg\text{-}day)^{-1}$		
			UR	Unit Risk	see Table 6	$(ug/m^3)^{-1}$		
			DA_{event}	Dose Absorbed per Unit Area per Event	see Table 8	mg/cm^2-event		
			ET_C	Exposure Time - child	0.54	hr/event		
			ET_A	Exposure Time - adult	0.71	hr/event		
			GIABS	Gastrointestinal absorption	see Table 8	- -		
			FA	Fraction Absorbed Water	see Table 8	- -		
			MW	Molecular Weight	see Table 8	g/mol		
			SA_A	Skin Surface Area Available for Contact - adult	19652	cm^2		
			SA_C	Skin Surface Area Available for Contact - child	6365	cm^2		

Intake Equation/
Model Name

Preliminary Remediation Goal (PRG) non-cancer:

Ingestion

$$PRG_{nc\text{-}ing}\ (ug/L) = \frac{THQ \times AT\text{-}N \times RfD_o \times BW_C}{EF \times CF1 \times ED_C \times IR_C}$$

Dermal - inorganics

$$PRG_{nc\text{-}derm}\ (ug/L) = \frac{DA_{event}}{Kp \times ET_C \times CF3}$$

where

$$DA_{event}\ (ug/cm2\text{-}event) = \frac{THQ \times AT\text{-}N \times RfD_o \times GIABS \times BW_C}{EV \times CF1 \times ED_C \times EF \times SA_C}$$

Dermal - organics

if $ET_C <= t^*$

$$PRG_{nc\text{-}derm}\ (ug/L) = \frac{DA_{event}}{2 \times FA \times Kp \times [6 \times tau \times ET_C / \pi]^{0.5} \times CF3}$$

if $ET_C > t^*$

$$PRG_{nc\text{-}derm}\ (ug/L) = \frac{DA_{event}}{FA \times Kp \times [ET_C / (1 + B) + 2 \times tau \times (1 + 3B + 3B^2)/(1 + B)^2] \times CF3}$$

where

$$DA_{event}\ (ug/cm2\text{-}event) = \frac{THQ \times AT\text{-}N \times RfD_o \times GIABS \times BW_C}{EV \times CF1 \times ED_C \times EF \times SA_C}$$

$$B = \frac{Kp \times MW^{0.5}}{2.6}$$

$$tau = \frac{I_{SC}^2}{6 \times D_{SC}}$$

I_{SC} = Skin Thickness (cm; assumed)
1.00E-03

$D_{SC} = I_{SC} \times 10\text{^}(-2.8 - 0.0056 \times MW)$

$t^* =$ If B <= 0.6
$2.4 \times tau$

If B > 0.6
$6 \times tau \times (b - (b^2 - c^2)^{0.5})$

$$b = \frac{2 \times (1 + B)^2}{\pi} - c$$

$$c = \frac{1 + 3 \times B + 3 \times B^2}{3 \times (1 + B)}$$

Inhalation

$$PRG_{nc\text{-}inh}\ (ug/L) = \frac{THQ \times AT\text{-}N \times RfC}{EF \times ED_C \times K}$$

Total

$$PRG_{nc\text{-}tot}\ (ug/L) = \frac{1}{1/PRG_{nc\text{-}ing} + 1/PRG_{nc\text{-}derm} + 1/PRG_{nc\text{-}inh}}$$

Preliminary Remediation Goal (PRG) cancer:

Ingestion

$$PRG_{ca\text{-}ing}\ (ug/L) = \frac{TR \times AT\text{-}C}{EF \times CF1 \times SF_o \times IFW_{adj}}$$

$$IFW_{adj} = \frac{ED_C \times IR_C}{BW_C} + \frac{ED_A \times IR_A}{BW_A}$$

Dermal - inorganics

$$PRG_{ca\text{-}derm}\ (ug/L) = \frac{DA_{event}}{Kp \times ET_{adj} \times CF3}$$

where

$$ET_{adj} = ET_C \times ED_C/26 + ET_A \times ED_A/26$$

$$DA_{event}\ (ug/cm2\text{-}event) = \frac{TR \times AT\text{-}C \times GIABS}{SF_o \times CF1 \times EF \times DFW_{adj}}$$

$$DFW_{adj} = \frac{EV \times ED_C \times SA_C}{BW_C} + \frac{EV \times ED_A \times SA_A}{BW_A}$$

Dermal - organics

if ET_{adj} <= t*

$$PRG_{ca\text{-}derm}\ (ug/L) = \frac{DA_{event}}{2 \times FA \times Kp \times [6 \times tau \times ET_{adj} / \pi]^{0.5} \times CF3}$$

if ET_{adj} > t*

$$PRG_{ca\text{-}derm}\ (ug/L) = \frac{DA_{event}}{FA \times Kp \times [ET_{adj} / (1 + B) + 2 \times tau \times (1 + 3B + 3B^2)/(1 + B)^2] \times CF3}$$

where

$$DA_{event}\ (ug/cm2\text{-}event) = \frac{TR \times AT\text{-}C \times GIABS}{SF_o \times CF1 \times EF \times DFW_{adj}}$$

$$B = \frac{Kp \times MW^{0.5}}{2.6}$$

$$tau = \frac{I_{SC}^2}{6 \times D_{SC}}$$

$$I_{SC} = \frac{\text{Skin Thickness (cm; assumed)}}{1.00E\text{-}03}$$

$$D_{SC} = I_{SC} \times 10\text{^}(-2.8 - 0.0056 \times MW)$$

$$t^* = \begin{cases} \text{If } B <= 0.6 \\ 2.4 \times tau \\ \\ \text{If } B > 0.6 \\ 6 \times tau \times (b - (b^2 - c^2)^{0.5}) \end{cases}$$

$$b = \frac{2 \times (1 + B)^2}{\pi} - c$$

$$c = \frac{1 + 3 \times B + 3 \times B^2}{3 \times (1 + B)}$$

Inhalation

$$PRG_{ca\text{-}inh}\ (ug/L) = \frac{TR \times AT\text{-}C}{EF \times (ED_C + ED_{A)} \times UR \times K}$$

Total

$$PRG_{ca\text{-}tot}\ (ug/L) = \frac{1}{1/PRG_{ca\text{-}ing} + 1/PRG_{ca\text{-}derm} + 1/PRG_{ca\text{-}inh}}$$

Preliminary Remediation Goal (PRG) mutagenic:

Ingestion

$$PRG_{mu\text{-}ing}\ (ug/L) = \frac{TR \times AT\text{-}C}{EF \times CF1 \times SF_o \times IFWM_{adj}}$$

$$IFWM_{adj} = \frac{ED_{0\text{-}2} \times IR_C \times 10}{BW_C} + \frac{ED_{2\text{-}6} \times IR_C \times 3}{BW_C} + \frac{ED_{6\text{-}16} \times IR_A \times 3}{BW_A} + \frac{ED_{16\text{-}26} \times IR_A}{BW_A}$$

Dermal - inorganics

$$PRG_{mu\text{-}derm}\ (ug/L) = \frac{DA_{event}}{Kp \times ET_{madj} \times CF3}$$

where

$$ET_{madj} = \frac{ET_C \times ED_{0\text{-}2} + ET_C \times ED_{2\text{-}6} + ET_A \times ED_{6\text{-}16} + ET_A \times ED_{16\text{-}26}}{ED_{0\text{-}2} + ED_{2\text{-}6} + ED_{6\text{-}16} + ED_{16\text{-}26}}$$

$$DA_{event}\ (ug/cm2\text{-}event) = \frac{TR \times AT\text{-}C \times GIABS}{SF_o \times CF1 \times EF \times DFWM_{adj}}$$

$$DFWM_{adj} = \frac{ED_{0\text{-}2} \times SA_C \times 10}{BW_C} + \frac{ED_{2\text{-}6} \times SA_C \times 3}{BW_C} + \frac{ED_{6\text{-}16} \times SA_A \times 3}{BW_A} + \frac{ED_{16\text{-}26} \times SA_A}{BW_A}$$

Dermal - organics

if $ET_{madj} <= t^*$

$$PRG_{mu\text{-}derm}\ (ug/L) = \frac{DA_{event}}{2 \times FA \times Kp \times [6 \times tau \times ET_{madj} / \pi]^{0.5} \times CF3}$$

if $ET_{madj} > t^*$

$$PRG_{mu\text{-}derm}\ (ug/L) = \frac{DA_{event}}{FA \times Kp \times [ET_{madj} / (1 + B) + 2 \times tau \times (1 + 3B + 3B^2)/(1 + B)^2] \times CF3}$$

where

$$DA_{event}\ (ug/cm2\text{-}event) = \frac{TR \times AT\text{-}C \times GIABS}{SF_o \times CF1 \times EF \times DFWM_{adj}}$$

$$B = \frac{Kp \times MW^{0.5}}{2.6}$$

$$tau = \frac{I_{SC}^2}{6 \times D_{SC}}$$

$$I_{SC} = \frac{\text{Skin Thickness (cm; assumed)}}{1.00E\text{-}03}$$

$$D_{SC} = I_{SC} \times 10\text{^}(-2.8 - 0.0056 \times MW)$$

$$t^* = \begin{cases} \text{If } B <= 0.6 \\ 2.4 \times tau \\ \text{If } B > 0.6 \\ 6 \times tau \times (b - (b^2 - c^2)^{0.5}) \end{cases}$$

$$b = \frac{2 \times (1 + B)^2}{\pi} - c$$

$$c = \frac{1 + 3 \times B + 3 \times B^2}{3 \times (1 + B)}$$

Inhalation

$$PRG_{mu\text{-}inh}\ (ug/L) = \frac{TR \times AT\text{-}C}{EF \times K \times INFM_{adj}}$$

$$INFM_{adj} = ED_{0\text{-}2} \times UR \times 10 + ED_{2\text{-}6} \times UR \times 3 + ED_{6\text{-}16} \times UR \times 3 + ED_{16\text{-}26} \times UR$$

Total

$$PRG_{mu\text{-}tot}\ (ug/L) = \frac{1}{1/PRG_{mu\text{-}ing} + 1/PRG_{mu\text{-}derm} + 1/PRG_{mu\text{-}inh}}$$

Preliminary Remediation Goal (PRG) vinyl chloride:

Ingestion

$$PRG_{vc\text{-}ing}\ (ug/L) = \frac{TR}{CF1 \times SF_o \times ((EF \times IFW_{adj}) / AT\text{-}C + (IR_C / BW_C))}$$

$$IFW_{adj} = \frac{ED_C \times IR_C}{BW_C} + \frac{ED_A \times IR_A}{BW_A}$$

Dermal - organics

$$ET_{adj} = ET_C \times ED_C/26 + ET_A \times ED_A/26$$

$$DFW_{adj} = \frac{EV \times ED_C \times SA_C}{BW_C} + \frac{EV \times ED_A \times SA_A}{BW_A}$$

if ET_{adj} <= t*

$$PRG_{vc\text{-}derm}\ (ug/L) = \frac{DA_{event}}{2 \times FA \times Kp \times [6 \times tau \times ET_{madj} / \pi]^{0.5} \times CF3}$$

if ET_{adj} > t*

$$PRG_{vc\text{-}derm}\ (ug/L) = \frac{DA_{event}}{FA \times Kp \times [ET_{adj} / (1 + B) + 2 \times tau \times (1 + 3B + 3B^2)/(1 + B)^2] \times CF3}$$

where

$$DA_{event}\ (ug/cm2\text{-}event) = \frac{TR \times GIABS}{SF_o \times CF1 \times ((EF \times DFW_{adj}) / AT\text{-}C + SA_C / BW_C)}$$

$$B = \frac{Kp \times MW^{0.5}}{2.6}$$

$$tau = \frac{I_{SC}^2}{6 \times D_{SC}}$$

I_{SC} = Skin Thickness (cm; assumed) = 1.00E-03

$$D_{SC} = I_{SC} \times 10^{(-2.8 - 0.0056 \times MW)}$$

t^* = If B <= 0.6: $2.4 \times tau$

If B > 0.6: $6 \times tau \times (b - (b^2 - c^2)^{0.5})$

$$b = \frac{2 \times (1 + B)^2}{\pi} - c$$

$$c = \frac{1 + 3 \times B + 3 \times B^2}{3 \times (1 + B)}$$

Inhalation

$$PRG_{vc\text{-}inh}\ (ug/L) = \frac{TR}{UR \times K \times (EF \times (ED_C + ED_A))/AT\text{-}C + 1)}$$

Total

$$PRG_{vc\text{-}tot}\ (ug/L) = \frac{1}{1/PRG_{vc\text{-}ing} + 1/PRG_{vc\text{-}derm} + 1/PRG_{vc\text{-}inh}}$$

TABLE 3

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

WALTON & LONSBURY SUPERFUND SITE

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
1,1-Dichloroethane	Chronic	2E-01	mg/kg-day	(4)	2E-01	mg/kg-day	Kidney	3,000	PPRTV	06/01/18
cis-1,2-Dichloroethene	Chronic	2E-03	mg/kg-day	(4)	2E-03	mg/kg-day	Kidney	3,000	IRIS	06/01/18
Trichloroethene	Chronic	5E-04	mg/kg-day	(4)	5E-04	mg/kg-day	Cardiovascular/ Developmental/ Immune System	10 to 1,000	IRIS	06/01/18
Vinyl chloride	Chronic	3E-03	mg/kg-day	(4)	3E-03	mg/kg-day	Liver	30	IRIS	06/01/18
1,4-Dioxane	Chronic	3E-02	mg/kg-day	(4)	3E-02	mg/kg-day	Liver/Kidney	300	IRIS	06/01/18
Arsenic	Chronic	3E-04	mg/kg-day	(4)	3E-04	mg/kg-day	Skin	3	IRIS	06/01/18
Chromium, Hexavalent	Chronic	3E-03	mg/kg-day	0.025	7.5E-05	mg/kg-day	Gastrointestinal	900	IRIS	06/01/18
Cobalt	Chronic	3E-04	mg/kg-day	(4)	3E-04	mg/kg-day	Endocrine	3000	PPRTV	06/01/18
Manganese	Chronic	2.4E-02	mg/kg-day	0.04	9.6E-04	mg/kg-day	Nervous System	3	IRIS	06/01/18

(1) Oral Absorption Efficiencies from Exhibit 4-1, RAGS Part E, USEPA 2004b.

(2) Calculated as: (oral RfD) x (oral to dermal adjustment factor).

(3) Oral absorption efficiency exceeds 50%. Therefore, no adjustment of the oral reference dose is necessary (USEPA, 2001).

(4) Permeability constants (Kp) used for water absorption calculations: 2E-03 cm/hr for chromium (VI), 4E-04 cm/hr for cobalt, and 1E-03 cm/hr for the remaining inorganics (USEPA, 2004).

IRIS = Integrated Risk Information System

PPRTV = Provisional Peer Reviewed Toxicity Values developed by STSC

TABLE 4

NON-CANCER TOXICITY DATA -- INHALATION

WALTON & LONSBURY SUPERFUND SITE

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD[(1)]		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
1,1-Dichloroethane	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
cis-1,2-Dichloroethene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Trichloroethene	Chronic	2.0E+00	ug/m^3	N/A	N/A	Cardiovascular/ Endocrine	10 to 1000	IRIS	06/01/18
Vinyl chloride	Chronic	1.0E+02	ug/m^3	N/A	N/A	Liver	30	IRIS	06/01/18
1,4-Dioxane	Chronic	3.0E+01	ug/m^3	N/A	N/A	Respiratory	1000	IRIS	06/01/18
Arsenic	Chronic	1.5E-02	ug/m^3	N/A	N/A	Developmental	30	CalEPA	06/01/18
Chromium, Hexavalent	Chronic	1.0E-01	ug/m^3	N/A	N/A	Respiratory	300	IRIS	06/01/18
Cobalt	Chronic	6.0E-03	ug/m^3	N/A	N/A	Respiratory	300	PPRTV	06/01/18
Manganese	Chronic	5.0E-02	ug/m^3	N/A	N/A	Nervous System	1000	IRIS	06/01/18

IRIS = Integrated Risk Information System

PPRTV = Provisional Peer Reviewed Toxicity Value developed by STSC

CalEPA = California Environmental Protection Agency, Office of Environmental Health Hazard Assessment

N/A = Not Applicable or Not Available

TABLE 5

CANCER TOXICITY DATA -- ORAL/DERMAL

WALTON & LONSBURY SUPERFUND SITE

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal (2)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
1,1-Dichloroethane	5.7E-03	(mg/kg-day) $^{-1}$	(1)	5.7E-03	(mg/kg-day) $^{-1}$	C	CalEPA	06/01/18
cis-1,2-Dichloroethene	N/A	N/A	N/A	N/A	N/A	Inadequate	IRIS	06/01/18
Trichloroethene	4.6E-02	(mg/kg-day) $^{-1}$	(1)	4.6E-02	(mg/kg-day) $^{-1}$	Carcinogenic to humans	IRIS	06/01/18
Vinyl chloride	7.2E-01	(mg/kg-day) $^{-1}$	(1)	7.2E-01	(mg/kg-day) $^{-1}$	A	IRIS	06/01/18
1,4-Dioxane	1.0E-01	(mg/kg-day) $^{-1}$	(1)	1.0E-01	(mg/kg-day) $^{-1}$	Likely	IRIS	06/01/18
Arsenic	1.5E+00	(mg/kg-day) $^{-1}$	(1)	1.5E+00	(mg/kg-day) $^{-1}$	A	IRIS	06/01/18
Chromium, Hexavalent	5.0E-01	(mg/kg-day) $^{-1}$	0.025	2.0E+01	(mg/kg-day) $^{-1}$	NA	NJDEP	06/01/18
Cobalt	N/A	N/A	(1)	N/A	N/A	Likely	PPRTV	06/01/18
Manganese	N/A	N/A	0.04	N/A	N/A	D	IRIS	06/01/18

IRIS = Integrated Risk Information System

PPRTV = Provisional Peer Reviewed Toxicity Value

NJDEP = New Jersey Department of Environmental Protection

CalEPA = California Environmental Protection Agency, Office of Environmental Health Hazard Assessment

(1) Oral absorption efficiency exceeds 50%. Therefore, no adjustment of the oral slope factor is necessary.

(2) Calculated as: (oral slope factor) / (oral to dermal adjustment factor)

N/A = Not Applicable/Not Available

EPA Group:

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen (by the oral route)

E - Evidence of noncarcinogenicity

TABLE 6

CANCER TOXICITY DATA -- INHALATION

WALTON & LONSBURY SUPERFUND SITE

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
1,1-Dichloroethane	1.6E-06	$(ug/m^3)^{-1}$	N/A	N/A	C	CalEPA	06/01/18
cis-1,2-Dichloroethene	N/A	N/A	N/A	N/A	Inadequate	IRIS	06/01/18
Trichloroethene	4.1E-06	$(ug/m^3)^{-1}$	N/A	N/A	Carcinogenic to humans	IRIS	06/01/18
Vinyl chloride	4.4E-06	$(ug/m^3)^{-1}$	N/A	N/A	A	IRIS	06/01/18
1,4-Dioxane	5.0E-06	$(ug/m^3)^{-1}$	N/A	N/A	Likely	IRIS	06/01/18
Arsenic	4.3E-03	$(ug/m^3)^{-1}$	N/A	N/A	A	IRIS	06/01/18
Chromium, Hexavalent	8.4E-02	$(ug/m^3)^{-1}$	N/A	N/A	NA	NJDEP	06/01/18
Cobalt	9.0E-03	$(ug/m^3)^{-1}$	N/A	N/A	Likely	PPRTV	06/01/18
Manganese	N/A	N/A	N/A	N/A	D	IRIS	06/01/18

IRIS = Integrated Risk Information System

PPRTV = Provisional Peer Reviewed Toxicity Values

CalEPA = California Environmental Protection Agency, Office of Environmental Health Hazard Assessment

NJDEP = New Jersey Department of Environmental Protection

N/A = Not Applicable

EPA Group:

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen (by the oral route)

E - Evidence of noncarcinogenicity

TABLE 7. INTERMEDIATE GROUNDWATER PRG CALCULATIONS - INGESTION

Chemical	Mutagenic?	EF	ED_C	ED_A	BW_C	BW_A	IR_C	IR_A	AT-N	AT-C	CF1	SF_o	RfD_o	THQ	TR	IFW_{adj}	$IFWM_{adj}$	$PRG_{ca\text{-}ing}$	$PRG_{nc\text{-}ing}$
		days	yrs	yrs	kg	kg	L/day	L/day	days	days	mg/ug	$(mg/kg\text{-}day)^{-1}$	mg/kg-day			(L-yr/kg-day)	(L-yr/kg-day)	ug/L	ug/L
1,1-Dichloroethane		350	6	20	15	80	0.78	2.5	2190	25550	0.001	5.7E-03	2E-01	1	1E-06	0.937	2.914	**1.4E+01**	**4.0E+03**
cis-1,2-Dichloroethene		350	6	20	15	80	0.78	2.5	2190	25550	0.001	N/A	2E-03	1	1E-06	0.937	2.914	**N/A**	**4.0E+01**
Trichloroethene	Y	350	6	20	15	80	0.78	2.5	2190	25550	0.001	4.6E-02	5E-04	1	1E-06	0.937	2.914	**1.2E+00**	**1.0E+01**
kidney	Y	350	6	20	15	80	0.78	2.5	2190	25550	0.001	9.3E-03	N/A	1	1E-06	0.937	2.914	**2.7E+00**	
non-kidney		350	6	20	15	80	0.78	2.5	2190	25550	0.001	3.7E-02	N/A	1	1E-06	0.937	2.914	**2.1E+00**	
Vinyl chloride	Y	350	6	20	15	80	0.78	2.5	2190	25550	0.001	7.2E-01	3E-03	1	1E-06	0.937	2.914	**2.1E-02**	**6.0E+01**
1,4-Dioxane		350	6	20	15	80	0.78	2.5	2190	25550	0.001	1.0E-01	3E-02	1	1E-06	0.937	2.914	**7.8E-01**	**6.0E+02**
Arsenic		350	6	20	15	80	0.78	2.5	2190	25550	0.001	1.5E+00	3E-04	1	1E-06	0.937	2.914	**5.2E-02**	**6.0E+00**
Chromium, Hexavalent	Y	350	6	20	15	80	0.78	2.5	2190	25550	0.001	5.0E-01	3E-03	1	1E-06	0.937	2.914	**5.0E-02**	**6.0E+01**
Cobalt		350	6	20	15	80	0.78	2.5	2190	25550	0.001	N/A	3E-04	1	1E-06	0.937	2.914	**N/A**	**6.0E+00**
Manganese		350	6	20	15	80	0.78	2.5	2190	25550	0.001	N/A	2E-02	1	1E-06	0.937	2.914	**N/A**	**4.8E+02**

Notes

See Table 2 for input parameters and equations N/A - Not applicable or not available.

TABLE 8. INTERMEDIATE GROUNDWATER PRG CALCULATIONS - DERMAL

Chemical	MWT g/mol	logKow	Kp (cm/hr) predicted	B	Isc cm	Dsc cm^2/hr	tau (hr)	c	b	t_star1 B>0.6	t_star3 B<=0.6	t_star (hr)	GIABS	Mutagenic?	FA for tau>3	ET_C hr/event	ET_A hr/event	ET_{adj} hr/event	ET_{madj} hr/event	EV event/day	EF days	ED_C yrs	ED_A yrs	BW_C kg	BW_A kg	SA_C cm^2	SA_A cm^2	AT-N days	AT-C days	CF1 mg/ug	CF3 L/cm^3	SF_o $(mg/kg\text{-}day)^{-1}$	RfD_o mg/kg-day	THQ	TR	DFW_{adj} cm^2-evt-day/kg	$DFWM_{adj}$ evt-cm^2/kg	DA_{event} - ca ug/cm^2-evt	DA_{event} - nc ug/cm^2-evt	$PRG_{ca\text{-}derm}$ ug/L	$PRG_{nc\text{-}derm}$ ug/L
1,1-Dichloroethane	99.0	1.79	6.7E-03	0.026	1.0E-03	4.42E-07	0.38	3.5E-01	3.2E-01	N/A	0.90	0.90	1	--	1	1	0.71	0.671	0.671	1	350	6	20	15	80	6365	19652	2190	25550	0.001	0.001	5.7E-03	2E-01	1	1E-06	7459	23405	1.7E-03	4.9E-01	**1.8E+02**	**5.8E+04**
cis-1,2-Dichloroethene	96.9	1.86	1.1E-02	0.042	1.0E-03	4.54E-07	0.37	3.6E-01	3.3E-01	N/A	0.88	0.88	1	--	1	1	0.71	0.671	0.671	1	350	6	20	15	80	6365	19652	2190	25550	0.001	0.001	N/A	2E-03	1	1E-06	7459	23405	N/A	4.9E-03	**N/A**	**3.6E+02**
Trichloroethene	131.4	2.42	1.2E-02	0.051	1.0E-03	2.91E-07	0.57	3.7E-01	3.4E-01	N/A	1.37	1.37	1	Y	1	1	0.71	0.671	0.671	1	350	6	20	15	80	6365	19652	2190	25550	0.001	0.001	4.6E-02	5E-04	1	1E-06	7459	23405	6.8E-05	1.2E-03	**7.4E+00**	**6.9E+01**
kidney	131.4	2.42	1.2E-02	0.051	1.0E-03	2.91E-07	0.57	3.7E-01	3.4E-01	N/A	1.37	1.37	1	Y	1	1	0.71	0.671	0.671	1	350	6	20	15	80	6365	19652	2190	25550	0.001	0.001	9.3E-03	N/A	1	1E-06	7459	23405	3.4E-04	N/A	**1.7E+01**	
non-kidney	131.4	2.42	1.2E-02	0.051	1.0E-03	2.91E-07	0.57	3.7E-01	3.4E-01	N/A	1.37	1.37	1		1	1	0.71	0.671	0.671	1	350	6	20	15	80	6365	19652	2190	25550	0.001	0.001	3.7E-02	N/A	1	1E-06	7459	23405	2.6E-04	N/A	**1.3E+01**	
Vinyl chloride	62.5	1.38	8.4E-03	0.026	1.0E-03	7.08E-07	0.24	3.5E-01	3.2E-01	N/A	0.57	0.57	1	Y	1	1	0.71	0.671	0.671	1	350	6	20	15	80	6365	19652	2190	25550	0.001	0.001	7.2E-01	3E-03	1	1E-06	7459	23405	2.6E-06	7.4E-03	**2.8E-01**	**8.9E+02**
1,4-Dioxane	88.1	-0.27	3.3E-04	0.001	1.0E-03	5.09E-07	0.33	3.3E-01	3.0E-01	N/A	0.79	0.79	1	--	1	1	0.71	0.671	0.671	1	350	6	20	15	80	6365	19652	2190	25550	0.001	0.001	1.0E-01	3E-02	1	1E-06	7459	23405	9.8E-05	7.4E-02	**2.3E+02**	**1.9E+05**
Arsenic	--	--	1.0E-03	--	1.0E-03	--	--	--	--	--	--	--	1	--	1	1	0.71	0.671	0.671	1	350	6	20	15	80	6365	19652	2190	25550	0.001	0.001	1.5E+00	3E-04	1	1E-06	7459	23405	6.5E-06	7.4E-04	**9.7E+00**	**1.4E+03**
Chromium, Hexavalent	--	--	2.0E-03	--	1.0E-03	--	--	--	--	--	--	--	0.025	Y	1	1	0.71	0.671	0.671	1	350	6	20	15	80	6365	19652	2190	25550	0.001	0.001	5.0E-01	3E-03	1	1E-06	7459	23405	1.6E-07	1.8E-04	**1.2E-01**	**1.7E+02**
Cobalt	--	--	4.0E-04	--	1.0E-03	--	--	--	--	--	--	--	1	--	1	1	0.71	0.671	0.671	1	350	6	20	15	80	6365	19652	2190	25550	0.001	0.001	N/A	3E-04	1	1E-06	7459	23405	N/A	7.4E-04	**N/A**	**3.4E+03**
Manganese	--	--	1.0E-03	--	1.0E-03	--	--	--	--	--	--	--	0.04	--	1	1	0.71	0.671	0.671	1	350	6	20	15	80	6365	19652	2190	25550	0.001	0.001	N/A	2E-02	1	1E-06	7459	23405	N/A	2.4E-03	**N/A**	**4.4E+03**

Notes

See Table 2 for input parameters and equations N/A - Not applicable or not available.

log Kow, GIABS, and FA - From Regional Screening Level (November 2017) tables

Kp - predicted values utilize formula from RAGs part E Eq. 3.8: log Kp = -2.805603 + 0.6645865 log Kow - 0.0056118 MW (Equation more accurate in spreadsheet than in report) (Final - EPA/540/R/99/005, July 2004)

NA: Outside of Effective Predictive Domain (EPD). Calculated based on RAGS Part E criteria for MW and log Kow.

Inorganics: Rags Part E, Exhibit 3-1; Final - EPA/540/R/99/005, July 2004

TABLE 9. INTERMEDIATE GROUNDWATER PRG CALCULATIONS - INHALATION

Chemical	Mutagenic?	EF days	ED_C yrs	ED_A yrs	K L/m^3	AT-N days	AT-C days	UR $(ug/m^3)^{-1}$	RfC ug/m^3	THQ	TR	$INFM_{adj}$ $yr\text{-}ug/m^3$	$PRG_{ca\text{-}inh}$ ug/L	$PRG_{nc\text{-}inh}$ ug/L
1,1-Dichloroethane		350	6	20	0.5	2190	25550	1.6E-06	N/A	1	1E-06	1.2E-04	**3.5E+00**	**N/A**
cis-1,2-Dichloroethene		350	6	20	0.5	2190	25550	N/A	N/A	1	1E-06	N/A	**N/A**	**N/A**
Trichloroethene	Y	350	6	20	0.5	2190	25550	4.1E-06	2E+00	1	1E-06	3.0E-04	**9.6E-01**	**4.2E+00**
kidney	Y	350	6	20	0.5	2190	25550	1.0E-06	N/A	1	1E-06	7.2E-05	**2.0E+00**	
non-kidney		350	6	20	0.5	2190	25550	3.1E-06	N/A	1	1E-06	2.2E-04	**1.8E+00**	
Vinyl chloride	Y	350	6	20	0.5	2190	25550	4.4E-06	1E+02	1	1E-06	3.2E-04	**3.4E-01**	**2.1E+02**
1,4-Dioxane		350	6	20	0.5	2190	25550	5.0E-06	3E+01	1	1E-06	3.6E-04	**1.1E+00**	**6.3E+01**
Arsenic		350	6	20	0.5	2190	25550	4.3E-03	2E-02	1	1E-06	3.1E-01	**N/A**	**N/A**
Chromium, Hexavalent	Y	350	6	20	0.5	2190	25550	8.4E-02	1E-01	1	1E-06	6.0E+00	**N/A**	**N/A**
Cobalt		350	6	20	0.5	2190	25550	9.0E-03	6E-03	1	1E-06	6.5E-01	**N/A**	**N/A**
Manganese		350	6	20	0.5	2190	25550	N/A	5E-02	1	1E-06	N/A	**N/A**	**N/A**

Notes

See Table 2 for input parameters and equations N/A - Not applicable or not available.

PRGs shown as "N/A" are due to either lack of inhalation toxicity values or because the analyte is non-volatile.

Trichloroethene calculated to account for mutagenic contributions during early life. Slope factors for kidney and non-kidney (liver and non-Hodgkin lymphoma) presented in spreadsheet.
(source - https://www.epa.gov/risk/regional-screening-levels-frequent-questions#FQ48)
Final TCE cancer PRG shown calculated by 1/(1/kidney conc + 1/non-kidney conc)

TABLE 10. INTERMEDIATE GROUNDWATER PRG CALCULATIONS - RESULTS

	Carcinogenic Risk Level = 1E-06				Non-Cancer Hazard Quotient = 1			
Chemical	$PRG_{ca\text{-}ing}$ ug/L	$PRG_{ca\text{-}derm}$ ug/L	$PRG_{ca\text{-}inh}$ ug/L	Result ug/L	$PRG_{nc\text{-}ing}$ ug/L	$PRG_{nc\text{-}derm}$ ug/L	$PRG_{nc\text{-}inh}$ ug/L	Result ug/L
1,1-Dichloroethane	1.4E+01	1.8E+02	3.5E+00	**2.8E+00**	4.0E+03	5.8E+04	N/A	**3.8E+03**
cis-1,2-Dichloroethene	N/A	N/A	N/A	**N/A**	4.0E+01	3.6E+02	N/A	**3.6E+01**
Trichloroethene	1.2E+00	7.4E+00	9.6E-01	**4.9E-01**	1.0E+01	6.9E+01	4.2E+00	**2.8E+00**
Vinyl chloride	2.1E-02	2.8E-01	3.4E-01	**1.9E-02**	6.0E+01	8.9E+02	2.1E+02	**4.4E+01**
1,4-Dioxane	7.8E-01	2.3E+02	1.1E+00	**4.6E-01**	6.0E+02	1.9E+05	6.3E+01	**5.7E+01**
Arsenic	5.2E-02	9.7E+00	N/A	**5.2E-02**	6.0E+00	1.4E+03	N/A	**6.0E+00**
Chromium, Hexavalent	5.0E-02	1.2E-01	N/A	**3.5E-02**	6.0E+01	1.7E+02	N/A	**4.4E+01**
Cobalt	N/A	N/A	N/A	**N/A**	6.0E+00	3.4E+03	N/A	**6.0E+00**
Manganese	N/A	N/A	N/A	**N/A**	4.8E+02	4.4E+03	N/A	**4.3E+02**

Notes

See Table 2 for equations

N/A - Not applicable or not available.

A.5 – GROUNDWATER – IRRIGATION SCENARIO

Table 1. Human Health PRG development for the Irrigation Well Scenario

For the chemicals of concern (COCs) determined in Appendix A, the risk-based RSLs (see Appendix A) have been presented below.

COC	Cancer RSL (1E-06)	Cancer RSL (1E-05)	Cancer RSL (1E-04)	Non-cancer RSL (1)
Trichloroethene	20.4	204	2040	98.1
Vinyl chloride	0.0702	0.702	7.02	766
Chromium, Hexavalent	0.307	3.07	30.7	207

RSL - Regional Screening Level: units are micrograms per liter

ATTACHMENT B – ECOLOGICAL PRG CALCULATIONS

PRG Development - Ecological Risk in Surface Water

Summary of Surface Water Risk from BERA

The BERA concludes with high confidence there is severe risk to aquatic receptors in Bliss Brook mainly from the exposure to chromium (VI) in surface water, representing a significant ecological risk. The evidence in the BERA included comparison of the COPC levels in surface water samples to acute and chronic benchmarks which are protective of aquatic invertebrate, amphibian, and fish populations, and also utilized laboratory toxicity testing to compare toxicity of site surface water samples to reference locations using the water flea (*Ceriodaphnia dubia*).

The site Reasonable Maximum Exposure (RME) and Central Tendency Exposure (CTE) Hazard Quotients (HQs) for the chronic scenario were greater than 1 for barium, chromium (III), chromium (VI), and manganese (BERA, Table 24). In addition, the CTE and RME acute HQs were 4 and 7, respectively, for chromium (VI).

Barium and manganese had residual risk (RR) HQ values above 1. The RR was obtained by subtracting the reference risk from the site risk, to represent the risk exceeding levels at reference locations. The RR values for barium and manganese were 2 and 3, respectively, with no acute RR values above 1 for the chronic comparisons (Table 41), indicating that adverse effects are unlikely. Both chromium (III) and chromium (VI) had exceedences of reference risk at levels indicating, with high confidence, that adverse effects to aquatic receptors from exposure to surface water are possible in on-site samples in Bliss Brook. Highest risk was associated with acute RR values for chromium (VI) of 7 (RME) and 4 (CTE).

Based on the site-specific calculations, using the *Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses* (USEPA, 1985), the following site-specific benchmarks were derived (Appendix D of the BERA):

Chromium (III)

CCC = 10 ug/L (NRWQC = 74 ug/L at 100 mg/L hardness)

CMC = 608 ug/L (NRWQC = 540 ug/L at 100 mg/L hardness)

Chromium (VI)

CCC = 2 ug/L (NRWQC = 11 ug/L)

CMC = 17 ug/L (NRWQC = 16 ug/L)

The CCC represents the four-day average concentration that should not be exceeded more than once every three years, and the CMC is the one-hour average concentration that should not be exceeded once every three years on average. These site-specific CCC and CMC values were used as the chromium benchmarks in surface water to evaluate the potential risk to aquatic receptors (Tables 23 to 26 of the BERA). Although based on a similar pool of initial data, the site-specific data set (selected to represent only the conditions of hardness values on site and excluding some fish species) resulted in a smaller, yet more site-specific group of studies. There is added uncertainty in calculating the site-specific benchmarks based on a smaller group of data, but the process confirmed that even without salmonids and other sensitive species not likely to occur on site, the protective levels of chronic (CCC) exposures

with both forms of chromium are low, and possibly lower than those calculated with a broader dataset by the NRWQCs.

These benchmark data were then compared to results of the site-specific toxicity test. The only two samples showing a significant effect on survival and reproduction on *C. dubia* were samples SW-210 and SW-212 from Bliss Brook (Table 43). These samples, with elevated concentrations of both chromium (III) and chromium (VI), showed 100% mortality in the six-day toxicity tests. The toxicity test results are consistent with the calculated CCC and CMC of 2 ug/L and 17 ug/L, respectively. All samples with chromium (VI) less than 1 ug/L showed no toxicity in the lab, and the two samples with chromium (VI) greater than 100 ug/L (132 ug/L and 166 ug/L) were highly toxic. Ideally, samples including the range between 1 and 100 ug/L would have been tested for toxicity, however, although samples were collected along a gradient in the affected reach of the brook, no water samples were collected with chromium (VI) concentrations in this range.

Elevated concentrations of other dissolved metals (barium and manganese) also appear not to be associated with effects on *C. dubia*. Table 43 (BERA) indicates the levels of barium and manganese observed in Bliss Brook were not toxic to *C. dubia* in site-specific toxicity test. Therefore, the chromium (III) and chromium (VI) are identified as Contaminants of Concern (COCs) in surface water.

Basis of Surface Water PRGs

As discussed above, site-specific water quality criteria were developed, and compared to NRWQC values:

Chromium (III)

CCC = 10 ug/L	(NRWQC = 74 ug/L at 100 mg/L hardness)
CMC = 608 ug/L	(NRWQC = 570 ug/L at 100 mg/L hardness)

Chromium (VI)

CCC = 2 ug/L	(NRWQC = 11 ug/L)
CMC = 17 ug/L	(NRWQC = 16 ug/L)

These values are generally consistent with the results of the surface water toxicity tests from Bliss Brook. For chromium (III), the lower bounded value for the No Observed Effects Concentration (NOEC) was 39 ug/L in sample SW-205 (the samples-specific hardness at SW-205 was 105 mg/L, which is comparable to the NRWQC-adjusted value). The lowest concentration of chromium (III) observed in Bliss Brook with significant adverse effects was 174 ug/L; however, the effects observed in this sample are likely associated with the high concentration of chromium(VI) in the samples. Since one site sample resulted with a NOEC of 39 ug/L, the value of the CCC of 10 ug/L derived from the site-specific calculations appears to be conservative.

For chromium (VI), the lower bounded value for the NOEC was 0.5 ug/L; and was observed in all of the samples with no effects. However, the next higher concentration was 132 ug/L; which serves as the

Lowest Observed Effect Concentration (LOEC) and had 100% mortality of the test organisms. The gap in observed surface water chromium (VI) between 0.5 and 132 ug/L results in a wide range in the upper and lower bounded concentrations from which a PRG can be derived.

Table 1 presents the data available to derive a PRG for the site. The NRWQCs (chronic or CCC) and the acute (CMC) are shown as a comparison. The site CCC and the site CMC were derived as stated above and represent conservative site-specific, protective values. In addition, using the small dataset available from the laboratory toxicity tests, the NOEC and the LOEC were identified. Although there is uncertainty surrounding each of the site NOEC and LOEC, if the geometric mean value is used to calculate a PRG, similar values for PRGs result from the site CCC and site CMC (see Table 1). Therefore, the recommended PRGs for the site, consistent with data presented in the BERA, are represented by the geometric mean of the site NOEC and LOEC and results in surface water PRGs for Bliss Brook of 82 ug/L for chromium (III), and 8 ug/L for chromium (VI).

TABLE 1

SUMMARY OF ECOLOGICAL PRG DEVELOPMENT - BLISS BROOK SURFACE WATER

WALTON & LONSBURY SUPERFUND SITE

COC	NRWQC- CCC (*u* g/L)	NRWQC CMC (*u* g/L)	Site CCC[1] (*u* g/L)	Site CMC[2] (*u* g/L)	Site NOEC[3] (*u* g/L)	Site LOEC[4] (*u* g/L)	PRG[5] (*u* g/L)
Chromium[a]	74	570	10	608	39	174	82
Chromium, Hexavalent	11	16	2	17	0.5	132	8

Notes:

(1) Chromium CCC based on site-specific criteria

(2) Chromium CMC based on site-specific criteria

(3) No Observed Effect Concentration in site-specific toxicity tests with CD

(4) Lowest Observed Effect Concentration in site-specific toxicity tests with CD

(5) PRG is based on the geometric mean of the LOEC and NOEC

(a) NRWQC at 100 mg/L hardness

COC - Chemical of Concern

CD - *Ceriodaphnia dubia*

CMC - Criterion Maximum Concentration

CCC - Criterion Continuous Concentration

LOEC - Lowest Observed Effect Concentration

NOEC - No Observed Effect Concentration

NRWQC - National Recommended Water Quality Criterion (USEPA, 2016)

PRG - Preliminary Remediation Goal

APPENDIX C – PRG EXCEEDANCES

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		ISB-01	ISB-01	ISB-01	ISB-01	ISB-01	ISB-01	ISB-02	P-78-SB-01
Sample ID:		ISB-01A	ISB-01B	ISB-01C	ISB-01D	ISB-01E	ISB-01F	ISB-02	P-78-SB-01A
Sample Date:	W&L	8/6/2010	8/6/2010	8/6/2010	8/6/2010	8/6/2010	8/6/2010	8/10/2010	12/14/2010
Sample Depth:	Property	0-1 (ft bgs)	1.25-1.25 (ft bgs)	0-2.58 (ft bgs)	1.1-1.1 (ft bgs)	1.3-1.3 (ft bgs)	0-1.7 (ft bgs)	0-1 (ft bgs)	0-0.5 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate
Parameter									
VOCs (ug/kg)									
1,1,1-Trichloroethane		84 U				42 U		82 U	5.5 U
1,1-Dichloroethane		84 U				42 U		82 U	5.5 U
2-Butanone		84 U				42 U		82 U	11 U
2-Hexanone		84 U				42 U		82 U	11 U
4-Methyl-2-Pentanone		84 U				42 U		82 U	11 U
Acetone		111.5				63.7		82 U	220
Carbon Disulfide		84 U				42 U		82 U	5.5 U
Chloroethane		84 U				42 U		82 U	5.5 U
Chloroform		84 U				42 U		82 U	5.5 U
cis-1,2-Dichloroethene		84 U				42 U		82 U	5.5 U
Ethylbenzene		84 U				42 U		82 U	5.5 U
m,p-Xylene		170 U				84 U		160 U	5.5 U
Methyl acetate									5.9
Methylene Chloride		84 U				42 U		82 U	3.6 J
Naphthalene		84 U				42 U		82 U	
Tetrachloroethene		84 U				42 U		82 U	5.5 U
Toluene		84 U				42 U		82 U	5.5 U
Trichloroethene		84 U				42 U		82 U	5.5 U
SVOCs (ug/kg)									
2-Methylnaphthalene									260 U
4-Methylphenol									260 U
Acenaphthene				250 U			260 U	250 U	260 U
Acenaphthylene				250 U			260 U	250 U	260 U
Anthracene				250 U			260 U	250 U	260 U
Benzaldehyde									260 U
Benzo(a)anthracene	11,000			250 U			260 U	250 U	190 J
Benzo(a)pyrene	1,100			250 U			260 U	250 U	240 J
Benzo(b)fluoranthene	11,000			250 U			260 U	250 U	240 J
Benzo(g,h,i)perylene				250 U			260 U	250 U	210 J
Benzo(k)fluoranthene				250 U			260 U	250 U	220 J
Bis(2-ethylhexyl)phthalate									360
Butylbenzylphthalate									260 U
Caprolactam									260 U
Carbazole									260 U
Chrysene				250 U			260 U	250 U	240 J
Dibenz(a,h)anthracene	1,100			250 U			260 U	250 U	110 J
Dibenzofuran									260 U

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		ISB-01	ISB-01	ISB-01	ISB-01	ISB-01	ISB-01	ISB-02	P-78-SB-01
Sample ID:		ISB-01A	ISB-01B	ISB-01C	ISB-01D	ISB-01E	ISB-01F	ISB-02	P-78-SB-01A
Sample Date:	W&L	8/6/2010	8/6/2010	8/6/2010	8/6/2010	8/6/2010	8/6/2010	8/10/2010	12/14/2010
Sample Depth:	Property	0-1 (ft bgs)	1.25-1.25 (ft bgs)	0-2.58 (ft bgs)	1.1-1.1 (ft bgs)	1.3-1.3 (ft bgs)	0-1.7 (ft bgs)	0-1 (ft bgs)	0-0.5 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate
Parameter									
Dimethylphthalate									260 U
Di-n-butylphthalate									260 U
Fluoranthene				250 U			260 U	250 U	390
Fluorene				250 U			260 U	250 U	260 U
Indeno(1,2,3-cd)pyrene				250 U			260 U	250 U	190 J
Naphthalene				250 U			260 U	250 U	260 U
Pentachlorophenol									500 U
Phenanthrene				250 U			260 U	250 U	180 J
Phenol									260 U
Pyrene				250 U			260 U	250 U	350
Pesticides (ug/kg)									
4,4'-DDD									
4,4'-DDE									
4,4'-DDT									
Aldrin									
alpha-BHC									
alpha-Chlordane									
beta-BHC									
delta-BHC									
Dieldrin									
Endosulfan II									
Endosulfan sulfate									
Endrin									
Endrin aldehyde									
Endrin ketone									
gamma-Chlordane									
Heptachlor									
Heptachlor epoxide									
Methoxychlor									
PCBs (ug/kg)									
Aroclor-1260									
Inorganics (mg/kg)									
Aluminum				560			610	9700	12400
Antimony	31			520			1500 J3	9.6 U	7.8 U
Arsenic	6.8			3.0			6.6 J3	2.9	8.8
Barium				110			27	180	32.2
Beryllium				0.78 U			0.78 U	0.77 U	0.39 J

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		ISB-01	ISB-01	ISB-01	ISB-01	ISB-01	ISB-01	ISB-02	P-78-SB-01
Sample ID:		ISB-01A	ISB-01B	ISB-01C	ISB-01D	ISB-01E	ISB-01F	ISB-02	P-78-SB-01A
Sample Date:	W&L	8/6/2010	8/6/2010	8/6/2010	8/6/2010	8/6/2010	8/6/2010	8/10/2010	12/14/2010
Sample Depth:	Property	0-1 (ft bgs)	1.25-1.25 (ft bgs)	0-2.58 (ft bgs)	1.1-1.1 (ft bgs)	1.3-1.3 (ft bgs)	0-1.7 (ft bgs)	0-1 (ft bgs)	0-0.5 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate
Parameter									
Cadmium				2.0 U			2.0 U	1.9 U	0.43 J
Calcium				250			220	5700	622 J
Chromium				1100			2000	1100	416
Chromium, Hexavalent	3.0		330		240				7
Cobalt	23			2.0 U			2.0 U	6.3	3.3 J
Copper				11			23	24	40.6
Cyanide									0.86 U
Iron				3500			10000	16000	13600
Lead	200			510			1100	890	86.8
Magnesium				62			54	3200	1370
Manganese				17			55	430	124
Mercury									0.16 J
Nickel				2.0 U			18	12	7.2
Potassium				9.8 U			400	870	295 J
Selenium				2.0 U			2.0 U	3.8 U	4.6 U
Silver				0.98 U			0.98 U	0.96 U	1.3 U
Sodium				9.8 U			67	210	406 J
Thallium	0.78			2.0 U			2.0 U	2.1	3.3 U
Vanadium				6.4			12	19	27.7
Zinc				4.1			7.0	42	53.4
Other									
pH in Soil (S.U.)									

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		P-78-SB-01	P-78-SB-01	P-78-SB-01	P-78-SB-02	P-78-SB-02	P-78-SB-02	P-78-SB-03	P-78-SB-03
Sample ID:		P-78-SB-70A	P-78-SB-01B	P-78-SB-01C	P-78-SB-02A	P-78-SB-02B	P-78-SB-02C	P-78-SB-03A	P-78-SB-03B
Sample Date:	W&L	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010
Sample Depth:	Property	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)
Sample Type:	Soil PRGs	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
VOCs (ug/kg)									
1,1,1-Trichloroethane		5.9 U	6.8 U	5.3 U	4.9 U	5.9 U	3.7 U	7.4	8.9
1,1-Dichloroethane		5.9 U	6.8 U	5.3 U	4.9 U	5.9 U	3.7 U	3.9 U	3 U
2-Butanone		12 U	14 U	11 U	20	23	7.3 U	7.8 U	6.1 U
2-Hexanone		12 U	14 U	11 U	9.9 U	12 U	7.3 U	7.8 U	6.1 U
4-Methyl-2-Pentanone		12 U	14 U	11 U	9.9 U	12 U	7.3 U	7.8 U	6.1 U
Acetone		360	85	22	220	200	61	100	49
Carbon Disulfide		5.9 U	6.8 U	5.3 U	4.9 U	5.9 U	3.7 U	3.9 U	3 U
Chloroethane		5.9 U	6.8 U	5.3 U	4.9 U	5.9 U	3.7 U	3.9 U	3 U
Chloroform		5.9 U	6.8 U	5.3 U	4.9 U	5.9 U	3.7 U	3.9 U	3 U
cis-1,2-Dichloroethene		5.9 U	6.8 U	5.3 U	4.9 U	5.9 U	3.7 U	3.9 U	3 U
Ethylbenzene		5.9 U	6.8 U	5.3 U	4.9 U	5.9 U	3.7 U	3.9 U	3 U
m,p-Xylene		5.9 U	6.8 U	5.3 U	4.9 U	5.9 U	3.7 U	3.9 U	3 U
Methyl acetate		25	6.8 U	5.3 U	12	12	6.6	5.8	3 U
Methylene Chloride		41	6.8 U	3.4 J	4.7 J	5.6 J	3.1 J	2.8 J	2 J
Naphthalene									
Tetrachloroethene		5.9 U	6.8 U	5.3 U	4.9 U	5.9 U	3.7 U	2.8 J	3 U
Toluene		5.9 U	6.8 U	5.3 U	4.9 U	5.9 U	3.7 U	3.9 U	3 U
Trichloroethene		5.9 U	6.8 U	5.3 U	4.9 U	5.9 U	3.7 U	3.9 U	3 U
SVOCs (ug/kg)									
2-Methylnaphthalene		240 U	230 U	220 U	200 U	210 U	180 U	180 U	200 U
4-Methylphenol		240 U	230 U	220 U	200 U	210 U	180 U	180 U	200 U
Acenaphthene		240 U	230 U	220 U	200 U	210 U	180 U	180 U	200 U
Acenaphthylene		240 U	230 U	220 U	200 U	210 U	180 U	180 U	200 U
Anthracene		240 U	230 U	220 U	87 J	210 U	180 U	180 U	200 U
Benzaldehyde		240 U	230 U	220 U	200 U	210 U	180 U	180 U	200 U
Benzo(a)anthracene	11,000	250	230 U	220 U	220	210 U	180 U	260	200 U
Benzo(a)pyrene	1,100	280	230 U	220 U	210	83 J	180 U	250	200 U
Benzo(b)fluoranthene	11,000	310	230 U	220 U	210	210 U	180 U	220	200 U
Benzo(g,h,i)perylene		200 J	230 U	220 U	180 J	210 U	180 U	190	200 U
Benzo(k)fluoranthene		270	230 U	220 U	210	210 U	180 U	240	200 U
Bis(2-ethylhexyl)phthalate		240 U	230 U	220 U	200 U	210 U	180 U	180 U	200 U
Butylbenzylphthalate		240 U	230 U	220 U	200 U	210 U	180 U	180 U	200 U
Caprolactam		240 U	230 U	220 U	200 U	210 U	180 U	180 U	200 U
Carbazole		240 U	230 U	220 U	200 U	210 U	180 U	180 U	200 U
Chrysene		300	230 U	220 U	250	96 J	180 U	280	200 U
Dibenz(a,h)anthracene	1,100	240 U	230 U	220 U	200 U	210 U	180 U	73 J	200 U
Dibenzofuran		240 U	230 U	220 U	200 U	210 U	180 U	180 U	200 U

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		P-78-SB-01	P-78-SB-01	P-78-SB-01	P-78-SB-02	P-78-SB-02	P-78-SB-02	P-78-SB-03	P-78-SB-03
Sample ID:		P-78-SB-70A	P-78-SB-01B	P-78-SB-01C	P-78-SB-02A	P-78-SB-02B	P-78-SB-02C	P-78-SB-03A	P-78-SB-03B
Sample Date:	W&L	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010
Sample Depth:	Property	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)
Sample Type:	Soil PRGs	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
Dimethylphthalate		240 U	230 U	220 U	200 U	210 U	180 U	180 U	200 U
Di-n-butylphthalate		240 U	230 U	220 U	200 U	210 U	180 U	180 U	200 U
Fluoranthene		610	230 U	220 U	660	220	180 U	640	200 U
Fluorene		240 U	230 U	220 U	200 U	210 U	180 U	180 U	200 U
Indeno(1,2,3-cd)pyrene		180 J	230 U	220 U	160 J	210 U	180 U	180 J	200 U
Naphthalene		240 U	230 U	220 U	200 U	210 U	180 U	180 U	200 U
Pentachlorophenol		460 U	440 U	430 U	400 U	410 U	360 U	360 U	380 U
Phenanthrene		450	230 U	220 U	450	130 J	180 U	390	200 U
Phenol		240 U	230 U	220 U	200 U	210 U	180 U	180 U	200 U
Pyrene		480	230 U	220 U	400	150 J	180 U	460	200 U
Pesticides (ug/kg)									
4,4'-DDD									
4,4'-DDE									
4,4'-DDT									
Aldrin									
alpha-BHC									
alpha-Chlordane									
beta-BHC									
delta-BHC									
Dieldrin									
Endosulfan II									
Endosulfan sulfate									
Endrin									
Endrin aldehyde									
Endrin ketone									
gamma-Chlordane									
Heptachlor									
Heptachlor epoxide									
Methoxychlor									
PCBs (ug/kg)									
Aroclor-1260									
Inorganics (mg/kg)									
Aluminum		10200	13200	11300	10400	11700	10600	9200	10400
Antimony	31	0.70 J	6.5 U	5.6 U	0.53 J	6.4 U	5.7 U	0.33 J	5.1 U
Arsenic	6.8	6.1	2.1	1.5	3.1	2.9	1.8	3.3	2.4
Barium		28.2	39.8	36.6	24.7	29.9	44.7	43.3	31.9
Beryllium		0.34 J	0.46 J	0.35 J	0.43 J	0.48 J	0.42 J	0.48	0.44

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		P-78-SB-01	P-78-SB-01	P-78-SB-01	P-78-SB-02	P-78-SB-02	P-78-SB-02	P-78-SB-03	P-78-SB-03
Sample ID:		P-78-SB-70A	P-78-SB-01B	P-78-SB-01C	P-78-SB-02A	P-78-SB-02B	P-78-SB-02C	P-78-SB-03A	P-78-SB-03B
Sample Date:	W&L	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010
Sample Depth:	Property	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)
Sample Type:	Soil PRGs	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
Cadmium		0.36 J	0.33 J	0.24 J	0.40 J	0.38 J	0.32 J	0.55	0.49
Calcium		549	460 J	550	932	1300	615	625	538
Chromium		340	34.7	52.5	676	223	104	45.7	11.2
Chromium, Hexavalent	3.0	83	1.1 U	4.6	1.9 U	8.7	5.8	1	
Cobalt	23	2.8 J	3.6 J	4.7	4.3 J	4.5 J	3.3 J	5.4	4.0 J
Copper		28.9	8.2	6.2	30.9	13.5	6.5	20.6	11.8
Cyanide		0.66 U	0.69 U	0.63 U	0.62 U	0.61 U	0.58 U	0.60 U	0.59 U
Iron		10700	11300	8950	13300	13400	11900	12400	14000
Lead	200	66.6	16.2	8.2	23.1	21.9	8.0	46.1	14.1
Magnesium		1060	1030	1770	1670	1940	1100	1410	1540
Manganese		103	125	133	202	235	159	231	201
Mercury		0.10 J	0.040 J	0.13 U	0.010 J	0.030 J	0.010 J	0.040 J	0.020 J
Nickel		5.8	6.5	8.7	5.6	6.7	6.7	7.8	6.4
Potassium		248 J	184 J	271 J	270 J	289 J	185 J	260 J	187 J
Selenium		0.65 J	0.57 J	3.3 U	3.4 U	3.7 U	3.3 U	3.2 U	3.0 U
Silver		1.1 U	1.1 U	0.94 U	0.97 U	1.1 U	0.94 U	0.91 U	0.85 U
Sodium		255 J	321 J	286 J	318 J	255 J	262 J	276 J	255 J
Thallium	0.78	2.7 U	2.7 U	2.3 U	2.4 U	2.7 U	2.4 U	2.3 U	2.1 U
Vanadium		20.4	17.6	14.7	23.2	24.6	17.5	18.7	19.2
Zinc		43.5	45.1	46.1	55.7	52.4	46.9	50.0	40.0
Other									
pH in Soil (S.U.)									

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		P-78-SB-03	P-78-SB-04	P-78-SB-04	P-78-SB-04	P-78-SB-05	P-78-SB-05	P-78-SB-05	P-78-SB-09
Sample ID:		P-78-SB-03C	P-78-SB-04A	P-78-SB-04B	P-78-SB-04C	P-78-SB-05A	P-78-SB-05B	P-78-SB-05C	P-78-SB-09A
Sample Date:	W&L	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010
Sample Depth:	Property	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
VOCs (ug/kg)									
1,1,1-Trichloroethane		20	4.1 U	4.2 U	3.6 U	6.1 U	4.3 U	4.9 U	33
1,1-Dichloroethane		3.8 U	4.1 U	4.2 U	3.6 U	6.1 U	4.3 U	4.9 U	10
2-Butanone		11	8.2 U	8.4 U	7.3 U	12 U	8.6 U	9.8 U	12 U
2-Hexanone		7.6 U	8.2 U	8.4 U	7.3 U	12 U	8.6 U	9.8 U	12 U
4-Methyl-2-Pentanone		7.6 U	8.2 U	8.4 U	7.3 U	12 U	8.6 U	9.8 U	12 U
Acetone		140	120	86	240	12 U	120	98	180
Carbon Disulfide		3.8 U	4.1 U	4.2 U	3.6 U	6.1 U	4.3 U	4.9 U	5.9 U
Chloroethane		3.8 U	4.1 U	4.2 U	3.6 U	6.1 U	4.3 U	4.9 U	5.9 U
Chloroform		3.8 U	4.1 U	4.2 U	3.6 U	6.1 U	4.3 U	4.9 U	5.9 U
cis-1,2-Dichloroethene		3.8 U	4.1 U	4.2 U	3.6 U	6.1 U	4.3 U	4.9 U	5.9 U
Ethylbenzene		3.8 U	4.1 U	4.2 U	3.6 U	6.1 U	4.3 U	4.9 U	5.9 U
m,p-Xylene		3.8 U	4.1 U	4.2 U	3.6 U	6.1 U	4.3 U	4.9 U	5.9 U
Methyl acetate		23	3.7 J	3.9 J	16	6.1 U	29	93	130
Methylene Chloride		2.7 J	4.1 U	4.2 U	3.6 U	110	4.3 U	3.3 J	5.9 U
Naphthalene									
Tetrachloroethene		6.1	4.1 U	4.2 U	3.6 U	6.1 U	4.3 U	4.9 U	5.9 U
Toluene		3.8 U	4.1 U	4.2 U	3.6 U	6.1 U	4.3 U	4.9 U	5.9 U
Trichloroethene		3.8 U	4.1 U	4.2 U	3.6 U	6.1 U	4.3 U	4.9 U	5.9 U
SVOCs (ug/kg)									
2-Methylnaphthalene		190 U	120 J	190 U	200 U	210 U	200 U	230 U	210 U
4-Methylphenol		190 U	200 U	190 U	200 U	210 U	200 U	230 U	210 U
Acenaphthene		190 U	520	190 U	200 U	210 U	200 U	230 U	210 U
Acenaphthylene		190 U	200 U	190 U	200 U	210 U	200 U	230 U	210 U
Anthracene		190 U	950	190 U	200 U	210 U	200 U	230 U	210 U
Benzaldehyde		190 U	200 U	190 U	200 U	210 U	200 U	230 U	210 U
Benzo(a)anthracene	11,000	84 J	1400	190 U	110 J	210 U	200 U	230 U	210 U
Benzo(a)pyrene	1,100	94 J	1200	190 U	100 J	210 U	200 U	230 U	210 U
Benzo(b)fluoranthene	11,000	87 J	1100	190 U	200 U	210 U	200 U	230 U	210 U
Benzo(g,h,i)perylene		77 J	820	190 U	200 U	210 U	200 U	230 U	210 U
Benzo(k)fluoranthene		89 J	1100	190 U	93 J	210 U	200 U	230 U	210 U
Bis(2-ethylhexyl)phthalate		190 U	140 J	190 U	200 U	210 U	200 U	120 J	210 U
Butylbenzylphthalate		190 U	200 U	190 U	200 U	210 U	200 U	230 U	210 U
Caprolactam		190 U	200 U	190 U	200 U	210 U	200 U	230 U	210 U
Carbazole		190 U	650	190 U	200 U	210 U	200 U	230 U	210 U
Chrysene		93 J	1500	190 U	120 J	210 U	200 U	230 U	210 U
Dibenz(a,h)anthracene	1,100	190 U	320	190 U	200 U	210 U	200 U	230 U	210 U
Dibenzofuran		190 U	500	190 U	200 U	210 U	200 U	230 U	210 U

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		P-78-SB-03	P-78-SB-04	P-78-SB-04	P-78-SB-04	P-78-SB-05	P-78-SB-05	P-78-SB-05	P-78-SB-09
Sample ID:		P-78-SB-03C	P-78-SB-04A	P-78-SB-04B	P-78-SB-04C	P-78-SB-05A	P-78-SB-05B	P-78-SB-05C	P-78-SB-09A
Sample Date:	W&L	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010
Sample Depth:	Property	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
Dimethylphthalate		190 U	200 U	190 U	200 U	210 U	200 U	230 U	210 U
Di-n-butylphthalate		190 U	200 U	190 U	200 U	210 U	200 U	230 U	210 U
Fluoranthene		160 J	3900	190 U	310	210 U	200 U	230 U	210 U
Fluorene		190 U	680	190 U	200 U	210 U	200 U	230 U	210 U
Indeno(1,2,3-cd)pyrene		74 J	780	190 U	200 U	210 U	200 U	230 U	210 U
Naphthalene		190 U	170 J	190 U	200 U	210 U	200 U	230 U	210 U
Pentachlorophenol		370 U	390 U	370 U	380 U	400 U	390 U	440 U	410 U
Phenanthrene		89 J	5200	190 U	290	210 U	200 U	230 U	210 U
Phenol		190 U	200 U	190 U	200 U	210 U	200 U	230 U	210 U
Pyrene		140 J	3000	190 U	210	210 U	200 U	230 U	210 U
Pesticides (ug/kg)									
4,4'-DDD									
4,4'-DDE									
4,4'-DDT									
Aldrin									
alpha-BHC									
alpha-Chlordane									
beta-BHC									
delta-BHC									
Dieldrin									
Endosulfan II									
Endosulfan sulfate									
Endrin									
Endrin aldehyde									
Endrin ketone									
gamma-Chlordane									
Heptachlor									
Heptachlor epoxide									
Methoxychlor									
PCBs (ug/kg)									
Aroclor-1260									
Inorganics (mg/kg)									
Aluminum		10100	10500	11300	11000	10600	11400	12600	11400
Antimony	31	0.39 J	1.0 J	0.46 J	0.41 J	6.1 U	0.61 J	0.48 J	0.58 J
Arsenic	6.8	2.7	3.0	3.0	3.3	1.9	4.4	5.3	4.5
Barium		40.4	34.6	31.2	49.2	31.4	56.2	56.1	50.3
Beryllium		0.47 J	0.43	0.47 J	0.47	0.48 J	0.83	0.90	0.77

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		P-78-SB-03	P-78-SB-04	P-78-SB-04	P-78-SB-04	P-78-SB-05	P-78-SB-05	P-78-SB-05	P-78-SB-09
Sample ID:		P-78-SB-03C	P-78-SB-04A	P-78-SB-04B	P-78-SB-04C	P-78-SB-05A	P-78-SB-05B	P-78-SB-05C	P-78-SB-09A
Sample Date:	W&L	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010
Sample Depth:	Property	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
Cadmium		0.49	0.60	0.53	0.48	0.35 J	0.70	0.82	0.60
Calcium		898	635	636	635	650	2460	2670	1290
Chromium		21.5	123	34.6	43.5	11.3	25.9	62.2	95.9
Chromium, Hexavalent	3.0		1.3	0.75	0.89 U			3.8	0.98 U
Cobalt	23	5.2	10.9	7.4	6.5	4.1 J	10.9	13.5	9.8
Copper		13.0	21.2	10.2	12.9	7.0	99.1	50.8	76.8
Cyanide		0.58 U	0.59 U	0.59 U	0.58 U	0.62 U	0.59 U	0.59 U	0.61 U
Iron		13100	13500	14400	13200	11700	18100	20000	16200
Lead	200	23.4	147	27.9	44.9	10.1	29.4	44.3	64.9
Magnesium		1630	1670	1710	1500	1150	4350	5260	3970
Manganese		222	223	200	203	143	531	602	345
Mercury		0.060 J	0.030 J	0.020 J	0.030 J	0.030 J	0.12 U	0.12 U	0.010 J
Nickel		8.9	8.8	8.3	8.9	6.4	23.9	33.2	25.2
Potassium		285 J	321 J	322 J	319 J	415 J	1110	1160	868
Selenium		3.3 U	3.0 U	3.5 U	3.0 U	3.6 U	3.4 U	3.0 U	3.0 U
Silver		0.95 U	0.86 U	0.99 U	0.86 U	1.0 U	0.96 U	0.86 U	0.86 U
Sodium		252 J	313 J	241 J	265 J	281 J	376 J	287 J	271 J
Thallium	0.78	2.4 U	2.1 U	2.5 U	2.2 U	2.5 U	2.4 U	2.2 U	2.1 U
Vanadium		17.9	19.8	20.2	18.5	17.8	27.7	28.8	23.7
Zinc		41.4	47.1	34.7	37.8	28.4	61.6	63.2	53.0
Other									
pH in Soil (S.U.)									

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		P-78-SB-09	P-78-SB-09	P-78-SB-10	P-78-SB-10	P-78-SB-10	P-78-SB-14	P-78-SB-14	P-78-SB-14
Sample ID:		P-78-SB-09B	P-78-SB-09C	P-78-SB-10A	P-78-SB-10B	P-78-SB-10C	P-78-SB-14A	P-78-SB-14B	P-78-SB-14C
Sample Date:	W&L	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/15/2010	12/15/2010	12/15/2010
Sample Depth:	Property	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
VOCs (ug/kg)									
1,1,1-Trichloroethane		22	78	6.3 U	5.9 U	4.9 U	5.9 U	3.2 J	4.8 U
1,1-Dichloroethane		25	65	6.3 U	5.9 U	4.9 U	5.9 U	4.3 U	5
2-Butanone		11 U	11 U	13 U	12 U	9.9 U	12 U	8.6 U	9.6 U
2-Hexanone		11 U	11 U	13 U	12 U	9.9 U	12 U	8.6 U	9.6 U
4-Methyl-2-Pentanone		11 U	11 U	13 U	12 U	9.9 U	12 U	8.6 U	9.6 U
Acetone		11 U	11 U	300	90	42	47	31	130
Carbon Disulfide		5.6 U	5.3 U	6.3 U	5.9 U	4.9 U	5.9 U	4.3 U	4.8 U
Chloroethane		5.6 U	9.7	6.3 U	5.9 U	4.9 U	5.9 U	4.3 U	4.8 U
Chloroform		5.6 U	5.3 U	6.3 U	5.9 U	4.9 U	5.9 U	4.3 U	4.8 U
cis-1,2-Dichloroethene		5.6 U	5.3 U	6.3 U	5.9 U	4.9 U	5.6 J	5.2	43
Ethylbenzene		5.6 U	5.3 U	6.3 U	5.9 U	4.9 U	5.9 U	4.3 U	4.8 U
m,p-Xylene		5.6 U	5.3 U	6.3 U	5.9 U	4.9 U	5.9 U	4.3 U	4.8 U
Methyl acetate		49	51	35	5.9 U	6.4	5.9 U	4.3 U	9.9
Methylene Chloride		5.6 U	5.3 U	6.3 U	5.9 U	4.9 U	32	16	12
Naphthalene									
Tetrachloroethene		5.6 U	5.3 U	6.3 U	5.9 U	4.9 U	5.9 U	4.3 U	3 J
Toluene		5.6 U	5.3 U	6.3 U	5.9 U	4.9 U	5.9 U	4.3 U	4.8 U
Trichloroethene		7.5	5.3 U	6.3 U	5.9 U	4.9 U	48	110	850
SVOCs (ug/kg)									
2-Methylnaphthalene		220 U	220 U	250 U	220 U	220 U	250 U	210 U	200 U
4-Methylphenol		220 U	220 U	250 U	220 U	220 U	250 U	210 U	200 U
Acenaphthene		220 U	220 U	250 U	220 U	220 U	250 U	210 U	200 U
Acenaphthylene		220 U	220 U	250 U	220 U	220 U	250 U	210 U	200 U
Anthracene		220 U	220 U	250 U	220 U	220 U	250 U	210 U	200 U
Benzaldehyde		220 U	220 U	250 U	220 U	220 U	250 U	210 U	200 U
Benzo(a)anthracene	11,000	90 J	220 U	250 U	220 U	220 U	250 U	210 U	200 U
Benzo(a)pyrene	1,100	100 J	220 U	250 U	220 U	220 U	250 U	210 U	200 U
Benzo(b)fluoranthene	11,000	96 J	220 U	250 U	220 U	220 U	250 U	210 U	200 U
Benzo(g,h,i)perylene		220 U	220 U	250 U	220 U	220 U	250 U	210 U	200 U
Benzo(k)fluoranthene		100 J	220 U	250 U	220 U	220 U	250 U	210 U	200 U
Bis(2-ethylhexyl)phthalate		250	1300	290	220 U	220 U	110 J	210 U	200 U
Butylbenzylphthalate		220 U	220 U	250 U	220 U	220 U	250 U	210 U	200 U
Caprolactam		220 U	220 U	250 U	220 U	220 U	250 U	210 U	200 U
Carbazole		220 U	220 U	250 U	220 U	220 U	250 U	210 U	200 U
Chrysene		130 J	220 U	100 J	220 U	220 U	250 U	210 U	200 U
Dibenz(a,h)anthracene	1,100	220 U	220 U	250 U	220 U	220 U	250 U	210 U	200 U
Dibenzofuran		220 U	220 U	250 U	220 U	220 U	250 U	210 U	200 U

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		P-78-SB-09	P-78-SB-09	P-78-SB-10	P-78-SB-10	P-78-SB-10	P-78-SB-14	P-78-SB-14	P-78-SB-14
Sample ID:		P-78-SB-09B	P-78-SB-09C	P-78-SB-10A	P-78-SB-10B	P-78-SB-10C	P-78-SB-14A	P-78-SB-14B	P-78-SB-14C
Sample Date:	W&L	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/15/2010	12/15/2010	12/15/2010
Sample Depth:	Property	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
Dimethylphthalate		220 U	220 U	250 U	220 U	220 U	250 U	210 U	200 U
Di-n-butylphthalate		220 U	220 U	250 U	220 U	220 U	250 U	210 U	200 U
Fluoranthene		260	220 U	190 J	220 U	220 U	250 U	210 U	200 U
Fluorene		220 U	220 U	250 U	220 U	220 U	250 U	210 U	200 U
Indeno(1,2,3-cd)pyrene		220 U	220 U	250 U	220 U	220 U	250 U	210 U	200 U
Naphthalene		220 U	220 U	250 U	220 U	220 U	250 U	210 U	200 U
Pentachlorophenol		430 U	420 U	490 U	430 U	420 U	490 U	410 U	390 U
Phenanthrene		93 J	220 U	110 J	220 U	220 U	250 U	210 U	200 U
Phenol		220 U	220 U	250 U	220 U	220 U	250 U	210 U	200 U
Pyrene		170 J	220 U	170 J	220 U	220 U	250 U	210 U	200 U
Pesticides (ug/kg)									
4,4'-DDD									
4,4'-DDE									
4,4'-DDT									
Aldrin									
alpha-BHC									
alpha-Chlordane									
beta-BHC									
delta-BHC									
Dieldrin									
Endosulfan II									
Endosulfan sulfate									
Endrin									
Endrin aldehyde									
Endrin ketone									
gamma-Chlordane									
Heptachlor									
Heptachlor epoxide									
Methoxychlor									
PCBs (ug/kg)									
Aroclor-1260									
Inorganics (mg/kg)									
Aluminum		7560	6830	7990	8660	7320	6560	5130	4400
Antimony	31	0.98 J	6.1 U	6.6 U	5.5 U	5.8 U	6.8 U	6.5 U	5.3 U
Arsenic	6.8	3.4	1.3	4.9	3.2	0.92 J	1.4	2.3	1.1
Barium		39.8	32.6	25.9	29.0	40.7	29.3	19.4 J	18.7
Beryllium		0.28 J	0.29 J	0.29 J	0.37 J	0.33 J	0.19 J	0.27 J	0.27 J

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		P-78-SB-09	P-78-SB-09	P-78-SB-10	P-78-SB-10	P-78-SB-10	P-78-SB-14	P-78-SB-14	P-78-SB-14
Sample ID:		P-78-SB-09B	P-78-SB-09C	P-78-SB-10A	P-78-SB-10B	P-78-SB-10C	P-78-SB-14A	P-78-SB-14B	P-78-SB-14C
Sample Date:	W&L	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/14/2010	12/15/2010	12/15/2010	12/15/2010
Sample Depth:	Property	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
Cadmium		0.57	0.23 J	0.44 J	0.41 J	0.26 J	0.15 J	0.31 J	0.25 J
Calcium		620	335 J	351 J	296 J	315 J	347 J	402 J	479
Chromium		180	80.2	133	45.8	16.6	74.7	56.9	54.6
Chromium, Hexavalent	3.0	10	1.8	5.7 U	1 U		1.2 U	3.6	3.1
Cobalt	23	6.7	3.7 J	2.9 J	3.9 J	3.0 J	6.0	7.8	9.3
Copper		19.2	4.5	26.7	11.0	1.6 J	3.0	1.9 J	2.6
Cyanide		0.66 U	0.14 J	0.77 U	0.65 U	0.62 U	0.26 J	0.61 U	0.59 U
Iron		9420	7790	13100	12500	9800	5090	11800	8590
Lead	200	103	12.3	61.0	20.8	5.2	36.9	12.2	24.2
Magnesium		694	516	772	805	1140	483 J	1360	1250
Manganese		147	67.0	169	253	135	32.2	124	103
Mercury		0.040 J	0.010 J	0.12 J	0.010 J	0.12 U	0.030 J	0.12 U	0.12 U
Nickel		6.8	3.4 J	7.0	7.3	5.3	2.8 J	4.7	5.3
Potassium		168 J	129 J	167 J	132 J	108 J	184 J	282 J	210 J
Selenium		0.59 J	3.6 U	3.8 U	3.2 U	3.4 U	3.9 U	3.8 U	3.1 U
Silver		1.1 U	1.0 U	1.1 U	0.91 U	0.97 U	0.13 J	1.1 U	0.89 U
Sodium		305 J	237 J	349 J	266 J	255 J	184 J	198 J	213 J
Thallium	0.78	2.6 U	2.5 U	2.7 U	2.3 U	2.4 U	2.8 U	2.7 U	2.2 U
Vanadium		14.2	11.0	26.7	18.3	12.9	9.8	19.5	13.6
Zinc		35.2	24.9	34.9	30.3	23.7	14.4	23.1	23.9
Other									
pH in Soil (S.U.)									

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		P-78-SB-15	P-78-SB-15	P-78-SB-15	P-78-SB-15	P-78-SB-19	P-78-SB-19	P-78-SB-19	P-78-SB-20
Sample ID:		P-78-SB-15A	P-78-SB-15B	P-78-SB-15C	P-78-SB-72C	P-78-SB-19A	P-78-SB-19B	P-78-SB-19C	P-78-SB-20A
Sample Date:	W&L	12/15/2010	12/15/2010	12/15/2010	12/15/2010	12/15/2010	12/15/2010	12/15/2010	12/15/2010
Sample Depth:	Property	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Duplicate	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
VOCs (ug/kg)									
1,1,1-Trichloroethane		5.1 U	4.5 U	6.1 U	4.2 U	4.3 U	4.1 U	5.5	6.4 U
1,1-Dichloroethane		5.1 U	4.5 U	6.1 U	4.2 U	4.3 U	4.1 U	5.1	6.4 U
2-Butanone		10 U	8.9 U	12 U	8.3 U	14	13	8 U	13 U
2-Hexanone		10 U	8.9 U	12 U	8.3 U	8.6 U	8.1 U	8 U	13 U
4-Methyl-2-Pentanone		10 U	8.9 U	12 U	8.3 U	8.6 U	8.1 U	8 U	13 U
Acetone		160	120	12 U	20	240	270	190	58
Carbon Disulfide		5.1 U	4.5 U	6.1 U	4.2 U	4.3 U	4.1 U	4 U	6.4 U
Chloroethane		5.1 U	4.5 U	6.1 U	4.2 U	4.3 U	4.1 U	4 U	6.4 U
Chloroform		5.1 U	4.5 U	6.1 U	4.2 U	4.3 U	4.1 U	4 U	6.4 U
cis-1,2-Dichloroethene		5.1 U	4.5 U	6.1 U	4.2 U	4.3 U	4.1 U	4.2	6.4 U
Ethylbenzene		5.1 U	4.5 U	6.1 U	4.2 U	4.3 U	4.1 U	4 U	6.4 U
m,p-Xylene		5.1 U	4.5 U	6.1 U	4.2 U	4.3 U	4.1 U	4 U	6.4 U
Methyl acetate		33	4.5 U	6.1 U	4.2 U	4.3 U	4.1 U	4 U	32
Methylene Chloride		20	6.4	6.1 U	2.8 J	12	11	12	20
Naphthalene									
Tetrachloroethene		5.1 U	4.5 U	6.1 U	4.2 U	4.3 U	4.1 U	4 U	6.4 U
Toluene		5.1 U	4.5 U	6.1 U	4.2 U	4.3 U	4.1 U	4 U	6.4 U
Trichloroethene		5.1 U	4.5 U	6.1 U	4.2 U	53	27	46	6.4 U
SVOCs (ug/kg)									
2-Methylnaphthalene		280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
4-Methylphenol		280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Acenaphthene		280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Acenaphthylene		280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Anthracene		280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Benzaldehyde		280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Benzo(a)anthracene	11,000	280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Benzo(a)pyrene	1,100	280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Benzo(b)fluoranthene	11,000	280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Benzo(g,h,i)perylene		280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Benzo(k)fluoranthene		280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Bis(2-ethylhexyl)phthalate		280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Butylbenzylphthalate		280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Caprolactam		280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Carbazole		280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Chrysene		280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Dibenz(a,h)anthracene	1,100	280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Dibenzofuran		280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		P-78-SB-15	P-78-SB-15	P-78-SB-15	P-78-SB-15	P-78-SB-19	P-78-SB-19	P-78-SB-19	P-78-SB-20
Sample ID:		P-78-SB-15A	P-78-SB-15B	P-78-SB-15C	P-78-SB-72C	P-78-SB-19A	P-78-SB-19B	P-78-SB-19C	P-78-SB-20A
Sample Date:	W&L	12/15/2010	12/15/2010	12/15/2010	12/15/2010	12/15/2010	12/15/2010	12/15/2010	12/15/2010
Sample Depth:	Property	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Duplicate	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
Dimethylphthalate		280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Di-n-butylphthalate		280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Fluoranthene		160 J	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Fluorene		280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Indeno(1,2,3-cd)pyrene		280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Naphthalene		280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Pentachlorophenol		540 U	420 U	420 U	410 U	440 U	400 U	420 U	430 U
Phenanthrene		280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Phenol		280 U	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Pyrene		110 J	220 U	210 U	210 U	230 U	200 U	220 U	220 U
Pesticides (ug/kg)									
4,4'-DDD									
4,4'-DDE									
4,4'-DDT									
Aldrin									
alpha-BHC									
alpha-Chlordane									
beta-BHC									
delta-BHC									
Dieldrin									
Endosulfan II									
Endosulfan sulfate									
Endrin									
Endrin aldehyde									
Endrin ketone									
gamma-Chlordane									
Heptachlor									
Heptachlor epoxide									
Methoxychlor									
PCBs (ug/kg)									
Aroclor-1260									
Inorganics (mg/kg)									
Aluminum		8810	5360	4750	4840	5430	6220	5190	7120
Antimony	31	6.0 U	5.4 U	5.3 U	5.9 U	7.6 U	0.53 J	6.4 U	5.0 U
Arsenic	6.8	1.0	0.64 J	0.65 J	0.52 J	2.5	3.5	2.7	1.5
Barium		26.9	20.2	15.9 J	17.8 J	14.2 J	14.3 J	17.8 J	15.8 J
Beryllium		0.31 J	0.19 J	0.19 J	0.18 J	0.37 J	0.56 J	0.40 J	0.30 J

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		P-78-SB-15	P-78-SB-15	P-78-SB-15	P-78-SB-15	P-78-SB-19	P-78-SB-19	P-78-SB-19	P-78-SB-20
Sample ID:		P-78-SB-15A	P-78-SB-15B	P-78-SB-15C	P-78-SB-72C	P-78-SB-19A	P-78-SB-19B	P-78-SB-19C	P-78-SB-20A
Sample Date:	W&L	12/15/2010	12/15/2010	12/15/2010	12/15/2010	12/15/2010	12/15/2010	12/15/2010	12/15/2010
Sample Depth:	Property	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Duplicate	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
Cadmium		0.30 J	0.16 J	0.18 J	0.14 J	0.63 U	0.57 U	0.53 U	0.42 U
Calcium		877	387 J	449	365 J	196 J	252 J	277 J	300 J
Chromium		22.4	8.1	6.5	6.4	14.5	56.0	23.0	14.6
Chromium, Hexavalent	3.0						3.2		
Cobalt	23	13.2	3.4 J	3.3 J	2.9 J	3.9 J	14.1	18.4	4.1 J
Copper		4.8	2.1 J	2.2 J	1.9 J	3.3	1.6 J	3.8	5.3
Cyanide		0.71 U	0.15 J	0.61 U	0.58 U	0.65 U	0.61 U	0.12 J	0.61 U
Iron		9020	6080	7280	5610	19800	30600	19800	10600
Lead	200	14.3	4.6	3.0	3.4	9.5	4.5	5.0	7.5
Magnesium		1710	1350	1610	1390	594 J	820	964	1710
Manganese		276	167	232	133	266	781	918	161
Mercury		0.070 J	0.010 J	0.12 U	0.12 U	0.010 J	0.12 U	0.12 U	0.020 J
Nickel		7.0	6.6	6.3	6.3	3.0 J	5.0	4.8	8.2
Potassium		250 J	207 J	207 J	218 J	81.9 J	129 J	211 J	145 J
Selenium		3.5 U	3.1 U	3.1 U	3.4 U	1.3 J	1.8 J	0.85 J	0.93 J
Silver		1.0 U	0.90 U	0.88 U	0.98 U	1.3 U	1.1 U	1.1 U	0.84 U
Sodium		439 J	279 J	199 J	350 J	362 J	288 J	266 J	189 J
Thallium	0.78	2.5 U	2.2 U	2.2 U	2.4 U	3.2 U	2.9 U	2.7 U	2.1 U
Vanadium		12.1	6.8	6.2	6.3	17.7	21.6	17.7	13.7
Zinc		39.3	20.6	22.9	18.7	19.7	20.2	21.2	30.2
Other									
pH in Soil (S.U.)									

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		P-78-SB-20	P-78-SB-24	P-78-SB-24	P-78-SB-24	P-78-SB-25	P-78-SB-25	P-78-SB-25	P-78-SB-29
Sample ID:		P-78-SB-20B	P-78-SB-24A	P-78-SB-24B	P-78-SB-24C	P-78-SB-25A	P-78-SB-25B	P-78-SB-25C	P-78-SB-29A
Sample Date:	W&L	12/15/2010	12/15/2010	12/15/2010	12/15/2010	12/16/2010	12/16/2010	12/16/2010	12/16/2010
Sample Depth:	Property	0.75-1.25 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
VOCs (ug/kg)									
1,1,1-Trichloroethane		5.9 U	7.1 U	4.2 U	9.5	3.8 U	3.6 U	3.5 U	5.5 U
1,1-Dichloroethane		5.9 U	7.1 U	4.2 U	7.2 U	3.8 U	3.6 U	3.5 U	5.5 U
2-Butanone		12 U	14 U	8.4 U	14 U	7.6 U	7.1 U	7 U	11 U
2-Hexanone		12 U	14 U	8.4 U	14 U	7.6 U	7.1 U	7 U	11 U
4-Methyl-2-Pentanone		12 U	14 U	8.4 U	14 U	7.6 U	7.1 U	7 U	11 U
Acetone		140	45	49	180	30	18	24	200
Carbon Disulfide		5.9 U	7.1 U	4.2 U	7.2 U	3.8 U	3.6 U	3.5 U	5.5 U
Chloroethane		5.9 U	7.1 U	4.2 U	7.2 U	3.8 U	3.6 U	3.5 U	5.5 U
Chloroform		5.9 U	7.1 U	4.2 U	7.2 U	3.8 U	3.6 U	3.5 U	5.5 U
cis-1,2-Dichloroethene		5.9 U	7.1 U	4.2 U	7.2 U	3.8 U	3.6 U	3.5 U	5.5 U
Ethylbenzene		5.9 U	7.1 U	4.2 U	7.2 U	3.8 U	3.6 U	3.5 U	5.5 U
m,p-Xylene		5.9 U	7.1 U	4.2 U	7.2 U	3.8 U	3.6 U	3.5 U	5.5 U
Methyl acetate		5.9 U	7.1 U	4.2 U	7.2 U	3.8 U	3.6 U	3.5 U	20
Methylene Chloride		7	7.1 U	4.2 U	7.2 U	3.3 J	3.6 U	2.4 J	5.5 U
Naphthalene									
Tetrachloroethene		5.9 U	7.1 U	4.2 U	7.2 U	3.8 U	3.6 U	3.5 U	5.5 U
Toluene		5.9 U	7.1 U	4.2 U	7.2 U	3.8 U	3.6 U	3.5 U	5.5 U
Trichloroethene		5.9 U	7.1 U	3.8 J	11	3.8 U	3.6 U	3.5 U	8
SVOCs (ug/kg)									
2-Methylnaphthalene		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
4-Methylphenol		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Acenaphthene		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Acenaphthylene		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Anthracene		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Benzaldehyde		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Benzo(a)anthracene	11,000	210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Benzo(a)pyrene	1,100	210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Benzo(b)fluoranthene	11,000	210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Benzo(g,h,i)perylene		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Benzo(k)fluoranthene		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Bis(2-ethylhexyl)phthalate		210 U	250 U	210 U	210 U	250 U	92 J	83 J	260 U
Butylbenzylphthalate		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Caprolactam		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Carbazole		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Chrysene		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Dibenz(a,h)anthracene	1,100	210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Dibenzofuran		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		P-78-SB-20	P-78-SB-24	P-78-SB-24	P-78-SB-24	P-78-SB-25	P-78-SB-25	P-78-SB-25	P-78-SB-29
Sample ID:		P-78-SB-20B	P-78-SB-24A	P-78-SB-24B	P-78-SB-24C	P-78-SB-25A	P-78-SB-25B	P-78-SB-25C	P-78-SB-29A
Sample Date:	W&L	12/15/2010	12/15/2010	12/15/2010	12/15/2010	12/16/2010	12/16/2010	12/16/2010	12/16/2010
Sample Depth:	Property	0.75-1.25 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
Dimethylphthalate		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Di-n-butylphthalate		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Fluoranthene		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Fluorene		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Indeno(1,2,3-cd)pyrene		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Naphthalene		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Pentachlorophenol		400 U	480 U	420 U	410 U	480 U	420 U	400 U	500 U
Phenanthrene		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Phenol		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Pyrene		210 U	250 U	210 U	210 U	250 U	210 U	210 U	260 U
Pesticides (ug/kg)									
4,4'-DDD									
4,4'-DDE									
4,4'-DDT									
Aldrin									
alpha-BHC									
alpha-Chlordane									
beta-BHC									
delta-BHC									
Dieldrin									
Endosulfan II									
Endosulfan sulfate									
Endrin									
Endrin aldehyde									
Endrin ketone									
gamma-Chlordane									
Heptachlor									
Heptachlor epoxide									
Methoxychlor									
PCBs (ug/kg)									
Aroclor-1260									
Inorganics (mg/kg)									
Aluminum		6660	6880	4850	14900	3940	4490	3470	4910
Antimony	31	6.4 U	8.5 U	6.3 U	6.3 U	6.0 U	5.6 U	6.1 U	7.1 U
Arsenic	6.8	1.1 J	1.5	1.1	1.7	0.64 J	0.63 J	0.47 J	1.1 J
Barium		21.2 J	19.7 J	12.8 J	47.9	10.5 J	11.7 J	9.1 J	12.2 J
Beryllium		0.26 J	0.14 J	0.11 J	0.31 J	0.10 J	0.11 J	0.13 J	0.11 J

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		P-78-SB-20	P-78-SB-24	P-78-SB-24	P-78-SB-24	P-78-SB-25	P-78-SB-25	P-78-SB-25	P-78-SB-29
Sample ID:		P-78-SB-20B	P-78-SB-24A	P-78-SB-24B	P-78-SB-24C	P-78-SB-25A	P-78-SB-25B	P-78-SB-25C	P-78-SB-29A
Sample Date:	W&L	12/15/2010	12/15/2010	12/15/2010	12/15/2010	12/16/2010	12/16/2010	12/16/2010	12/16/2010
Sample Depth:	Property	0.75-1.25 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	0-0.5 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
Cadmium		0.54 U	0.22 J	0.53 U	0.53 U	0.50 U	0.47 U	0.51 U	0.59 U
Calcium		391 J	382 J	278 J	721	218 J	350 J	328 J	163 J
Chromium		9.7	12.0	5.5	20.5	5.0	4.7	4.1	12.9
Chromium, Hexavalent	3.0								
Cobalt	23	3.9 J	3.8 J	3.1 J	5.7	1.4 J	2.3 J	1.8 J	1.4 J
Copper		4.9	3.5 J	1.8 J	5.8	3.4	2.4	2.3 J	7.3
Cyanide		0.58 U	0.71 U	0.61 U	0.63 U	0.61 U	0.59 U	0.12 J	0.72 U
Iron		9220	7000	5530	8110	3410	5140	4790	4070
Lead	200	4.9	13.8	4.2	8.5	3.6	2.7	2.9	15.7
Magnesium		1760	571 J	485 J	1430	557	1240	945	689
Manganese		160	68.1	49.3	147	43.5	91.9	86.9	48.1
Mercury		0.12 U	0.040 J	0.12 U	0.13 U	0.020 J	0.12 U	0.11 U	0.030 J
Nickel		8.2	2.4 J	2.4 J	7.1	4.4	6.7	3.8 J	2.9 J
Potassium		220 J	176 J	99.4 J	629	71.0 J	129 J	102 J	85.1 J
Selenium		0.84 J	1.3 J	3.7 U	0.67 J	3.5 U	0.46 J	3.6 U	4.1 U
Silver		1.1 U	1.4 U	1.1 U	1.1 U	1.6	0.93 U	0.29 J	1.2 U
Sodium		361 J	683 J	481 J	380 J	103 J	152 J	126 J	167 J
Thallium	0.78	2.7 U	3.6 U	2.6 U	2.6 U	2.5 U	2.3 U	2.5 U	2.9 U
Vanadium		11.8	12.7	7.8	18.5	5.9	6.0	5.8	12.6
Zinc		41.2	23.7	15.1	28.0	12.6	17.2	14.6	20.7
Other									
pH in Soil (S.U.)									

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		P-78-SB-29	P-78-SB-29	PASI_SB-01	PASI_SB-01	PASI_SB-01	PASI_SB-02	PASI_SB-02	PASI_SB-02
Sample ID:		P-78-SB-29B	P-78-SB-29C	SB-01A	SB-01B	SS-01	SB-02A	SB-02B	SS-02
Sample Date:	W&L	12/16/2010	12/16/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010
Sample Depth:	Property	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	2-3 (ft bgs)	6-7 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	4-5 (ft bgs)	0-1 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
VOCs (ug/kg)									
1,1,1-Trichloroethane		18	15	50 U	68 U	62 U	66 U	72 U	56 U
1,1-Dichloroethane		5.9	5	50 U	68 U	62 U	66 U	72 U	56 U
2-Butanone		7.2 U	6.6 U	50 U	68 U	62 U	66 U	72 U	56 U
2-Hexanone		7.2 U	6.6 U	50 U	68 U	62 U	66 U	72 U	56 U
4-Methyl-2-Pentanone		7.2 U	6.6 U	50 U	68 U	62 U	66 U	72 U	56 U
Acetone		34	70	50 U	68 U	62 U	66 U	72 U	56 U
Carbon Disulfide		3.6 U	3.3 U	50 U	68 U	62 U	66 U	72 U	56 U
Chloroethane		3.6 U	3.3 U	50 U	68 U	62 U	66 U	72 U	56 U
Chloroform		3.6 U	3.3 U	50 U	68 U	62 U	66 U	72 U	56 U
cis-1,2-Dichloroethene		4.7	4.6	50 U	68 U	62 U	66 U	72 U	56 U
Ethylbenzene		3.6 U	3.3 U	50 U	68 U	62 U	66 U	72 U	56 U
m,p-Xylene		3.6 U	3.3 U	100 U	140 U	120 U	130 U	140 U	110 U
Methyl acetate		10	20						
Methylene Chloride		2.3 J	2.3 J	50 U	68 U	62 U	66 U	72 U	56 U
Naphthalene				50 U	68 U	62 U	66 U	72 U	56 U
Tetrachloroethene		3.6 U	3.3 U	50 U	68 U	62 U	66 U	72 U	56 U
Toluene		3.6 U	3.3 U	50 U	68 U	62 U	66 U	72 U	56 U
Trichloroethene		18	18	50 U	68 U	62 U	66 U	72 U	56 U
SVOCs (ug/kg)									
2-Methylnaphthalene		210 U	200 U						
4-Methylphenol		210 U	200 U						
Acenaphthene		210 U	200 U	230 U	270 U	240 U	280 U	280 U	250 U
Acenaphthylene		210 U	200 U	230 U	270 U	240 U	280 U	280 U	250 U
Anthracene		210 U	200 U	230 U	270 U	240 U	280 U	280 U	250 U
Benzaldehyde		210 U	200 U						
Benzo(a)anthracene	11,000	210 U	200 U	230 U	270 U	240 U	280 U	280 U	250 U
Benzo(a)pyrene	1,100	210 U	200 U	230 U	270 U	240 U	280 U	280 U	250 U
Benzo(b)fluoranthene	11,000	210 U	200 U	230 U	270 U	240 U	280 U	280 U	250 U
Benzo(g,h,i)perylene		210 U	200 U	230 U	270 U	240 U	280 U	280 U	250 U
Benzo(k)fluoranthene		210 U	200 U	230 U	270 U	240 U	280 U	280 U	250 U
Bis(2-ethylhexyl)phthalate		210 U	83 J						
Butylbenzylphthalate		210 U	200 U						
Caprolactam		210 U	200 U						
Carbazole		210 U	200 U						
Chrysene		210 U	200 U	230 U	270 U	240 U	280 U	280 U	250 U
Dibenz(a,h)anthracene	1,100	210 U	200 U	230 U	270 U	240 U	280 U	280 U	250 U
Dibenzofuran		210 U	200 U						

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		P-78-SB-29	P-78-SB-29	PASI_SB-01	PASI_SB-01	PASI_SB-01	PASI_SB-02	PASI_SB-02	PASI_SB-02
Sample ID:		P-78-SB-29B	P-78-SB-29C	SB-01A	SB-01B	SS-01	SB-02A	SB-02B	SS-02
Sample Date:	W&L	12/16/2010	12/16/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010
Sample Depth:	Property	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	2-3 (ft bgs)	6-7 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	4-5 (ft bgs)	0-1 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
Dimethylphthalate		210 U	200 U						
Di-n-butylphthalate		210 U	200 U						
Fluoranthene		210 U	200 U	230 U	270 U	240 U	280 U	280 U	250 U
Fluorene		210 U	200 U	230 U	270 U	240 U	280 U	280 U	250 U
Indeno(1,2,3-cd)pyrene		210 U	200 U	230 U	270 U	240 U	280 U	280 U	250 U
Naphthalene		210 U	200 U	230 U	270 U	240 U	280 U	280 U	250 U
Pentachlorophenol		400 U	390 U						
Phenanthrene		210 U	200 U	230 U	270 U	240 U	280 U	280 U	250 U
Phenol		210 U	200 U						
Pyrene		210 U	200 U	230 U	270 U	240 U	280 U	280 U	250 U
Pesticides (ug/kg)									
4,4'-DDD									
4,4'-DDE									
4,4'-DDT									
Aldrin									
alpha-BHC									
alpha-Chlordane									
beta-BHC									
delta-BHC									
Dieldrin									
Endosulfan II									
Endosulfan sulfate									
Endrin									
Endrin aldehyde									
Endrin ketone									
gamma-Chlordane									
Heptachlor									
Heptachlor epoxide									
Methoxychlor									
PCBs (ug/kg)									
Aroclor-1260									
Inorganics (mg/kg)									
Aluminum		7140	3540	9800	9900	6500	10000	9700	7500
Antimony	31	7.0 U	5.3 U	10 U	2.0 U	10 U	10 U	9.8 U	20 U
Arsenic	6.8	2.1	1.1	3.0	2.0 U	5.8	3.4	2.0 U	2.1
Barium		26.2	15.2 J	45	32	110	54	54	32
Beryllium		0.37 J	0.15 J	0.83 U	0.78 U	0.82 U	0.82 U	0.78 U	0.78 U

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		P-78-SB-29	P-78-SB-29	PASI_SB-01	PASI_SB-01	PASI_SB-01	PASI_SB-02	PASI_SB-02	PASI_SB-02
Sample ID:		P-78-SB-29B	P-78-SB-29C	SB-01A	SB-01B	SS-01	SB-02A	SB-02B	SS-02
Sample Date:	W&L	12/16/2010	12/16/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010	8/5/2010
Sample Depth:	Property	0.75-1.25 (ft bgs)	1.5-2 (ft bgs)	2-3 (ft bgs)	6-7 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	4-5 (ft bgs)	0-1 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
Cadmium		0.31 J	0.44 U	2.1 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Calcium		362 J	196 J	920	570	14000	680	760	900
Chromium		13.7	6.6	720	140	4400	1400	1100	3100
Chromium, Hexavalent	3.0			5.3	7.9	190	50	39	100
Cobalt	23	3.7 J	2.0 J	6.4	9.6	14 J1	27	18	14
Copper		5.0	2.4	31	4.0 U	180	200	62	80
Cyanide		0.59 U	0.57 U						
Iron		10900	5250	17000	16000	23000	17000	12000	15000
Lead	200	5.9	3.2	53	7.7	2900	350	210	910
Magnesium		1690	875	2300	3600	2100	1700	1700	2700
Manganese		148	96.7	250	300	340 J1	150	140	230
Mercury		0.12 U	0.11 U						
Nickel		7.1	3.9	7.7	12	17	9.5	8.3	12
Potassium		241 J	119 J	460	910	610	480	620	570
Selenium		1.1 J	3.1 U	4.2 U	4.0 U	4.1 U	4.1 U	3.9 U	4.0 U
Silver		1.2 U	0.88 U	1.0 U	0.98 U	1.0 U	1.0 U	0.98 U	0.98 U
Sodium		379 J	116 J	49	50	86	43	59	57
Thallium	0.78	2.9 U	2.2 U	4.2 U	4.0 U	4.1 U	4.1 U	3.9 U	4.0 U
Vanadium		19.7	8.2	18	15	25	18	15	17
Zinc		28.9	15.8	66	51	250	780	100	190
Other									
pH in Soil (S.U.)									

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		PASI_SB-03	PASI_SB-03	PASI_SB-03	PASI_SB-04	PASI_SB-04	PASI_SB-04	PASI_SB-05	PASI_SB-05
Sample ID:		SB-03A	SB-03B	SS-03	SB-04A	SB-04B	SS-04	SB-05A	SB-05B
Sample Date:	W&L	8/5/2010	8/5/2010	8/5/2010	8/6/2010	8/6/2010	8/5/2010	8/6/2010	8/6/2010
Sample Depth:	Property	2-3 (ft bgs)	6-7 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	4-5 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	4-5 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
VOCs (ug/kg)									
1,1,1-Trichloroethane		72 U	70 U	61 U	81 U	73 U	69 U	44 U	76 U
1,1-Dichloroethane		72 U	70 U	61 U	81 U	73 U	69 U	44 U	76 U
2-Butanone		72 U	70 U	61 U	81 U	73 U	69 U	44 U	76 U
2-Hexanone		72 U	70 U	61 U	81 U	73 U	69 U	44 U	76 U
4-Methyl-2-Pentanone		72 U	70 U	61 U	81 U	73 U	69 U	44 U	76 U
Acetone		165 J	142.5 J	61 U	145.8 J	73 U	169.9 J	44 U	76 U
Carbon Disulfide		72 U	70 U	61 U	81 U	73 U	69 U	44 U	76 U
Chloroethane		72 U	70 U	61 U	81 U	73 U	69 U	44 U	76 U
Chloroform		72 U	70 U	61 U	81 U	73 U	69 U	44 U	76 U
cis-1,2-Dichloroethene		72 U	70 U	61 U	81 U	73 U	69 U	44 U	76 U
Ethylbenzene		72 U	70 U	61 U	81 U	73 U	69 U	44 U	76 U
m,p-Xylene		140 U	140 U	120 U	160 U	150 U	140 U	88 U	150 U
Methyl acetate									
Methylene Chloride		72 U	70 U	61 U	81 U	73 U	69 U	44 U	76 U
Naphthalene		72 U	70 U	61 U	81 U	73 U	69 U	44 U	76 U
Tetrachloroethene		72 U	70 U	61 U	81 U	73 U	69 U	44 U	76 U
Toluene		72 U	70 U	61 U	81 U	73 U	69 U	44 U	76 U
Trichloroethene		72 U	70 U	61 U	81 U	73 U	69 U	44 U	76 U
SVOCs (ug/kg)									
2-Methylnaphthalene									
4-Methylphenol									
Acenaphthene		260 U	380 U	250 U	260 U	260 U	270 U	270 U	240 U
Acenaphthylene		260 U	380 U	250 U	260 U	260 U	270 U	270 U	240 U
Anthracene		260 U	380 U	250 U	260 U	260 U	270 U	270 U	240 U
Benzaldehyde									
Benzo(a)anthracene	11,000	260 U	380 U	250 U	260 U	260 U	290	270 U	240 U
Benzo(a)pyrene	1,100	260 U	380 U	250 U	260 U	260 U	270	270 U	240 U
Benzo(b)fluoranthene	11,000	260 U	380 U	250 U	260 U	260 U	320	270 U	240 U
Benzo(g,h,i)perylene		260 U	380 U	250 U	260 U	260 U	270 U	270 U	240 U
Benzo(k)fluoranthene		260 U	380 U	250 U	260 U	260 U	270 U	270 U	240 U
Bis(2-ethylhexyl)phthalate									
Butylbenzylphthalate									
Caprolactam									
Carbazole									
Chrysene		260 U	380 U	250 U	260 U	260 U	330	270 U	240 U
Dibenz(a,h)anthracene	1,100	260 U	380 U	250 U	260 U	260 U	270 U	270 U	240 U
Dibenzofuran									

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		PASI_SB-03	PASI_SB-03	PASI_SB-03	PASI_SB-04	PASI_SB-04	PASI_SB-04	PASI_SB-05	PASI_SB-05
Sample ID:		SB-03A	SB-03B	SS-03	SB-04A	SB-04B	SS-04	SB-05A	SB-05B
Sample Date:	W&L	8/5/2010	8/5/2010	8/5/2010	8/6/2010	8/6/2010	8/5/2010	8/6/2010	8/6/2010
Sample Depth:	Property	2-3 (ft bgs)	6-7 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	4-5 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	4-5 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
Dimethylphthalate									
Di-n-butylphthalate									
Fluoranthene		260 U	420	250 U	260 U	260 U	580	270 U	240 U
Fluorene		260 U	530	250 U	260 U	260 U	270 U	270 U	240 U
Indeno(1,2,3-cd)pyrene		260 U	380 U	250 U	260 U	260 U	270 U	270 U	240 U
Naphthalene		260 U	430	250 U	260 U	260 U	270 U	270 U	240 U
Pentachlorophenol									
Phenanthrene		260 U	1200	250 U	260 U	260 U	280	270 U	240 U
Phenol									
Pyrene		260 U	420	250 U	260 U	260 U	460	270 U	240 U
Pesticides (ug/kg)									
4,4'-DDD									
4,4'-DDE									
4,4'-DDT									
Aldrin									
alpha-BHC									
alpha-Chlordane									
beta-BHC									
delta-BHC									
Dieldrin									
Endosulfan II									
Endosulfan sulfate									
Endrin									
Endrin aldehyde									
Endrin ketone									
gamma-Chlordane									
Heptachlor									
Heptachlor epoxide									
Methoxychlor									
PCBs (ug/kg)									
Aroclor-1260									
Inorganics (mg/kg)									
Aluminum		8000	8700	8300	14000	2000	12000	11000	6400
Antimony	31	2.0 U	2.0 U	2.0 U	2.0 U	10 U	9.8 U	1.9 U	10 U
Arsenic	6.8	2.7	2.0 U	7.6	3.8	2.0 U	3.3	2.6	2.0 U
Barium		37	61	25	61	18	230	32	19
Beryllium		0.78 U	0.80 U	0.78 U	0.80 U	0.80 U	0.78 U	0.77 U	0.80 U

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		PASI_SB-03	PASI_SB-03	PASI_SB-03	PASI_SB-04	PASI_SB-04	PASI_SB-04	PASI_SB-05	PASI_SB-05
Sample ID:		SB-03A	SB-03B	SS-03	SB-04A	SB-04B	SS-04	SB-05A	SB-05B
Sample Date:	W&L	8/5/2010	8/5/2010	8/5/2010	8/6/2010	8/6/2010	8/5/2010	8/6/2010	8/6/2010
Sample Depth:	Property	2-3 (ft bgs)	6-7 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	4-5 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	4-5 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
Cadmium		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	1.9 U	2.0 U
Calcium		1300	1500	1500	3200	380	920	430	760
Chromium		290	300	83	140	790	950	29	640
Chromium, Hexavalent	3.0	44	6.1	9	6.5	11	56	4.4 U	24
Cobalt	23	20	51	8.4	5.5	2.0 U	15	4.1	6.3
Copper		39	81	22	20	23	86	5.2	17
Cyanide									
Iron		15000	11000	17000	15000	4900	16000	16000	12000
Lead	200	340	420	66	78	61	1900	11	5.3
Magnesium		2800	2100	3300	2200	270	2200	1800	1900
Manganese		280	200	390	250	48	260	260	440
Mercury									
Nickel		19	10	14	9.8	2.5	50	6.7	8.4
Potassium		640	710	740	590	260	460	290	580
Selenium		3.9 U	4.0 U	3.9 U	4.0 U	4.0 U	3.9 U	1.9 U	2.0 U
Silver		0.98 U	1.0 U	0.98 U	1.0 U	1.0 U	1.2	0.96 U	1.0 U
Sodium		50	71	71	69	35	43	32	34
Thallium	0.78	3.9 U	4.0 U	3.9 U	4.0 U	4.0 U	3.9 U	1.9 U	2.0 U
Vanadium		16	16	18	23	3.2	23	17	18
Zinc		52	60	39	41	8.3	71	32	22
Other									
pH in Soil (S.U.)									

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		PASI_SB-05	PASI_SB-05	PASI_SB-06	PASI_SB-06	PASI_SB-06	PASI_SB-07	PASI_SB-07	PASI_SB-07
Sample ID:		SS-05	SS-50	SB-06A	SB-06B	SS-06	SB-07A	SB-07B	SS-07
Sample Date:	W&L	8/5/2010	8/5/2010	8/9/2010	8/9/2010	8/5/2010	8/6/2010	8/6/2010	8/6/2010
Sample Depth:	Property	0-1 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	7-8 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	5-6 (ft bgs)	0-1 (ft bgs)
Sample Type:	Soil PRGs	Field Duplicate	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate
Parameter									
VOCs (ug/kg)									
1,1,1-Trichloroethane		100 U	92 U	65 U	78 U	80 U	82 U	62 U	62 U
1,1-Dichloroethane		100 U	92 U	65 U	78 U	80 U	82 U	62 U	62 U
2-Butanone		100 U	92 U	65 U	78 U	80 U	82 U	62 U	62 U
2-Hexanone		100 U	92 U	65 U	78 U	80 U	82 U	62 U	62 U
4-Methyl-2-Pentanone		100 U	92 U	65 U	78 U	80 U	82 U	62 U	62 U
Acetone		100 U	92 U	65 U	78 U	118.4	82 U	62 U	111.7
Carbon Disulfide		100 U	92 U	65 U	78 U	80 U	82 U	62 U	62 U
Chloroethane		100 U	92 U	65 U	78 U	80 U	82 U	62 U	62 U
Chloroform		100 U	92 U	65 U	78 U	80 U	82 U	62 U	62 U
cis-1,2-Dichloroethene		100 U	92 U	65 U	78 U	80 U	82 U	62 U	62 U
Ethylbenzene		100 U	92 U	65 U	78 U	80 U	82 U	62 U	62 U
m,p-Xylene		210 U	180 U	130 U	160 U	160 U	160 U	120 U	120 U
Methyl acetate									
Methylene Chloride		100 U	92 U	65 U	78 U	80 U	82 U	62 U	62 U
Naphthalene		100 U	92 U	65 U	78 U	80 U	301	62 U	62 U
Tetrachloroethene		100 U	92 U	65 U	78 U	80 U	82 U	62 U	62 U
Toluene		100 U	92 U	65 U	78 U	80 U	82 U	62 U	62 U
Trichloroethene		100 U	92 U	65 U	78 U	80 U	82 U	62 U	62 U
SVOCs (ug/kg)									
2-Methylnaphthalene									
4-Methylphenol									
Acenaphthene		2200	1800	370	260 U	2400	7600	250 U	730
Acenaphthylene		250 U	280 U	270 U	260 U	260 U	390	250 U	280 U
Anthracene		6200	4100	650	260 U	3500	19000	280	1700
Benzaldehyde									
Benzo(a)anthracene	11,000	9200	6600	1900	260 U	11000	41000	680	6200
Benzo(a)pyrene	1,100	7100	5000	1700	260 U	9700	34000	560	5200
Benzo(b)fluoranthene	11,000	6500	5000	1900	260 U	9100	36000	620	6100
Benzo(g,h,i)perylene		4200	2900	1200	260 U	5900	21000	370	3800
Benzo(k)fluoranthene		6100	4000	1400	260 U	9200	27000	570	4400
Bis(2-ethylhexyl)phthalate									
Butylbenzylphthalate									
Caprolactam									
Carbazole									
Chrysene		8400	6100	2100	260 U	12000	39000	630	6400
Dibenz(a,h)anthracene	1,100	1000	280 U	270 U	260 U	260 U	10000	250 U	690
Dibenzofuran									

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		PASI_SB-05	PASI_SB-05	PASI_SB-06	PASI_SB-06	PASI_SB-06	PASI_SB-07	PASI_SB-07	PASI_SB-07
Sample ID:		SS-05	SS-50	SB-06A	SB-06B	SS-06	SB-07A	SB-07B	SS-07
Sample Date:	W&L	8/5/2010	8/5/2010	8/9/2010	8/9/2010	8/5/2010	8/6/2010	8/6/2010	8/6/2010
Sample Depth:	Property	0-1 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	7-8 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	5-6 (ft bgs)	0-1 (ft bgs)
Sample Type:	Soil PRGs	Field Duplicate	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate
Parameter									
Dimethylphthalate									
Di-n-butylphthalate									
Fluoranthene		33000	19000	4500	260 U	30000	100000	1600	17000
Fluorene		3200	2000	270	260 U	1700	8500	250 U	700
Indeno(1,2,3-cd)pyrene		4000	2800	1100	260 U	5800	20000	250 U	3600
Naphthalene		330	280 U	270	260 U	1300	4700	250 U	280 U
Pentachlorophenol									
Phenanthrene		31000	14000	3500	260 U	25000	91000	1300	10000
Phenol									
Pyrene		22000	13000	3400	260 U	24000	76000	1300	11000
Pesticides (ug/kg)									
4,4'-DDD									
4,4'-DDE									
4,4'-DDT									
Aldrin									
alpha-BHC									
alpha-Chlordane									
beta-BHC									
delta-BHC									
Dieldrin									
Endosulfan II									
Endosulfan sulfate									
Endrin									
Endrin aldehyde									
Endrin ketone									
gamma-Chlordane									
Heptachlor									
Heptachlor epoxide									
Methoxychlor									
PCBs (ug/kg)									
Aroclor-1260									
Inorganics (mg/kg)									
Aluminum		15000	13000	5700	13000	10000	7400	8700	11000
Antimony	31	2.0 U	2.0 U	38 U	9.8 U	20 U	20 U	19 U	42
Arsenic	6.8	3.3	2.7	3.4	2.5	3.2	2.3	2.3	2.2
Barium		42	34	50	27	32	36	25	37
Beryllium		0.82 U	0.78 U	0.77 U	0.78 U	0.78 U	0.80 U	0.77 U	0.80 U

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		PASI_SB-05	PASI_SB-05	PASI_SB-06	PASI_SB-06	PASI_SB-06	PASI_SB-07	PASI_SB-07	PASI_SB-07
Sample ID:		SS-05	SS-50	SB-06A	SB-06B	SS-06	SB-07A	SB-07B	SS-07
Sample Date:	W&L	8/5/2010	8/5/2010	8/9/2010	8/9/2010	8/5/2010	8/6/2010	8/6/2010	8/6/2010
Sample Depth:	Property	0-1 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	7-8 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	5-6 (ft bgs)	0-1 (ft bgs)
Sample Type:	Soil PRGs	Field Duplicate	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate
Parameter									
Cadmium		2.0 U	2.0 U	1.9 U	2.0 U	2.0 U	2.0 U	1.9 U	2.0 U
Calcium		600	570	2800	1700	900	2900	1000	670
Chromium		94	63	3000	1500	1100	3200	1600	4000
Chromium, Hexavalent	3.0	4.5 U	4.4 U	93	370	4.4 U	11	12	70
Cobalt	23	6.6	5.4	2700	14	5.3	4.6	5.5	5.4
Copper		35	25	2100	34	440	170	31	540
Cyanide									
Iron		15000	14000	24000	24000	14000	15000	19000	14000
Lead	200	54	35	3100	1900	190	160	39	200
Magnesium		1800	1900	1800	5400	1900	1900	3600	1500
Manganese		220	200	210	680	200	210	310	170
Mercury									
Nickel		9.1	8.7	36	13	8.4	9.3	11	9.5
Potassium		400	370	550	920	420	490	690	450
Selenium		4.1 U	3.9 U	3.8 U	3.9 U	2.0 U	2.0 U	1.9 U	2.0 U
Silver		1.0 U	0.98 U	42	0.98 U	0.98 U	1.0 U	0.96 U	1.0 U
Sodium		38	35	63	130	38	49	50	37
Thallium	0.78	4.1 U	3.9 U	3.7	2.7	2.0 U	2.0 U	1.9 U	2.0 U
Vanadium		26	21	15	23	21	21	20	24
Zinc		40	35	380 J1	77	88	85	56	96
Other									
pH in Soil (S.U.)									

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		PASI_SB-07	PASI_SB-08	PASI_SB-08	PASI_SB-08	PASI_SB-09	PASI_SB-09	PASI_SB-09	PASI_SB-10
Sample ID:		SS-51	SB-08A	SB-08B	SS-08	SB-09A	SB-09B	SS-09	SB-10A
Sample Date:	W&L	8/6/2010	8/6/2010	8/6/2010	8/6/2010	8/9/2010	8/9/2010	8/6/2010	8/9/2010
Sample Depth:	Property	0-1 (ft bgs)	2-3 (ft bgs)	6-7 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	4-5 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)
Sample Type:	Soil PRGs	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
VOCs (ug/kg)									
1,1,1-Trichloroethane		72 U	78 U	83 U	110 U	100 U	110 U	160 U	74 U
1,1-Dichloroethane		72 U	78 U	83 U	110 U	100 U	110 U	160 U	74 U
2-Butanone		72 U	78 U	83 U	110 U	100 U	110 U	160 U	74 U
2-Hexanone		72 U	78 U	83 U	110 U	100 U	110 U	160 U	74 U
4-Methyl-2-Pentanone		72 U	78 U	83 U	110 U	100 U	110 U	160 U	74 U
Acetone		110.4	78 U	83 U	186.6	100 U	110 U	329.3	74 U
Carbon Disulfide		72 U	78 U	83 U	110 U	100 U	110 U	160 U	74 U
Chloroethane		72 U	78 U	83 U	110 U	100 U	110 U	160 U	74 U
Chloroform		72 U	78 U	83 U	110 U	100 U	110 U	160 U	74 U
cis-1,2-Dichloroethene		72 U	78 U	83 U	110 U	100 U	110 U	160 U	74 U
Ethylbenzene		72 U	78 U	83 U	110 U	100 U	110 U	160 U	74 U
m,p-Xylene		140 U	160 U	170 U	220 U	200 U	220 U	320 U	150 U
Methyl acetate									
Methylene Chloride		72 U	78 U	83 U	110 U	100 U	110 U	160 U	74 U
Naphthalene		72 U	78 U	83 U	110 U	100 U	110 U	160 U	74 U
Tetrachloroethene		72 U	78 U	83 U	110 U	100 U	110 U	160 U	74 U
Toluene		72 U	78 U	83 U	110 U	100 U	110 U	160 U	74 U
Trichloroethene		72 U	78 U	83 U	110 U	100 U	110 U	160 U	74 U
SVOCs (ug/kg)									
2-Methylnaphthalene									
4-Methylphenol									
Acenaphthene		910	1300	250 U	270 U	280 U	360 U	250 U	250 U
Acenaphthylene		260 U	230 U	250 U	270 U	280 U	360 U	250 U	250 U
Anthracene		2000	3000	250 U	270 U	280 U	360 U	250 U	250 U
Benzaldehyde									
Benzo(a)anthracene	11,000	6200	6800	250 U	430	280 U	360 U	250 U	250 U
Benzo(a)pyrene	1,100	5400	5500	250 U	390	280 U	360 U	250 U	250 U
Benzo(b)fluoranthene	11,000	6000	6000	250 U	450	280 U	360 U	250 U	250 U
Benzo(g,h,i)perylene		3900	3500	250 U	264 L	280 U	360 U	250 U	250 U
Benzo(k)fluoranthene		5100	4500	250 U	370	280 U	360 U	250 U	250 U
Bis(2-ethylhexyl)phthalate									
Butylbenzylphthalate									
Caprolactam									
Carbazole									
Chrysene		6600	6400	250 U	470	280 U	360 U	250 U	250 U
Dibenz(a,h)anthracene	1,100	710	830	250 U	270 U	280 U	360 U	250 U	250 U
Dibenzofuran									

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		PASI_SB-07	PASI_SB-08	PASI_SB-08	PASI_SB-08	PASI_SB-09	PASI_SB-09	PASI_SB-09	PASI_SB-10
Sample ID:		SS-51	SB-08A	SB-08B	SS-08	SB-09A	SB-09B	SS-09	SB-10A
Sample Date:	W&L	8/6/2010	8/6/2010	8/6/2010	8/6/2010	8/9/2010	8/9/2010	8/6/2010	8/9/2010
Sample Depth:	Property	0-1 (ft bgs)	2-3 (ft bgs)	6-7 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	4-5 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)
Sample Type:	Soil PRGs	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
Dimethylphthalate									
Di-n-butylphthalate									
Fluoranthene		17000	19000	250 U	700	280 U	360 U	250 U	250 U
Fluorene		760	1300	250 U	270 U	280 U	360 U	250 U	250 U
Indeno(1,2,3-cd)pyrene		3600	3400	250 U	270	280 U	360 U	250 U	250 U
Naphthalene		390	460	250 U	270 U	280 U	360 U	250 U	250 U
Pentachlorophenol									
Phenanthrene		12000	17000	250 U	260 L	280 U	360 U	250 U	250 U
Phenol									
Pyrene		13000	14000	250 U	630	280 U	360 U	250 U	250 U
Pesticides (ug/kg)									
4,4'-DDD									
4,4'-DDE									
4,4'-DDT									
Aldrin									
alpha-BHC									
alpha-Chlordane									
beta-BHC									
delta-BHC									
Dieldrin									
Endosulfan II									
Endosulfan sulfate									
Endrin									
Endrin aldehyde									
Endrin ketone									
gamma-Chlordane									
Heptachlor									
Heptachlor epoxide									
Methoxychlor									
PCBs (ug/kg)									
Aroclor-1260									
Inorganics (mg/kg)									
Aluminum		11000	5600	4900	13000	12000	7700	9600	9500
Antimony	31	48	20 U	10 U	9.8 U	9.6 U	2.0 U	10 U	1.9 U
Arsenic	6.8	2.6	2.0 U	2.0	3.0	2.2	2.0 U	3.0	3.2
Barium		39	19	17	68	38	33	54	35
Beryllium		0.78 U	0.78 U	0.80 U	0.78 U	0.77 U	0.80 U	0.80 U	0.77 U

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		PASI_SB-07	PASI_SB-08	PASI_SB-08	PASI_SB-08	PASI_SB-09	PASI_SB-09	PASI_SB-09	PASI_SB-10
Sample ID:		SS-51	SB-08A	SB-08B	SS-08	SB-09A	SB-09B	SS-09	SB-10A
Sample Date:	W&L	8/6/2010	8/6/2010	8/6/2010	8/6/2010	8/9/2010	8/9/2010	8/6/2010	8/9/2010
Sample Depth:	Property	0-1 (ft bgs)	2-3 (ft bgs)	6-7 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	4-5 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)
Sample Type:	Soil PRGs	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
Cadmium		2.0 U	2.0 U	2.0 U	2.0 U	1.9 U	2.0 U	2.0 U	1.9 U
Calcium		700	800	990	980	760	930	1400	2300
Chromium		4300	3200	1100	1200	500	140	650	180
Chromium, Hexavalent	3.0	50	110	88	4.6 U	4.5 U	4.7 U	57	31
Cobalt	23	5.9	4.1	3.9	6.3	4.3	2.7	11	9.2
Copper		610	52	28	300	16	10	67	30
Cyanide									
Iron		15000	10000	11000	15000	15000	11000	16000	19000
Lead	200	220	41	7.1	63	21	34	450	290
Magnesium		1600	2300	2600	1900	1900	1100	2800	3800
Manganese		170	190	310	280	220	120	350	460
Mercury									
Nickel		9.7	7.8	9.5	9.8	7.8	5.4	19	14
Potassium		440	520	760	530	540	5650	700	1000
Selenium		2.0 U	2.0 U	2.0 U	2.0 U	3.8 U	4.0 U	2.0 U	3.8 U
Silver		0.98 U	0.98 U	1.0 U	0.98 U	0.96 U	1.0 U	1.0 U	0.96 U
Sodium		40	33	49	44	64	69	76	100
Thallium	0.78	2.0 U	2.0 U	2.0 U	2.0 U	1.9 U	2.0 U	2.0 U	2.1
Vanadium		27	14	15	23	20	15	22	22
Zinc		95	36	27	270	37	27	62	61
Other									
pH in Soil (S.U.)									

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		PASI_SB-10	PASI_SB-10	PASI_SB-11	PASI_SB-11	PASI_SB-12	PASI_SB-12	PASI_SB-12	PASI_SB-13
Sample ID:		SB-10B	SS-10	SB-11A	SS-11	SB-12A	SS-12	SS-52	SS-13
Sample Date:	W&L	8/9/2010	8/6/2010	8/9/2010	8/9/2010	8/9/2010	8/9/2010	8/9/2010	8/9/2010
Sample Depth:	Property	3-4 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	0-1 (ft bgs)	0-1 (ft bgs)	0-1 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate	Field Sample
Parameter									
VOCs (ug/kg)									
1,1,1-Trichloroethane		76 U	66 U	91 U	140 U	92 U	130 U	100 U	87 U
1,1-Dichloroethane		76 U	66 U	91 U	140 U	92 U	130 U	100 U	87 U
2-Butanone		76 U	66 U	91 U	140 U	92 U	130 U	100 U	87 U
2-Hexanone		76 U	66 U	91 U	140 U	92 U	130 U	100 U	87 U
4-Methyl-2-Pentanone		76 U	66 U	91 U	140 U	92 U	130 U	100 U	87 U
Acetone		76 U	120	91 U	140 U	92 U	130 U	100 U	87 U
Carbon Disulfide		76 U	66 U	91 U	140 U	92 U	130 U	100 U	87 U
Chloroethane		76 U	66 U	91 U	140 U	92 U	130 U	100 U	87 U
Chloroform		76 U	66 U	91 U	140 U	92 U	130 U	100 U	87 U
cis-1,2-Dichloroethene		76 U	66 U	91 U	140 U	92 U	130 U	100 U	87 U
Ethylbenzene		76 U	66 U	91 U	140 U	92 U	130 U	100 U	87 U
m,p-Xylene		150 U	130 U	180 U	280 U	180 U	260 U	200 U	170 U
Methyl acetate									
Methylene Chloride		76 U	66 U	91 U	140 U	92 U	130 U	100 U	87 U
Naphthalene		76 U	66 U	91 U	140 U	92 U	130 U	100 U	87 U
Tetrachloroethene		76 U	66 U	91 U	140 U	92 U	130 U	100 U	87 U
Toluene		76 U	66 U	91 U	140 U	92 U	130 U	100 U	87 U
Trichloroethene		76 U	66 U	91 U	140 U	92 U	130 U	100 U	87 U
SVOCs (ug/kg)									
2-Methylnaphthalene									
4-Methylphenol									
Acenaphthene		260 U	250 U	270 U	260 U	240 U	290 U	340 U	300 U
Acenaphthylene		260 U	250 U	270 U	260 U	240 U	290 U	340 U	300 U
Anthracene		260 U	250 U	270 U	260 U	240 U	290 U	340 U	300 U
Benzaldehyde									
Benzo(a)anthracene	11,000	260 U	250 U	270 U	720	240 U	290 U	340 U	630
Benzo(a)pyrene	1,100	260 U	250 U	270 U	690	240 U	290 U	340 U	640
Benzo(b)fluoranthene	11,000	260 U	250 U	270 U	750	240 U	290 U	340 U	930
Benzo(g,h,i)perylene		260 U	250 U	270 U	510	240 U	290 U	340 U	570
Benzo(k)fluoranthene		260 U	250 U	270 U	800	240 U	290 U	340 U	790
Bis(2-ethylhexyl)phthalate									
Butylbenzylphthalate									
Caprolactam									
Carbazole									
Chrysene		260 U	250 U	270 U	910	240 U	290 U	340 U	840
Dibenz(a,h)anthracene	1,100	260 U	250 U	270 U	260 U	240 U	290 U	340 U	300 U
Dibenzofuran									

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		PASI_SB-10	PASI_SB-10	PASI_SB-11	PASI_SB-11	PASI_SB-12	PASI_SB-12	PASI_SB-12	PASI_SB-13
Sample ID:		SB-10B	SS-10	SB-11A	SS-11	SB-12A	SS-12	SS-52	SS-13
Sample Date:	W&L	8/9/2010	8/6/2010	8/9/2010	8/9/2010	8/9/2010	8/9/2010	8/9/2010	8/9/2010
Sample Depth:	Property	3-4 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	0-1 (ft bgs)	0-1 (ft bgs)	0-1 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate	Field Sample
Parameter									
Dimethylphthalate									
Di-n-butylphthalate									
Fluoranthene		260 U	250 U	270 U	2300	240 U	290 U	340 U	1700
Fluorene		260 U	250 U	270 U	260 U	240 U	290 U	340 U	300 U
Indeno(1,2,3-cd)pyrene		260 U	250 U	270 U	470	240 U	290 U	340 U	500
Naphthalene		260 U	250 U	270 U	260 U	240 U	290 U	340 U	300 U
Pentachlorophenol									
Phenanthrene		260 U	250 U	270 U	1800	240 U	290 U	340 U	860
Phenol									
Pyrene		260 U	250 U	270 U	1700	240 U	290 U	340 U	1300
Pesticides (ug/kg)									
4,4'-DDD									
4,4'-DDE									
4,4'-DDT									
Aldrin									
alpha-BHC									
alpha-Chlordane									
beta-BHC									
delta-BHC									
Dieldrin									
Endosulfan II									
Endosulfan sulfate									
Endrin									
Endrin aldehyde									
Endrin ketone									
gamma-Chlordane									
Heptachlor									
Heptachlor epoxide									
Methoxychlor									
PCBs (ug/kg)									
Aroclor-1260									
Inorganics (mg/kg)									
Aluminum		9500	7200	10000	15000	8900	14000	14000	13000
Antimony	31	2.0 U	9.8 U	2.0 U	9.6 U	1.9 U	2.0 U	2.0 U	38 U
Arsenic	6.8	3.7	2.6	2.0 U	2.3	1.9 U	2.0 U	2.2	1.9 U
Barium		30	65	34	39	26	33	36	29
Beryllium		0.80 U	0.78 U	0.78 U	0.77 U	0.77 U	0.78 U	0.80 U	0.77 U

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		PASI_SB-10	PASI_SB-10	PASI_SB-11	PASI_SB-11	PASI_SB-12	PASI_SB-12	PASI_SB-12	PASI_SB-13
Sample ID:		SB-10B	SS-10	SB-11A	SS-11	SB-12A	SS-12	SS-52	SS-13
Sample Date:	W&L	8/9/2010	8/6/2010	8/9/2010	8/9/2010	8/9/2010	8/9/2010	8/9/2010	8/9/2010
Sample Depth:	Property	3-4 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	0-1 (ft bgs)	0-1 (ft bgs)	0-1 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate	Field Sample
Parameter									
Cadmium		2.0 U	2.0 U	2.0 U	1.9 U	1.9 U	2.0 U	2.0 U	1.9 U
Calcium		2200	1300	750	1100	530	1100	1100	710
Chromium		76	1500	71	1300	17	43	49	2500
Chromium, Hexavalent	3.0	5.1	61	4.4 U	25	9.9	4.4 U	4.6 U	
Cobalt	23	7.7	26	3.7	2.7	4.3	2.1	2.0	2.0
Copper		19	90	8.8	120	4.4	11	14	180
Cyanide									
Iron		17000	16000	12000	12000	12000	10000	10000	10000
Lead	200	120	1300	14	65	5.4	20	21	56
Magnesium		3700	2700	2100	1700	1900	1800	1600	1500
Manganese		530	320	190	160	200	120	110	130
Mercury									
Nickel		13	24	8.2	6.6	7.1	5.2	5.6	5.5
Potassium		970	610	410	470	430	430	480	470
Selenium		4.0 U	2.0 U	3.9 U	3.8 U	3.8 U	3.9 U	4.0 U	3.8 U
Silver		1.0 U	0.98 U	0.98 U	0.96 U	0.96 U	0.98 U	1.0 U	0.96 U
Sodium		96	60	40	52	35	53	55	43
Thallium	0.78	2.4	2.0 U	2.0 U	1.9 U	1.9 U	2.0 U	2.0 U	1.9 U
Vanadium		20	18	20	26	15	24	25	22
Zinc		43	94	32	53	29	25	27	51
Other									
pH in Soil (S.U.)									

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		PASI_SB-14	PASI_SB-15	PASI_SB-15	PASI_SB-16	PASI_SB-16	PASI_SB-17	PASI_SB-18	PASI_SB-20
Sample ID:		SS-14	SB-15A	SS-15	SB-16A	SS-16	SS-17	SS-18	SB-20A
Sample Date:	W&L	8/9/2010	8/9/2010	8/9/2010	8/9/2010	8/9/2010	8/9/2010	8/9/2010	8/10/2010
Sample Depth:	Property	0-1 (ft bgs)	2-3 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	0-1 (ft bgs)	0-1 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
VOCs (ug/kg)									
1,1,1-Trichloroethane		82 U	77 U	130 U	78 U	100 U	110 U	100 U	87 U
1,1-Dichloroethane		82 U	77 U	130 U	78 U	100 U	110 U	100 U	87 U
2-Butanone		82 U	77 U	130 U	78 U	100 U	110 U	100 U	87 U
2-Hexanone		82 U	77 U	130 U	78 U	100 U	110 U	100 U	87 U
4-Methyl-2-Pentanone		82 U	77 U	130 U	78 U	100 U	110 U	100 U	87 U
Acetone		82 U	77 U	130 U	78 U	100 U	110 U	100 U	87 U
Carbon Disulfide		82 U	77 U	130 U	78 U	100 U	110 U	100 U	87 U
Chloroethane		82 U	77 U	130 U	78 U	100 U	110 U	100 U	87 U
Chloroform		82 U	77 U	130 U	78 U	100 U	110 U	100 U	87 U
cis-1,2-Dichloroethene		82 U	77 U	130 U	78 U	100 U	110 U	100 U	87 U
Ethylbenzene		82 U	77 U	130 U	78 U	100 U	110 U	100 U	87 U
m,p-Xylene		160 U	150 U	250 U	160 U	200 U	220 U	210 U	170 U
Methyl acetate									
Methylene Chloride		82 U	77 U	130 U	78 U	100 U	110 U	100 U	87 U
Naphthalene		82 U	77 U	130 U	78 U	100 U	110 U	100 U	87 U
Tetrachloroethene		82 U	77 U	130 U	78 U	100 U	110 U	100 U	87 U
Toluene		82 U	77 U	130 U	78 U	100 U	110 U	100 U	87 U
Trichloroethene		82 U	77 U	130 U	78 U	100 U	110 U	100 U	87 U
SVOCs (ug/kg)									
2-Methylnaphthalene									
4-Methylphenol									
Acenaphthene		280 U	250 U	280 U	270 U	260 U	250 U	280 U	240 U
Acenaphthylene		280 U	250 U	280 U	270 U	260 U	250 U	280 U	240 U
Anthracene		280 U	250 U	280 U	270 U	260 U	250 U	280 U	240 U
Benzaldehyde									
Benzo(a)anthracene	11,000	390	250 U	440	270 U	410	250 U	280 U	240 U
Benzo(a)pyrene	1,100	370	250 U	410	270 U	350	250 U	280 U	240 U
Benzo(b)fluoranthene	11,000	540	250 U	520	270 U	320	250 U	280 U	240 U
Benzo(g,h,i)perylene		300	250 U	300	270 U	260 U	250 U	280 U	240 U
Benzo(k)fluoranthene		340	250 U	460	270 U	390	250 U	280 U	240 U
Bis(2-ethylhexyl)phthalate									
Butylbenzylphthalate									
Caprolactam									
Carbazole									
Chrysene		490	250 U	530	270 U	430	250 U	280 U	240 U
Dibenz(a,h)anthracene	1,100	280 U	250 U	280 U	270 U	260 U	250 U	280 U	240 U
Dibenzofuran									

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		PASI_SB-14	PASI_SB-15	PASI_SB-15	PASI_SB-16	PASI_SB-16	PASI_SB-17	PASI_SB-18	PASI_SB-20
Sample ID:		SS-14	SB-15A	SS-15	SB-16A	SS-16	SS-17	SS-18	SB-20A
Sample Date:	W&L	8/9/2010	8/9/2010	8/9/2010	8/9/2010	8/9/2010	8/9/2010	8/9/2010	8/10/2010
Sample Depth:	Property	0-1 (ft bgs)	2-3 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	0-1 (ft bgs)	0-1 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
Dimethylphthalate									
Di-n-butylphthalate									
Fluoranthene		1100	250 U	1200	270 U	1000	360	410	240 U
Fluorene		280 U	250 U	280 U	270 U	260 U	250 U	280 U	240 U
Indeno(1,2,3-cd)pyrene		280 U	250 U	280 U	270 U	260 U	250 U	280 U	240 U
Naphthalene		280 U	250 U	280 U	270 U	260 U	250 U	280 U	240 U
Pentachlorophenol									
Phenanthrene		650	250 U	780	270 U	770	250 U	280 U	240 U
Phenol									
Pyrene		790	250 U	900	270 U	770	310	340	240 U
Pesticides (ug/kg)									
4,4'-DDD									
4,4'-DDE									
4,4'-DDT									
Aldrin									
alpha-BHC									
alpha-Chlordane									
beta-BHC									
delta-BHC									
Dieldrin									
Endosulfan II									
Endosulfan sulfate									
Endrin									
Endrin aldehyde									
Endrin ketone									
gamma-Chlordane									
Heptachlor									
Heptachlor epoxide									
Methoxychlor									
PCBs (ug/kg)									
Aroclor-1260									
Inorganics (mg/kg)									
Aluminum		15000	8900	12000	12000	13000	12000	13000	9100
Antimony	31	39 U	1.9 U	19 U	9.8 U	2.0 U	2.0 U	1.9 U	1.9 U
Arsenic	6.8	2.7	1.9 U	2.3	2.0 U	2.6	2.5	3.7	1.9 U
Barium		36	24	36	33	55	46	59	26
Beryllium		0.78 U	0.77 U	0.77 U	0.78 U	0.80 U	0.80 U	0.77 U	0.77 U

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		PASI_SB-14	PASI_SB-15	PASI_SB-15	PASI_SB-16	PASI_SB-16	PASI_SB-17	PASI_SB-18	PASI_SB-20
Sample ID:		SS-14	SB-15A	SS-15	SB-16A	SS-16	SS-17	SS-18	SB-20A
Sample Date:	W&L	8/9/2010	8/9/2010	8/9/2010	8/9/2010	8/9/2010	8/9/2010	8/9/2010	8/10/2010
Sample Depth:	Property	0-1 (ft bgs)	2-3 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)	0-1 (ft bgs)	0-1 (ft bgs)	0-1 (ft bgs)	2-3 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter									
Cadmium		2.0 U	1.9 U	1.9 U	2.0 U	2.0 U	2.0 U	1.9 U	1.9 U
Calcium		660	510	860	720	980	520	620	750
Chromium		4500	95	2000	590	520	60	160	69
Chromium, Hexavalent	3.0	4.5 U	4.4 U	4.7 U	4.6 U		4.7 U		4.5 U
Cobalt	23	2.8	2.7	3.0	3.0	2.8	2.4	3.0	3.9
Copper		150	3.8	99	14	28	16	30	6.2
Cyanide									
Iron		14000	9500	12000	13000	12000	12000	13000	12000
Lead	200	67	5.0	55	20	68	31	67	8.8
Magnesium		1600	2000	1500	2100	1400	1200	1500	1800
Manganese		160	140	180	150	190	170	200	160
Mercury									
Nickel		7.6	7.1	6.0	7.8	6.7	6.0	7.5	7.8
Potassium		510	400	360	590	370	310	380	420
Selenium		3.9 U	3.8 U	3.8 U	3.9 U	4.0 U	4.0 U	3.8 U	3.8 U
Silver		0.98 U	0.96 U	0.96 U	0.98 U	1.0 U	1.0 U	0.96 U	0.96 U
Sodium		52	40	46	51	48	39	43	38
Thallium	0.78	2.0 U	1.9 U	1.9 U	2.0 U	2.0 U	2.0 U	1.9 U	1.9 U
Vanadium		26	13	22	22	23	21	22	18
Zinc		72	27	51	29	54	40	49	31
Other									
pH in Soil (S.U.)									

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		PASI_SB-20	PASI_SB-20	SB-21	SB-21	SB-21	SB-21	SB-22	SB-22
Sample ID:		SB-20B	SS-20	SB-21A	SB-21B	SB-21C	SS-21	SS-22	SS-53
Sample Date:	W&L	8/10/2010	8/9/2010	8/10/2010	8/10/2010	8/10/2010	8/10/2010	8/10/2010	8/10/2010
Sample Depth:	Property	8-9 (ft bgs)	0-1 (ft bgs)	1.5-2.5 (ft bgs)	3.5-4 (ft bgs)	0-4 (ft bgs)	0.5-1 (ft bgs)	0.5-1 (ft bgs)	0.5-1 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate
Parameter									
VOCs (ug/kg)									
1,1,1-Trichloroethane		73 U	72 U						
1,1-Dichloroethane		73 U	72 U						
2-Butanone		73 U	72 U						
2-Hexanone		73 U	72 U						
4-Methyl-2-Pentanone		73 U	72 U						
Acetone		73 U	72 U						
Carbon Disulfide		73 U	72 U						
Chloroethane		73 U	72 U						
Chloroform		73 U	72 U						
cis-1,2-Dichloroethene		73 U	72 U						
Ethylbenzene		73 U	72 U						
m,p-Xylene		150 U	140 U						
Methyl acetate									
Methylene Chloride		73 U	72 U						
Naphthalene		73 U	72 U						
Tetrachloroethene		73 U	72 U						
Toluene		73 U	72 U						
Trichloroethene		73 U	72 U						
SVOCs (ug/kg)									
2-Methylnaphthalene									
4-Methylphenol									
Acenaphthene		220 U	260 U						
Acenaphthylene		220 U	260 U						
Anthracene		220 U	340						
Benzaldehyde									
Benzo(a)anthracene	11,000	220 U	1100						
Benzo(a)pyrene	1,100	220 U	1100						
Benzo(b)fluoranthene	11,000	220 U	1100						
Benzo(g,h,i)perylene		220 U	810						
Benzo(k)fluoranthene		220 U	1300						
Bis(2-ethylhexyl)phthalate									
Butylbenzylphthalate									
Caprolactam									
Carbazole									
Chrysene		220 U	1400						
Dibenz(a,h)anthracene	1,100	220 U	260 U						
Dibenzofuran									

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		PASI_SB-20	PASI_SB-20	SB-21	SB-21	SB-21	SB-21	SB-22	SB-22
Sample ID:		SB-20B	SS-20	SB-21A	SB-21B	SB-21C	SS-21	SS-22	SS-53
Sample Date:	W&L	8/10/2010	8/9/2010	8/10/2010	8/10/2010	8/10/2010	8/10/2010	8/10/2010	8/10/2010
Sample Depth:	Property	8-9 (ft bgs)	0-1 (ft bgs)	1.5-2.5 (ft bgs)	3.5-4 (ft bgs)	0-4 (ft bgs)	0.5-1 (ft bgs)	0.5-1 (ft bgs)	0.5-1 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate
Parameter									
Dimethylphthalate									
Di-n-butylphthalate									
Fluoranthene		220 U	3500						
Fluorene		220 U	260 U						
Indeno(1,2,3-cd)pyrene		220 U	750						
Naphthalene		220 U	260 U						
Pentachlorophenol									
Phenanthrene		220 U	2600						
Phenol									
Pyrene		220 U	2400						
Pesticides (ug/kg)									
4,4'-DDD									
4,4'-DDE									
4,4'-DDT									
Aldrin									
alpha-BHC									
alpha-Chlordane									
beta-BHC									
delta-BHC									
Dieldrin									
Endosulfan II									
Endosulfan sulfate									
Endrin									
Endrin aldehyde									
Endrin ketone									
gamma-Chlordane									
Heptachlor									
Heptachlor epoxide									
Methoxychlor									
PCBs (ug/kg)									
Aroclor-1260				90 U	90 U		100 U	90 U	100 U
Inorganics (mg/kg)									
Aluminum		11000	11000			8800			
Antimony	31	39 U	40 U			10 U			
Arsenic	6.8	3.7	3.9			2.0 U			
Barium		54	33			24			
Beryllium		0.78 U	0.80 U			0.80 U			

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		PASI_SB-20	PASI_SB-20	SB-21	SB-21	SB-21	SB-21	SB-22	SB-22
Sample ID:		SB-20B	SS-20	SB-21A	SB-21B	SB-21C	SS-21	SS-22	SS-53
Sample Date:	W&L	8/10/2010	8/9/2010	8/10/2010	8/10/2010	8/10/2010	8/10/2010	8/10/2010	8/10/2010
Sample Depth:	Property	8-9 (ft bgs)	0-1 (ft bgs)	1.5-2.5 (ft bgs)	3.5-4 (ft bgs)	0-4 (ft bgs)	0.5-1 (ft bgs)	0.5-1 (ft bgs)	0.5-1 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate
Parameter									
Cadmium		2.0 U	2.0 U			2.0 U			
Calcium		1800	650			620			
Chromium		3000	3100			1300			
Chromium, Hexavalent	3.0	470	4.3 U						
Cobalt	23	8.0	3.0			3.2			
Copper		29	180			56			
Cyanide									
Iron		26000	13000			11000			
Lead	200	13	80			27			
Magnesium		4800	1900			1700			
Manganese		830	160			140			
Mercury									
Nickel		14	7.8			7.6			
Potassium		1600	630			530			
Selenium		3.9 U	4.0 U			4.0 U			
Silver		0.98 U	1.0 U			1.0 U			
Sodium		160	41			35			
Thallium	0.78	3.5	2.0 U			2.0 U			
Vanadium		36	21			16			
Zinc		42	51			56			
Other									
pH in Soil (S.U.)									

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		SB-23
Sample ID:		SS-23
Sample Date:	W&L	8/10/2010
Sample Depth:	Property	0.5-1 (ft bgs)
Sample Type:	Soil PRGs	Field Sample
Parameter		
VOCs (ug/kg)		
1,1,1-Trichloroethane		
1,1-Dichloroethane		
2-Butanone		
2-Hexanone		
4-Methyl-2-Pentanone		
Acetone		
Carbon Disulfide		
Chloroethane		
Chloroform		
cis-1,2-Dichloroethene		
Ethylbenzene		
m,p-Xylene		
Methyl acetate		
Methylene Chloride		
Naphthalene		
Tetrachloroethene		
Toluene		
Trichloroethene		
SVOCs (ug/kg)		
2-Methylnaphthalene		
4-Methylphenol		
Acenaphthene		
Acenaphthylene		
Anthracene		
Benzaldehyde		
Benzo(a)anthracene	11,000	
Benzo(a)pyrene	1,100	
Benzo(b)fluoranthene	11,000	
Benzo(g,h,i)perylene		
Benzo(k)fluoranthene		
Bis(2-ethylhexyl)phthalate		
Butylbenzylphthalate		
Caprolactam		
Carbazole		
Chrysene		
Dibenz(a,h)anthracene	1,100	
Dibenzofuran		

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		SB-23
Sample ID:		SS-23
Sample Date:	W&L	8/10/2010
Sample Depth:	Property	0.5-1 (ft bgs)
Sample Type:	Soil PRGs	Field Sample
Parameter		
Dimethylphthalate		
Di-n-butylphthalate		
Fluoranthene		
Fluorene		
Indeno(1,2,3-cd)pyrene		
Naphthalene		
Pentachlorophenol		
Phenanthrene		
Phenol		
Pyrene		
Pesticides (ug/kg)		
4,4'-DDD		
4,4'-DDE		
4,4'-DDT		
Aldrin		
alpha-BHC		
alpha-Chlordane		
beta-BHC		
delta-BHC		
Dieldrin		
Endosulfan II		
Endosulfan sulfate		
Endrin		
Endrin aldehyde		
Endrin ketone		
gamma-Chlordane		
Heptachlor		
Heptachlor epoxide		
Methoxychlor		
PCBs (ug/kg)		
Aroclor-1260		90 U
Inorganics (mg/kg)		
Aluminum		
Antimony	31	
Arsenic	6.8	
Barium		
Beryllium		

TABLE C-1
COMPARISON OF HISTORICAL WALTON LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		SB-23
Sample ID:		SS-23
Sample Date:	W&L	8/10/2010
Sample Depth:	Property	0.5-1 (ft bgs)
Sample Type:	Soil PRGs	Field Sample
Parameter		
Cadmium		
Calcium		
Chromium		
Chromium, Hexavalent	3.0	
Cobalt	23	
Copper		
Cyanide		
Iron		
Lead	200	
Magnesium		
Manganese		
Mercury		
Nickel		
Potassium		
Selenium		
Silver		
Sodium		
Thallium	0.78	
Vanadium		
Zinc		
Other		
pH in Soil (S.U.)		

TABLE C-2
COMPARISON OF RI WALTON AND LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		SO-101	SO-101	SO-101	SO-101	SO-102	SO-102	SO-102	SO-103	SO-103	SO-104
Sample ID:		WL-RS0-101-5.0-6.0	WL-RS0-101D-5.0-6.0	WL-SO-101-5.1-6.1	WL-SO-101D-5.1-6.1	WL-RS0-102-0.7-1.7	WL-RS0-102D-0.7-1.7	WL-SO-102-0.5-1.5	WL-RS0-103-4.8-5.8	WL-SO-103-4.4-5.4	WL-RS0-104-4.0-5.0
Sample Date:	W&L	7/10/2014	7/10/2014	6/19/2014	6/19/2014	7/10/2014	7/10/2014	6/18/2014	7/10/2014	6/18/2014	7/10/2014
Sample Depth:	Property	5-6 (ft bgs)	5-6 (ft bgs)	5.1-6.1 (ft bgs)	5.1-6.1 (ft bgs)	0.7-1.7 (ft bgs)	0.7-1.7 (ft bgs)	0.5-1.5 (ft bgs)	4.8-5.8 (ft bgs)	4.4-5.4 (ft bgs)	4-5 (ft bgs)
Sample Type:	Soil PRGs	Field Duplicate	Field Duplicate	Field Duplicate	Field Duplicate	Field Duplicate	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample
Parameter											
VOCs (ug/kg)											
1,1,1-Trichloroethane				7.3 U	8.5 U			6.9 U		6.1 U	
1,1-Dichloroethane				7.3 U	8.5 U			R		6.1 U	
2-Butanone				14 J	40 J			370		29	
2-Hexanone				15 U	17 U			72		12 U	
4-Methyl-2-pentanone				15 U	17 U			7.3 J		12 U	
Acetone				93	110			2400		75	
Carbon disulfide				1.2 J	0.86 J			6.9 U		0.64 J	
Chloroethane				7.3 U	8.5 U			6.9 U		6.1 U	
Chloroform				7.3 U	8.5 U			64 JEB		6.1 U	
cis-1,2-Dichloroethene				7.3 U	8.5 U			6.9 U		6.1 U	
Ethylbenzene				7.3 U	8.5 U			0.27 J		0.50 J	
m,p-Xylene				7.3 U	8.5 U			0.16 J		0.14 J	
Methyl acetate				7.3 U	8.5 U			6.9 U		6.1 U	
Methylene chloride				7.3 U	8.5 U			6.9 U		6.1 U	
Naphthalene											
Tetrachloroethene				7.3 U	8.5 U			6.9 U		6.1 U	
Toluene				7.3 U	8.5 U			67		1.1 J	
Trichloroethene				7.3 U	8.5 U			41		6.1 U	
SVOCs (ug/kg)											
2-Methylnaphthalene				100 U	110 U	820 UJ	830 UJ		20 UJ		
4-Methylphenol				2600 U	1400 U	4200 UJ	370 J		1000 UJ		
Acenaphthene				100 U	110 U	580 J	490 J		20 UJ		
Acenaphthylene				46 J	49 J	1200 J	930 J		20 UJ		
Anthracene				50 J	50 J	2800 J	2100 J		20 UJ		
Benzaldehyde				2600 U	1400 U	4200 UJ	4300 UJ		1000 UJ		
Benzo(a)anthracene	11,000			300 J	350 J	5300 J	4600 J		20 UJ		
Benzo(a)pyrene	1,100			300	330	3500 J	3000 J		20 UJ		
Benzo(b)fluoranthene	11,000			450	500	4600 J	4000 J		20 UJ		
Benzo(g,h,i)perylene				210	220	2200 J	1900 J		20 UJ		
Benzo(k)fluoranthene				140	160	1500 J	1400 J		20 UJ		
Bis(2-ethylhexyl)phthalate				2600 U	1400 U	4200 UJ	4300 UJ		1000 UJ		
Butylbenzylphthalate				2600 U	1400 U	4200 UJ	4300 UJ		1000 UJ		
Caprolactam				2600 U	1400 U	4200 UJ	4300 UJ		1000 UJ		
Carbazole				2600 U	1400 U	1500 J	1200 J		1000 UJ		
Chrysene				320	340	3800 J	3300 J		20 UJ		
Dibenz(a,h)anthracene	1,100			44 J	50 J	450 J	380 J		20 UJ		
Dibenzofuran				2600 U	1400 U	1300 J	1100 J		1000 UJ		
Dimethylphthalate				2600 U	1400 U	4200 UJ	420 J		1000 UJ		
Di-n-butylphthalate				2600 U	1400 U	4200 UJ	4300 UJ		1000 UJ		
Fluoranthene				600	690	10000 J	9100 J		6.7 J		
Fluorene				100 U	110 U	1000 J	830 J		20 UJ		
Indeno(1,2,3-cd)pyrene				280	310	3000 J	2500 J		20 UJ		
Naphthalene				100 U	110 U	820 UJ	830 UJ		20 UJ		
Pentachlorophenol				200 U	220 U	1700 UJ	1700 UJ		41 UJ		
Phenanthrene				170	190	13000 J	10000 J		6.5 J		
Phenol				2600 U	1400 U	520 J	640 J		1000 UJ		
Pyrene				480	530	8300 J	8000 J		7.4 J		

TABLE C-2
COMPARISON OF RI WALTON AND LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		SO-101	SO-101	SO-101	SO-101	SO-102	SO-102	SO-102	SO-103	SO-103	SO-104
Sample ID:		WL-RS0-101-5.0-6.0	WL-RS0-101D-5.0-6.0	WL-SO-101-5.1-6.1	WL-SO-101D-5.1-6.1	WL-RS0-102-0.7-1.7	WL-RS0-102D-0.7-1.7	WL-SO-102-0.5-1.5	WL-RS0-103-4.8-5.8	WL-SO-103-4.4-5.4	WL-RS0-104-4.0-5.0
Sample Date:	W&L	7/10/2014	7/10/2014	6/19/2014	6/19/2014	7/10/2014	7/10/2014	6/18/2014	7/10/2014	6/18/2014	7/10/2014
Sample Depth:	Property	5-6 (ft bgs)	5-6 (ft bgs)	5.1-6.1 (ft bgs)	5.1-6.1 (ft bgs)	0.7-1.7 (ft bgs)	0.7-1.7 (ft bgs)	0.5-1.5 (ft bgs)	4.8-5.8 (ft bgs)	4.4-5.4 (ft bgs)	4-5 (ft bgs)
Sample Type:	Soil PRGs	Field Duplicate	Field Duplicate	Field Duplicate	Field Duplicate	Field Duplicate	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample
Parameter											
Pesticides (ug/kg)											
4,4'-DDD				5.1 U	5.4 U	42 UJ	41 UJ		4.0 UJ		
4,4'-DDE				9.2	4.6 J	23 J	22 J		4.0 UJ		
4,4'-DDT				0.88 J	0.78 J	49 J	60 J		4.0 UJ		
Aldrin				2.6 U	2.8 U	21 UJ	21 UJ		2.1 UJ		
alpha-BHC				2.6 U	2.8 U	21 UJ	21 UJ		2.1 UJ		
alpha-Chlordane				2.6 U	2.8 U	21 UJ	21 UJ		2.1 UJ		
beta-BHC				2.6 U	2.8 U	21 UJ	21 UJ		2.1 UJ		
delta-BHC				2.6 U	2.8 U	21 UJ	21 UJ		2.1 UJ		
Dieldrin				5.1 U	5.4 U	42 UJ	41 UJ		4.0 UJ		
Endosulfan II				5.1 U	5.4 U	42 UJ	41 UJ		4.0 UJ		
Endosulfan sulfate				5.1 U	5.4 U	42 UJ	41 UJ		4.0 UJ		
Endrin				5.1 U	5.4 U	42 UJ	14 J		0.29 J		
Endrin aldehyde				0.73 J	0.65 J	22 J	22 J		4.0 UJ		
Endrin ketone				5.1 U	5.4 U	42 UJ	41 UJ		4.0 UJ		
gamma-Chlordane				0.68 J	2.8 U	9.8 J	10 J		2.1 UJ		
Heptachlor				1.9 JEB	1.5 JEB	21 UJ	21 UJ		2.1 UJ		
Heptachlor epoxide				2.6 U	2.8 U	21 UJ	21 UJ		2.1 UJ		
Methoxychlor				1.2 J	0.74 J	210 UJ	210 UJ		21 UJ		
PCBs (ug/kg)											
Aroclor-1260				51 U	54 U	420 UJ	410 UJ		40 UJ		
Inorganics (mg/kg)											
Aluminum		6990	7230					8120 J		10800 J	9370
Antimony	31	0.60 J	1.4 J					0.97 J		0.19 UJ	1.6 J
Arsenic	6.8	2.5 J	2.7 J					4.0 J		2.2 J	2.9 J
Barium		52.6 J	63.5 J					50.8 J		33.5 J	34.3 J
Beryllium		0.67 U	0.78 U					0.63 U		0.60 U	0.58 U
Cadmium		0.13 U	0.16 U					0.23 J		0.18 J	0.12 U
Calcium		1690	1670					39000 J		884 J	1030
Chromium		34.2 J	63.9 J					544 J		58.9 J	988 J
Chromium, Hexavalent	3.0	0.62 UJ	0.13 J					0.53 UJ		1.46 J	107 J
Cobalt	23	158 J	152 J					6.9 J		3.7 J	5.4 J
Copper		10.6 J	16.2 J					25.9 J		6.1 J	22.9 J
Cyanide		0.067 UJ	0.078 U					0.71 EB		0.062 EB	0.058 U
Iron		6380	7540					11200 J		11500 J	17700
Lead	200	82.6 JEB	191 JEB					108 J		15.2 J	79.0 JEB
Magnesium		1260	1380					3120 J		1230 J	2630
Manganese		119 JEB	119 JEB					304 J		193 J	229 JEB
Mercury		0.072 J-	0.084 J-					0.064 J-		0.055 J-	0.090 J-
Nickel		6.7 JEB	7.2 JEB					19.3 J		6.2 J	10.9 JEB
Potassium		669 UJ	782 UJ					1060 J		602 UJ	640 JEB
Selenium		1.1 J	1.3 J					0.90 J		0.67 J	0.76 J
Silver		0.88	1.2					1.7 J		0.60 UJ	0.58 U
Sodium		669 U	782 U					285 J		623 J	578 U
Thallium	0.78	0.67 U	0.78 U					0.63 U		0.60 U	0.58 U
Vanadium		16.6 J	16.8 J					10.9 J		15.0 J	17.5 J
Zinc		27.4 J	32.4 J					74.8		29.8	30.8 J

TABLE C-2
COMPARISON OF RI WALTON AND LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		SO-101	SO-101	SO-101	SO-101	SO-102	SO-102	SO-102	SO-103	SO-103	SO-104
Sample ID:		WL-RS0-101-5.0-6.0	WL-RS0-101D-5.0-6.0	WL-SO-101-5.1-6.1	WL-SO-101D-5.1-6.1	WL-RS0-102-0.7-1.7	WL-RS0-102D-0.7-1.7	WL-SO-102-0.5-1.5	WL-RS0-103-4.8-5.8	WL-SO-103-4.4-5.4	WL-RS0-104-4.0-5.0
Sample Date:	W&L	7/10/2014	7/10/2014	6/19/2014	6/19/2014	7/10/2014	7/10/2014	6/18/2014	7/10/2014	6/18/2014	7/10/2014
Sample Depth:	Property	5-6 (ft bgs)	5-6 (ft bgs)	5.1-6.1 (ft bgs)	5.1-6.1 (ft bgs)	0.7-1.7 (ft bgs)	0.7-1.7 (ft bgs)	0.5-1.5 (ft bgs)	4.8-5.8 (ft bgs)	4.4-5.4 (ft bgs)	4-5 (ft bgs)
Sample Type:	Soil PRGs	Field Duplicate	Field Duplicate	Field Duplicate	Field Duplicate	Field Duplicate	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample
Parameter											
Other											
pH in Soil (S.U.)				6	6			12		6.8	

TABLE C-2
COMPARISON OF RI WALTON AND LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		SO-104	SO-105	SO-105	SO-106	SO-106	SO-107	SO-107	SO-107	SO-107	SO-108
Sample ID:		WL-SO-104-3.7-4.7	WL-SO-105-0.5-1.5	WL-SO-105-09-10	WL-RS0-106-0.5-1.5	WL-SO-106-0.5-1.5	WL-RS0-107-0.5-1.5	WL-RS0-107-5.2-6.2	WL-SO-107-0.5-1.5	WL-SO-107-05-06	WL-RS0-108-0.5-1.5
Sample Date:	W&L	6/19/2014	6/17/2014	6/17/2014	7/10/2014	6/18/2014	7/10/2014	7/10/2014	6/18/2014	6/18/2014	7/10/2014
Sample Depth:	Property	3.7-4.7 (ft bgs)	0.5-1.5 (ft bgs)	9-10 (ft bgs)	0.5-1.5 (ft bgs)	0.5-1.5 (ft bgs)	0.5-1.5 (ft bgs)	5.2-6.2 (ft bgs)	0.5-1.5 (ft bgs)	5-6 (ft bgs)	0.5-1.5 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter											
VOCs (ug/kg)											
1,1,1-Trichloroethane		5.2 U	5.4 U	5.2 U		5.7 U			5.2 U	5.5 U	
1,1-Dichloroethane		5.2 U	5.4 U	5.2 U		5.7 U			5.2 U	5.5 U	
2-Butanone		10 U	11 U	10 U		11 U			10 U	11 U	
2-Hexanone		10 U	11 U	10 U		11 U			10 U	11 U	
4-Methyl-2-pentanone		10 U	11 U	10 U		11 U			10 U	11 U	
Acetone		10 U	11 U	10 U		11 U			10 U	11 U	
Carbon disulfide		5.2 U	5.4 U	5.2 U		5.7 U			5.2 U	2.2 J	
Chloroethane		5.2 U	5.4 U	5.2 U		5.7 U			5.2 U	5.5 U	
Chloroform		5.2 U	5.4 U	5.2 U		5.7 U			5.2 U	5.5 U	
cis-1,2-Dichloroethene		5.2 U	5.4 U	5.2 U		5.7 U			5.2 U	5.5 U	
Ethylbenzene		5.2 U	5.4 U	5.2 U		5.7 U			5.2 U	5.5 U	
m,p-Xylene		5.2 U	5.4 U	5.2 U		5.7 U			5.2 U	5.5 U	
Methyl acetate		5.2 U	5.4 U	5.2 U		5.7 U			5.2 U	5.5 U	
Methylene chloride		5.2 U	5.4 U	5.2 U		5.7 U			5.2 U	5.5 U	
Naphthalene											
Tetrachloroethene		5.2 U	0.39 J	5.2 U		0.56 J			5.2 U	5.5 U	
Toluene		5.2 U	5.4 U	5.2 U		5.7 U			5.2 U	5.5 U	
Trichloroethene		5.2 U	5.4 U	5.2 U		4.9 J			5.2 U	0.38 J	
SVOCs (ug/kg)											
2-Methylnaphthalene		36 U	37 U	7.5 UJ	71 UJ		76 UJ	18 UJ			450 J
4-Methylphenol		560 U	380 U	380 UJ	5500 UJ		2000 UJ	920 UJ			3800 UJ
Acenaphthene		36 U	37 U	7.5 UJ	37 J		76 UJ	18 UJ			1800 J
Acenaphthylene		36 U	37 U	7.5 UJ	71 UJ		76 UJ	18 UJ			730 UJ
Anthracene		27 J	30 J	7.5 UJ	75 J		29 J	7.5 J			3400 J
Benzaldehyde		560 U	380 U	380 UJ	5500 UJ		2000 UJ	920 UJ			3800 UJ
Benzo(a)anthracene	11,000	97 J	130	7.5 UJ	350 J		160 J	30 J			3700 J
Benzo(a)pyrene	1,100	71	110	7.5 UJ	230 J		200 J	23 J			2700 J
Benzo(b)fluoranthene	11,000	110	170	7.5 UJ	330 J		400 J	35 J			3600 J
Benzo(g,h,i)perylene		43	69	7.5 UJ	170 J		220 J	17 J			1800 J
Benzo(k)fluoranthene		33 J	58	7.5 UJ	120 J		93 J	11 J			1300 J
Bis(2-ethylhexyl)phthalate		560 U	380 U	380 UJ	5500 UJ		2000 UJ	920 UJ			3800 UJ
Butylbenzylphthalate		560 U	380 U	380 UJ	5500 UJ		2000 UJ	920 UJ			3800 UJ
Caprolactam		560 U	380 U	380 UJ	5500 UJ		2000 UJ	920 UJ			3800 UJ
Carbazole		560 U	380 U	380 UJ	5500 UJ		2000 UJ	920 UJ			2100 J
Chrysene		88	130	7.5 UJ	310 J		260 J	27 J			2700 J
Dibenz(a,h)anthracene	1,100	36 U	37 U	7.5 UJ	39 J		49 J	18 UJ			380 J
Dibenzofuran		560 U	380 U	380 UJ	5500 UJ		2000 UJ	920 UJ			1500 J
Dimethylphthalate		560 U	380 U	380 UJ	5500 UJ		2000 UJ	920 UJ			3800 UJ
Di-n-butylphthalate		560 U	380 U	380 UJ	5500 UJ		2000 UJ	920 UJ			3800 UJ
Fluoranthene		210	270	7.5 UJ	670 J		260 J	50 J			13000 J
Fluorene		36 U	37 U	7.5 UJ	54 J		76 UJ	18 UJ			2200 J
Indeno(1,2,3-cd)pyrene		62	96	7.5 UJ	200 J		300 J	23 J			2200 J
Naphthalene		36 U	37 U	7.5 UJ	28 JEB		76 UJ	18 UJ			850 JEB
Pentachlorophenol		74 U	74 U	15 UJ	140 UJ		150 UJ	36 UJ			1500 UJ
Phenanthrene		110	160	7.5 UJ	500 J		130 J	30 J			15000 J
Phenol		560 U	380 U	380 UJ	5500 UJ		2000 UJ	920 UJ			3800 UJ
Pyrene		150	210	7.5 UJ	530 J		240 J	45 J			5800 J

TABLE C-2
COMPARISON OF RI WALTON AND LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		SO-104	SO-105	SO-105	SO-106	SO-106	SO-107	SO-107	SO-107	SO-107	SO-108
Sample ID:		WL-SO-104-3.7-4.7	WL-SO-105-0.5-1.5	WL-SO-105-09-10	WL-RS0-106-0.5-1.5	WL-SO-106-0.5-1.5	WL-RS0-107-0.5-1.5	WL-RS0-107-5.2-6.2	WL-SO-107-0.5-1.5	WL-SO-107-05-06	WL-RS0-108-0.5-1.5
Sample Date:	W&L	6/19/2014	6/17/2014	6/17/2014	7/10/2014	6/18/2014	7/10/2014	7/10/2014	6/18/2014	6/18/2014	7/10/2014
Sample Depth:	Property	3.7-4.7 (ft bgs)	0.5-1.5 (ft bgs)	9-10 (ft bgs)	0.5-1.5 (ft bgs)	0.5-1.5 (ft bgs)	0.5-1.5 (ft bgs)	5.2-6.2 (ft bgs)	0.5-1.5 (ft bgs)	5-6 (ft bgs)	0.5-1.5 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter											
Pesticides (ug/kg)											
4,4'-DDD		3.6 U	3.7 U	3.7 U	71 UJ		11 J	3.6 UJ			0.95 J
4,4'-DDE		2.0 J	0.66 J	3.7 U	71 J		2.7 J	1.3 J			1.2 J
4,4'-DDT		18	1.6 J	3.7 U	2400 J		40 J	2.5 J			8.1 J
Aldrin		1.9 U	1.9 U	1.9 U	6.9 J		1.9 UJ	1.9 UJ			1.9 UJ
alpha-BHC		1.9 U	1.9 U	0.094 J	38 J		1.9 UJ	1.9 UJ			0.53 J
alpha-Chlordane		1.9 U	1.9 U	1.9 U	37 UJ		1.9 UJ	1.9 UJ			1.9 UJ
beta-BHC		1.9 U	1.9 U	1.9 U	37 UJ		0.77 J	1.9 UJ			1.9 UJ
delta-BHC		1.9 U	1.9 U	1.9 U	37 UJ		1.9 UJ	1.9 UJ			1.9 UJ
Dieldrin		3.6 U	3.7 U	3.7 U	71 UJ		3.8 UJ	3.6 UJ			3.7 UJ
Endosulfan II		3.6 U	0.21 J	3.7 U	71 UJ		3.8 UJ	3.6 UJ			3.7 UJ
Endosulfan sulfate		3.6 U	3.7 U	3.7 U	71 UJ		3.8 UJ	3.6 UJ			3.7 UJ
Endrin		3.6 U	3.7 U	3.7 U	25 J		4.2 J	2.2 J			6.2 J
Endrin aldehyde		7.3 J	0.40 J	0.086 J	2700 J		27 J	1.4 J			2.3 J
Endrin ketone		3.6 U	0.011 J	3.7 U	71 UJ		3.8 UJ	3.6 UJ			3.7 UJ
gamma-Chlordane		1.0 J	0.17 J	1.9 U	110 J		1.8 J	1.9 UJ			1.9 UJ
Heptachlor		1.9 U	1.9 U	1.9 U	37 UJ		1.9 UJ	1.9 UJ			0.56 J
Heptachlor epoxide		1.9 U	1.9 U	1.9 U	37 UJ		1.9 UJ	1.9 UJ			1.9 UJ
Methoxychlor		19 U	1.1 J	19 U	370 UJ		6.1 J	19 UJ			19 UJ
PCBs (ug/kg)											
Aroclor-1260		36 U	37 U	37 U	360 UJ		38 UJ	36 UJ			37 UJ
Inorganics (mg/kg)											
Aluminum			7710	7120		7850 J			6740 J	6680 J	
Antimony	31		0.19 J-	2.7 J-		1.8 J			2.3 J	0.11 UJ	
Arsenic	6.8		2.0	2.9		2.5 J			2.2 J	3.0 J	
Barium			30.3	20.6		36.3 J			27.9 J	13.4 J	
Beryllium			0.56 U	0.55 U		0.56 U			0.55 U	0.55 U	
Cadmium			0.22 J	0.11 UJ		0.15 J			2.9 J	0.11 UJ	
Calcium			1010	953		1380 J			7990 J	975 J	
Chromium			134 J	1390 J		1990 J			472 J	2360 J	
Chromium, Hexavalent	3.0		6.88 J	254 J		82.8 J			6.94 J	34.0 J	
Cobalt	23		4.4 J	5.3 J		68.4 J			5.8 J	6.7 J	
Copper			14.4	16.7		55.9 J			77.9 J	30.4 J	
Cyanide			0.085 U	0.055 U		0.21 EB			0.66 EB	0.085 EB	
Iron			9850	14900		13500 J			13600 J	15800 J	
Lead	200		24.1	15.0		309 J			263 J	76.3 J	
Magnesium			1840 J	2580 J		1700 J			2290 J	3550 J	
Manganese			218	280		131 J			164 J	257 J	
Mercury			0.062	0.013 J		0.063 J-			0.042 J-	0.0080 J-	
Nickel			8.8	10.8		9.9 J			17.4 J	14.0 J	
Potassium			427 J-	605 J-		559 UJ			708 J	551 UJ	
Selenium			0.58 J	0.60 J		0.34 J			0.26 J	0.37 J	
Silver			0.56 U	0.55 U		5.1 J			1.2 J	0.55 UJ	
Sodium			68.2 J	52.0 J		48.9 J			85.8 J	39.4 J	
Thallium	0.78		0.56 U	0.55 U		0.56 U			0.55 U	0.55 U	
Vanadium			14.6	7.6		2.8 UJ			2.8 UJ	2.8 UJ	
Zinc			69.1	31.1		129			149	46.1	

TABLE C-2
COMPARISON OF RI WALTON AND LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		SO-104	SO-105	SO-105	SO-106	SO-106	SO-107	SO-107	SO-107	SO-107	SO-108
Sample ID:		WL-SO-104-3.7-4.7	WL-SO-105-0.5-1.5	WL-SO-105-09-10	WL-RS0-106-0.5-1.5	WL-SO-106-0.5-1.5	WL-RS0-107-0.5-1.5	WL-RS0-107-5.2-6.2	WL-SO-107-0.5-1.5	WL-SO-107-05-06	WL-RS0-108-0.5-1.5
Sample Date:	W&L	6/19/2014	6/17/2014	6/17/2014	7/10/2014	6/18/2014	7/10/2014	7/10/2014	6/18/2014	6/18/2014	7/10/2014
Sample Depth:	Property	3.7-4.7 (ft bgs)	0.5-1.5 (ft bgs)	9-10 (ft bgs)	0.5-1.5 (ft bgs)	0.5-1.5 (ft bgs)	0.5-1.5 (ft bgs)	5.2-6.2 (ft bgs)	0.5-1.5 (ft bgs)	5-6 (ft bgs)	0.5-1.5 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter											
Other											
pH in Soil (S.U.)		7.9	6.7	5		7.7			9.9	7.1	

TABLE C-2
COMPARISON OF RI WALTON AND LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		SO-108	SO-108	SO-108	SO-113	SO-147	SO-147	SO-147	SO-147	SO-148	SO-148
Sample ID:		WL-RS0-108-08-10	WL-SO-108-0.5-1.5	WL-SO-108-08-10	WL-SO-113-00-01	WL-RS0-147-0.5-1.5	WL-RS0-147-9.0-10.0	WL-SO-147-00-01	WL-SO-147-09-10	WL-RS0-148-0.5-1.5	WL-SO-148-0.5-1.5
Sample Date:	W&L	7/10/2014	6/18/2014	6/18/2014	6/17/2014	7/10/2014	7/10/2014	6/19/2014	6/19/2014	7/10/2014	6/19/2014
Sample Depth:	Property	8-10 (ft bgs)	0.5-1.5 (ft bgs)	8-10 (ft bgs)	0-1 (ft bgs)	0.5-1.5 (ft bgs)	9-10 (ft bgs)	0-1 (ft bgs)	9-10 (ft bgs)	0.5-1.5 (ft bgs)	0.5-1.5 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter											
VOCs (ug/kg)											
1,1,1-Trichloroethane			330 U	5.5 U	7.0 U			5.7 U	5.0 U		24 J
1,1-Dichloroethane			330 U	5.5 U	7.0 U			5.7 U	5.0 U		320 U
2-Butanone			660 U	11 U	14 U			11 U	10 U		640 U
2-Hexanone			660 U	11 U	14 U			11 U	10 U		640 U
4-Methyl-2-pentanone			660 U	11 U	14 U			11 U	10 U		640 U
Acetone			110 J	11 U	14 U			11 U	10 U		120 J
Carbon disulfide			330 U	5.5 U	7.0 U			5.7 U	5.0 U		320 U
Chloroethane			330 U	5.5 U	7.0 U			5.7 U	5.0 U		320 U
Chloroform			330 U	5.5 U	7.0 U			5.7 U	5.0 U		320 U
cis-1,2-Dichloroethene			330 U	1.2 J	7.0 U			5.7 U	5.0 U		320 U
Ethylbenzene			330 U	5.5 U	7.0 U			5.7 U	5.0 U		320 U
m,p-Xylene			330 U	5.5 U	7.0 U			5.7 U	5.0 U		320 U
Methyl acetate			330 U	5.5 U	7.0 U			5.7 U	5.0 U		250 J
Methylene chloride			330 U	5.5 U	7.0 U			5.7 U	5.0 U		320 U
Naphthalene											
Tetrachloroethene			330 U	5.5 U	7.0 U			5.7 U	5.0 U		320 U
Toluene			2800	5.5 U	7.0 U			5.7 U	5.0 U		650
Trichloroethene			37 J	0.97 J	7.0 U			5.7 U	5.0 U		18 J
SVOCs (ug/kg)											
2-Methylnaphthalene		3.8 UJ			21 U			370 U	7.3 U		110 U
4-Methylphenol		390 UJ			1100 U			3800 U	370 U		990 U
Acenaphthene		3.8 UJ			21 U			370 U	7.3 U		140
Acenaphthylene		3.8 UJ			21 U			370 U	7.3 U		110 U
Anthracene		3.8 UJ			21 U			370 J	7.3 U		160
Benzaldehyde		390 UJ			1100 U			3800 U	370 U		990 U
Benzo(a)anthracene	11,000	3.8 UJ			12 J			1200 J	7.3 UJ		390 J
Benzo(a)pyrene	1,100	3.8 UJ			13 J			910	7.3 U		280
Benzo(b)fluoranthene	11,000	3.8 UJ			21			1400	7.3 U		420
Benzo(g,h,i)perylene		3.8 UJ			8.8 J			580	7.3 U		160
Benzo(k)fluoranthene		3.8 UJ			21 U			430	7.3 U		140
Bis(2-ethylhexyl)phthalate		390 UJ			1100 U			3800 U	370 U		990 U
Butylbenzylphthalate		390 UJ			1100 U			3800 U	370 U		990 U
Caprolactam		390 UJ			1100 U			3800 U	370 U		990 U
Carbazole		390 UJ			1100 U			300 J	370 U		91 J
Chrysene		3.8 UJ			17 J			1000	7.3 U		330
Dibenz(a,h)anthracene	1,100	3.8 UJ			21 U			370 U	7.3 U		110 U
Dibenzofuran		390 UJ			1100 U			3800 U	370 U		990 U
Dimethylphthalate		390 UJ			1100 U			3800 U	370 U		990 U
Di-n-butylphthalate		390 UJ			1100 U			3800 U	370 U		990 U
Fluoranthene		3.8 UJ			35			2700	4.7 J		810
Fluorene		3.8 UJ			21 U			170 J	7.3 U		77 J
Indeno(1,2,3-cd)pyrene		3.8 UJ			13 J			780	7.3 U		240
Naphthalene		3.8 UJ			21 U			370 U	7.3 U		110 U
Pentachlorophenol		7.7 UJ			42 U			750 U	15 U		230 U
Phenanthrene		3.8 UJ			15 J			1900	4.5 J		720
Phenol		390 UJ			1100 U			3800 U	370 U		990 U
Pyrene		3.8 UJ			28			1800	7.3 U		610

TABLE C-2
COMPARISON OF RI WALTON AND LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		SO-108	SO-108	SO-108	SO-113	SO-147	SO-147	SO-147	SO-147	SO-148	SO-148
Sample ID:		WL-RS0-108-08-10	WL-SO-108-0.5-1.5	WL-SO-108-08-10	WL-SO-113-00-01	WL-RS0-147-0.5-1.5	WL-RS0-147-9.0-10.0	WL-SO-147-00-01	WL-SO-147-09-10	WL-RS0-148-0.5-1.5	WL-SO-148-0.5-1.5
Sample Date:	W&L	7/10/2014	6/18/2014	6/18/2014	6/17/2014	7/10/2014	7/10/2014	6/19/2014	6/19/2014	7/10/2014	6/19/2014
Sample Depth:	Property	8-10 (ft bgs)	0.5-1.5 (ft bgs)	8-10 (ft bgs)	0-1 (ft bgs)	0.5-1.5 (ft bgs)	9-10 (ft bgs)	0-1 (ft bgs)	9-10 (ft bgs)	0.5-1.5 (ft bgs)	0.5-1.5 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter											
Pesticides (ug/kg)											
4,4'-DDD		3.8 UJ			4.2 U			3.7 U	3.6 U		3.8 U
4,4'-DDE		3.8 UJ			0.84 J			15	3.6 U		3.8 U
4,4'-DDT		3.8 UJ			4.4			27 J	3.6 U		1.5 J
Aldrin		1.9 UJ			2.2 U			1.9 U	1.9 U		2.0 U
alpha-BHC		1.9 UJ			2.2 U			1.9 U	1.9 U		2.0 U
alpha-Chlordane		1.9 UJ			2.2 U			1.9 U	1.9 U		2.0 U
beta-BHC		1.9 UJ			2.2 U			1.9 U	1.9 U		2.0 U
delta-BHC		1.9 UJ			0.34 JEB			1.9 U	1.9 U		2.0 U
Dieldrin		3.8 UJ			0.57 J			3.7 U	3.6 U		3.8 U
Endosulfan II		3.8 UJ			0.13 J			3.7 U	3.6 U		3.8 U
Endosulfan sulfate		3.8 UJ			4.2 U			3.7 U	3.6 U		3.8 U
Endrin		3.8 UJ			4.2 U			3.7 U	3.6 U		3.8 U
Endrin aldehyde		3.8 UJ			4.2 U			4.2 J	3.6 U		3.8 U
Endrin ketone		3.8 UJ			4.2 U			3.7 U	3.6 U		3.8 U
gamma-Chlordane		1.9 UJ			0.12 J			1.6 J	1.9 U		2.0 U
Heptachlor		1.9 UJ			2.2 U			1.9 U	1.9 U		2.0 U
Heptachlor epoxide		1.9 UJ			0.10 J			1.9 U	1.9 U		2.0 U
Methoxychlor		19 UJ			2.7 J			19 U	19 U		20 U
PCBs (ug/kg)											
Aroclor-1260		38 UJ			42 U			37 U	36 U		38 U
Inorganics (mg/kg)											
Aluminum			8230 J	4630 J	6880	9780	6640			7350	
Antimony	31		2.8 J	0.18 UJ	0.12 J-	0.70 J	0.23 UJ			0.39 J	
Arsenic	6.8		2.3 J	0.74 J	1.9	3.7 J	4.0 J			9.4 J	
Barium			73.0 J	16.6 J	25.4	33.6 J	30.3 J			24.4 J	
Beryllium			0.55 U	0.59 U	0.62 U	0.57 U	0.55 U			0.55 U	
Cadmium			0.51 J	0.12 UJ	0.12 UJ	0.19	0.11 U			0.11 U	
Calcium			3470 J	1170 J	696	1710	1210			1880	
Chromium			2170 J	206 J	30.3 J	454 J	1450 J			234 J	
Chromium, Hexavalent	3.0		79.8 J	9.22 J	0.25 J	32.3 J	37.0 J			52.0 J	
Cobalt	23		25.9 J	9.4 J	3.1 J	5.7 J	5.6 J			4.5 J	
Copper			130 J	14.6 J	5.6 J	30.8 J	18.0 J			17.0 J	
Cyanide			0.55 EB	0.53 EB	0.062 U	0.12 EB	0.055 UJ			0.055 U	
Iron			13900 J	6650 J	11300	13000	20100			14600	
Lead	200		1310 J	20.9 J	16.4	89.6 JEB	6.4 JEB			76.5 JEB	
Magnesium			2410 J	2010 J	635 J	1890	2450			2170	
Manganese			170 J	130 J	121	202 JEB	643 JEB			268 JEB	
Mercury			0.068 J-	0.015 J-	0.028 J	0.059 J-	0.055 UJ			0.10 J-	
Nickel			10.5 J	10.0 J	4.3	8.5 JEB	7.4 JEB			8.7 JEB	
Potassium			578 J	597 J	363 J-	570 JEB	632 JEB			549 UJ	
Selenium			0.31 J	0.23 J	0.85 J	0.84 J	0.50 J			0.67 J	
Silver			1.6 J	0.59 UJ	0.62 U	0.57 U	0.55 U			0.55 U	
Sodium			90.9 J	51.6 J	80.4 J	568 U	549 U			549 U	
Thallium	0.78		0.55 U	0.59 U	0.62 U	0.57 U	0.55 U			0.55 U	
Vanadium			2.7 UJ	3.5 J	20.5	12.2 J	5.8 J			12.6 J	
Zinc			97.0	39.3	31.0	55.5 J	37.6 J			63.8 J	

TABLE C-2
COMPARISON OF RI WALTON AND LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		SO-108	SO-108	SO-108	SO-113	SO-147	SO-147	SO-147	SO-147	SO-148	SO-148
Sample ID:		WL-RS0-108-08-10	WL-SO-108-0.5-1.5	WL-SO-108-08-10	WL-SO-113-00-01	WL-RS0-147-0.5-1.5	WL-RS0-147-9.0-10.0	WL-SO-147-00-01	WL-SO-147-09-10	WL-RS0-148-0.5-1.5	WL-SO-148-0.5-1.5
Sample Date:	W&L	7/10/2014	6/18/2014	6/18/2014	6/17/2014	7/10/2014	7/10/2014	6/19/2014	6/19/2014	7/10/2014	6/19/2014
Sample Depth:	Property	8-10 (ft bgs)	0.5-1.5 (ft bgs)	8-10 (ft bgs)	0-1 (ft bgs)	0.5-1.5 (ft bgs)	9-10 (ft bgs)	0-1 (ft bgs)	9-10 (ft bgs)	0.5-1.5 (ft bgs)	0.5-1.5 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter											
Other											
pH in Soil (S.U.)			8.9	7.3	5.2			7	5.6		7.1

TABLE C-2
COMPARISON OF RI WALTON AND LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		SO-149	SO-149	SO-150	SO-150
Sample ID:		WL-RS0-149-4.8-5.8	WL-SO-149-05-06	WL-RS0-150-5.9-6.9	WL-SO-150-5.4-6.4
Sample Date:	W&L	7/10/2014	6/19/2014	7/10/2014	6/19/2014
Sample Depth:	Property	4.8-5.8 (ft bgs)	5-6 (ft bgs)	5.9-6.9 (ft bgs)	5.4-6.4 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample
Parameter					
VOCs (ug/kg)					
1,1,1-Trichloroethane			5.5 U		8.6 U
1,1-Dichloroethane			5.5 U		8.6 U
2-Butanone			6.7 J		50
2-Hexanone			11 U		17 U
4-Methyl-2-pentanone			11 U		17 U
Acetone			27		130
Carbon disulfide			1.1 J		4.3 J
Chloroethane			5.5 U		8.6 U
Chloroform			5.5 U		8.6 U
cis-1,2-Dichloroethene			5.5 U		0.68 J
Ethylbenzene			5.5 U		8.6 U
m,p-Xylene			5.5 U		8.6 U
Methyl acetate			5.5 U		8.6 U
Methylene chloride			5.5 U		8.6 U
Naphthalene					
Tetrachloroethene			5.5 U		8.6 U
Toluene			5.5 U		8.6 U
Trichloroethene			5.5 U		8.6 U
SVOCs (ug/kg)					
2-Methylnaphthalene			3.8 U		110 U
4-Methylphenol			390 U		2900 U
Acenaphthene			3.8 U		110 U
Acenaphthylene			3.8 U		110 U
Anthracene			3.8 U		54 J
Benzaldehyde			390 U		2900 U
Benzo(a)anthracene	11,000		3.8 UJ		220 J
Benzo(a)pyrene	1,100		3.8 U		220
Benzo(b)fluoranthene	11,000		1.9 J		290
Benzo(g,h,i)perylene			3.8 U		140
Benzo(k)fluoranthene			3.8 U		93 J
Bis(2-ethylhexyl)phthalate			390 U		2900 U
Butylbenzylphthalate			390 U		2900 U
Caprolactam			390 U		2900 U
Carbazole			390 U		2900 U
Chrysene			3.8 U		210
Dibenz(a,h)anthracene	1,100		3.8 U		110 U
Dibenzofuran			390 U		2900 U
Dimethylphthalate			390 U		2900 U
Di-n-butylphthalate			390 U		2900 U
Fluoranthene			2.7 J		510
Fluorene			3.8 U		110 U
Indeno(1,2,3-cd)pyrene			3.8 U		180
Naphthalene			3.8 U		110 U
Pentachlorophenol			7.6 U		230 U
Phenanthrene			2.3 J		180
Phenol			390 U		2900 U
Pyrene			2.2 J		370

TABLE C-2
COMPARISON OF RI WALTON AND LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		SO-149	SO-149	SO-150	SO-150
Sample ID:		WL-RS0-149-4.8-5.8	WL-SO-149-05-06	WL-RS0-150-5.9-6.9	WL-SO-150-5.4-6.4
Sample Date:	W&L	7/10/2014	6/19/2014	7/10/2014	6/19/2014
Sample Depth:	Property	4.8-5.8 (ft bgs)	5-6 (ft bgs)	5.9-6.9 (ft bgs)	5.4-6.4 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample
Parameter					
Pesticides (ug/kg)					
4,4'-DDD			3.8 U		5.8 U
4,4'-DDE			3.8 U		5.8 U
4,4'-DDT			3.8 U		0.98 J
Aldrin			2.0 U		3.0 U
alpha-BHC			2.0 U		3.0 U
alpha-Chlordane			2.0 U		3.0 U
beta-BHC			2.0 U		3.0 U
delta-BHC			2.0 U		3.0 U
Dieldrin			3.8 U		5.8 U
Endosulfan II			3.8 U		5.8 U
Endosulfan sulfate			3.8 U		5.8 U
Endrin			3.8 U		5.8 U
Endrin aldehyde			3.8 U		5.8 U
Endrin ketone			3.8 U		5.8 U
gamma-Chlordane			2.0 U		3.0 U
Heptachlor			2.0 U		1.0 JEB
Heptachlor epoxide			2.0 U		3.0 U
Methoxychlor			20 U		30 U
PCBs (ug/kg)					
Aroclor-1260			38 U		58 U
Inorganics (mg/kg)					
Aluminum		5310		3690	
Antimony	31	2.8 J		0.12 UJ	
Arsenic	6.8	1.7 J		0.82 J	
Barium		37.1 J		16.1 J	
Beryllium		0.55 U		0.58 U	
Cadmium		0.11 U		0.12 U	
Calcium		1190		1160	
Chromium		55.8 J		86.1 J	
Chromium, Hexavalent	3.0	22.3 J		39.7 J	
Cobalt	23	236 J		33.1 J	
Copper		12.9 J		3.7 J	
Cyanide		0.055 UJ		0.058 UJ	
Iron		7990		4470	
Lead	200	614 JEB		8.9 JEB	
Magnesium		1490		1160	
Manganese		177 JEB		114 JEB	
Mercury		0.022 J-		0.013 J-	
Nickel		8.9 JEB		5.2 JEB	
Potassium		568 JEB		583 UJ	
Selenium		0.56 J		0.66 J	
Silver		0.62		0.58 U	
Sodium		549 U		583 U	
Thallium	0.78	0.55 U		0.58 U	
Vanadium		15.4 J		7.3 J	
Zinc		28.9 J		21.1 J	

TABLE C-2
COMPARISON OF RI WALTON AND LONSBURY PROPERTY SOIL ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		SO-149	SO-149	SO-150	SO-150
Sample ID:		WL-RS0-149-4.8-5.8	WL-SO-149-05-06	WL-RS0-150-5.9-6.9	WL-SO-150-5.4-6.4
Sample Date:	W&L	7/10/2014	6/19/2014	7/10/2014	6/19/2014
Sample Depth:	Property	4.8-5.8 (ft bgs)	5-6 (ft bgs)	5.9-6.9 (ft bgs)	5.4-6.4 (ft bgs)
Sample Type:	Soil PRGs	Field Sample	Field Sample	Field Sample	Field Sample
Parameter					
Other					
pH in Soil (S.U.)			6.8		6.7

TABLE C-3

COMPARISON OF TOTAL LEAD IN SOIL, FINE FRACTION (<150 µm) TO THE SOIL PRG FOR RESIDENTIAL YARDS WEST OF NORTH AVENUE

WALTON & LONSBURY SUPERFUND SITE

Exposure Point/Sample Location	Field Duplicates	Soil Sample Type	Results for Fine Fraction (< 150 µm) Samples	
			Total Lead, dry weight (mg/Kg)	
			Result	Lab Qualifier
48 North Avenue				
48NO-01		residential flood plain	372	
48NO-02		residential flood plain	280	
48NO-03		residential flood plain	781	
48NO-04		residential flood plain	163	
48NO-05		residential flood plain	241	
Mass Electric Parcel				
ME-01		residential flood plain	490	
ME-02		residential flood plain	790	
42 North Avenue				
42NO-01		residential flood plain	369	
42NO-02	FD	residential flood plain	397	
42NO-02	FD	residential flood plain	411	
42NO-03		residential flood plain	409	
42NO-04		residential flood plain	511	
SO-611		residential flood plain	474	
SO-612		residential flood plain	478	
34 North Avenue				
34NO-01		residential flood plain	471	
34NO-02	FD	residential flood plain	109	
34NO-02	FD	residential flood plain	90.8	
34NO-03		residential flood plain	472	
34NO-04		residential flood plain	303	
SO-617		residential flood plain	705	
10 Deanville Road				
10DE-01		residential flood plain	89.1	
10DE-02		residential flood plain	172	
10DE-03		residential flood plain	272	
10DE-04		residential flood plain	308	
10DE-05		residential flood plain	142	
10DE-06		residential flood plain	136	
10DE-07		residential flood plain	89.8	
10DE-08		residential flood plain	172	
10DE-09		residential flood plain	220	
10DE-10		residential flood plain	1240	
10DE-11		residential flood plain	198	
10DE-12		residential flood plain	131	
SO-622	FD	residential flood plain	199	
SO-622	FD	residential flood plain	203	
SO-623		residential flood plain	263	
28 North Avenue				
28NO-01		residential flood plain	1170	
28NO-02		residential flood plain	127	
28NO-03		residential flood plain	162	
28NO-04		residential flood plain	68.5	
28NO-05		residential flood plain	124	
28NO-06		residential flood plain	360	

TABLE C-3

COMPARISON OF TOTAL LEAD IN SOIL, FINE FRACTION (<150 µm) TO THE SOIL PRG FOR RESIDENTIAL YARDS WEST OF NORTH AVENUE

WALTON & LONSBURY SUPERFUND SITE

Exposure Point/Sample Location		Soil Sample Type	Results for Fine Fraction (< 150 µm) Samples	
			Total Lead, dry weight (mg/Kg)	
	Field Duplicates		Result	Lab Qualifier
28NO-07		residential flood plain	126	
28NO-08		residential flood plain	228	
28NO-09		residential flood plain	358	
SO-624		residential flood plain	149	

mg/Kg = milligram per kilogram

FD = Field duplicate collected at this location.

Sample result exceeds residential human health PRG of 200 mg/Kg.

TABLE C-4
COMPARISON OF RI WALTON AND LONSBURY PROPERTY SHALLOW GROUNDWATER ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		AE-01S	AE-01S	DEP-5S	DEP-5S	DEP-5S	MW-10S	MW-10S	MW-12S	MW-12S
Sample ID:	W&L Property	WL-GW-AE-01S-1	WL-GW-AE-01S-2	WL-GW-DEP-5S-1	WL-GW-DEP-5S-2	WL-GW-DEP-5S-3	WL-GW-MW-10S-1	WL-GW-MW-10S-2	WL-GW-MW-12S-1	WL-GW-MW-12S-2
Sample Date:	Construction Worker	8/19/2014	12/16/2014	8/20/2014	12/17/2014	9/15/2015	8/20/2014	12/16/2014	8/19/2014	12/15/2014
Sample Type:	Shallow	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate
Parameter	Groundwater PRG									
VOCs (ug/L)										
1,1,1-Trichloroethane		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.22 J	1500	640
1,1,2-Trichloroethane		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	10 U	0.50 U
1,1-Dichloroethane		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.22 J	0.50 U	390	250
1,1-Dichloroethene		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	140	39 J
1,2-Dibromo-3-chloropropane		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	10 U	0.50 U
1,2-Dichloroethane		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	10 U	0.50 U
2-Butanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	100 U	5.0 U
Acetone		5.0 U	11	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	100 U	5.0 U
Benzene		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	10 U	0.50 U
Bromodichloromethane		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	10 U	0.50 U
Bromoform		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	10 U	0.50 U
Carbon disulfide		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	10 U	0.50 U
Chloroethane		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	240	62
Chloroform		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	10 U	0.50 U
cis-1,2-Dichloroethene		0.78	0.19 J	0.50 U	0.50 U	0.50 U	4.6	1.2	190 J	110
Cyclohexane		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	10 U	0.50 U
Ethylbenzene		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	10 U	0.50 U
Isopropylbenzene		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	10 U	0.50 U
m,p-Xylene		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	10 U	0.50 U
Methyl tert-butyl ether		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	10 U	0.50 U
Methylcyclohexane		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	10 U	0.50 U
Methylene chloride		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	10 U	0.50 U
o-Xylene		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	10 U	0.50 U
Tetrachloroethene		0.26 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.23 J	12	5.9
Toluene		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	10 U	0.50 U
trans-1,2-Dichloroethene		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	7.0 J	3.9
Trichloroethene		1.3 J	0.84	0.15 U	0.50 U	0.50 U	1.1 J	8.1	7.4 J	5.9
Vinyl chloride		0.12	0.50 U	0.015 U	0.50 U	0.50 U	0.32	0.50 U	33 J	24 J
1,4-Dioxane (ug/L)										
1,4-Dioxane		0.11 J		0.10 U		0.10 U	0.059 J		1.0	
Inorganics (ug/L)										
Aluminum		1080	765	8630 J	2130	2570 J	74.1 J	28.9	45.5	98.3
Antimony		4.0 U	2.0 U	1.4 J	2.0 U	2.7	1.1 J	2.1 U	0.72 J	2.0 U
Arsenic		0.31 J-	0.12 J	3.6	1.1	1.5	1.0 U	0.52 J	4.3 J-	2.4
Barium		46.6	27.0	51.3 J	22.3	33.8	77.8	61.7	219	118
Beryllium		0.48 J	0.41 J	1.0 U	1.0 U	0.21 J	1.0 U	1.0 UJ	1.0 U	1.0 UJ
Cadmium		0.44	0.40 UJ	0.29 J	0.40 U	0.16 J	0.30 J	0.70	0.82	0.46
Calcium		12900	11800	4570 J-	3810	5050	33600	28700	36800	39100
Chromium		22900	34600	107 J	27.1	29.8	66.7 J	19.8	59.4	50.5
Chromium, Hexavalent	98	23000	36800	0.60	6.75 J+	0.50 U	1.20	2.70 J+	0.50 U	0.80 J+
Cobalt		5.0	4.7	119	119 J	125 J	6.4	7.4	24.6	6.2
Copper		207	230	46.3	16.9	23.0	7.0	27.8	4.1	4.7 J-
Cyanide		3.4 J+	1.4 J	4.0 J+	1.4 J	10.0 U	6.1 J+	3.8	3.6 J+	2.4 J
Iron		5980	9210	5010	1670	2330	1750	249	1850	613
Lead		1.4	0.22 U	108 J	26.1	33.7	2.3 J	2.5	0.47	0.50
Magnesium		2080	1840	1290	500 U	715 J	4010	3720	3560	3790
Manganese		413	721	130	44.1	84.8 J	372	225	817	488

TABLE C-4
COMPARISON OF RI WALTON AND LONSBURY PROPERTY SHALLOW GROUNDWATER ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		AE-01S	AE-01S	DEP-5S	DEP-5S	DEP-5S	MW-10S	MW-10S	MW-12S	MW-12S
Sample ID:	W&L Property	WL-GW-AE-01S-1	WL-GW-AE-01S-2	WL-GW-DEP-5S-1	WL-GW-DEP-5S-2	WL-GW-DEP-5S-3	WL-GW-MW-10S-1	WL-GW-MW-10S-2	WL-GW-MW-12S-1	WL-GW-MW-12S-2
Sample Date:	Construction Worker	8/19/2014	12/16/2014	8/20/2014	12/17/2014	9/15/2015	8/20/2014	12/16/2014	8/19/2014	12/15/2014
Sample Type:	Shallow	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate
Parameter	Groundwater PRG									
Mercury		0.20 U	0.20 UJ	0.16 J-	0.20 UJ	0.20 U	0.20 UJ	0.20 UJ	0.20 U	0.20 UJ
Nickel		13.4	14.2	6.4 J	3.2 J	4.0 J	5.6 J	2.7	2.6	1.6
Potassium		1480	877	1320	696	1240 J	11200	9230	7840	8250
Selenium		5.0 U	5.0 U	1.0 J	0.42 J	0.85 J	0.47 J	5.0 U	0.41 J	5.0 U
Silver		2.0 U	0.016 J	1.0 UJ	1.0 U	0.19 J	1.0 U	0.020 J	1.0 U	1.0 UJ
Sodium		43400	33800	25100	15600	27100	14900	9390	167000	77200
Vanadium		5.0 U	5.0 U	8.7	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Zinc		178	178	31.2 J	15.8 J	20.4	10.4 J	96.6	21.3 J+	9.1
Other										
Dissolved oxygen, field (mg/L)		0.30	2.07	0.37	5.54	2.50	0.10	0.36	0.00	0.47
ORP, field (mV)		261.0	102.0	183	240.5	157.6	-12.3	113.8	84.9	124.1
pH, field (S.U.)		4.61	4.53	5.83	5.81	5.53	6.07	6.22	5.59	5.41
Spec. cond., field (umho/cm)		372	192	162	100	231	339.3	250	1103	516
Temperature, field (deg C)		19.0	10.61	21.0	10.66	24.53	20.4	7.91	18.5	8.72
Turbidity, field (N.T.U.)		13.1	4.52	93	49.8	95.3	2.96	1.86	2.34	4.06

TABLE C-4
COMPARISON OF RI WALTON AND LONSBURY PROPERTY SHALLOW GROUNDWATER ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		MW-12S	MW-7	MW-7	MW-9S	MW-9S
Sample ID:	W&L Property	WL-GW-MW-12SD-2	WL-GW-MW-7-1	WL-GW-MW-7-2	WL-GW-MW-9S-1	WL-GW-MW-9S-2
Sample Date:	Construction Worker	12/15/2014	8/18/2014	12/16/2014	8/20/2014	12/17/2014
Sample Type:	Shallow	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	Groundwater PRG					
VOCs (ug/L)						
1,1,1-Trichloroethane		650	0.22 J	0.50 U	0.50 U	0.50 U
1,1,2-Trichloroethane		0.50 U	0.50 U	0.50 U	0.50 U	0.52
1,1-Dichloroethane		260	0.50 U	0.50 U	0.50 U	0.23 J
1,1-Dichloroethene		34 J	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dibromo-3-chloropropane		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichloroethane		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
2-Butanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Acetone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzene		0.50 U	0.50 U	0.50 U	0.18 J	0.43 J
Bromodichloromethane		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Bromoform		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Carbon disulfide		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chloroethane		68	0.50 U	0.50 U	0.50 U	0.50 U
Chloroform		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
cis-1,2-Dichloroethene		110	0.50 U	0.50 U	0.16 J	0.21 J
Cyclohexane		0.50 U	0.50 U	0.50 U	0.54	0.41 J
Ethylbenzene		0.50 U	0.50 U	0.50 U	0.27 J	0.30 J
Isopropylbenzene		0.50 U	0.50 U	0.50 U	1.1	0.89
m,p-Xylene		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Methyl tert-butyl ether		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Methylcyclohexane		0.50 U	0.50 U	0.50 U	1.1	0.49 J
Methylene chloride		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
o-Xylene		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Tetrachloroethene		5.1	0.50 U	0.50 U	0.50 U	0.50 U
Toluene		0.50 U	0.50 U	0.50 U	0.59	0.50 U
trans-1,2-Dichloroethene		3.5	0.50 U	0.50 U	0.50 U	0.11 J
Trichloroethene		5.3	0.20 J	0.50 U	0.069 J	0.21 J
Vinyl chloride		30	0.015 U	0.50 U	2.5	1.0
1,4-Dioxane (ug/L)						
1,4-Dioxane			0.31		0.077 J	
Inorganics (ug/L)						
Aluminum		88.7	248	230	20.0 UJ	109
Antimony		2.0 U	0.60 J	2.0 U	2.0 U	2.8 U
Arsenic		2.3	0.21 J-	0.19 J	6.0	1.8
Barium		119	10.0 U	10.0 U	179	120
Beryllium		1.0 U	0.12 J	1.0 U	1.0 U	1.0 U
Cadmium		0.45	0.14	0.40 U	0.040 UJ	0.74
Calcium		39000	7450	8800	22900	33900
Chromium		49.1	14200	11800	13.9 J	35.0
Chromium, Hexavalent	98	0.90 J+	13700	11300	0.50 U	0.50 U
Cobalt		6.3 J	1.0 U	1.1 J	29.5	635 J
Copper		6.6	73.3	39.7	2.0 U	21.8
Cyanide		2.5 U	2.9 J+	1.8 J	3.8 J+	12.0
Iron		572	3140	2980	25800	4880
Lead		0.40	0.20 U	0.20 U	0.31 J	6.1
Magnesium		3600	1040	1240	3250	3870
Manganese		481	157	191	955	442

TABLE C-4
COMPARISON OF RI WALTON AND LONSBURY PROPERTY SHALLOW GROUNDWATER ANALYTICAL RESULTS (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:		MW-12S	MW-7	MW-7	MW-9S	MW-9S
Sample ID:	W&L Property	WL-GW-MW-12SD-2	WL-GW-MW-7-1	WL-GW-MW-7-2	WL-GW-MW-9S-1	WL-GW-MW-9S-2
Sample Date:	Construction Worker	12/15/2014	8/18/2014	12/16/2014	8/20/2014	12/17/2014
Sample Type:	Shallow	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	Groundwater PRG					
Mercury		0.20 UJ	0.20 U	0.20 UJ	0.20 UJ	0.20 UJ
Nickel		1.6 J	2.7	2.9 J	1.4 J	20.1 J
Potassium		8220	6350	4890	13800	18400
Selenium		5.0 U	5.0 U	5.0 U	5.0 U	0.36 J
Silver		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Sodium		73100	12800	11200	42300	44300
Vanadium		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Zinc		8.8 UJ	23.8 J+	37.7 J	2.0 UJ	82.2 J
Other						
Dissolved oxygen, field (mg/L)			0.71	4.07	2.02	1.33
ORP, field (mV)			362.4	410.1	-74.1	50.1
pH, field (S.U.)			3.60	4.27	6.46	6.34
Spec. cond., field (umho/cm)			211.8	178	505	554
Temperature, field (deg C)			18.9	9.63	21.0	9.84
Turbidity, field (N.T.U.)			1.40	3.69	1.69	6.48

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			AE-01B						AE-01D		
Sample ID:	Residential	Residential	WL-GW-AE-01B-1	WL-GW-AE-01BD-1	WL-GW-AE-01B-2	WL-GWF-AE-01B-1	WL-GWF-AE-01BD-1	WL-GWF-AE-01B-2	WL-GW-AE-01D-1	WL-GW-AE-01D-2	WL-GWF-AE-01D-1
Sample Date:	Groundwater	Groundwater	8/18/2014	8/18/2014	12/16/2014	8/18/2014	8/18/2014	12/16/2014	8/19/2014	12/16/2014	8/19/2014
Sample Type:	Drinking Water	Irrigation Well	Field Duplicate	Field Duplicate	Field Sample	Field Duplicate	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200		0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	
1,1,2-Trichloroethane			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	
1,1-Dichloroethane	2.8		0.5 U	0.19 J	0.19 J				0.5 U	0.13 J	
1,1-Dichloroethene			0.25 J	0.3 J	0.5 U				0.25 J	0.5 U	
1,2-Dibromo-3-chloropropane			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	
1,2-Dichloroethane			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	
2-Butanone			5 U	5 U	5 U				5 U	5 U	
Acetone			5 U	5 U	5 U				5 U	5 U	
Benzene			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	
Bromodichloromethane			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	
Bromoform			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	
Carbon disulfide			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	
Chloroethane			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	
Chloroform			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	
cis-1,2-Dichloroethene	70		2.5 J	3.5 J	3				3.5	3.6	
Cyclohexane			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	
Ethylbenzene			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	
Isopropylbenzene			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	
m,p-Xylene			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	
Methyl tert-butyl ether			0.2 J	0.32 J	0.37 J				0.5 U	0.12 J	
Methylcyclohexane			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	
Methylene chloride			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	
o-Xylene			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	
Tetrachloroethene			0.68	0.92	0.78				1.2	1.1	
Toluene			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	
trans-1,2-Dichloroethene			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	
Trichloroethene	5	98	4.7	6	6.2				6.3	6.9	
Vinyl chloride	2	7	0.75	0.93	0.44 J				0.75	0.49 J	
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46		0.1	0.097 J					0.044 J		
Inorganics, Dissolved (ug/L)											
Aluminum						20 U	20 U	20 U			20 U
Antimony						2 U	2 U	2 U			2 U
Arsenic	10					2.2	2.2	1.1			0.63 J
Barium						44	45.2	46.7			36.1
Beryllium						1 U	1 U	1 U			1 U
Cadmium						0.04 U	0.04 U	0.4 U			0.12 U
Calcium						52100	53000	55100			32300
Chromium	100					8.5 J-	8.3 J-	14.4			0.68 J-
Chromium, Hexavalent	0.035	100				5.1 J	0.3 J	7.1 J+			0.5 UJ
Cobalt	6					4.8	4.8	4			9.2
Copper						2 UJ	2 UJ	2 UJ			2 UJ
Iron						222	229	206			1080
Lead	15					0.16 J	0.052 J	0.2 U			0.17 J
Magnesium						5930	5950	5720			5730
Manganese	300					1300	1300	1290			796

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			AE-01B						AE-01D		
Sample ID:	Residential	Residential	WL-GW-AE-01B-1	WL-GW-AE-01BD-1	WL-GW-AE-01B-2	WL-GWF-AE-01B-1	WL-GWF-AE-01BD-1	WL-GWF-AE-01B-2	WL-GW-AE-01D-1	WL-GW-AE-01D-2	WL-GWF-AE-01D-1
Sample Date:	Groundwater	Groundwater	8/18/2014	8/18/2014	12/16/2014	8/18/2014	8/18/2014	12/16/2014	8/19/2014	12/16/2014	8/19/2014
Sample Type:	Drinking Water	Irrigation Well	Field Duplicate	Field Duplicate	Field Sample	Field Duplicate	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury						0.2 UJ	0.2 UJ	0.2 UJ			0.2 UJ
Nickel						1.9	1.8	2.3			2.6
Potassium						1510	1530	1520			1290
Selenium						5 U	5 U	5 U			5 U
Silver						1 UJ	1 UJ	1 U			1 UJ
Sodium						51500	51900	51000			57700
Vanadium						5 U	5 U	5 U			5 U
Zinc						3 U	3.3	2.5 U			4.9
Inorganics (ug/L)											
Aluminum			118	115	272				20 U	51.5	
Antimony			2 U	2 U	2 U				2 U	2 U	
Arsenic	10		2.4 J-	2.5 J-	1.3				0.8 J-	0.49 J	
Barium			44	44.5	48				35.1	34.3	
Beryllium			1 U	1 U	1 UJ				1 U	0.088 J	
Cadmium			0.039 J	0.024 J	0.4 UJ				0.096	0.4 UJ	
Calcium			50600	51500	57000				31700	32500	
Chromium	100		19.7 J-	20.1	21.9				1.9 J-	21.5	
Chromium, Hexavalent	0.035	100	1.7	1.6	10.3 J+				0.5 U	2.9 J+	
Cobalt	6		4.2	4.2	4.2				9	7.5	
Copper			2 UJ	2 UJ	0.26 J				2 UJ	0.49 J	
Cyanide			2.5 U	3.3 J+	2.8				2.5 U	2.5 U	
Iron			405	395	579				1100	1670	
Lead	15		0.33	0.27	1				0.22	0.87	
Magnesium			5550	5660	6290				5670	5650	
Manganese	300		1280	1310	1330				777	743	
Mercury			0.2 U	0.2 U	0.2 UJ				0.2 U	0.2 UJ	
Nickel			2	1.9	2				2.5	2.5	
Potassium			1510	1520	1560				1250	1270	
Selenium			5 U	5 U	5 U				5 U	5 U	
Silver			1 U	1 U	0.012 J				1 U	1 UJ	
Sodium			51800	52100	53300				57900	58300	
Vanadium			5 U	5 U	5 U				5 U	5 U	
Zinc			3.8 U	4.4 J+	3.4				4.4 J+	4.3	
Other											
Dissolved oxygen, field (mg/L)			0.21		0.48				0.16	0.35	
ORP, field (mV)			-5.8		40.7				63.2	80.4	
pH, field (S.U.)			6.51		6.44				5.86	5.97	
Spec. cond., field (umho/cm)			617		650				572.5	585	
Temperature, field (deg C)			14		12.44				15.1	12.71	
Turbidity, field (N.T.U.)			4.31		6.97				0.68	7.44	

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:				AE-01S				AE-02B			
Sample ID:	Residential	Residential	WL-GWF-AE-01D-2	WL-GW-AE-01S-1	WL-GW-AE-01S-2	WL-GWF-AE-01S-1	WL-GWF-AE-01S-2	WL-GW-AE-02B-1	WL-GW-AE-02B-2	WL-GWF-AE-02B-1	WL-GWF-AE-02B-2
Sample Date:	Groundwater	Groundwater	12/16/2014	8/19/2014	12/16/2014	8/19/2014	12/16/2014	8/13/2014	12/11/2014	8/13/2014	12/11/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200			0.5 U	0.5 U			0.5 U	0.5 U		
1,1,2-Trichloroethane				0.5 U	0.5 U			0.5 U	0.5 U		
1,1-Dichloroethane	2.8			0.5 U	0.5 U			0.18 J	0.13 J		
1,1-Dichloroethene				0.5 U	0.5 U			0.3 J	0.5 U		
1,2-Dibromo-3-chloropropane				0.5 U	0.5 U			0.5 U	0.5 U		
1,2-Dichloroethane				0.5 U	0.5 U			0.5 U	0.5 U		
2-Butanone				5 U	5 U			5 U	5 U		
Acetone				5 U	11			5 U	5 U		
Benzene				0.5 U	0.5 U			0.5 U	0.5 U		
Bromodichloromethane				0.5 U	0.5 U			0.5 U	0.5 U		
Bromoform				0.5 U	0.5 U			0.5 U	0.5 U		
Carbon disulfide				0.5 U	0.5 U			0.5 U	0.5 U		
Chloroethane				0.5 U	0.5 U			0.5 U	0.5 U		
Chloroform				0.5 U	0.5 U			0.5 U	0.5 U		
cis-1,2-Dichloroethene	70			0.78	0.19 J			4.6	3.1		
Cyclohexane				0.5 U	0.5 U			0.5 U	0.5 U		
Ethylbenzene				0.5 U	0.5 U			0.5 U	0.5 U		
Isopropylbenzene				0.5 U	0.5 U			0.5 U	0.5 U		
m,p-Xylene				0.5 U	0.5 U			0.5 U	0.5 U		
Methyl tert-butyl ether				0.5 U	0.5 U			0.2 J	0.11 J		
Methylcyclohexane				0.5 U	0.5 U			0.5 U	0.5 U		
Methylene chloride				0.5 U	0.5 U			0.5 U	0.5 U		
o-Xylene				0.5 U	0.5 U			0.5 U	0.5 U		
Tetrachloroethene				0.26 J	0.5 U			1.2	0.93		
Toluene				0.5 U	0.5 U			0.5 U	0.5 U		
trans-1,2-Dichloroethene				0.5 U	0.5 U			0.5 U	0.5 U		
Trichloroethene	5	98		1.3 J	0.84			6	5.5		
Vinyl chloride	2	7		0.12	0.5 U			1.3	0.32 J		
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46			0.11 J				0.082 J			
Inorganics, Dissolved (ug/L)											
Aluminum			20 U			690	791			35.8	249
Antimony			2 U			4 U	2 U			2 U	2 U
Arsenic	10		0.38			0.2 J	0.17 J			4.1	3
Barium			35.4			48.2	30.7			32.6	43.6
Beryllium			1 U			0.57 J	1 U			1 U	1 U
Cadmium			0.4 U			0.42	0.49			0.053	0.4 U
Calcium			32800			13700	12300			39700	32900
Chromium	100		8.7			24200	37300			2 UJ	13.1
Chromium, Hexavalent	0.035	100	3.2 J+			23700 J	35100			0.5 U	0.5 U
Cobalt	6		8			5	5.5			7.2	6.1
Copper			2 UJ			231	257			2 UJ	2 UJ
Iron			1090			5280	9800			2040 J	1770
Lead	15		0.21 U			0.1 J	0.2 U			0.11 J	0.2 U
Magnesium			5510			2080	1880			6750	5730
Manganese	300		758			419	791			1330 J	1000

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:				AE-01S				AE-02B			
Sample ID:	Residential	Residential	WL-GWF-AE-01D-2	WL-GW-AE-01S-1	WL-GW-AE-01S-2	WL-GWF-AE-01S-1	WL-GWF-AE-01S-2	WL-GW-AE-02B-1	WL-GW-AE-02B-2	WL-GWF-AE-02B-1	WL-GWF-AE-02B-2
Sample Date:	Groundwater	Groundwater	12/16/2014	8/19/2014	12/16/2014	8/19/2014	12/16/2014	8/13/2014	12/11/2014	8/13/2014	12/11/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury			0.2 UJ			0.2 UJ	0.014 J			0.2 UJ	0.036 J
Nickel			2.6			14.2	16.4			2.4	2.5
Potassium			1340			1510	947			1620	1310
Selenium			5 U			5 U	5 U			5 U	5 U
Silver			1 U			2 UJ	1 U			1 U	1 U
Sodium			59500			46000	36100			60400	57200
Vanadium			5 U			5 U	5 U			5 U	5 UJ
Zinc			4.9 U			181	200			2.5	3.3 U
Inorganics (ug/L)											
Aluminum				1080	765			698 J	1630		
Antimony				4 U	2 U			2 U	2 U		
Arsenic	10			0.31 J-	0.12 J			4.4	5.1		
Barium				46.6	27			37.1	39.4		
Beryllium				0.48 J	0.41 J			0.11 J	1 U		
Cadmium				0.44	0.4 UJ			0.052	0.4 UJ		
Calcium				12900	11800			37800	31300 J		
Chromium	100			22900	34600			5 UJ	14.1		
Chromium, Hexavalent	0.035	100		23000	36800			0.5 U	0.5 U		
Cobalt	6			5	4.7			7.9	7.6		
Copper				207	230			2 UJ	3.3 J-		
Cyanide				3.4 J+	1.4 J			3.2 J+	3		
Iron				5980	9210			3090	4190		
Lead	15			1.4	0.22 U			0.81	2.3		
Magnesium				2080	1840			7110 J	6070 J		
Manganese	300			413	721			1430	1020		
Mercury				0.2 U	0.2 UJ			0.2 UJ	0.2 UJ		
Nickel				13.4	14.2			3.5	5.1		
Potassium				1480	877			1630	1540		
Selenium				5 U	5 U			5 U	5 U		
Silver				2 U	0.016 J			1 U	1 U		
Sodium				43400	33800			58400	58000		
Vanadium				5 U	5 U			0.95 J	5 UJ		
Zinc				178	178			5.3 J+	8.8		
Other											
Dissolved oxygen, field (mg/L)				0.3	2.07			0.04	0.35		
ORP, field (mV)				261	102			2.8	70.6		
pH, field (S.U.)				4.61	4.53			6.11	6.18		
Spec. cond., field (umho/cm)				372	192			632.5	592		
Temperature, field (deg C)				19	10.61			13.9	11.77		
Turbidity, field (N.T.U.)				13.1	4.52			17.1	10.1		

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			AE-03B				AE-04B				
Sample ID:	Residential	Residential	WL-GW-AE-03B-1	WL-GW-AE-03B-2	WL-GWF-AE-03B-1	WL-GWF-AE-03B-2	WL-GW-AE-04B-1	WL-GW-AE-04B-2	WL-GW-AE-04B-3	WL-GWF-AE-04B-1	WL-GWF-AE-04B-2
Sample Date:	Groundwater	Groundwater	8/19/2014	12/9/2014	8/19/2014	12/9/2014	8/12/2014	12/11/2014	9/22/2015	8/12/2014	12/11/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200		6.1	7.2			93	53	11		
1,1,2-Trichloroethane			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
1,1-Dichloroethane	2.8		1.6	1.9			9	8.9	8		
1,1-Dichloroethene			0.88	0.8 U			12 J	4.8	2		
1,2-Dibromo-3-chloropropane			0.5 U	0.5 U			0.11 J	0.5 U	0.5 U		
1,2-Dichloroethane			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
2-Butanone			5 U	5 U			7.4	5 U	5 U		
Acetone			5 U	5 U			22	16	5 U		
Benzene			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Bromodichloromethane			0.5 U	0.5 U			R	0.5 U	0.5 U		
Bromoform			0.5 U	0.5 U			0.13 J-	0.5 U	0.5 U		
Carbon disulfide			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Chloroethane			0.5 U	0.5 U			0.84	0.5 U	0.5 U		
Chloroform			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
cis-1,2-Dichloroethene	70		0.62	1.1			4.6 J	13	0.73		
Cyclohexane			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Ethylbenzene			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Isopropylbenzene			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
m,p-Xylene			0.5 U	0.5 U			0.12 J	0.5 U	0.5 U		
Methyl tert-butyl ether			0.29 J	0.23 J			0.27 J	0.31 J	0.5 U		
Methylcyclohexane			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Methylene chloride			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
o-Xylene			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Tetrachloroethene			0.5 U	0.5 U			1.7	0.98	0.39 J		
Toluene			0.5 U	0.5 U			0.41 J	0.27 J	0.5 U		
trans-1,2-Dichloroethene			0.5 U	0.5 U			0.11 J	0.12 J	0.5 U		
Trichloroethene	5	98	3.3	5.9			20	46	17		
Vinyl chloride	2	7	4.4	4.1			1.4	2.1	0.5 U		
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46		0.34				5		0.41		
Inorganics, Dissolved (ug/L)											
Aluminum					20 U	20 U				608	661
Antimony					2 U	2 U				2 U	2 U
Arsenic	10				4.4	5.7				0.56 J	1 U
Barium					50	49.7				90.9	102
Beryllium					1 U	1 U				0.93 J	1.1
Cadmium					0.047 U	0.4 U				1.6	1.6
Calcium					44500	43900				34100	33000
Chromium	100				2 UJ	2 U				73000 J	51000
Chromium, Hexavalent	0.035	100			0.5 UJ	0.5 U				72000	
Cobalt	6				6.5	6.6				25.6	24
Copper					2 UJ	2 UJ				238	283
Iron					5940	5850				12300 J	16000
Lead	15				0.094 J	0.2 U				0.084 J	0.2 U
Magnesium					7780	7690				7410	7100
Manganese	300				1900	1700				1370 J	1170

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			AE-03B				AE-04B				
Sample ID:	Residential	Residential	WL-GW-AE-03B-1	WL-GW-AE-03B-2	WL-GWF-AE-03B-1	WL-GWF-AE-03B-2	WL-GW-AE-04B-1	WL-GW-AE-04B-2	WL-GW-AE-04B-3	WL-GWF-AE-04B-1	WL-GWF-AE-04B-2
Sample Date:	Groundwater	Groundwater	8/19/2014	12/9/2014	8/19/2014	12/9/2014	8/12/2014	12/11/2014	9/22/2015	8/12/2014	12/11/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury					0.2 UJ	0.2 UJ				0.2 UJ	0.019 J
Nickel					2	1.8				29	28.1
Potassium					1280	1260				4380	4740
Selenium					5 U	5 U				5 U	5 U
Silver					1 UJ	1 UJ				1 U	1 U
Sodium					69100	71100				60300	59900
Vanadium					5 U	5 U				5 U	5 UJ
Zinc					3.4	2.8				202	188
Inorganics (ug/L)											
Aluminum			104	73.1			873 J	704	996 J		
Antimony			2 U	2 U			2 U	2 U	2 U		
Arsenic	10		4.4 J-	5.9			1 U	1 U	0.92 J		
Barium			48.7	51.6			96	102	71.7		
Beryllium			1 U	1 U			0.91 J	1 U	0.43 J		
Cadmium			0.069	0.4 U			1.5	1.6	1		
Calcium			43500	45300			32300	30900 J	52500		
Chromium	100		0.19 J-	2 U			72800	56400	13800		
Chromium, Hexavalent	0.035	100	0.5 U	0.5 U			71600	53200	14100		
Cobalt	6		6.4	6.8			26.9	25.3	10.8 J		
Copper			2 UJ	0.77 J			242	296	112		
Cyanide			2.8 J+	2.5 U			4.2 J+	2.1 J	10 U		
Iron			6020	6270			19100	14800	5040 J		
Lead	15		0.31	0.34 U			0.78	0.34	1.7		
Magnesium			7580	7990			7350 J	6620 J	11400 J		
Manganese	300		1870	1770			1490	1100	4990		
Mercury			0.2 U	0.2 UJ			0.2 UJ	0.2 UJ	0.2 U		
Nickel			2	2.1			29.7	28.2	11.7 J		
Potassium			1270	1310			4360	4740	3040		
Selenium			5 U	5 U			0.5 J	0.43	0.39 J		
Silver			1 U	1 UJ			1 U	1 U	1 U		
Sodium			67600	73400			60900	58100	58500		
Vanadium			5 U	5 U			5 U	R	5 U		
Zinc			2.7 U	3.4 J			207	201	73 J		
Other											
Dissolved oxygen, field (mg/L)			3.92	1.19			0.29	1.27	0.31		
ORP, field (mV)			35.9	-132.2			293	-47.2	167		
pH, field (S.U.)			5.8	6.32			5.15	5.3	5.92		
Spec. cond., field (umho/cm)			752	785			585	623	659		
Temperature, field (deg C)			12.7	9.84			14	11.58	13.96		
Turbidity, field (N.T.U.)			4.4	4.89			13.7	4.54	54.7		

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:				AE-04D				AE-04S			
Sample ID:	Residential	Residential	WL-GWF-AE-04B-3	WL-GW-AE-04D-1	WL-GW-AE-04D-2	WL-GWF-AE-04D-1	WL-GWF-AE-04D-2	WL-GW-AE-04S-1	WL-GW-AE-04S-2	WL-GWF-AE-04S-1	WL-GWF-AE-04S-2
Sample Date:	Groundwater	Groundwater	9/22/2015	8/12/2014	12/15/2014	8/12/2014	12/15/2014	8/12/2014	12/11/2014	8/12/2014	12/11/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200			100	58			52	0.5 U		
1,1,2-Trichloroethane				0.5 U	0.5 U			0.5 U	0.5 U		
1,1-Dichloroethane	2.8			5.8	6.9			14	0.5 U		
1,1-Dichloroethene				12 J	4.4			8.8 J	0.5 U		
1,2-Dibromo-3-chloropropane				0.5 U	0.5 U			0.5 U	0.5 U		
1,2-Dichloroethane				0.5 U	0.5 U			0.5 U	0.5 U		
2-Butanone				7.7	4.4 J			2.5 J	5 U		
Acetone				22	28			10 U	5 U		
Benzene				0.5 U	0.5 U			0.5 U	0.5 U		
Bromodichloromethane				R	0.5 U			R	0.5 U		
Bromoform				R	0.5 U			R	0.5 U		
Carbon disulfide				0.5 U	0.5 U			0.5 U	0.5 U		
Chloroethane				0.98	0.63			1.6	0.5 U		
Chloroform				0.5 U	0.5 U			0.5 U	0.5 U		
cis-1,2-Dichloroethene	70			5.5 J	15			16 J	0.5 U		
Cyclohexane				0.5 U	0.5 U			0.5 U	0.5 U		
Ethylbenzene				0.5 U	0.5 U			0.5 U	0.5 U		
Isopropylbenzene				0.5 U	0.5 U			0.5 U	0.5 U		
m,p-Xylene				0.12 J	0.5 U			0.5 U	0.5 U		
Methyl tert-butyl ether				0.17 J	0.31 J			0.5 U	0.5 U		
Methylcyclohexane				0.5 U	0.5 U			0.5 U	0.5 U		
Methylene chloride				0.5 U	0.5 U			0.5 U	0.5 U		
o-Xylene				0.5 U	0.5 U			0.5 U	0.5 U		
Tetrachloroethene				2	1.2			2.1	0.5 U		
Toluene				0.46 J	0.35 J			0.36 J	0.5 U		
trans-1,2-Dichloroethene				0.13 J	0.19 J			0.28 J	0.5 U		
Trichloroethene	5	98		23	62			19	0.5 U		
Vinyl chloride	2	7		1.6	3.5			2.6	0.5 U		
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46			3.5				1.7			
Inorganics, Dissolved (ug/L)											
Aluminum			359			2090	2030			50.6	281
Antimony			2 U			2 U	2 U			2 U	2 U
Arsenic	10		0.38 J			0.57 J	0.32 J			1.1	1 U
Barium			73.7			117	119			207	86.1
Beryllium			0.47 J			1.4	1.3			1 U	1 U
Cadmium			1 J			2.6	2.4			0.024 J	2
Calcium			56600			25000	25000			27500	7070
Chromium	100		14100			87900 J	70400			105 J	15.6
Chromium, Hexavalent	0.035	100	13500			86500	65000			0.5 U	0.5 U
Cobalt	6		10.9 J			36.7	32			2.6	14.5
Copper			119			772	713			2 UJ	15
Iron			4570 J			14800 J	18300			47300 J	200 U
Lead	15		1 U			0.64	0.57			1.2	5
Magnesium			11700 J			5540	5020			4210	960
Manganese	300		4590			1080 J	1000			1890 J	304

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:				AE-04D				AE-04S			
Sample ID:	Residential	Residential	WL-GWF-AE-04B-3	WL-GW-AE-04D-1	WL-GW-AE-04D-2	WL-GWF-AE-04D-1	WL-GWF-AE-04D-2	WL-GW-AE-04S-1	WL-GW-AE-04S-2	WL-GWF-AE-04S-1	WL-GWF-AE-04S-2
Sample Date:	Groundwater	Groundwater	9/22/2015	8/12/2014	12/15/2014	8/12/2014	12/15/2014	8/12/2014	12/11/2014	8/12/2014	12/11/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury			0.2 U			0.2 UJ	0.03 J			0.2 UJ	0.2 UJ
Nickel			12.2			43	36.8			1.8	10.3
Potassium			3100 J			3940	4510			2900	500 U
Selenium			5 U			5 U	5 U			5 U	5 U
Silver			1 U			1 U	1 U			1 U	1 U
Sodium			61700 J			54900	53600			178000	33200
Vanadium			5 U			5 U	5 U			5 U	5 UJ
Zinc			76.9 J			355	315			25.8	315
Inorganics (ug/L)											
Aluminum				2180 J	2100			207 J	306		
Antimony				2 U	2 UJ			2 U	2 U		
Arsenic	10			1 U	0.31 J			1 U	1 U		
Barium				121	102 J			217	89.2		
Beryllium				1.4	1.5			1 U	1 U		
Cadmium				2.4	1.9 J			0.011 J	1.9		
Calcium				23900	24800			22600	7470 J		
Chromium	100			86400	71300			271	19.1		
Chromium, Hexavalent	0.035	100		83000	64500			0.5 U	0.5 U		
Cobalt	6			38.7	26.6 J			2.7	15.1		
Copper				777	592 J			2 UJ	14.2		
Cyanide				5.2 J+	2 J			5.9 J+	2.8		
Iron				22300	17100 J			46500	200 U		
Lead	15			0.88	0.9			0.47	5.1		
Magnesium				5650 J	5040			4360 J	1050 J		
Manganese	300			1100	947			2010	295		
Mercury				0.04 J-	0.2 UJ			0.2 UJ	0.2 UJ		
Nickel				42.4	32 J			0.94 J	9.8		
Potassium				3840	4340			2860	500 UJ		
Selenium				0.42 J	5 U			0.36 J	5 U		
Silver				1 U	0.038 J			1 U	1 U		
Sodium				53500	51800			166000	32800		
Vanadium				5 U	5 U			5 U	R		
Zinc				363	263 J			3.2 J+	318		
Other											
Dissolved oxygen, field (mg/L)				0.26	2.42			0.15	8.17		
ORP, field (mV)				459.9	-9.1			57.6	5		
pH, field (S.U.)				4.11	4.49			5.71	5.19		
Spec. cond., field (umho/cm)				529	585			1425	287		
Temperature, field (deg C)				13.4	12.9			15.4	8.78		
Turbidity, field (N.T.U.)				3.71	4.69			13.8	0.87		

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			AE-05B				AE-06B				
Sample ID:	Residential	Residential	WL-GW-AE-05B-1	WL-GW-AE-05B-2	WL-GWF-AE-05B-1	WL-GWF-AE-05B-2	WL-GW-AE-06B-1	WL-GW-AE-06B-2	WL-GW-AE-06B-3	WL-GWF-AE-06B-1	WL-GWF-AE-06B-2
Sample Date:	Groundwater	Groundwater	8/6/2014	12/10/2014	8/6/2014	12/10/2014	8/6/2014	12/11/2014	9/22/2015	8/6/2014	12/11/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200		0.17 J	0.21 J			12	15	23		
1,1,2-Trichloroethane			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
1,1-Dichloroethane	2.8		0.63	0.55			20	15	36		
1,1-Dichloroethene			0.5 U	0.5 U			5.3 J	6	3.7		
1,2-Dibromo-3-chloropropane			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
1,2-Dichloroethane			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
2-Butanone			5 U	5 U			5 U	5 U	5 U		
Acetone			5 U	5 U			5 U	5 U	5.6		
Benzene			0.5 U	0.5 U			0.5 U	0.27 J	0.5 U		
Bromodichloromethane			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Bromoform			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Carbon disulfide			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Chloroethane			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Chloroform			1.2 U	1.6 U			0.5 U	1.6 U	0.5 U		
cis-1,2-Dichloroethene	70		0.5 U	0.5 U			0.79 J	1	3.4		
Cyclohexane			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Ethylbenzene			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Isopropylbenzene			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
m,p-Xylene			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Methyl tert-butyl ether			0.5 U	0.5 U			0.8	0.7	0.49 J		
Methylcyclohexane			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Methylene chloride			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
o-Xylene			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Tetrachloroethene			0.5 U	0.5 U			0.71	0.95	0.5 U		
Toluene			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
trans-1,2-Dichloroethene			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Trichloroethene	5	98	1.4	1.8			20	30	20		
Vinyl chloride	2	7	0.012 J	0.5 U			0.22	0.5 U	0.7		
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46		1.7				23		9.4		
Inorganics, Dissolved (ug/L)											
Aluminum					20 U	55.7 J+				20 U	20 U
Antimony					2 U	2 U				0.78 J	2 U
Arsenic	10				0.26 J	1 U				0.65 J	1 U
Barium					27.4	24.6				63.4	55.2
Beryllium					1 U	1 U				1 U	1 U
Cadmium					0.052	0.4 U				0.058	0.4 U
Calcium					35400	32100				47500	55500
Chromium	100				7860	7960				22100	78500
Chromium, Hexavalent	0.035	100			7550	7510				21400	45500
Cobalt	6				1 U	1 U				1.4	1.3
Copper					2 UJ	2 UJ				2 UJ	2 UJ
Iron					2230	2060				6160	11600
Lead	15				0.31	0.2 U				0.2 U	0.2 U
Magnesium					8290	7420				11900	14300
Manganese	300				32.2	24.2				892	568

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			AE-05B				AE-06B				
Sample ID:	Residential	Residential	WL-GW-AE-05B-1	WL-GW-AE-05B-2	WL-GWF-AE-05B-1	WL-GWF-AE-05B-2	WL-GW-AE-06B-1	WL-GW-AE-06B-2	WL-GW-AE-06B-3	WL-GWF-AE-06B-1	WL-GWF-AE-06B-2
Sample Date:	Groundwater	Groundwater	8/6/2014	12/10/2014	8/6/2014	12/10/2014	8/6/2014	12/11/2014	9/22/2015	8/6/2014	12/11/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury					0.2 UJ	0.2 UJ				0.2 UJ	0.2 UJ
Nickel					2.3	1.8				1.5	1.4
Potassium					3580	3620				7820	10400
Selenium					5 U	5 U				5 U	5 U
Silver					1 U	1 U				1 U	1 U
Sodium					140000	122000				63800	68200
Vanadium					5 UJ	5 UJ				5 UJ	5 UJ
Zinc					4.4 U	255				4 U	3.8 U
Inorganics (ug/L)											
Aluminum			124	463			237	416	897 J		
Antimony			2 U	2 U			0.72 J	2 U	2 U		
Arsenic	10		0.3 J	1 U			0.82 J	1 U	1.3		
Barium			28.5	27			65.7	58	49.3		
Beryllium			1 U	1 U			1 U	1 U	0.062 J		
Cadmium			0.075	0.4 UJ			0.05	0.4 UJ	0.047 J		
Calcium			36800	32100 J			50300	54100 J	43700		
Chromium	100		8070	8290			25300	40000	17600		
Chromium, Hexavalent	0.035	100	7250	8130			21600	36600	16300		
Cobalt	6		1 U	1 U			1.5	1.6	1.7 J		
Copper			2 U	2 UJ			2 U	2 UJ	3.2		
Cyanide			5.1 J	2.6 U			4.6 J	2.3 J	10 U		
Iron			2410	2880			8720	12500	7150 J		
Lead	15		0.2 U	0.49			0.96	1.5	4.7		
Magnesium			8960	7720 J			12800	14300 J	11200 J		
Manganese	300		38	35.9			911	554	535		
Mercury			0.2 UJ	0.2 UJ			0.2 UJ	0.2 UJ	0.2 U		
Nickel			1.8	1.9			1.5	1.9	3.6 J		
Potassium			3750	3620			8510	10900	9020		
Selenium			0.28 J	5 U			0.35 J	0.37	5 U		
Silver			1 UJ	1 U			1 UJ	1 U	1 U		
Sodium			137000	130000			65400	70700	65400		
Vanadium			5 UJ	R			5 UJ	R	5 U		
Zinc			2.9 U	123			6.4 U	4.9 U	14.5 J		
Other											
Dissolved oxygen, field (mg/L)			3.45	1.68			0.25	0.34	0.29		
ORP, field (mV)			272.6	262.5			142.5	176.1	166.5		
pH, field (S.U.)			5.85	5.9			6.66	6.67	6.94		
Spec. cond., field (umho/cm)			886	983			705	791	627		
Temperature, field (deg C)			13.2	11.67			15.5	11.38	14.46		
Turbidity, field (N.T.U.)			6.57	2.69			18.7	-27	60		

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:				AE-07B				AE-07D			
Sample ID:	Residential	Residential	WL-GWF-AE-06B-3	WL-GW-AE-07B-1	WL-GW-AE-07B-2	WL-GWF-AE-07B-1	WL-GWF-AE-07B-2	WL-GW-AE-07D-1	WL-GW-AE-07D-2	WL-GWF-AE-07D-1	WL-GWF-AE-07D-2
Sample Date:	Groundwater	Groundwater	9/22/2015	8/4/2014	12/2/2014	8/4/2014	12/2/2014	8/4/2014	12/3/2014	8/4/2014	12/3/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200			1.5	1.5			12	9.9		
1,1,2-Trichloroethane				0.5 U	0.5 U			0.5 U	0.5 U		
1,1-Dichloroethane	2.8			2.5	5.9			12	9.9		
1,1-Dichloroethene				0.65	0.5 U			3.4	2.3		
1,2-Dibromo-3-chloropropane				0.5 U	0.5 U			0.5 U	0.5 U		
1,2-Dichloroethane				0.5 U	0.5 U			0.5 U	0.5 U		
2-Butanone				5 U	5 U			5 U	5 U		
Acetone				5 U	5 U			5 U	5 U		
Benzene				0.5 U	0.5 U			0.5 U	0.5 U		
Bromodichloromethane				0.5 U	0.5 U			0.5 U	0.5 U		
Bromoform				0.5 U	0.5 U			0.5 U	0.5 U		
Carbon disulfide				0.5 U	0.5 U			0.5 U	0.5 U		
Chloroethane				0.5 U	0.5 U			0.5 U	0.5 U		
Chloroform				0.5 U	0.5 U			0.5 U	0.5 U		
cis-1,2-Dichloroethene	70			0.69	0.57			6.4	5.9		
Cyclohexane				0.5 U	0.5 U			0.5 U	0.5 U		
Ethylbenzene				0.5 U	0.5 U			0.5 U	0.5 U		
Isopropylbenzene				0.5 U	0.5 U			0.5 U	0.5 U		
m,p-Xylene				0.5 U	0.5 U			0.5 U	0.5 U		
Methyl tert-butyl ether				0.5 U	0.24 J			0.43 J	0.35 J		
Methylcyclohexane				0.5 U	0.5 U			0.5 U	0.5 U		
Methylene chloride				0.5 U	0.5 U			0.5 U	0.5 U		
o-Xylene				0.5 U	0.5 U			0.5 U	0.5 U		
Tetrachloroethene				0.5 U	0.5 U			0.31 J	0.21 J		
Toluene				0.5 U	0.5 U			0.5 U	0.5 U		
trans-1,2-Dichloroethene				0.5 U	0.5 U			0.5 U	0.5 U		
Trichloroethene	5	98		5.4	4.8			26	22		
Vinyl chloride	2	7		0.012 J	0.5 U			0.06	0.5 U		
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46			1.5				2.5			
Inorganics, Dissolved (ug/L)											
Aluminum			27.5			20 U	20 U			21.6	20 U
Antimony			2 U			2 U	2 U			2 U	2 U
Arsenic	10		0.38 J			0.37 J	0.31 J			0.15 J	0.14 J
Barium			46.4			12.5	19			67.5	61.7
Beryllium			1 U			1 U	1 U			1 U	1 U
Cadmium			0.069 J			0.11	0.4 U			0.079	0.4 U
Calcium			47500			20400	36000			32000	32000
Chromium	100		16300			516	390			4180	3800
Chromium, Hexavalent	0.035	100	16000			449	322			3970	3250
Cobalt	6		1 UJ			1.4	1.8			1 U	1 U
Copper			1 J			2 UJ	1.3 J			2 UJ	0.9 J
Iron			5270 J			150 J-	325			935 J-	1010
Lead	15		1 U			0.14 J	0.2 U			0.15 J	0.2 U
Magnesium			11400 J			8080 J	14100			9950 J	10100
Manganese	300		461			132	245 J			18.7	13.8 J

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:				AE-07B				AE-07D			
Sample ID:	Residential	Residential	WL-GWF-AE-06B-3	WL-GW-AE-07B-1	WL-GW-AE-07B-2	WL-GWF-AE-07B-1	WL-GWF-AE-07B-2	WL-GW-AE-07D-1	WL-GW-AE-07D-2	WL-GWF-AE-07D-1	WL-GWF-AE-07D-2
Sample Date:	Groundwater	Groundwater	9/22/2015	8/4/2014	12/2/2014	8/4/2014	12/2/2014	8/4/2014	12/3/2014	8/4/2014	12/3/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury			0.2 U			0.2 UJ	0.2 UJ			0.038 J-	0.2 UJ
Nickel			1.2			3.3 J-	4			3 J-	2.9
Potassium			9110 J			3040 J	3960 J			9350 J	10700 J
Selenium			5 U			5 U	5 U			5 U	5 U
Silver			1 U			1 U	1 U			1 U	1 U
Sodium			68000 J			28700	43500			118000	110000
Vanadium			5 U			5 U	5 U			5 U	5 U
Zinc			7.1 J			12	11.4			9.9	5
Inorganics (ug/L)											
Aluminum				128	5450			107	281		
Antimony				2 U	2 U			2 U	2 U		
Arsenic	10			0.51 J	3.8			0.18 J	0.24 J		
Barium				13.2	25.8			65.7	55.5		
Beryllium				1 U	1 U			1 U	1 U		
Cadmium				0.12	0.4 U			0.097	0.4 U		
Calcium				20600	34100			30500	30000		
Chromium	100			511	497			4260	3420		
Chromium, Hexavalent	0.035	100		452	335			3900	3120		
Cobalt	6			1.5	6.1			1 U	1 U		
Copper				2 UJ	12.3			2.2	2 J		
Cyanide				4.6 J	2.1 J			5.7 J	2.5 U		
Iron				488 J-	12900			1040 J-	1260		
Lead	15			0.45	10.7			0.79	1.3		
Magnesium				8160 J	15700			9540 J	9490		
Manganese	300			148	466			20.7	20.3		
Mercury				0.2 UJ	0.2 UJ			0.2 UJ	0.2 UJ		
Nickel				3.5 J-	11.9			3.1 J-	3.1		
Potassium				3050 J	4250			8990 J	9940		
Selenium				5 U	0.82 J			5 U	5 U		
Silver				1 U	1 U			1 U	1 U		
Sodium				28900	41400			115000	102000		
Vanadium				5 U	5 U			5 U	5 U		
Zinc				12.4 J+	34 J			12 J+	7 J		
Other											
Dissolved oxygen, field (mg/L)				1.18	0.85			3.44	1.37		
ORP, field (mV)				163.1	188.3			240.7	372.1		
pH, field (S.U.)				5.27	5.37			5.77	5.31		
Spec. cond., field (umho/cm)				371.7	565			0.84	790		
Temperature, field (deg C)				13.4	10.91			13.4	11.33		
Turbidity, field (N.T.U.)				9.93	-19			5.88	4.33		

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			AE-08B						AE-		
Sample ID:	Residential	Residential	WL-GW-AE-08B-1	WL-GW-AE-08B-2	WL-GW-AE-08B-3	WL-GWF-AE-08B-1	WL-GWF-AE-08B-2	WL-GWF-AE-08B-3	WL-GW-AE-08D-1	WL-GW-AE-08D-2	WL-GW-AE-08D-3
Sample Date:	Groundwater	Groundwater	8/11/2014	12/9/2014	9/15/2015	8/11/2014	12/9/2014	9/15/2015	8/11/2014	12/9/2014	9/15/2015
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200		0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	0.5 U
1,1,2-Trichloroethane			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	2.8		0.24 J	0.13 J	0.5 U				0.5 U	0.5 U	0.5 U
1,1-Dichloroethene			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	0.5 U
1,2-Dibromo-3-chloropropane			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	0.5 U
1,2-Dichloroethane			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	0.38 J
2-Butanone			5 U	5 U	5 U				5 U	5 U	5 U
Acetone			5 UJ	5 U	5 U				5 UJ	5 U	5 U
Benzene			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	0.5 U
Bromodichloromethane			R	0.5 U	0.5 U				R	0.5 U	0.5 U
Bromoform			R	0.5 U	0.5 U				R	0.5 U	0.5 U
Carbon disulfide			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	0.5 U
Chloroethane			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	0.5 U
Chloroform			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	0.5 U
cis-1,2-Dichloroethene	70		0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	0.5 U
Cyclohexane			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	0.5 U
Ethylbenzene			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	0.5 U
Isopropylbenzene			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	0.5 U
m,p-Xylene			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	0.5 U
Methyl tert-butyl ether			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	0.5 U
Methylcyclohexane			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	0.5 U
Methylene chloride			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	0.5 U
o-Xylene			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	0.5 U
Tetrachloroethene			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	0.5 U
Toluene			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	0.5 U
trans-1,2-Dichloroethene			0.5 U	0.5 U	0.5 U				0.5 U	0.5 U	0.5 U
Trichloroethene	5	98	0.19 J	0.28 J	0.5 U				0.15 UJ	0.5 U	0.5 U
Vinyl chloride	2	7	0.012 J	0.5 U	0.5 U				0.012 J	0.5 U	0.5 U
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46		0.48		0.12				0.058 J		0.1 U
Inorganics, Dissolved (ug/L)											
Aluminum						20 U	20 U	20 UJ			
Antimony						2 U	2 U	0.077 J			
Arsenic	10					0.43 J	1 U	0.3 J			
Barium						12.9	10.8	10 U			
Beryllium						1 U	1 U	1 U			
Cadmium						0.15	0.4 U	1 U			
Calcium						25700	25200	18100			
Chromium	100					285 J	922	133			
Chromium, Hexavalent	0.035	100				286	920	450			
Cobalt	6					2.8	1.1	1 UJ			
Copper						2 UJ	1.8 J	2 U			
Iron						57.4 J	290	200 U			
Lead	15					0.032 J	0.2 U	1 U			
Magnesium						7780	8100	7430 J			
Manganese	300					436 J	230	3.2			

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			AE-08B						AE-		
Sample ID:	Residential	Residential	WL-GW-AE-08B-1	WL-GW-AE-08B-2	WL-GW-AE-08B-3	WL-GWF-AE-08B-1	WL-GWF-AE-08B-2	WL-GWF-AE-08B-3	WL-GW-AE-08D-1	WL-GW-AE-08D-2	WL-GW-AE-08D-3
Sample Date:	Groundwater	Groundwater	8/11/2014	12/9/2014	9/15/2015	8/11/2014	12/9/2014	9/15/2015	8/11/2014	12/9/2014	9/15/2015
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury						0.2 UJ	0.2 UJ	0.2 U			
Nickel						8.7	4.7	1 UJ			
Potassium						1840	1740	1560 J			
Selenium						5 U	5 U	5 U			
Silver						1 U	1 UJ	1 U			
Sodium						30600	40800	16500			
Vanadium						5 U	5 U	5 U			
Zinc						5.1	5.1	4.9 J			
Inorganics (ug/L)											
Aluminum			20 UJ	2210	265 J				155 J	248	20 UJ
Antimony			2 U	2 U	0.07 J				0.67 J	2 U	2 U
Arsenic	10		1 U	1.8	0.41 J				1 U	1 U	0.19 J
Barium			13.5	23.4	11.5				8.6 J	10 U	10 U
Beryllium			1 U	1 U	1 U				1 U	1 U	0.041 J
Cadmium			0.14	0.4 U	0.054 J				0.036 J	0.4 U	1 U
Calcium			24500	24100	26100				22200	20000	23600
Chromium	100		249	897	781				15.4	11.7	34.4
Chromium, Hexavalent	0.035	100	252	906	719				18.2	12.9 J+	34.3
Cobalt	6		3.2	3.6	1 UJ				0.27 J	1 U	1 UJ
Copper			2 UJ	11.2	2.4				2 UJ	0.96 J	2 U
Cyanide			3.6 J+	2.5 U	10 U				4.5 J+	2.5 U	10 U
Iron			200 UJ	4030	766				281 J	386	200 U
Lead	15		0.2 U	3.8	1 U				0.46	0.64	1 U
Magnesium			7640 J	8700	7890 J				6050 J	5440	5980 J
Manganese	300		501	421	143 J				15.1	14.3	3 J
Mercury			0.058 J-	0.2 UJ	0.2 U				0.063 J-	0.2 UJ	0.2 U
Nickel			9.8	9.1	3.1 J				1.4	1.5	1 UJ
Potassium			1820	2070	1650 J				1850	2100	1960 J
Selenium			5 U	0.41 J	5 U				5 U	5 U	5 U
Silver			1 U	1 UJ	0.012 J				1 U	1 UJ	0.013 J
Sodium			29200	39100	39600				27200	26700	28500
Vanadium			5 U	5 U	5 U				5 U	5 U	5 U
Zinc			5.2 J+	21.7 J	5.6				4.7 J+	6.2 J	2.1
Other											
Dissolved oxygen, field (mg/L)			3.73	6.46	5.24				3.32	4.94	4.66
ORP, field (mV)			152.9	245.2	159.7				225.4	262.3	156.8
pH, field (S.U.)			5.89	5.98	5.61				5.8	5.76	5.6
Spec. cond., field (umho/cm)			383.9	449	522				318	331	364
Temperature, field (deg C)			14.5	10.69	14.5				14.5	10.16	14.23
Turbidity, field (N.T.U.)			0.23	4.43	2.77				5.46	4.85	1.81

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			08D			AE-09S				AE-	
Sample ID:	Residential	Residential	WL-GWF-AE-08D-1	WL-GWF-AE-08D-2	WL-GWF-AE-08D-3	WL-GW-AE-09S-1	WL-GW-AE-09S-2	WL-GWF-AE-09S-1	WL-GWF-AE-09S-2	WL-GW-AE-10S-1	WL-GW-AE-10S-2
Sample Date:	Groundwater	Groundwater	8/11/2014	12/9/2014	9/15/2015	8/5/2014	12/8/2014	8/5/2014	12/8/2014	8/5/2014	12/15/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200					0.76	0.23 J			0.5 U	0.33 J
1,1,2-Trichloroethane						0.5 U	0.5 U			0.5 U	0.5 U
1,1-Dichloroethane	2.8					32	20			8.8	8.4
1,1-Dichloroethene						7.3 J	4			4.1	5.1
1,2-Dibromo-3-chloropropane						0.5 U	0.5 U			0.5 U	0.5 U
1,2-Dichloroethane						0.5 U	0.5 U			0.5 U	0.5 U
2-Butanone						5 U	5 U			5 U	5 U
Acetone						5 U	5 U			5 U	5 U
Benzene						0.5 U	0.5 U			0.5 U	0.5 U
Bromodichloromethane						0.5 U	0.5 U			0.5 U	0.5 U
Bromoform						0.5 U	0.5 U			0.5 U	0.5 U
Carbon disulfide						0.5 U	0.5 U			0.5 U	0.5 U
Chloroethane						0.43 J	0.5 U			0.5 U	0.5 U
Chloroform						0.5 U	0.5 U			0.5 U	0.5 U
cis-1,2-Dichloroethene	70					51	40			25	37
Cyclohexane						0.5 U	0.5 U			0.5 U	0.5 U
Ethylbenzene						0.5 U	0.5 U			0.5 U	0.5 U
Isopropylbenzene						0.5 U	0.5 U			0.5 U	0.5 U
m,p-Xylene						0.5 U	0.5 U			0.5 U	0.5 U
Methyl tert-butyl ether						0.49 J	0.29 J			1	0.84
Methylcyclohexane						0.5 U	0.5 U			0.5 U	0.5 U
Methylene chloride						0.5 U	0.5 U			0.5 U	0.5 U
o-Xylene						0.5 U	0.5 U			0.5 U	0.5 U
Tetrachloroethene						0.5 U	0.5 U			0.5 U	0.5 U
Toluene						0.5 U	0.5 U			0.5 U	0.5 U
trans-1,2-Dichloroethene						0.5 U	0.5 U			0.5 U	0.5 U
Trichloroethene	5	98				9.2	4.7			4	8.6
Vinyl chloride	2	7				2.9	1.4			2	1.9
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46					2.4				0.77	
Inorganics, Dissolved (ug/L)											
Aluminum			20 U	20 U	20 UJ			20 UJ	1060 J+		
Antimony			2 U	2 U	2 U			2 U	2 U		
Arsenic	10		0.29 J	1 U	0.18 J			0.43 J	1 U		
Barium			10 U	10 U	10 U			215	207		
Beryllium			1 U	1 U	1 U			1 U	1 U		
Cadmium			0.036 J	0.4 U	0.026 J			0.43	0.4 U		
Calcium			22600	19900	24500			45600	42200		
Chromium	100		16.5 J	11.6	33.3			1.4 J	4.2		
Chromium, Hexavalent	0.035	100	17.9	12.3 J+	34.6			0.5 U	0.5 U		
Cobalt	6		1 U	1 U	1 UJ			11.8 J	9.8		
Copper			2 UJ	0.69 J	2 U			2 U	3		
Iron			9.5 J	200 U	200 U			10300 J	12300		
Lead	15		0.044 J	0.2 U	1 U			0.2 U	2.3		
Magnesium			5830	5300	6170 J			9740 J	10500		
Manganese	300		6.4 J	1.8 U	1.5			1610 J	1420		

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			08D			AE-09S				AE-	
Sample ID:	Residential	Residential	WL-GWF-AE-08D-1	WL-GWF-AE-08D-2	WL-GWF-AE-08D-3	WL-GW-AE-09S-1	WL-GW-AE-09S-2	WL-GWF-AE-09S-1	WL-GWF-AE-09S-2	WL-GW-AE-10S-1	WL-GW-AE-10S-2
Sample Date:	Groundwater	Groundwater	8/11/2014	12/9/2014	9/15/2015	8/5/2014	12/8/2014	8/5/2014	12/8/2014	8/5/2014	12/15/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury			0.2 UJ	0.2 UJ	0.2 U			0.2 UJ	0.2 UJ		
Nickel			1.7	1.1	1 UJ			4.3 J	3.7		
Potassium			1870	2140	2110 J			3700	3020		
Selenium			5 U	5 U	5 U			5 U	5 U		
Silver			1 U	1 UJ	1 U			1 U	1 UJ		
Sodium			27700	26300	29300			300000	220000		
Vanadium			5 U	5 U	5 U			0.74 J	5 U		
Zinc			3.1	9.8	3.3 J			11.4	11.4		
Inorganics (ug/L)											
Aluminum						109	26400			178	1640
Antimony						2 U	4 U			2 U	2 U
Arsenic	10					0.4 J	8.6			2.5	2.9
Barium						213	327			281	291
Beryllium						0.11 J+	2 U			0.1 J+	0.12 J
Cadmium						0.4	2.4 J-			0.04 U	0.4 UJ
Calcium						45300	40400			66300	66400
Chromium	100					1.5 J-	69.1			5.4 J-	17.7
Chromium, Hexavalent	0.035	100				0.5 U	0.5 U			0.5 U	0.5 U
Cobalt	6					11.7	16.6			1 U	2.3
Copper						2 U	56.2			2 U	2.9 J-
Cyanide						4.4 J	2.5 U			5.5 J	3.7
Iron						10200	31500			12600	10300
Lead	15					0.35 J	50			0.37 J	3.2
Magnesium						9750 J	14700			16000 J	16600
Manganese	300					1630	1870			1100	1280
Mercury						0.046 J-	0.023 J			0.2 UJ	0.2 UJ
Nickel						4.2	31			2.1	6
Potassium						3740	4350			3130	3900
Selenium						5 U	2.8 J			5 U	5 U
Silver						1 U	2 UJ			1 U	1 UJ
Sodium						198000	192000			171000	165000
Vanadium						1.1 J	56.2			0.96 J	3.2 J
Zinc						13.6 J+	97.3 J			7.5 J+	18.2
Other											
Dissolved oxygen, field (mg/L)						0.17	2.58			0.14	1.11
ORP, field (mV)						22.1	46.7			124.6	91.8
pH, field (S.U.)						5.76	6			5.62	5.74
Spec. cond., field (umho/cm)						1780	1170			1377	1425
Temperature, field (deg C)						11.87	11.73			14.7	12.28
Turbidity, field (N.T.U.)						3.91	11.2			3.98	58

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			10S		AE-11B						
Sample ID:	Residential	Residential	WL-GWF-AE-10S-1	WL-GWF-AE-10S-2	WL-GW-AE-11B-2	WL-GW-AE-11B-3	WL-GW-AE-11B-3-D	WL-GWF-AE-11B-2	WL-GWF-AE-11B-3	WL-GWF-AE-11B-3-D	WL-GW-AE-12B-2
Sample Date:	Groundwater	Groundwater	8/5/2014	12/15/2014	12/11/2014	9/16/2015	9/16/2015	12/11/2014	9/16/2015	9/16/2015	12/8/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate	Field Sample	Field Duplicate	Field Duplicate	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200				0.5 U	0.5 U	0.5 U				9.8
1,1,2-Trichloroethane					0.5 U	0.5 U	0.5 U				0.5 U
1,1-Dichloroethane	2.8				0.5 U	0.5 U	0.5 U				10
1,1-Dichloroethene					0.5 U	0.5 U	0.5 U				2.9
1,2-Dibromo-3-chloropropane					0.5 U	0.5 U	0.5 U				0.5 U
1,2-Dichloroethane					0.5 U	0.5 U	0.5 U				0.5 U
2-Butanone					5 U	5 U	5 U				5 U
Acetone					5 U	5 U	5 U				5 U
Benzene					0.5 U	0.5 U	0.5 U				0.5 U
Bromodichloromethane					0.5 U	0.5 U	0.5 U				0.5 U
Bromoform					0.5 U	0.5 U	0.5 U				0.5 U
Carbon disulfide					0.5 U	0.5 U	0.5 U				0.5 U
Chloroethane					0.5 U	0.5 U	0.5 U				0.5 U
Chloroform					0.5 U	1.1	0.99				0.5 U
cis-1,2-Dichloroethene	70				0.5 U	0.5 U	0.5 U				5.5
Cyclohexane					0.5 U	0.5 U	0.5 U				0.5 U
Ethylbenzene					0.5 U	0.5 U	0.5 U				0.5 U
Isopropylbenzene					0.5 U	0.5 U	0.5 U				0.5 U
m,p-Xylene					0.5 U	0.5 U	0.5 U				0.5 U
Methyl tert-butyl ether					0.5 U	0.5 U	0.5 U				0.33 J
Methylcyclohexane					0.5 U	0.5 U	0.5 U				0.5 U
Methylene chloride					0.5 U	0.5 U	0.5 U				0.5 U
o-Xylene					0.5 U	0.5 U	0.5 U				0.5 U
Tetrachloroethene					0.5 U	0.5 U	0.5 U				0.54
Toluene					0.5 U	0.5 U	0.5 U				0.5 U
trans-1,2-Dichloroethene					0.5 U	0.5 U	0.5 U				0.5 U
Trichloroethene	5	98			0.5 U	0.5 U	0.5 U				23
Vinyl chloride	2	7			0.5 U	0.5 U	0.5 U				0.5 U
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46					0.1 U	0.1 U				
Inorganics, Dissolved (ug/L)											
Aluminum			20 UJ	23.7				20 U	20 UJ	20 UJ	
Antimony			2 U	2 U				2 U	2 U	2 U	
Arsenic	10		2.5	2.7				1 U	0.1 J	0.11 J	
Barium			280	323				10 U	10 U	10 U	
Beryllium			1 U	1 U				1 U	1 U	1 U	
Cadmium			0.04 U	0.4 U				0.4 U	0.037 J	0.027 J	
Calcium			65200	69800				19600	21100	20800	
Chromium	100		3.1 J	6.9				16.6	56.2	55.7	
Chromium, Hexavalent	0.035	100	0.5 U	0.5 U				15.1 J+	53.8	52.3	
Cobalt	6		1 UJ	2				1.2	1 UJ	1 UJ	
Copper			2 U	1.2 J				2 UJ	2 U	2 U	
Iron			12200 J	8540				200 U	200 U	200 U	
Lead	15		0.2 U	0.2 U				0.2 U	1 U	1 U	
Magnesium			15500 J	16200				4700	5050 J	5020 J	
Manganese	300		1070 J	1300				398	50.3	49.4	

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			10S		AE-11B						
Sample ID:	Residential	Residential	WL-GWF-AE-10S-1	WL-GWF-AE-10S-2	WL-GW-AE-11B-2	WL-GW-AE-11B-3	WL-GW-AE-11B-3-D	WL-GWF-AE-11B-2	WL-GWF-AE-11B-3	WL-GWF-AE-11B-3-D	WL-GW-AE-12B-2
Sample Date:	Groundwater	Groundwater	8/5/2014	12/15/2014	12/11/2014	9/16/2015	9/16/2015	12/11/2014	9/16/2015	9/16/2015	12/8/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate	Field Sample	Field Duplicate	Field Duplicate	Field Sample
Parameter	PRGs	PRGs									
Mercury			0.2 UJ	0.034 J				0.2 UJ	0.028 J	0.2 U	
Nickel			1.7 J	4.6				2.5	1.4 J	1.4 J	
Potassium			3020	3960				1990	1390 J	1390 J	
Selenium			5 U	5 U				5 U	5 U	5 U	
Silver			1 U	1 U				1 U	1 U	1 U	
Sodium			166000	171000				41100	38500	37500	
Vanadium			5 U	5 U				5 UJ	5 U	5 U	
Zinc			6.2	10.7				2.3 U	3 J	3.5 J	
Inorganics (ug/L)											
Aluminum					76.7	20 UJ	20 UJ				70.7
Antimony					2 U	2 U	2 U				2 U
Arsenic	10				1 U	0.14 J	0.15 J				1 U
Barium					10.2	10 U	10 U				38.1
Beryllium					1 U	1 U	1 U				1 U
Cadmium					0.4 UJ	0.051 J	0.029 J				0.4 U
Calcium					18900 J	21200	21000				41600
Chromium	100				20.6	61	60.3				8460
Chromium, Hexavalent	0.035	100			13.6 J+	57.4	57				8920
Cobalt	6				1.2	1 UJ	1 UJ				1.5
Copper					2 UJ	2 U	2 U				0.68 J
Cyanide					1.7 J	10 U	10 U				2.5 U
Iron					230	200 U	200 U				2570
Lead	15				0.2 U	1 U	1 U				0.21 U
Magnesium					4800 J	5140 J	5090 J				12500
Manganese	300				374	50.2 J	50.2 J				285
Mercury					0.2 UJ	0.2 U	0.2 U				0.2 UJ
Nickel					2.5	1.3 J	1.3 J				7.6
Potassium					2030	1350 J	1360 J				4460
Selenium					5 U	5 U	5 U				5 U
Silver					1 U	0.039 J	0.04 J				1 UJ
Sodium					41000	39700	38800				92800
Vanadium					R	5 U	5 U				5 U
Zinc					2.3 U	2.3	2.4				15.1 J
Other											
Dissolved oxygen, field (mg/L)					3.42	6.36					2.39
ORP, field (mV)					63.4	284.8					148.9
pH, field (S.U.)					5.98	5.56					5.91
Spec. cond., field (umho/cm)					388	361					964
Temperature, field (deg C)					11.8	13.95					9.54
Turbidity, field (N.T.U.)					2.81	2.18					4.82

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			AE-12B			AE-13B				AE-	
Sample ID:	Residential	Residential	WL-GW-AE-12B-3	WL-GWF-AE-12B-2	WL-GWF-AE-12B-3	WL-GW-AE-13B-2	WL-GW-AE-13B-3	WL-GWF-AE-13B-2	WL-GWF-AE-13B-3	WL-GW-AE-14B-2	WL-GW-AE-14B-3
Sample Date:	Groundwater	Groundwater	9/15/2015	12/8/2014	9/15/2015	12/2/2014	9/21/2015	12/2/2014	9/21/2015	12/4/2014	9/16/2015
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200		1.2			0.5 U	0.5 U			0.24 J	0.57
1,1,2-Trichloroethane			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
1,1-Dichloroethane	2.8		4.5			0.62	0.5 U			3.6	9.5
1,1-Dichloroethene			0.8			0.5 U	0.5 U			0.5 U	1
1,2-Dibromo-3-chloropropane			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
1,2-Dichloroethane			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
2-Butanone			5 U			5 U	5 U			5 U	5 U
Acetone			5 U			5 U	5 U			5 U	5 U
Benzene			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Bromodichloromethane			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Bromoform			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Carbon disulfide			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Chloroethane			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Chloroform			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
cis-1,2-Dichloroethene	70		0.63			0.5 U	0.5 U			0.66	2.2
Cyclohexane			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Ethylbenzene			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Isopropylbenzene			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
m,p-Xylene			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Methyl tert-butyl ether			0.5 U			0.24 J	0.5 U			0.48 J	0.53
Methylcyclohexane			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Methylene chloride			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
o-Xylene			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Tetrachloroethene			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Toluene			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
trans-1,2-Dichloroethene			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Trichloroethene	5	98	4.8			0.5 U	0.5 U			1.5	1.7
Vinyl chloride	2	7	0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46		1.3				0.23 U				1.1
Inorganics, Dissolved (ug/L)											
Aluminum				20 U	93.8 J			20 U	20 U		
Antimony				2 U	0.11 J			2 U	2 U		
Arsenic	10			1 U	0.26			1.5	1.4		
Barium				37.1	37.6			51	26.9		
Beryllium				1 U	0.05 J			1 U	1 U		
Cadmium				0.4 U	0.19 J			0.4 U	1 U		
Calcium				42100	40700			49700	26500		
Chromium	100			8460	3720			2 U	2 U		
Chromium, Hexavalent	0.035	100		8440	3150			0.5 U	0.5 U		
Cobalt	6			1.5	1.2 J			9.9	6.7 J		
Copper				0.22 J	2.6			2 UJ	0.12 J		
Iron				2380	1140			21600	10300 J		
Lead	15			0.2 U	1 U			0.2 U	1 U		
Magnesium				12700	11100 J			15400	8660 J		
Manganese	300			282	209			2000 J	1160		

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			AE-12B			AE-13B				AE-	
Sample ID:	Residential	Residential	WL-GW-AE-12B-3	WL-GWF-AE-12B-2	WL-GWF-AE-12B-3	WL-GW-AE-13B-2	WL-GW-AE-13B-3	WL-GWF-AE-13B-2	WL-GWF-AE-13B-3	WL-GW-AE-14B-2	WL-GW-AE-14B-3
Sample Date:	Groundwater	Groundwater	9/15/2015	12/8/2014	9/15/2015	12/2/2014	9/21/2015	12/2/2014	9/21/2015	12/4/2014	9/16/2015
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury				0.2 UJ	0.2 U			0.2 UJ	0.2 U		
Nickel				7.4	5.9 J			3.4	1.4		
Potassium				4450	3960 J			3900 J	1540 J		
Selenium				5 U	5 U			5 U	5 U		
Silver				1 UJ	1 U			1 U	1 U		
Sodium				91000	78900			57500	25200 J		
Vanadium				5 U	5 U			5 U	0.2 J		
Zinc				10.4	8.4 J			7.1	12.3 J		
Inorganics (ug/L)											
Aluminum			1380 J			2250	365 J			1960	20 UJ
Antimony			0.16 J			2 U	2 U			2 U	2 U
Arsenic	10		1.3			2	2.1			3.3	0.97 J
Barium			43.1			53.9	27.4			102	140
Beryllium			0.24 J			1 U	1 U			1 U	0.068 J
Cadmium			0.17 J			0.4 U	1 U			0.4 U	0.093 J
Calcium			40000			46900	23700			60500	78800
Chromium	100		3120			6.3 U	2 U			7.4 U	2 U
Chromium, Hexavalent	0.035	100	3170			0.5 U	0.5 U			0.5 U	0.5 U
Cobalt	6		2.2 J			11.2	6.8 J			21.7	21.8 J
Copper			3.3			10.5	2 U			5.5	2 U
Cyanide			10 U			2.1 J	10 U			1.4 J	10 U
Iron			3920			22800	11300 J			15100	19300
Lead	15		2.6			3.6	1 U			3.8	1 U
Magnesium			11500 J			15000	8150 J			16300	19500 J
Manganese	300		250 J			2080	1220			3240	4320 J
Mercury			0.2 U			0.2 UJ	0.2 U			0.2 UJ	0.2 U
Nickel			8 J			6.4	1.8 J			9.5	6.2 J
Potassium			3800 J			4090	1550			4000	2870 J
Selenium			0.49 J			5 U	5 U			5 U	5 U
Silver			0.019 J			1 U	1 U			1 U	1 U
Sodium			79700			53300	23300			101000	118000
Vanadium			5 U			5 U	1.3 J			5 U	5 U
Zinc			14.3			15.5 J	19.1 J			27.1 J	21.6
Other											
Dissolved oxygen, field (mg/L)			2.41			0.76	0.22			0.79	0.14
ORP, field (mV)			166.1			-78.1	1.9			-6	2.3
pH, field (S.U.)			5.6			5.87	5.85			5.57	5.9
Spec. cond., field (umho/cm)			1043			1186	308			1100	1245
Temperature, field (deg C)			13.42			9.99	13.68			11.18	13.56
Turbidity, field (N.T.U.)			177			40	39.1			78.8	5.77

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			14B		AE-14D						AE-
Sample ID:	Residential	Residential	WL-GWF-AE-14B-2	WL-GWF-AE-14B-3	WL-GW-AE-14D-2	WL-GW-AE-14D-3	WL-GWF-AE-14D-2	WL-GWF-AE-14D-3	WL-GW-AE-15B-2	WL-GW-AE-15BD-2	WL-GW-AE-15B-3
Sample Date:	Groundwater	Groundwater	12/4/2014	9/16/2015	12/4/2014	9/16/2015	12/4/2014	9/16/2015	12/11/2014	12/11/2014	9/21/2015
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200				1.1	2.6			0.5 U	0.5 U	0.5 U
1,1,2-Trichloroethane					0.5 U	0.5 U			0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	2.8				3.1	5.2			0.12 J	0.5 U	0.5 U
1,1-Dichloroethene					0.5 U	0.99			0.5 U	0.5 U	0.5 U
1,2-Dibromo-3-chloropropane					0.5 U	0.5 U			0.5 U	0.5 U	0.5 U
1,2-Dichloroethane					0.5 U	0.5 U			0.5 U	0.5 UJ	0.5 U
2-Butanone					5 U	5 U			5 U	5 U	5 U
Acetone					5 U	5 U			5 U	5 U	5 U
Benzene					0.5 U	0.5 U			0.5 U	0.5 U	0.5 U
Bromodichloromethane					0.5 U	0.5 U			0.5 U	0.5 U	0.5 U
Bromoform					0.5 U	0.5 U			0.5 U	0.5 U	0.5 U
Carbon disulfide					0.5 U	0.5 U			0.5 U	0.5 U	0.5 U
Chloroethane					0.5 U	0.5 U			0.5 U	0.5 U	0.5 U
Chloroform					0.5 U	0.5 U			0.5 U	0.5 U	0.5 U
cis-1,2-Dichloroethene	70				1.5	2.7			0.5 U	0.5 U	0.5 U
Cyclohexane					5.1	0.5 U			0.5 U	0.5 U	0.5 U
Ethylbenzene					0.57	0.5 U			0.5 U	0.5 U	0.5 U
Isopropylbenzene					0.49 J	0.5 U			0.5 U	0.5 U	0.5 U
m,p-Xylene					1.9	0.5 U			0.5 U	0.5 U	0.5 U
Methyl tert-butyl ether					0.23 J	0.5 U			0.22 J	0.5 U	0.5 U
Methylcyclohexane					18	0.5 U			0.5 U	0.5 U	0.5 U
Methylene chloride					0.5 U	0.5 U			0.5 U	0.5 U	0.5 U
o-Xylene					0.19 J	0.5 U			0.5 U	0.5 U	0.5 U
Tetrachloroethene					0.5 U	0.5 U			0.5 U	0.5 U	0.5 U
Toluene					0.5 U	0.5 U			0.5 U	0.5 U	0.5 UJ
trans-1,2-Dichloroethene					0.5 U	0.5 U			0.5 U	0.5 U	0.5 U
Trichloroethene	5	98			4.7	7.5			2.5 J	0.5 UJ	2.8
Vinyl chloride	2	7			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46					0.1 U					0.49
Inorganics, Dissolved (ug/L)											
Aluminum			212	20 UJ			20 U	20 UJ			
Antimony			2 U	2 U			2 U	2 U			
Arsenic	10		0.69 J	0.99 J			0.28 J	0.13 J			
Barium			107	145			139	161			
Beryllium			1 U	0.086 J			1 U	0.065 J			
Cadmium			0.4 U	0.1 J			0.4 U	0.18 J			
Calcium			62800	81100			82000	68300			
Chromium	100		2 U	2 U			2 U	30.8			
Chromium, Hexavalent	0.035	100	0.5 U	0.5 U			0.5 U	26.8			
Cobalt	6		21.7	22.5 J			8.5	1.8 J			
Copper			0.81 J	2 U			0.31 J	2 U			
Iron			12000	20100			200 UJ	200 U			
Lead	15		0.42	1 U			0.2 U	1 U			
Magnesium			16300	20200 J			21700	15900 J			
Manganese	300		3060 J	4580			2250 J	427			

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			14B		AE-14D						AE-
Sample ID:	Residential	Residential	WL-GWF-AE-14B-2	WL-GWF-AE-14B-3	WL-GW-AE-14D-2	WL-GW-AE-14D-3	WL-GWF-AE-14D-2	WL-GWF-AE-14D-3	WL-GW-AE-15B-2	WL-GW-AE-15BD-2	WL-GW-AE-15B-3
Sample Date:	Groundwater	Groundwater	12/4/2014	9/16/2015	12/4/2014	9/16/2015	12/4/2014	9/16/2015	12/11/2014	12/11/2014	9/21/2015
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate	Field Sample
Parameter	PRGs	PRGs									
Mercury			0.2 UJ	0.2 U			0.2 UJ	0.2 U			
Nickel			7.6	6.7 J			8.8	5.2 J			
Potassium			3920 J	3080 J			17100 J	18300 J			
Selenium			5 U	5 U			5 U	5 U			
Silver			1 U	1 U			1 U	1 U			
Sodium			106000	120000			308000	330000			
Vanadium			5 U	5 U			5 U	5 U			
Zinc			25.3	35.8 J			10	8.3 J			
Inorganics (ug/L)											
Aluminum					763	155 J			72.4	104	52.1 J
Antimony					2 U	0.073 J			2 U	2 U	2 U
Arsenic	10				0.54 J	0.27 J			1 U	1 U	0.27 J
Barium					124	162			22.9	22.5	25.5
Beryllium					1 U	0.1 J			1 U	1 U	1 U
Cadmium					0.4 U	0.24 J			0.4 UJ	0.4 UJ	0.14 J
Calcium					76500	66700			31000 J	31100 J	34600
Chromium	100				2.6 U	30			12100	12200	11700
Chromium, Hexavalent	0.035	100			0.5 U	27.7			11900	11500	11500
Cobalt	6				8.2	1.9 J			1 U	1 U	0.29 J
Copper					1.2 J	2 U			2 UJ	2 UJ	2 U
Cyanide					1.8 J	10 U			1.9 J	1.6 J	10 U
Iron					1230	286			3670	3670	3760 J
Lead	15				1	1 U			0.2 U	0.2 U	1 U
Magnesium					20200	15700 J			7900 J	7850 J	8880 J
Manganese	300				2280	410 J			101	101	132
Mercury					0.2 UJ	0.2 U			0.2 UJ	0.2 UJ	0.2 U
Nickel					8.9	4.7 J			1.6	1.6	2.5 J
Potassium					15700	17600 J			2950	2950	2930
Selenium					5 U	5 U			5 U	0.43 J	5 U
Silver					1 U	0.065 J			1 U	1 U	1 U
Sodium					292000	308000			77900	77600	71000
Vanadium					5 U	5 U			R	R	5 U
Zinc					8.5 J	7.6			2.8 U	3.7 U	2 UJ
Other											
Dissolved oxygen, field (mg/L)					0.72	1.14			0.24		0.27
ORP, field (mV)					-128.1	308.2			11		122
pH, field (S.U.)					5.76	5.85			6.16		6.19
Spec. cond., field (umho/cm)					2014	1979			652		528
Temperature, field (deg C)					11.19	13.54			12.37		12.91
Turbidity, field (N.T.U.)					24.3	13.7			4.16		4.4

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			15B			AE-15D				AE-	
Sample ID:	Residential	Residential	WL-GWF-AE-15B-2	WL-GWF-AE-15BD-2	WL-GWF-AE-15B-3	WL-GW-AE-15D-2	WL-GW-AE-15D-3	WL-GWF-AE-15D-2	WL-GWF-AE-15D-3	WL-GW-AE-15S-2	WL-GW-AE-15S-3
Sample Date:	Groundwater	Groundwater	12/11/2014	12/11/2014	9/21/2015	12/9/2014	9/21/2015	12/9/2014	9/21/2015	12/9/2014	9/21/2015
Sample Type:	Drinking Water	Irrigation Well	Field Duplicate	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200					0.5 U	0.5 U			0.5 U	0.5 U
1,1,2-Trichloroethane						0.5 U	0.5 U			0.5 U	0.5 U
1,1-Dichloroethane	2.8					0.5 U	0.5 U			0.5 U	0.5 U
1,1-Dichloroethene						0.5 U	0.5 U			0.5 U	0.5 U
1,2-Dibromo-3-chloropropane						0.5 U	0.5 U			0.5 U	0.5 U
1,2-Dichloroethane						0.5 U	0.5 U			0.5 U	0.5 U
2-Butanone						5 U	5 U			5 U	5 U
Acetone						5 U	5 U			5 U	5 U
Benzene						0.5 U	0.5 U			0.5 U	0.5 U
Bromodichloromethane						0.5 U	0.5 U			0.5 U	0.5 U
Bromoform						0.5 U	0.5 U			0.5 U	0.5 U
Carbon disulfide						0.5 U	0.5 U			0.5 U	0.5 U
Chloroethane						0.5 U	0.5 U			0.5 U	0.5 U
Chloroform						0.5 U	0.5 U			0.5 U	0.5 U
cis-1,2-Dichloroethene	70					0.5 U	0.5 U			0.5 U	0.5 U
Cyclohexane						0.5 U	0.5 U			0.5 U	0.5 U
Ethylbenzene						0.5 U	0.5 U			0.5 U	0.5 U
Isopropylbenzene						0.5 U	0.5 U			0.5 U	0.5 U
m,p-Xylene						0.5 U	0.5 U			0.5 U	0.5 U
Methyl tert-butyl ether						0.5 U	0.5 U			0.5 U	0.5 U
Methylcyclohexane						0.5 U	0.5 U			0.5 U	0.5 U
Methylene chloride						0.5 U	0.5 U			0.5 U	0.5 U
o-Xylene						0.5 U	0.5 U			0.5 U	0.5 U
Tetrachloroethene						0.5 U	0.5 U			0.5 U	0.5 U
Toluene						0.5 U	0.5 UJ			0.5 U	0.5 UJ
trans-1,2-Dichloroethene						0.5 U	0.5 U			0.5 U	0.5 U
Trichloroethene	5	98				1.6	2.2			0.17 J	0.5 U
Vinyl chloride	2	7				0.5 U	0.5 U			0.5 U	0.5 U
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46						0.13 U				4.9
Inorganics, Dissolved (ug/L)											
Aluminum			20 U	20 U	20 U			54.8 J+	50.4		
Antimony			2 U	2 U	2 U			2 U	2 U		
Arsenic	10		1 U	1 U	0.25 J			1 U	0.13 J		
Barium			21.2	21.3	26.3			50.8	80.7		
Beryllium			1 U	1 U	1 U			1 U	0.08 J		
Cadmium			0.4 U	0.4 U	0.13 J			0.5	0.64 J		
Calcium			31100	31500	36700			36100	45000		
Chromium	100		12200	12000	12000			12100	11600		
Chromium, Hexavalent	0.035	100	11700	11800				12000			
Cobalt	6		1 U	1 U	1 UJ			1.5	2.2 J		
Copper			2 UJ	2 UJ	0.48 J			0.27 J	1.2 J		
Iron			3160	3210	3580 J			3530	3430 J		
Lead	15		0.2 U	0.2 U	1 U			0.2 U	1 U		
Magnesium			7790	7870	9040 J			8820	10400 J		
Manganese	300		101	98.5	121			578	593		

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			15B			AE-15D				AE-	
Sample ID:	Residential	Residential	WL-GWF-AE-15B-2	WL-GWF-AE-15BD-2	WL-GWF-AE-15B-3	WL-GW-AE-15D-2	WL-GW-AE-15D-3	WL-GWF-AE-15D-2	WL-GWF-AE-15D-3	WL-GW-AE-15S-2	WL-GW-AE-15S-3
Sample Date:	Groundwater	Groundwater	12/11/2014	12/11/2014	9/21/2015	12/9/2014	9/21/2015	12/9/2014	9/21/2015	12/9/2014	9/21/2015
Sample Type:	Drinking Water	Irrigation Well	Field Duplicate	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury			0.2 UJ	0.2 UJ	0.2 U			0.2 UJ	0.2 U		
Nickel			1.6	1.6	2.4			19.5	22.5		
Potassium			2840	2860	2940 J			4630	4590 J		
Selenium			5 U	5 U	5 U			5 U	5 U		
Silver			1 U	1 U	0.018 J			1 UJ	0.064 J		
Sodium			74900	76000	73400 J			121000	151000 J		
Vanadium			5 UJ	5 UJ	5 U			5 U	5 U		
Zinc			2.4 U	2.1 U	2.4 J			51	86.8 J		
Inorganics (ug/L)											
Aluminum						421	678 J			65.1 U	31.8 J
Antimony						2 U	2 U			2 U	2 U
Arsenic	10					1 U	0.9 J			1 U	0.21 J
Barium						52.6	80.7			25.5	80.8
Beryllium						1 U	0.12 J			1 U	0.043 J
Cadmium						0.48 J-	0.6 J			0.4 U	0.19 J
Calcium						35300	41400			9620	27300
Chromium	100					11500	11000			1780	1880
Chromium, Hexavalent	0.035	100				12300				1830	1800 J
Cobalt	6					1.9	2.7 J			1 U	0.32 J
Copper						0.98 J	2.1			0.5 J	2 U
Cyanide						2.5 U	10 U			4.6 U	10 U
Iron						4080	4740 J			589	630 J
Lead	15					0.81	1 U			0.49 U	1 U
Magnesium						8840	10200 J			2100	6870 J
Manganese	300					616	701			256	435
Mercury						0.2 UJ	0.2 U			0.2 UJ	0.2 U
Nickel						19.9	22.2 J			3.8	5 J
Potassium						4540	4580			2580	3630
Selenium						5 U	5 U			5 U	5 U
Silver						1 UJ	1 U			1 UJ	1 U
Sodium						119000	155000			97600	216000
Vanadium						5 U	5 U			5 U	5 U
Zinc						52.3 J	88 J			2.4 UJ	10.3 J
Other											
Dissolved oxygen, field (mg/L)						2.76	0.41			5.96	4.81
ORP, field (mV)						182.8	230.8			44.7	148.1
pH, field (S.U.)						5.28	5.6			5.31	5.2
Spec. cond., field (umho/cm)						876	1005			541	1124
Temperature, field (deg C)						11.44	14.02			9.32	14.96
Turbidity, field (N.T.U.)						-56	0.92			12.7	1.09

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			15S		AE-16S		AE-17S			AE-18S	
Sample ID:	Residential	Residential	WL-GWF-AE-15S-2	WL-GWF-AE-15S-3	WL-GW-AE-16S-2	WL-GWF-AE-16S-2	WL-GW-AE-17S-2	WL-GW-AE-17S-3	WL-GWF-AE-17S-2	WL-GW-AE-18S-2	WL-GWF-AE-18S-2
Sample Date:	Groundwater	Groundwater	12/9/2014	9/21/2015	12/4/2014	12/4/2014	12/4/2014	9/21/2015	12/4/2014	12/3/2014	12/3/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200				0.15 J		0.5 U	0.5 U		0.5 U	
1,1,2-Trichloroethane					0.5 U		0.5 U	0.5 U		0.5 U	
1,1-Dichloroethane	2.8				0.34 J		0.5 U	0.5 U		0.5 U	
1,1-Dichloroethene					0.5 U		0.5 U	0.5 U		0.5 U	
1,2-Dibromo-3-chloropropane					0.5 U		0.5 U	0.5 U		0.5 U	
1,2-Dichloroethane					0.5 U		0.5 U	0.5 U		0.5 U	
2-Butanone					5 U		5 U	5 U		5 U	
Acetone					5 U		5 U	5 U		5 U	
Benzene					0.1 J		0.12 J	0.32 J		0.5 U	
Bromodichloromethane					0.5 U		0.5 U	0.5 U		0.5 U	
Bromoform					0.5 U		0.5 U	0.5 U		0.5 U	
Carbon disulfide					0.5 U		0.5 U	0.5 U		0.5 U	
Chloroethane					0.5 U		0.5 U	0.5 U		0.5 U	
Chloroform					0.5 U		0.5 U	0.5 U		0.5 U	
cis-1,2-Dichloroethene	70				0.12 J		0.5 U	0.5 U		0.5 U	
Cyclohexane					0.25 J		1.1	0.49 J		0.5 U	
Ethylbenzene					0.5 U		0.73	0.76		0.5 U	
Isopropylbenzene					0.5 U		1	3		0.5 U	
m,p-Xylene					0.5 U		0.5 U	0.5 U		0.5 U	
Methyl tert-butyl ether					0.5 U		0.5 U	0.5 U		0.5 U	
Methylcyclohexane					0.5 U		0.2 J	0.5 U		0.5 U	
Methylene chloride					0.5 U		0.5 U	0.5 U		0.5 U	
o-Xylene					0.5 U		0.5 U	0.5 U		0.5 U	
Tetrachloroethene					0.5 U		0.5 U	0.5 U		0.5 U	
Toluene					0.5 U		0.5 U	0.5 UJ		0.5 U	
trans-1,2-Dichloroethene					0.5 U		0.5 U	0.5 U		0.5 U	
Trichloroethene	5	98			0.3 J		0.5 U	0.5 U		0.5 U	
Vinyl chloride	2	7			0.5 U		0.5 U	0.5 U		0.5 U	
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46										
Inorganics, Dissolved (ug/L)											
Aluminum			20 U	20 U		20 U			39.9		38.5
Antimony			2 U	2 U		2 U			2 U		2 U
Arsenic	10		1 U	0.16 J		0.73 J			0.88 J		0.11 J
Barium			27.7	81.9		139			35.2		20.2
Beryllium			1 U	0.05 J		1 U			1 U		1 U
Cadmium			0.4 U	0.22 J		0.4 U			0.4 U		0.4 U
Calcium			10800	29000		29100			15000		5660
Chromium	100		1800	2080		2 U			2 U		2 U
Chromium, Hexavalent	0.035	100	1820	1910		0.5 U			0.5 U		0.5 U
Cobalt	6		1 U	1 UJ		5.3			1.5		1 U
Copper			0.84 J	0.73 J		4.1			4		0.16 J
Iron			577	578 J		1130			382		200 UJ
Lead	15		0.2 U	1 U		0.57			0.23 U		0.2 U
Magnesium			2320	6450 J		4000			1720		1450
Manganese	300		251	405		560 J			482 J		22.3 J

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			15S		AE-16S		AE-17S			AE-18S	
Sample ID:	Residential	Residential	WL-GWF-AE-15S-2	WL-GWF-AE-15S-3	WL-GW-AE-16S-2	WL-GWF-AE-16S-2	WL-GW-AE-17S-2	WL-GW-AE-17S-3	WL-GWF-AE-17S-2	WL-GW-AE-18S-2	WL-GWF-AE-18S-2
Sample Date:	Groundwater	Groundwater	12/9/2014	9/21/2015	12/4/2014	12/4/2014	12/4/2014	9/21/2015	12/4/2014	12/3/2014	12/3/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury			0.2 UJ	0.2 U		0.2 UJ			0.2 UJ		0.2 UJ
Nickel			4.4	5.1		4.8			2.6		1.5
Potassium			2850	3630 J		4250 J			1670 J		814 J
Selenium			5 U	5 U		5 U			5 U		5 U
Silver			1 UJ	0.072 J		1 U			1 U		1 U
Sodium			109000	222000 J		125000			26600		7090
Vanadium			5 U	5 U		5 U			5 U		5 U
Zinc			4.2	9.7 J		78.5			57.9		51.1
Inorganics (ug/L)											
Aluminum					668		488			171	
Antimony					2 U		2 U			2 U	
Arsenic	10				0.84 J		1.1			0.14 J	
Barium					141		35			20.5	
Beryllium					1 U		1 U			1 U	
Cadmium					0.4 U		0.4 U			0.4 U	
Calcium					29100		14700			5880	
Chromium	100				2 U		2 U			2 U	
Chromium, Hexavalent	0.035	100			0.5 U		0.5 U			0.5 U	
Cobalt	6				5.5		1.7			1 U	
Copper					6.5		4.5			0.44 J	
Cyanide					2.8		2.8			2 J	
Iron					1420		974			200 UJ	
Lead	15				2.7		1.9			0.41	
Magnesium					3930		1730			1580	
Manganese	300				567		491			29.5	
Mercury					0.2 UJ		0.2 UJ			0.2 UJ	
Nickel					4.9		3.2			1.8	
Potassium					4360		1620			888	
Selenium					5 U		5 U			5 U	
Silver					1 U		1 U			1 U	
Sodium					135000		25200			7540	
Vanadium					5 U		5 U			5 U	
Zinc					76.2 J		54.5 J			47.9 J	
Other											
Dissolved oxygen, field (mg/L)					0.81		3.15	0.28		4.29	
ORP, field (mV)					114.6		-3.9	-43.4		299.7	
pH, field (S.U.)					5.65		5.75	6.31		5.65	
Spec. cond., field (umho/cm)					854		259	512		120	
Temperature, field (deg C)					10.25		13.01	20.16		12.2	
Turbidity, field (N.T.U.)					4.71		4.95	2.06		4.31	

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			AE-19S		AE-20B				AE-ML-01A		AE-M
Sample ID:	Residential	Residential	WL-GW-AE-19S-2	WL-GWF-AE-19S-2	WL-GW-AE-20B-2	WL-GW-AE-20B-3	WL-GWF-AE-20B-2	WL-GWF-AE-20B-3	WL-GW-AE-ML-01A-3	WL-GWF-AE-ML-01A-3	WL-GW-AE-ML-01B-3
Sample Date:	Groundwater	Groundwater	12/4/2014	12/4/2014	12/4/2014	9/15/2015	12/4/2014	9/15/2015	9/22/2015	9/22/2015	9/22/2015
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200		3.7		0.5 U	0.5 U			0.5 U		0.5 U
1,1,2-Trichloroethane			0.5 U		0.5 U	0.5 U			0.5 U		0.5 U
1,1-Dichloroethane	2.8		3.2		0.96	0.5 U			0.5 U		0.5 U
1,1-Dichloroethene			0.96 U		0.5 U	0.5 U			0.5 U		0.5 U
1,2-Dibromo-3-chloropropane			0.5 U		0.5 U	0.5 U			0.5 U		0.5 U
1,2-Dichloroethane			0.5 U		0.5 U	0.5 U			0.5 U		0.5 U
2-Butanone			5 U		5 U	5 U			5 U		5 U
Acetone			5 U		5 U	5 U			5 U		5 U
Benzene			0.5 U		0.5 U	0.5 U			0.5 U		0.5 U
Bromodichloromethane			0.5 U		0.5 U	0.5 U			0.5 U		0.5 U
Bromoform			0.5 U		0.5 U	0.5 U			0.5 U		0.5 U
Carbon disulfide			0.5 U		0.5 U	0.5 U			0.5 U		0.5 U
Chloroethane			0.5 U		0.5 U	0.5 U			0.5 U		0.5 U
Chloroform			0.5 U		0.5 U	0.5 U			0.5 U		0.5 U
cis-1,2-Dichloroethene	70		1.6		3.1	0.5 U			2.6		2.3
Cyclohexane			0.5 U		0.5 U	0.5 U			0.5 U		0.5 U
Ethylbenzene			0.5 U		0.5 U	0.5 U			0.5 U		0.5 U
Isopropylbenzene			0.5 U		0.5 U	0.5 U			0.5 U		0.5 U
m,p-Xylene			0.5 U		0.5 U	0.5 U			0.5 U		0.5 U
Methyl tert-butyl ether			0.11 J		0.5 U	0.5 U			0.5 U		0.5 U
Methylcyclohexane			0.5 U		0.5 U	0.5 U			0.5 U		0.5 U
Methylene chloride			0.5 U		0.5 U	0.5 U			0.95 U		0.5 U
o-Xylene			0.5 U		0.5 U	0.5 U			0.5 U		0.5 U
Tetrachloroethene			0.5 U		0.5 U	0.5 U			0.58		0.5 U
Toluene			0.5 U		0.5 U	0.5 U			0.5 U		0.39 J
trans-1,2-Dichloroethene			0.5 U		0.5 U	0.5 U			0.5 U		0.5 U
Trichloroethene	5	98	7.6		1.1	0.46 J			6.3		6.2
Vinyl chloride	2	7	0.5 U		0.5 U	0.5 U			0.5 U		0.5 U
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46					0.095 J			0.1 U		0.1 U
Inorganics, Dissolved (ug/L)											
Aluminum				132			21.7	24.3 J		20 U	
Antimony				2 U			2 U	2 U		2 U	
Arsenic	10			0.47 J			0.35 J	0.37 J		2.9	
Barium				56.8			42.7	15.2		75.1	
Beryllium				1 U			1 U	0.041 J		1 U	
Cadmium				0.4 U			0.4 U	0.065 J		0.11 J	
Calcium				20300			44400	22600		93700	
Chromium	100			2.4			1360	62.6		2 U	
Chromium, Hexavalent	0.035	100		2 J+			1120	58.2		0.5 U	
Cobalt	6			1 U			3.2	2.4 J		7.3 J	
Copper				0.97 J			1.1 J	2 U		2 U	
Iron				200 UJ			456	200 U		2010 J	
Lead	15			0.2 U			0.2 U	1 U		1 U	
Magnesium				4140			16500	8280 J		12400 J	
Manganese	300			42.3 J			266 J	43.7		1660	

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			AE-19S		AE-20B				AE-ML-01A		AE-M
Sample ID:	Residential	Residential	WL-GW-AE-19S-2	WL-GWF-AE-19S-2	WL-GW-AE-20B-2	WL-GW-AE-20B-3	WL-GWF-AE-20B-2	WL-GWF-AE-20B-3	WL-GW-AE-ML-01A-3	WL-GWF-AE-ML-01A-3	WL-GW-AE-ML-01B-3
Sample Date:	Groundwater	Groundwater	12/4/2014	12/4/2014	12/4/2014	9/15/2015	12/4/2014	9/15/2015	9/22/2015	9/22/2015	9/22/2015
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury				0.2 UJ			0.2 UJ	0.2 U		0.2 U	
Nickel				2.4			5.3	3.9 J		2.9	
Potassium				7090 J			3090 J	1560 J		1930 J	
Selenium				5 U			5 U	5 U		5 U	
Silver				1 U			1 U	1 U		1 U	
Sodium				56100			57000	20400		68100 J	
Vanadium				5 U			5 U	5 U		0.19 J	
Zinc				13.5			26.5	11.2 J		10.7 J	
Inorganics (ug/L)											
Aluminum			1240		171	123 J			20 UJ		20 UJ
Antimony			2 U		2 U	0.078 J			2 U		2 U
Arsenic	10		0.95 J		0.47 J	0.48 J			3.2		1.4
Barium			54.5		40.1	15.5			72.7		90.5
Beryllium			1 U		1 U	0.046 J			1 U		1 U
Cadmium			0.4 U		0.4 U	0.053 J			0.13 J		0.046 J
Calcium			19100		43700	23600			87100		83900
Chromium	100		3.8 U		1340	78.2			2 U		2 U
Chromium, Hexavalent	0.035	100	1.7 J+		1270	61.3			0.5 U		0.5 U
Cobalt	6		1 U		3.1	2.1 J			7.5 J		0.88 J
Copper			2.9		2.1	2 U			2 U		2 U
Cyanide			1.7 J		3	10 U			10 U		10 U
Iron			1930		758	286			2110 J		680 J
Lead	15		1.4		0.38	1 U			1 U		1 U
Magnesium			4200		16200	8860 J			11700 J		8730 J
Manganese	300		76.1		253	40 J			1770		1950
Mercury			0.2 UJ		0.2 UJ	0.2 U			0.2 U		0.2 U
Nickel			3.6		5.3	3.6 J			2.8 J		1.3 J
Potassium			6690		2970	1490 J			1880		2610
Selenium			0.48 J		5 U	5 U			5 U		5 U
Silver			1 U		1 U	1 U			1 U		1 U
Sodium			53100		55600	21300			63900		73300
Vanadium			5 U		5 U	5 U			0.37 J		5 U
Zinc			13.5 J		24.7 J	9.1			29.7 J		15.9 J
Other											
Dissolved oxygen, field (mg/L)			7.41		1.18	3.15			0.53		0.33
ORP, field (mV)			255.9		-42.8	125.5			-41.3		-137
pH, field (S.U.)			5.84		6	5.64			6.6		7.39
Spec. cond., field (umho/cm)			430		648	349			855		802
Temperature, field (deg C)			12.35		11.14	14.11			15.72		16.43
Turbidity, field (N.T.U.)			17.3		8.12	4.11			2.5		0.73

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			L-01B	AE-ML-01C		AE-ML-02				AE-ML-03A	
Sample ID:	Residential	Residential	WL-GWF-AE-ML-01B-3	WL-GW-AE-ML-01C-3	WL-GWF-AE-ML-01C-3	WL-GW-AE-ML-02-3	WL-GW-AE-ML-02-3-D	WL-GWF-AE-ML-02-3	WL-GWF-AE-ML-02-3-D	WL-GW-AE-ML-03A-3	WL-GWF-AE-ML-03A-3
Sample Date:	Groundwater	Groundwater	9/22/2015	9/22/2015	9/22/2015	9/21/2015	9/21/2015	9/21/2015	9/21/2015	9/16/2015	9/16/2015
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate	Field Duplicate	Field Duplicate	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200			0.5 U		0.82	0.76			0.5 U	
1,1,2-Trichloroethane				0.5 U		0.5 U	0.5 U			0.5 U	
1,1-Dichloroethane	2.8			0.5 U		25	18			0.5 U	
1,1-Dichloroethene				0.5 U		2.7	2.6			0.5 U	
1,2-Dibromo-3-chloropropane				0.5 U		0.5 U	0.5 U			0.5 U	
1,2-Dichloroethane				0.5 U		0.5 U	0.5 U			0.5 U	
2-Butanone				5 U		5 U	5 U			5 U	
Acetone				5 U		5 U	5 U			5 U	
Benzene				0.5 U		0.5 U	0.5 U			0.5 U	
Bromodichloromethane				0.5 U		0.5 U	0.5 U			0.5 U	
Bromoform				0.5 U		0.5 U	0.5 U			0.5 U	
Carbon disulfide				0.5 U		0.5 U	0.5 U			0.5 U	
Chloroethane				0.5 U		0.5 U	0.5 U			0.5 U	
Chloroform				0.5 U		0.5 U	0.5 U			0.5 U	
cis-1,2-Dichloroethene	70			2.2		1.6	1.5			0.5 U	
Cyclohexane				0.5 U		0.5 U	0.5 U			0.5 U	
Ethylbenzene				0.5 U		0.5 U	0.5 U			0.5 U	
Isopropylbenzene				0.5 U		0.5 U	0.5 U			0.5 U	
m,p-Xylene				0.5 U		0.23 J	0.5 U			0.5 U	
Methyl tert-butyl ether				0.43 J		0.69	0.72			0.5 U	
Methylcyclohexane				0.5 U		0.5 U	0.5 U			0.5 U	
Methylene chloride				0.52 U		0.24 J	0.5 U			0.5 U	
o-Xylene				0.5 U		0.5 U	0.5 U			0.5 U	
Tetrachloroethene				0.5 U		0.5 U	0.5 U			0.5 U	
Toluene				0.47 J		4.6 J	4.3 J			1.3	
trans-1,2-Dichloroethene				0.5 U		0.5 U	0.5 U			0.5 U	
Trichloroethene	5	98		4		6.2	5.8			0.5 U	
Vinyl chloride	2	7		0.5 U		0.5 U	0.5 U			0.5 U	
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46			0.1 U		13 J	8.5 J			0.1 U	
Inorganics, Dissolved (ug/L)											
Aluminum			20 U		20 U			20 U	20 U		20 UJ
Antimony			2 U		2 U			2 U	2 U		0.33 J
Arsenic	10		1.3		2.3			0.73 J	0.77 J		2.1
Barium			89.8		118			105	104		29.6
Beryllium			1 U		1 U			1 U	1 U		1 U
Cadmium			0.043 J		1 U			1 U	1 U		1 U
Calcium			84700		71500			79800	81400		14900
Chromium	100		2 U		2 U			2 U	2 U		2 U
Chromium, Hexavalent	0.035	100	0.5 U		0.5 U			0.5 U	0.5 U		0.5 U
Cobalt	6		1 UJ		1 UJ			1.1 J	1.2 J		1 UJ
Copper			2 U		2 U			0.32 J	0.25 J		2 U
Iron			583 J		398 J			16600 J	16700 J		200 U
Lead	15		1 U		1 U			1 U	1 U		1 U
Magnesium			8700 J		7480 J			14400 J	14400 J		3710 J
Manganese	300		1750		1480			3730	3850		60.3

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			L-01B	AE-ML-01C		AE-ML-02				AE-ML-03A	
Sample ID:	Residential	Residential	WL-GWF-AE-ML-01B-3	WL-GW-AE-ML-01C-3	WL-GWF-AE-ML-01C-3	WL-GW-AE-ML-02-3	WL-GW-AE-ML-02-3-D	WL-GWF-AE-ML-02-3	WL-GWF-AE-ML-02-3-D	WL-GW-AE-ML-03A-3	WL-GWF-AE-ML-03A-3
Sample Date:	Groundwater	Groundwater	9/22/2015	9/22/2015	9/22/2015	9/21/2015	9/21/2015	9/21/2015	9/21/2015	9/16/2015	9/16/2015
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate	Field Duplicate	Field Duplicate	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury			0.2 U		0.2 U			0.2 U	0.2 U		0.2 U
Nickel			1.1		1.4			1.1	1.2		1 UJ
Potassium			2520 J		2990 J			3790 J	3910 J		1880 J
Selenium			5 U		5 U			5 U	5 U		5 U
Silver			1 U		1 U			1 U	1 U		1 U
Sodium			71400 J		53900 J			86400 J	85900 J		33300
Vanadium			5 U		5 U			5 U	5 U		5 U
Zinc			11.7 J		16.1 J			19.3 J	18.1 J		2.8 J
Inorganics (ug/L)											
Aluminum				328 J		36.1 J	38.3 J			72.1 J	
Antimony				2 U		2 U	2 U			0.3 J	
Arsenic	10			2.7		0.63 J	0.59 J			2.1	
Barium				101		103	98.7			29.1	
Beryllium				0.039 J		1 U	1 U			1 U	
Cadmium				1 U		1 U	0.026 J			1 U	
Calcium				66800		77000	74400			14200	
Chromium	100			42.2		13.4	13.9			2 U	
Chromium, Hexavalent	0.035	100		0.5 U		0.5 U	0.5 U			0.5 U	
Cobalt	6			0.86 J		0.98 J	0.91 J			1 UJ	
Copper				2 U		2 U	2 U			2 U	
Cyanide				10 U		10 U	10 U			10 U	
Iron				1600 J		18200 J	18200 J			29.7 J-	
Lead	15			1 U		1 U	1 U			1 U	
Magnesium				7220 J		14200 J	13900 J			3460 J	
Manganese	300			1410		3750	3710			54.1 J	
Mercury				0.2 U		0.2 U	0.2 U			0.2 U	
Nickel				1.4 J		1.2 J	1.1 J			1 UJ	
Potassium				2870		4040	3990			1850 J	
Selenium				0.41 J		5 U	5 U			5 U	
Silver				1 U		1 U	1 U			1 U	
Sodium				56000		82900	79000			35800	
Vanadium				5 U		5 U	5 U			5 U	
Zinc				35.5 J		142 J	141 J			5.3	
Other											
Dissolved oxygen, field (mg/L)				0.34		0.1				0.46	
ORP, field (mV)				-169.2		-239				139.5	
pH, field (S.U.)				7.34		7.35				7.9	
Spec. cond., field (umho/cm)				664		849				300	
Temperature, field (deg C)				16.54		14.45				14.51	
Turbidity, field (N.T.U.)				0.96		7.1				2.14	

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			AE-ML-03B		AE-ML-03C		AE-ML-04A				AE-M
Sample ID:	Residential	Residential	WL-GW-AE-ML-03B-3	WL-GWF-AE-ML-03B-3	WL-GW-AE-ML-03C-3	WL-GWF-AE-ML-03C-3	WL-GW-AE-ML-04A-3	WL-GW-AE-ML-04A-3-D	WL-GWF-AE-ML-04A-3	WL-GWF-AE-ML-04A-3-D	WL-GW-AE-ML-04B-3
Sample Date:	Groundwater	Groundwater	9/16/2015	9/16/2015	9/16/2015	9/16/2015	9/23/2015	9/23/2015	9/23/2015	9/23/2015	9/23/2015
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate	Field Duplicate	Field Duplicate	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200		0.5 U		0.5 U		8.8	7.8			0.91
1,1,2-Trichloroethane			0.5 U		0.5 U		0.5 U	0.5 U			0.5 U
1,1-Dichloroethane	2.8		0.5 U		0.5 U		12	10			7.8
1,1-Dichloroethene			0.5 U		0.5 U		4.2	3.5			0.94
1,2-Dibromo-3-chloropropane			0.5 U		0.5 U		0.5 U	0.5 U			0.5 U
1,2-Dichloroethane			0.5 U		0.42 J+		0.5 U	0.5 U			0.5 U
2-Butanone			5 U		5 U		5 U	5 U			5 U
Acetone			5 U		5 U		5 U	5 U			5 U
Benzene			0.5 U		0.5 U		0.5 U	0.5 U			0.5 U
Bromodichloromethane			0.5 U		0.5 U		0.5 U	0.5 U			0.5 U
Bromoform			0.5 U		0.5 U		0.5 U	0.5 U			0.5 U
Carbon disulfide			0.5 U		0.5 U		0.5 U	0.5 U			0.5 U
Chloroethane			0.5 U		0.5 U		0.5 U	0.5 U			0.5 U
Chloroform			0.5 U		0.5 U		0.5 U	0.5 U			0.5 U
cis-1,2-Dichloroethene	70		0.5 U		0.5 U		1.8	1.5			0.64
Cyclohexane			0.5 U		0.5 U		0.5 U	0.5 U			0.5 U
Ethylbenzene			0.5 U		0.5 U		0.5 U	0.5 U			0.5 U
Isopropylbenzene			0.5 U		0.5 U		0.5 U	0.5 U			0.5 U
m,p-Xylene			0.5 U		0.5 U		0.5 U	0.5 U			0.5 U
Methyl tert-butyl ether			0.5 U		0.5 U		0.74	0.71			0.5 J
Methylcyclohexane			0.5 U		0.5 U		0.5 U	0.5 U			0.5 U
Methylene chloride			0.5 U		0.5 U		0.5 U	0.5 U			0.5 U
o-Xylene			0.5 U		0.5 U		0.5 U	0.5 U			0.5 U
Tetrachloroethene			0.5 U		0.5 U		0.48 J	0.5 U			0.5 U
Toluene			0.5 U		0.5 U		0.5 U	0.5 U			0.5 U
trans-1,2-Dichloroethene			0.5 U		0.5 U		0.5 U	0.5 U			0.5 U
Trichloroethene	5	98	0.5 U		0.5 U		19	17			2
Vinyl chloride	2	7	0.5 U		0.5 U		0.5 U	0.5 U			0.5 U
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46		0.1 U		0.1 U		3.2	3.1			0.95
Inorganics, Dissolved (ug/L)											
Aluminum				20 UJ		20 UJ			20 U	20 U	
Antimony				0.31 J		0.27 J			2 U	2 U	
Arsenic	10			2.1		2			0.35 J	0.47 J	
Barium				19.3		18			127	130	
Beryllium				1 U		1 U			1 U	1 U	
Cadmium				1 U		1 U			0.17 J	0.17 J	
Calcium				15700		15500			70300 J	70400 J	
Chromium	100			2 U		2 U			19500	19800	
Chromium, Hexavalent	0.035	100		0.5 U		0.5 U			17900	17900	
Cobalt	6			1 UJ		1 UJ			5.8 J	6.1 J	
Copper				2 U		2 U			2 U	2 U	
Iron				200 U		200 U			5420 J	5540 J	
Lead	15			1 U		1 U			1 U	1 U	
Magnesium				4940 J		4870 J			18800 J	19000 J	
Manganese	300			36		33.6			2170	2250	

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			AE-ML-03B		AE-ML-03C		AE-ML-04A				AE-M
Sample ID:	Residential	Residential	WL-GW-AE-ML-03B-3	WL-GWF-AE-ML-03B-3	WL-GW-AE-ML-03C-3	WL-GWF-AE-ML-03C-3	WL-GW-AE-ML-04A-3	WL-GW-AE-ML-04A-3-D	WL-GWF-AE-ML-04A-3	WL-GWF-AE-ML-04A-3-D	WL-GW-AE-ML-04B-3
Sample Date:	Groundwater	Groundwater	9/16/2015	9/16/2015	9/16/2015	9/16/2015	9/23/2015	9/23/2015	9/23/2015	9/23/2015	9/23/2015
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate	Field Duplicate	Field Duplicate	Field Sample
Parameter	PRGs	PRGs									
Mercury				0.2 U		0.2 U			0.2 U	0.2 U	
Nickel				1 UJ		1 UJ			6.3 J	6.4 J	
Potassium				1440 J		1400 J			7520 J	7550 J	
Selenium				5 U		5 U			0.36 J	5 U	
Silver				1 U		1 U			1 U	1 U	
Sodium				21100		17900			92000	91600	
Vanadium				5 U		5 U			R	R	
Zinc				2.9 J		2.6 J			15.8 J	16.1 J	
Inorganics (ug/L)											
Aluminum			48.3 J		20 UJ		27.6 J	20 UJ			20 UJ
Antimony			0.34 J		0.32 J		2 U	2 U			2 U
Arsenic	10		2		2.1		1 U	1 U			1 U
Barium			19.8		18.7		131	133			194
Beryllium			1 U		1 U		1 U	1 U			1 U
Cadmium			1 U		1 U		1 U	1 U			1 U
Calcium			15800		15700		68900 J	70600 J			79200 J
Chromium	100		2 U		2 U		18900	18600			2 U
Chromium, Hexavalent	0.035	100	0.5 U		0.5 U		17700	17200			0.5 U
Cobalt	6		1 UJ		1 UJ		5.5 J	5.6 J			5.6 J
Copper			2 U		2 U		2 U	2 U			2 U
Cyanide			4 J		10 U		10 UJ	10 UJ			10 UJ
Iron			28.9 J-		10.6 J-		5550 J	5630 J			13000 J
Lead	15		1 U		1 U		1 U	1 U			1 U
Magnesium			5100 J		5070 J		18600 J	19100 J			21000 J
Manganese	300		34.8 J		33.1 J		2230	2160			2840
Mercury			0.2 U		0.2 U		0.2 U	0.035 J			0.16 J
Nickel			1 UJ		1 UJ		5.8 J	5.9 J			7.5 J
Potassium			1420 J		1350 J		7140 J	7220 J			4300 J
Selenium			5 U		5 U		5 U	5 U			5 U
Silver			1 U		1 U		1 U	1 U			1 U
Sodium			21400		18200		88100 J	89400 J			115000 J
Vanadium			5 U		5 U		R	R			R
Zinc			2.2		2 U		14.4 J	15.7 J			24.5 J
Other											
Dissolved oxygen, field (mg/L)			0.18		0.17		0.75				0.33
ORP, field (mV)			-234		-211		76.7				-66.5
pH, field (S.U.)			8.67		8.77		6.42				6.22
Spec. cond., field (umho/cm)			206		196		980				1174
Temperature, field (deg C)			14.15		13.15		14.43				14.81
Turbidity, field (N.T.U.)			1.5		0.55		3.4				2.07

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			L-04B	AE-ML-04C		AE-ML-04E		DEP-1D			
Sample ID:	Residential	Residential	WL-GWF-AE-ML-04B-3	WL-GW-AE-ML-04C-3	WL-GWF-AE-ML-04C-3	WL-GW-AE-ML-04E-3	WL-GWF-AE-ML-04E-3	WL-GW-DEP-1D-1	WL-GW-DEP-1D-2	WL-GWF-DEP-1D-1	WL-GWF-DEP-1D-2
Sample Date:	Groundwater	Groundwater	9/23/2015	9/23/2015	9/23/2015	9/23/2015	9/23/2015	8/6/2014	12/4/2014	8/6/2014	12/4/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200			0.5 U		4.9		0.5 U	0.5 U		
1,1,2-Trichloroethane				0.5 U		0.5 U		0.5 U	0.5 U		
1,1-Dichloroethane	2.8			2.1		13		0.5 U	0.5 U		
1,1-Dichloroethene				0.5 U		2.2		0.5 U	0.5 U		
1,2-Dibromo-3-chloropropane				0.5 U		0.5 U		0.5 U	0.5 U		
1,2-Dichloroethane				0.5 U		0.5 U		0.5 U	0.5 U		
2-Butanone				5 U		5 U		5 U	5 U		
Acetone				5 U		5 U		5 U	5 U		
Benzene				0.5 U		0.5 U		0.5 U	0.5 U		
Bromodichloromethane				0.5 U		0.5 U		0.5 U	0.5 U		
Bromoform				0.5 U		0.5 U		0.5 U	0.5 U		
Carbon disulfide				0.5 U		0.5 U		0.5 U	0.5 U		
Chloroethane				0.5 U		0.5 U		0.5 U	0.5 U		
Chloroform				0.5 U		1		0.5 U	0.5 U		
cis-1,2-Dichloroethene	70			0.5 U		0.85		0.5 U	0.5 U		
Cyclohexane				0.5 U		0.5 U		0.5 U	0.5 U		
Ethylbenzene				0.5 U		0.5 U		0.5 U	0.5 U		
Isopropylbenzene				0.5 U		0.5 U		0.5 U	0.5 U		
m,p-Xylene				0.5 U		0.5 U		0.5 U	0.5 U		
Methyl tert-butyl ether				0.48 J		0.92		0.5 U	0.5 U		
Methylcyclohexane				0.5 U		0.5 U		0.5 U	0.5 U		
Methylene chloride				0.5 U		0.39 J		0.5 U	0.5 U		
o-Xylene				0.5 U		0.5 U		0.5 U	0.5 U		
Tetrachloroethene				0.5 U		0.5 U		0.5 U	0.5 U		
Toluene				0.5 U		0.5 U		0.5 U	0.5 U		
trans-1,2-Dichloroethene				0.5 U		0.5 U		0.5 U	0.5 U		
Trichloroethene	5	98		0.5 U		9.6		0.15 U	0.5 U		
Vinyl chloride	2	7		0.5 U		0.5 U		0.015 U	0.5 U		
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46			5.9		3.8		0.1 U			
Inorganics, Dissolved (ug/L)											
Aluminum			20 U		20 U		20 U			20 U	20 U
Antimony			2 U		2 U		2 U			2 U	2 U
Arsenic	10		0.98 J		2.4		0.6 J			0.42 J	0.38 J
Barium			197		73		57.8			81.3	110
Beryllium			1 U		1 U		1 U			1 U	1 U
Cadmium			1 U		1 U		1 U			0.13	0.4 U
Calcium			82300 J		42800 J		58000 J			20600	31500
Chromium	100		2 U		2 U		4890			2 UJ	2 U
Chromium, Hexavalent	0.035	100	0.5 U		0.5 U		4850			0.5 U	0.5 U
Cobalt	6		6 J		0.56 J		0.68 J			3.6	3.2
Copper			2 U		2 U		2 U			2 UJ	0.33 J
Iron			14800 J		1600 J		1420 J			447 J-	429
Lead	15		1 U		1 U		1 U			0.2 U	0.2 U
Magnesium			21700 J		17900 J		10300 J			3170	5070
Manganese	300		3140		1090		801			957	1560 J

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			L-04B	AE-ML-04C		AE-ML-04E		DEP-1D			
Sample ID:	Residential	Residential	WL-GWF-AE-ML-04B-3	WL-GW-AE-ML-04C-3	WL-GWF-AE-ML-04C-3	WL-GW-AE-ML-04E-3	WL-GWF-AE-ML-04E-3	WL-GW-DEP-1D-1	WL-GW-DEP-1D-2	WL-GWF-DEP-1D-1	WL-GWF-DEP-1D-2
Sample Date:	Groundwater	Groundwater	9/23/2015	9/23/2015	9/23/2015	9/23/2015	9/23/2015	8/6/2014	12/4/2014	8/6/2014	12/4/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury			0.12 J		0.2 U		0.2 U			0.2 UJ	0.2 UJ
Nickel			8.6 J		1.4 J		1.1 J			4	2.7
Potassium			4470 J		2130 J		6040 J			3150	4860 J
Selenium			5 U		5 U		5 U			5 U	5 U
Silver			1 U		1 U		1 U			1 U	1 U
Sodium			122000		29700		71700			261000	322000
Vanadium			R		R		R			0.59 J-	5 U
Zinc			23.7 J		4.1 J		2 U			6.6	2 U
Inorganics (ug/L)											
Aluminum				20 UJ		31.3 J		280	56		
Antimony				2 U		2.1		2 U	2 U		
Arsenic	10			2.2		1 U		0.47 J	0.38 J		
Barium				73.9		63.3		84.4	102		
Beryllium				1 U		1 U		1 U	1 U		
Cadmium				1 U		1 U		0.15	0.4 U		
Calcium				42900 J		59300 J		21800	30800		
Chromium	100			4.8		5480		2 UJ	2 U		
Chromium, Hexavalent	0.035	100		0.5 U		4670		0.5 U	0.5 U		
Cobalt	6			1 UJ		1 UJ		3.7	3.2		
Copper				2 U		2 U		2 U	0.19 J		
Cyanide				10 UJ		10 UJ		5.5 J	2.5 U		
Iron				1550 J		2650 J		778	486		
Lead	15			1 U		1 U		0.34	0.2 U		
Magnesium				17600 J		10700 J		3610	4840		
Manganese	300			1100		842		979	1650		
Mercury				0.047 J		0.2 U		0.038 J-	0.2 UJ		
Nickel				1.2 J		1 UJ		4.1	2.8		
Potassium				2080 J		5830 J		3360	4700		
Selenium				5 U		5 U		0.43 J	5 U		
Silver				1 U		1 U		1 UJ	1 U		
Sodium				29600 J		71900 J		265000	312000		
Vanadium				R		R		1 J-	5 U		
Zinc				4.6 J		5.1 J		3.7 U	2.5 UJ		
Other											
Dissolved oxygen, field (mg/L)				0.39		0		2.78	0.25		
ORP, field (mV)				-106.9		-19.1		168	166.8		
pH, field (S.U.)				6.92		7.36		5.55	5.69		
Spec. cond., field (umho/cm)				513		776		1391	1740		
Temperature, field (deg C)				14.51		15.09		12.8	12.5		
Turbidity, field (N.T.U.)				1.61		6		7.7	2.01		

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			DEP-1S				DEP-2D				
Sample ID:	Residential	Residential	WL-GW-DEP-1S-1	WL-GW-DEP-1S-2	WL-GWF-DEP-1S-1	WL-GWF-DEP-1S-2	WL-GW-DEP-2D-1	WL-GW-DEP-2DD-1	WL-GW-DEP-2D-2	WL-GWF-DEP-2D-1	WL-GWF-DEP-2DD-1
Sample Date:	Groundwater	Groundwater	8/6/2014	12/4/2014	8/6/2014	12/4/2014	8/4/2014	8/4/2014	12/3/2014	8/4/2014	8/4/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate	Field Sample	Field Duplicate	Field Duplicate
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200		0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
1,1,2-Trichloroethane			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
1,1-Dichloroethane	2.8		0.5 U	0.5 U			0.16 J	0.15 J	0.56		
1,1-Dichloroethene			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
1,2-Dibromo-3-chloropropane			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
1,2-Dichloroethane			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
2-Butanone			5 U	5 U			5 U	5 U	5 U		
Acetone			5 U	5 U			5 U	5 U	5 U		
Benzene			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Bromodichloromethane			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Bromoform			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Carbon disulfide			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Chloroethane			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Chloroform			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
cis-1,2-Dichloroethene	70		0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Cyclohexane			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Ethylbenzene			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Isopropylbenzene			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
m,p-Xylene			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Methyl tert-butyl ether			0.5 U	0.5 U			0.5 U	0.5 U	0.21 J		
Methylcyclohexane			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Methylene chloride			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
o-Xylene			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Tetrachloroethene			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Toluene			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
trans-1,2-Dichloroethene			0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Trichloroethene	5	98	0.15 U	0.5 U			0.15 U	0.15 U	0.5 U		
Vinyl chloride	2	7	0.015 U	0.5 U			0.015 U	0.015 U	0.5 U		
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46		0.1 U				0.1 U	0.1 U			
Inorganics, Dissolved (ug/L)											
Aluminum					110 J-	58.9				20 U	20 U
Antimony					2 UJ	2 U				2 U	2 U
Arsenic	10				0.15 J-	0.22 J				1.3	1.3
Barium					25.4 J-	10.3				18.9	18.8
Beryllium					0.2 J-	1 U				1 U	1 U
Cadmium					0.087 J-	0.4 U				0.04 U	0.068
Calcium					4060 J-	2240				15900	16000
Chromium	100				2 UJ	2 U				2 UJ	2 UJ
Chromium, Hexavalent	0.035	100			0.5 U	0.5 U				0.5 U	0.5 U
Cobalt	6				1.4 J-	1.4				1.9	1.9
Copper					2 UJ	0.17 J				2 UJ	2 UJ
Iron					200 UJ	200 UJ				5950	5960
Lead	15				0.23 J-	0.2 U				0.03 J	0.027 J
Magnesium					732 J-	500 U				5510 J	5440 J
Manganese	300				190 J-	191 J				574	575

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			DEP-1S				DEP-2D				
Sample ID:	Residential	Residential	WL-GW-DEP-1S-1	WL-GW-DEP-1S-2	WL-GWF-DEP-1S-1	WL-GWF-DEP-1S-2	WL-GW-DEP-2D-1	WL-GW-DEP-2DD-1	WL-GW-DEP-2D-2	WL-GWF-DEP-2D-1	WL-GWF-DEP-2DD-1
Sample Date:	Groundwater	Groundwater	8/6/2014	12/4/2014	8/6/2014	12/4/2014	8/4/2014	8/4/2014	12/3/2014	8/4/2014	8/4/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate	Field Sample	Field Duplicate	Field Duplicate
Parameter	PRGs	PRGs									
Mercury					0.2 UJ	0.2 UJ				0.2 UJ	0.2 UJ
Nickel					1.9 J-	1.3				1.1 J-	1 J-
Potassium					261 J-	500 UJ				1230 J	1230 J
Selenium					0.35 J-	5 U				5 U	5 U
Silver					1 UJ	1 U				1 U	1 U
Sodium					27200 J-	17400				15800	15400
Vanadium					5 UJ	5 U				0.52 J	0.56 J
Zinc					4.8 UJ	5.6				2.2 U	2.2 U
Inorganics (ug/L)											
Aluminum			644 J-	101			517	506	213		
Antimony			2 UJ	2 U			2 U	2 U	2 U		
Arsenic	10		0.29 J-	0.21 J			1.3	1.3	1.8		
Barium			30.4 J-	10 U			21.6	21.1	65.5		
Beryllium			0.19 J-	1 U			1 U	0.11 J	1 U		
Cadmium			0.089 J-	0.4 U			0.04 U	0.04 U	0.4 U		
Calcium			4130 J-	2150			15500	15300	42800		
Chromium	100		2 UJ	2 U			0.64 J-	0.61 J-	2 U		
Chromium, Hexavalent	0.035	100	0.5 U	0.5 U			0.5 U	0.5 U	0.5 U		
Cobalt	6		1.7 J-	1.4			2.2	2.2	5.2		
Copper			2 UJ	2 UJ			2 UJ	2 UJ	0.16 J		
Cyanide			4 J	1.9 J			4.8 J	7.1 J	2.4 J		
Iron			561 J-	200 UJ			6340	6000	16100		
Lead	15		1.3 J-	0.3			0.66	0.66	0.33		
Magnesium			938 J-	500 U			5500 J	5440 J	14000		
Manganese	300		218 J-	191			590	576	1570		
Mercury			0.2 UJ	0.2 UJ			0.2 UJ	0.2 UJ	0.2 UJ		
Nickel			2.1 J-	1.6			1.7 J-	1.6 J-	2.4		
Potassium			366 J-	500 U			1280 J	1250 J	2300		
Selenium			0.5 J-	5 U			5 U	5 U	5 U		
Silver			1 UJ	1 U			1 U	1 U	1 U		
Sodium			29300 J-	16900			15400	15100	47900		
Vanadium			1 J-	5 U			1.6 J	1.3 J	5 U		
Zinc			4 UJ	2.1 UJ			3.8 J+	3.5 J+	4.3 J		
Other											
Dissolved oxygen, field (mg/L)			8.49	3.46			0.1		0.44		
ORP, field (mV)			283	266.1			27.2		-76.7		
pH, field (S.U.)			4.71	5.1			5.97		5.61		
Spec. cond., field (umho/cm)			191	114			259		1075		
Temperature, field (deg C)			14.7	12.45			13.1		11.28		
Turbidity, field (N.T.U.)			8.6	1.84			21		4.61		

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:				DEP-2S				DEP-3D			
Sample ID:	Residential	Residential	WL-GWF-DEP-2D-2	WL-GW-DEP-2S-1	WL-GW-DEP-2S-2	WL-GWF-DEP-2S-1	WL-GWF-DEP-2S-2	WL-GW-DEP-3D-1	WL-GW-DEP-3D-2	WL-GWF-DEP-3D-1	WL-GWF-DEP-3D-2
Sample Date:	Groundwater	Groundwater	12/3/2014	8/5/2014	12/2/2014	8/5/2014	12/2/2014	8/5/2014	12/3/2014	8/5/2014	12/3/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200			0.5 U	0.5 U			0.5 U	0.5 U		
1,1,2-Trichloroethane				0.5 U	0.5 U			0.5 U	0.5 U		
1,1-Dichloroethane	2.8			0.5 U	0.5 U			0.5 U	0.5 U		
1,1-Dichloroethene				0.5 U	0.5 U			0.5 U	0.5 U		
1,2-Dibromo-3-chloropropane				0.5 U	0.5 U			0.5 U	0.5 U		
1,2-Dichloroethane				0.5 U	0.5 U			0.5 U	0.5 U		
2-Butanone				5 U	5 U			5 U	5 U		
Acetone				5 U	5 U			5 U	5 U		
Benzene				0.33 J	0.26 J			0.5 U	0.5 U		
Bromodichloromethane				0.5 U	0.5 U			0.5 U	0.5 U		
Bromoform				0.5 U	0.5 U			0.5 U	0.5 U		
Carbon disulfide				0.5 U	0.5 U			0.5 U	0.32 J		
Chloroethane				0.5 U	0.5 U			0.5 U	0.5 U		
Chloroform				0.5 U	0.5 U			0.5 U	0.5 U		
cis-1,2-Dichloroethene	70			0.5 U	0.5 U			0.5 U	0.5 U		
Cyclohexane				0.5 U	0.5 U			0.5 U	0.5 U		
Ethylbenzene				0.5 U	0.5 U			0.5 U	0.5 U		
Isopropylbenzene				0.5 U	0.5 U			0.5 U	0.5 U		
m,p-Xylene				0.5 U	0.5 U			0.5 U	0.5 U		
Methyl tert-butyl ether				0.54	0.43 J			0.5 U	0.18 J		
Methylcyclohexane				0.5 U	0.5 U			0.5 U	0.5 U		
Methylene chloride				0.5 U	0.5 U			0.5 U	0.5 U		
o-Xylene				0.5 U	0.5 U			0.5 U	0.5 U		
Tetrachloroethene				0.5 U	0.5 U			0.5 U	0.5 U		
Toluene				0.5 U	0.5 U			0.5 U	0.5 U		
trans-1,2-Dichloroethene				0.5 U	0.5 U			0.5 U	0.5 U		
Trichloroethene	5	98		0.15 U	0.5 U			0.15 U	0.5 U		
Vinyl chloride	2	7		0.015 U	0.5 U			0.032	0.5 U		
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46			0.12				0.18			
Inorganics, Dissolved (ug/L)											
Aluminum			20 U			20 UJ	24.8			1110	1460
Antimony			2 U			2 U	2 U			2 U	2 U
Arsenic	10		1.8			1.8	1.6			0.43 J	0.56 J
Barium			69.3			109	128			97.1	106
Beryllium			1 U			1 U	1 U			1 U	1 U
Cadmium			0.4 U			0.04 U	0.4 U			0.04 U	0.4 U
Calcium			43500			63900	79000			38000	36100
Chromium	100		2 U			2 UJ	2 U			4 J	6.7
Chromium, Hexavalent	0.035	100	0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Cobalt	6		5.3			1 UJ	1 U			2 J	1.7
Copper			2 UJ			2 U	0.33 J			2 U	2.5
Iron			16200			30200 J	42000			24400 J	28400
Lead	15		0.2 U			0.2 U	0.2 U			2	2.5
Magnesium			14400			7360 J	10600			11700 J	12300
Manganese	300		1510 J			3230 J	4240 J			1130 J	1060 J

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:				DEP-2S				DEP-3D			
Sample ID:	Residential	Residential	WL-GWF-DEP-2D-2	WL-GW-DEP-2S-1	WL-GW-DEP-2S-2	WL-GWF-DEP-2S-1	WL-GWF-DEP-2S-2	WL-GW-DEP-3D-1	WL-GW-DEP-3D-2	WL-GWF-DEP-3D-1	WL-GWF-DEP-3D-2
Sample Date:	Groundwater	Groundwater	12/3/2014	8/5/2014	12/2/2014	8/5/2014	12/2/2014	8/5/2014	12/3/2014	8/5/2014	12/3/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury			0.2 UJ			0.046 J-	0.2 UJ			0.041 J-	0.2 UJ
Nickel			2.4			1.3 UJ	1.1			2.4 J	2.7
Potassium			2370 J			6270	7270 J			3790	2870 J
Selenium			5 U			5 U	5 U			5 U	5 U
Silver			1 U			1 U	1 U			1 U	1 U
Sodium			49800			120000	160000			108000	120000
Vanadium			5 U			1.7 J	5 U			4.2 J	5.4
Zinc			4.1			9	24			24.4	10.5
Inorganics (ug/L)											
Aluminum				61	50.5			7960	24400		
Antimony				2 U	2 U			2 U	2 UJ		
Arsenic	10			2	1.5			3.4	5.1		
Barium				109	104			130 J	152 J		
Beryllium				1 U	1 U			0.38 J	1.8		
Cadmium				0.04 U	0.4 U			0.18 J	0.4 UJ		
Calcium				63700	67900			16100	27700		
Chromium	100			0.14 J-	2 U			58	83.2		
Chromium, Hexavalent	0.035	100		0.5 U	0.5 U			0.5 U	0.5 U		
Cobalt	6			1 U	1 U			9.1 J	12.1 J		
Copper				2 U	0.19 J			20.6 J	29.4 J		
Cyanide				4.1 J	2.5 U			5.2 J	1.8 J		
Iron				30400	37100			33600 J	43400 J		
Lead	15			0.4 J	0.37			31.8 J	49.7		
Magnesium				7320 J	8740			8030 J	19900		
Manganese	300			3320	3820			1700	1930		
Mercury				0.2 UJ	0.2 UJ			0.046 J-	0.2 UJ		
Nickel				1.4	1.2			16.6 J	22.3 J		
Potassium				6310	6150			2450	4120		
Selenium				5 U	5 U			1.2 J	2.2 J		
Silver				1 U	1 U			1 UJ	1 UJ		
Sodium				146000	138000			43400	98400		
Vanadium				1.8 J	5 U			52.4	68		
Zinc				7.6 J+	25.6 J			56.8 J	66.7 J		
Other											
Dissolved oxygen, field (mg/L)				0.69	0.86			0.17	0.22		
ORP, field (mV)				-53.2	-36.9			-52.2	3.5		
pH, field (S.U.)				6.09	6.45			6.36	6.32		
Spec. cond., field (umho/cm)				1236	1347			993	1038		
Temperature, field (deg C)				18.7	8.72			13.3	11.09		
Turbidity, field (N.T.U.)				2.8	1.44			1402	over limit		

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			DEP-3S				DEP-4D				
Sample ID:	Residential	Residential	WL-GW-DEP-3S-1	WL-GW-DEP-3S-2	WL-GWF-DEP-3S-1	WL-GWF-DEP-3S-2	WL-GW-DEP-4D-1	WL-GW-DEP-4D-2	WL-GWF-DEP-4D-1	WL-GWF-DEP-4D-2	WL-GW-DEP-4S-1
Sample Date:	Groundwater	Groundwater	8/5/2014	12/3/2014	8/5/2014	12/3/2014	8/18/2014	12/10/2014	8/18/2014	12/10/2014	8/18/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200		0.5 U	0.5 U			0.5 U	0.5 U			0.5 U
1,1,2-Trichloroethane			0.5 U	0.5 U			0.5 U	0.5 U			0.5 U
1,1-Dichloroethane	2.8		0.5 U	0.5 U			1.7	1.1			0.15 J
1,1-Dichloroethene			0.5 U	0.5 U			0.54	0.5 U			0.5 U
1,2-Dibromo-3-chloropropane			0.5 U	0.5 U			0.5 U	0.5 U			0.5 U
1,2-Dichloroethane			0.5 U	0.5 U			0.5 U	0.5 U			0.5 U
2-Butanone			5 U	5 U			5 U	5 U			5 U
Acetone			5 U	5 U			5 U	5 U			5 U
Benzene			0.5 U	0.5 U			0.5 U	0.5 U			0.5 U
Bromodichloromethane			0.5 U	0.5 U			0.5 U	0.5 U			0.5 U
Bromoform			0.5 U	0.5 U			0.5 U	0.5 U			0.5 U
Carbon disulfide			0.5 U	0.24 J			0.5 U	0.5 U			0.5 U
Chloroethane			0.5 U	0.5 U			0.5 U	0.5 U			0.5 U
Chloroform			0.5 U	0.5 U			0.5 U	0.5 U			0.5 U
cis-1,2-Dichloroethene	70		0.5 U	0.5 U			2.3	5.1			1.6
Cyclohexane			0.5 U	0.5 U			0.5 U	0.5 U			0.5 U
Ethylbenzene			0.5 U	0.5 U			0.5 U	0.5 U			0.5 U
Isopropylbenzene			0.5 U	0.5 U			0.5 U	0.5 U			0.5 U
m,p-Xylene			0.5 U	0.5 U			0.5 U	0.5 U			0.5 U
Methyl tert-butyl ether			0.5 U	0.5 U			0.67	0.4 J			5.6
Methylcyclohexane			0.5 U	0.5 U			0.5 U	0.5 U			0.5 U
Methylene chloride			0.5 U	0.5 U			0.5 U	0.5 U			0.5 U
o-Xylene			0.5 U	0.5 U			0.5 U	0.5 U			0.5 U
Tetrachloroethene			0.5 U	0.5 U			0.5 U	0.29 J			0.5 U
Toluene			0.5 U	0.5 U			0.5 U	0.5 U			0.5 U
trans-1,2-Dichloroethene			0.5 U	0.5 U			0.5 U	0.5 U			0.5 U
Trichloroethene	5	98	0.15 U	0.5 U			3.2	4.4			3
Vinyl chloride	2	7	0.083	0.5 U			1.5	0.84			0.81
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46		0.1 U				0.33				0.051 J
Inorganics, Dissolved (ug/L)											
Aluminum					35	323			54.9	50 J+	
Antimony					2 U	2 U			0.61 J	2 U	
Arsenic	10				1.1	1.2			1.8	1.3	
Barium					119	137			582	522	
Beryllium					1 U	1 U			0.096 J+	1 U	
Cadmium					0.04 U	0.4 U			0.72	0.49 U	
Calcium					27100	33100			169000	125000	
Chromium	100				20.9 J	52.8			1.2 J-	2 U	
Chromium, Hexavalent	0.035	100			0.5 U	0.5 U			0.5 UJ	0.5 U	
Cobalt	6				1 UJ	1 U			81.6	52.2	
Copper					2 U	0.84 J			2 UJ	2 UJ	
Iron					12500 J	19400			12700	10100	
Lead	15				0.2 U	0.68			0.27	0.2 U	
Magnesium					5790 J	7680			23800	17500	
Manganese	300				1860 J	2290 J			19900	13500	

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			DEP-3S				DEP-4D				
Sample ID:	Residential	Residential	WL-GW-DEP-3S-1	WL-GW-DEP-3S-2	WL-GWF-DEP-3S-1	WL-GWF-DEP-3S-2	WL-GW-DEP-4D-1	WL-GW-DEP-4D-2	WL-GWF-DEP-4D-1	WL-GWF-DEP-4D-2	WL-GW-DEP-4S-1
Sample Date:	Groundwater	Groundwater	8/5/2014	12/3/2014	8/5/2014	12/3/2014	8/18/2014	12/10/2014	8/18/2014	12/10/2014	8/18/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury					0.078 J-	0.2 UJ			0.2 UJ	0.29	
Nickel					1 UJ	1.7			28.2	21	
Potassium					3060	3400 J			10000	9360	
Selenium					5 U	5 U			0.33 J	5 U	
Silver					1 U	1 U			1 UJ	1 U	
Sodium					192000	178000			1060000	1190000	
Vanadium					1 J	5 U			0.5 J	5 UJ	
Zinc					2 U	4.3			20.1	14.4	
Inorganics (ug/L)											
Aluminum			106	3500			20 U	65.8 U			48.5
Antimony			2 U	2 U			2 U	2 U			2 U
Arsenic	10		1.1	2.5			2 J-	1.4			1.4 J-
Barium			121	141			552	543			223
Beryllium			1 U	1 U			1 U	1 U			1 U
Cadmium			0.1 U	0.4 U			0.6	0.75			0.04 U
Calcium			27500	31800			163000	124000 J			63500
Chromium	100		22	72.9			1.8 J-	2.4			5.2 J-
Chromium, Hexavalent	0.035	100	0.5 U	0.5 U			0.5 U	0.5 U			0.5 U
Cobalt	6		1 U	2.1			74.1	55.8			30.7
Copper			2 U	7.2			2 UJ	2 UJ			2 UJ
Cyanide			5.8 J	2.1 J			2.8 J+	2.5 U			3.7 J+
Iron			13000	22300			12600	10200			20000
Lead	15		0.37 J	7.7			0.2 U	0.2 U			0.21
Magnesium			5780 J	8340			22800	17200 J			8430
Manganese	300		1890	2480			18500	13600			21000
Mercury			0.2 UJ	0.2 UJ			0.2 U	0.33			0.2 U
Nickel			1 U	6.7			25	20.9			3.8
Potassium			3130	3420			9080	9600			7800
Selenium			5 U	0.45 J			5 U	5 U			0.27 J
Silver			1 U	1.1 U			1 U	1 U			1 U
Sodium			189000	183000			1010000	1220000			536000
Vanadium			1.3 J	6.8			5 U	5 UJ			5 U
Zinc			8.7 J+	16 J			17.2 J+	15.7			7.2 J+
Other											
Dissolved oxygen, field (mg/L)			2.1	5.23			0.07	0.59			0.08
ORP, field (mV)			-94.7	-30.5			81.9	90.4			-21.8
pH, field (S.U.)			6.47	6.6			5.36	6.02			5.75
Spec. cond., field (umho/cm)			1234	1255			6603	6760			3363
Temperature, field (deg C)			15.4	11.07			14.3	11.29			16.1
Turbidity, field (N.T.U.)			4.5	790			3.64	3.02			3.37

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			DEP-4S			DEP-5D					
Sample ID:	Residential	Residential	WL-GW-DEP-4S-2	WL-GWF-DEP-4S-1	WL-GWF-DEP-4S-2	WL-GW-DEP-5D-1	WL-GW-DEP-5D-2	WL-GWF-DEP-5D-1	WL-GWF-DEP-5D-2	WL-GW-DEP-5S-1	WL-GW-DEP-5S-2
Sample Date:	Groundwater	Groundwater	12/10/2014	8/18/2014	12/10/2014	8/20/2014	12/17/2014	8/20/2014	12/17/2014	8/20/2014	12/17/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200		0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
1,1,2-Trichloroethane			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
1,1-Dichloroethane	2.8		0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
1,1-Dichloroethene			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
1,2-Dibromo-3-chloropropane			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
1,2-Dichloroethane			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
2-Butanone			5 U			5 U	5 U			5 U	5 U
Acetone			5 U			5 U	5 U			5 U	5 U
Benzene			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Bromodichloromethane			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Bromoform			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Carbon disulfide			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Chloroethane			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Chloroform			4.9			0.5 U	0.5 U			0.5 U	0.5 U
cis-1,2-Dichloroethene	70		2.6			0.5 U	0.5 U			0.5 U	0.5 U
Cyclohexane			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Ethylbenzene			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Isopropylbenzene			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
m,p-Xylene			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Methyl tert-butyl ether			0.43 J			1.5	2.4			0.5 U	0.5 U
Methylcyclohexane			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Methylene chloride			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
o-Xylene			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Tetrachloroethene			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Toluene			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
trans-1,2-Dichloroethene			0.5 U			0.5 U	0.5 U			0.5 U	0.5 U
Trichloroethene	5	98	5.4			0.15 U	0.5 U			0.15 U	0.5 U
Vinyl chloride	2	7	0.49 J			0.015 U	0.5 U			0.015 U	0.5 U
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46					0.026 J				0.1 U	
Inorganics, Dissolved (ug/L)											
Aluminum				23.9 U	313 J+			20 U	20 U		
Antimony				2 U	2 U			2 U	2 U		
Arsenic	10			1.4	1 U			6.5	7.2		
Barium				226	153			37.2	41.4		
Beryllium				1 U	1 U			1 U	1 U		
Cadmium				0.04 U	0.67 U			0.04 U	0.4 U		
Calcium				64000	26600			20700	32200		
Chromium	100			4.3 J-	4.9			0.96 J-	0.51 J		
Chromium, Hexavalent	0.035	100		0.5 UJ	0.5 U			0.5 UJ	0.5 U		
Cobalt	6			30.3	21.8			1 U	1 U		
Copper				2 UJ	4.3			2 U	2 UJ		
Iron				19000	231			10300	11600		
Lead	15			0.33	0.2 U			0.041 J	0.2 U		
Magnesium				8350	5460			3300	4730		
Manganese	300			21900	5450			878	1100 J		

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			DEP-4S			DEP-5D					
Sample ID:	Residential	Residential	WL-GW-DEP-4S-2	WL-GWF-DEP-4S-1	WL-GWF-DEP-4S-2	WL-GW-DEP-5D-1	WL-GW-DEP-5D-2	WL-GWF-DEP-5D-1	WL-GWF-DEP-5D-2	WL-GW-DEP-5S-1	WL-GW-DEP-5S-2
Sample Date:	Groundwater	Groundwater	12/10/2014	8/18/2014	12/10/2014	8/20/2014	12/17/2014	8/20/2014	12/17/2014	8/20/2014	12/17/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury				0.079 J-	0.2 UJ			0.2 UJ	0.088 J		
Nickel				5.1	5.9			1.1	0.63 J		
Potassium				7940	2340			2420	2900 J		
Selenium				0.3 J	5 U			5 U	5 U		
Silver				1 UJ	1 U			1 U	1 U		
Sodium				553000	184000			161000	149000		
Vanadium				0.82 J	5 UJ			3 J	5 U		
Zinc				9.5	48.8			2 U	3.5 U		
Inorganics (ug/L)											
Aluminum			503			33.5 UJ	20 U			8630 J	2130
Antimony			2 U			2 U	2 U			1.4 J	2 U
Arsenic	10		1 U			6.5	7.3			3.6	1.1
Barium			153			37	41			51.3 J	22.3
Beryllium			1 U			1 U	1 U			1 U	1 U
Cadmium			0.44			0.049 UJ	0.4 U			0.29 J	0.4 U
Calcium			24400 J			20900	31300			4570 J-	3810
Chromium	100		5.6			2 UJ	1 J			107 J	27.1
Chromium, Hexavalent	0.035	100	0.5 U			0.5 U	0.5 U			0.6	6.75 J+
Cobalt	6		21.8			1 U	1 UJ			119	119 J
Copper			4.3			2 U	2 UJ			46.3	16.9
Cyanide			3.6 U			4.9 J+	1.6 J			4 J+	1.4 J
Iron			523			10500	11400			5010	1670
Lead	15		0.5			0.13 J	0.2 U			108 J	26.1
Magnesium			5330 J			3360	4610			1290	500 U
Manganese	300		5060			896	1090			130	44.1
Mercury			0.2 UJ			0.2 UJ	0.2 UJ			0.16 J-	0.2 UJ
Nickel			5.6			1 UJ	0.9 J			6.4 J	3.2 J
Potassium			2240			2430	2890			1320	696
Selenium			5 U			5 U	5 U			1 J	0.42 J
Silver			1 U			1 U	1 U			1 UJ	1 U
Sodium			173000			153000	135000			25100	15600
Vanadium			5 UJ			3.1 J	5 U			8.7	5 U
Zinc			50.4			2 UJ	5.2 UJ			31.2 J	15.8 J
Other											
Dissolved oxygen, field (mg/L)			2.5			0.06	0.73			0.37	5.54
ORP, field (mV)			235.4			-90.6	-58.2			183	240.5
pH, field (S.U.)			5.7			6.49	6.4			5.83	5.81
Spec. cond., field (umho/cm)			1054			1043	1016			162	100
Temperature, field (deg C)			6.87			17.1	13.84			21	10.66
Turbidity, field (N.T.U.)			5.87			1.5	2.96			93	49.8

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			DEP-5S				DEP-7D				
Sample ID:	Residential	Residential	WL-GW-DEP-5S-3	WL-GWF-DEP-5S-1	WL-GWF-DEP-5S-2	WL-GWF-DEP-5S-3	WL-GW-DEP-7D-1	WL-GW-DEP-7D-2	WL-GWF-DEP-7D-1	WL-GWF-DEP-7D-2	WL-GW-DEP-7S-1
Sample Date:	Groundwater	Groundwater	9/15/2015	8/20/2014	12/17/2014	9/15/2015	8/6/2014	12/3/2014	8/6/2014	12/3/2014	8/6/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200		0.5 U				0.5 U	0.5 U			0.5 U
1,1,2-Trichloroethane			0.5 U				0.5 U	0.5 U			0.5 U
1,1-Dichloroethane	2.8		0.5 U				0.5 U	0.5 U			0.5 U
1,1-Dichloroethene			0.5 U				0.5 U	0.5 U			0.5 U
1,2-Dibromo-3-chloropropane			0.5 U				0.5 U	0.5 U			0.5 U
1,2-Dichloroethane			0.5 U				0.5 U	0.5 U			0.5 U
2-Butanone			5 U				5 U	5 U			5 U
Acetone			5 U				5 U	5 U			5 U
Benzene			0.5 U				0.5 U	0.5 U			0.5 U
Bromodichloromethane			0.5 U				0.5 U	0.5 U			0.5 U
Bromoform			0.5 U				0.5 U	0.5 U			0.5 U
Carbon disulfide			0.5 U				0.5 U	0.5 U			0.5 U
Chloroethane			0.5 U				0.5 U	0.5 U			0.5 U
Chloroform			0.5 U				0.5 U	0.5 U			0.5 U
cis-1,2-Dichloroethene	70		0.5 U				0.5 U	0.5 U			0.5 U
Cyclohexane			0.5 U				0.5 U	0.5 U			0.5 U
Ethylbenzene			0.5 U				0.5 U	0.5 U			0.5 U
Isopropylbenzene			0.5 U				0.5 U	0.5 U			0.5 U
m,p-Xylene			0.5 U				0.5 U	0.5 U			0.5 U
Methyl tert-butyl ether			0.5 U				0.5 U	0.5 U			0.5 U
Methylcyclohexane			0.5 U				0.5 U	0.5 U			0.5 U
Methylene chloride			0.5 U				0.5 U	0.5 U			0.5 U
o-Xylene			0.5 U				0.5 U	0.5 U			0.5 U
Tetrachloroethene			0.5 U				0.5 U	0.5 U			0.5 U
Toluene			0.5 U				0.5 U	0.5 U			0.5 U
trans-1,2-Dichloroethene			0.5 U				0.5 U	0.5 U			0.5 U
Trichloroethene	5	98	0.5 U				0.15 U	0.5 U			0.15 U
Vinyl chloride	2	7	0.5 U				0.01 J	0.5 U			0.0077 J
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46		0.1 U				0.1 U				0.1 U
Inorganics, Dissolved (ug/L)											
Aluminum				3990	338	171 J			20 UJ	59.7	
Antimony				1.6 J	2 U	2.5			2 UJ	2 U	
Arsenic	10			2	0.45 J	0.42 J			0.085 J-	0.15 J	
Barium				33.3 J	12.2	21.4			10 UJ	11.1	
Beryllium				0.27 J	1 U	0.049 J			1 UJ	1 U	
Cadmium				0.15	0.4 U	0.094 J			0.074 J-	0.4 U	
Calcium				4130 J-	3760	5170			20300 J-	24200	
Chromium	100			49.4	11.1	4.1			3.2 J	2 U	
Chromium, Hexavalent	0.035	100		0.7 J	6.9 J+	0.5 U			4.1	1.1 J+	
Cobalt	6			103	110	99.6 J			1 UJ	1 U	
Copper				28.2	6.3	7.2			2 UJ	0.47 J	
Iron				2530	234	200 U			200 UJ	200 UJ	
Lead	15			49.8	4.2	2.1			0.2 UJ	0.2 U	
Magnesium				743	500 U	500 UJ			6200 J-	7880	
Manganese	300			76.8	9 J	44.6			126 J-	39.5 J	

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			DEP-5S				DEP-7D				
Sample ID:	Residential	Residential	WL-GW-DEP-5S-3	WL-GWF-DEP-5S-1	WL-GWF-DEP-5S-2	WL-GWF-DEP-5S-3	WL-GW-DEP-7D-1	WL-GW-DEP-7D-2	WL-GWF-DEP-7D-1	WL-GWF-DEP-7D-2	WL-GW-DEP-7S-1
Sample Date:	Groundwater	Groundwater	9/15/2015	8/20/2014	12/17/2014	9/15/2015	8/6/2014	12/3/2014	8/6/2014	12/3/2014	8/6/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury				0.12 J-	0.2 UJ	0.2 U			0.2 UJ	0.2 UJ	
Nickel				3.9	1.5	1.8 J			2.6 J-	2.2	
Potassium				1110	561 J	1170 J			2140 J-	2160 J	
Selenium				0.61 J	5 U	0.53 J			5 UJ	5 U	
Silver				1 UJ	1 U	1 U			1 UJ	1 U	
Sodium				25600	15600	28200			21200 J-	24400	
Vanadium				4.3 J	5 U	5 U			5 UJ	5 U	
Zinc				18.5	9 U	8.7 J			6.6 J-	4.1	
Inorganics (ug/L)											
Aluminum			2570 J				6910 J-	886			93.9
Antimony			2.7				2 UJ	2 U			2 U
Arsenic	10		1.5				1.9 J-	0.4 J			0.082 J
Barium			33.8				29.3 J-	11.8			15.6
Beryllium			0.21 J				0.43 J-	1 U			0.14 J
Cadmium			0.16 J				0.16 J-	0.4 U			0.046
Calcium			5050				19600 J-	22000			7530
Chromium	100		29.8				14.9 J-	3.1 U			2 UJ
Chromium, Hexavalent	0.035	100	0.5 U				3	1.1 J+			0.5 U
Cobalt	6		125 J				5.8 J-	1 U			1 U
Copper			23				12.8 J-	2 J			2 U
Cyanide			10 U				3.8 J	4			4.5 J
Iron			2330				11400 J-	1550			200 U
Lead	15		33.7				8.1 J-	1.1			0.2 U
Magnesium			715 J				8960 J-	7300			2840
Manganese	300		84.8 J				368 J-	65.3			54
Mercury			0.2 U				0.034 J-	0.2 UJ			0.2 UJ
Nickel			4 J				11.2 J-	3.2			1.7
Potassium			1240 J				2660 J-	1980			2590
Selenium			0.85 J				1 J-	5 U			5 U
Silver			0.19 J				1 UJ	1 U			1 UJ
Sodium			27100				21400 J-	21600			12900
Vanadium			5 U				15 J-	5 U			0.5 J-
Zinc			20.4				34.4 J-	7.3 J			5.6 U
Other											
Dissolved oxygen, field (mg/L)			2.5				2.13	1			6.28
ORP, field (mV)			157.6				527.7	238.1			420.8
pH, field (S.U.)			5.53				5.41	5.74			4.9
Spec. cond., field (umho/cm)			231				287.9	316			137
Temperature, field (deg C)			24.53				12.2	10.81			11.8
Turbidity, field (N.T.U.)			95.3				126	21.3			2.15

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			DEP-7S			DEP-8D		DEP-8S		MW-100D	
Sample ID:	Residential	Residential	WL-GW-DEP-7S-2	WL-GWF-DEP-7S-1	WL-GWF-DEP-7S-2	WL-GW-DEP-8D-3	WL-GWF-DEP-8D-3	WL-GW-DEP-8S-3	WL-GWF-DEP-8S-3	WL-GWF-MW-100D-3	WL-GW-MW-100D-3
Sample Date:	Groundwater	Groundwater	12/3/2014	8/6/2014	12/3/2014	9/16/2015	9/16/2015	9/16/2015	9/16/2015	9/17/2015	9/17/2015
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200		0.5 U			0.5 U		0.5 U			0.5 U
1,1,2-Trichloroethane			0.5 U			0.5 U		0.5 U			0.5 U
1,1-Dichloroethane	2.8		0.5 U			0.5 U		0.5 U			0.5 U
1,1-Dichloroethene			0.5 U			0.5 U		0.5 U			0.5 U
1,2-Dibromo-3-chloropropane			0.5 U			0.5 U		0.5 U			0.5 U
1,2-Dichloroethane			0.5 U			0.5 U		0.5 U			0.5 U
2-Butanone			5 U			5 U		5 U			5 U
Acetone			5 U			5 U		5 U			5 U
Benzene			0.5 U			0.5 U		0.5 U			0.5 U
Bromodichloromethane			0.5 U			0.5 U		0.5 U			0.5 U
Bromoform			0.5 U			0.5 U		0.5 U			0.5 U
Carbon disulfide			0.5 U			0.5 U		0.5 U			0.5 U
Chloroethane			0.5 U			0.5 U		0.5 U			0.5 U
Chloroform			0.5 U			0.5 U		0.5 U			0.5 U
cis-1,2-Dichloroethene	70		0.5 U			0.5 U		0.5 U			0.5 U
Cyclohexane			0.5 U			0.5 U		0.5 U			0.5 U
Ethylbenzene			0.5 U			0.5 U		0.5 U			0.5 U
Isopropylbenzene			0.5 U			0.5 U		0.5 U			0.5 U
m,p-Xylene			0.5 U			0.5 U		0.5 U			0.5 U
Methyl tert-butyl ether			0.5 U			0.5 U		0.5 U			0.5 U
Methylcyclohexane			0.5 U			0.5 U		0.5 U			0.5 U
Methylene chloride			0.5 U			0.5 U		0.5 U			0.5 U
o-Xylene			0.5 U			0.5 U		0.5 U			0.5 U
Tetrachloroethene			0.5 U			0.5 U		0.5 U			0.5 U
Toluene			0.5 U			0.5 U		0.5 U			0.5 U
trans-1,2-Dichloroethene			0.5 U			0.5 U		0.5 U			0.5 U
Trichloroethene	5	98	0.5 U			0.5 U		0.5 U			0.5 U
Vinyl chloride	2	7	0.5 U			0.5 U		0.5 U			0.5 U
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46					0.24		0.1 U			0.49
Inorganics, Dissolved (ug/L)											
Aluminum				48.5	75.2		20 UJ		20 UJ	20 UJ	
Antimony				2 U	2 U		2 U		2 U	2 U	
Arsenic	10			0.081 J	0.17 J		0.18 J		0.21 J	0.18 J	
Barium				15.5	21.6		34.4		39.8	18.2	
Beryllium				0.14 J	1 U		1 U		0.045 J	0.039 J	
Cadmium				0.034 J	0.4 U		0.051 J		0.066 J	0.035 J	
Calcium				7520	11700		26400		25700	29100	
Chromium	100			2 UJ	2 U		2 U		2 U	2 U	
Chromium, Hexavalent	0.035	100		1.2	0.5 U		0.5 U		0.5 U	0.5 U	
Cobalt	6			1 U	1 U		1 UJ		1 UJ	1 UJ	
Copper				2 UJ	0.21 J		2 U		2 U	2 U	
Iron				200 UJ	200 UJ		200 U		200 U	200 U	
Lead	15			0.2 U	0.2 U		1 U		1 U	1 U	
Magnesium				2550	4110		5240 J		5100 J	6380 J	
Manganese	300			49.7	144 J		12.4		27	2.8	

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			DEP-7S			DEP-8D		DEP-8S		MW-100D	
Sample ID:	Residential	Residential	WL-GW-DEP-7S-2	WL-GWF-DEP-7S-1	WL-GWF-DEP-7S-2	WL-GW-DEP-8D-3	WL-GWF-DEP-8D-3	WL-GW-DEP-8S-3	WL-GWF-DEP-8S-3	WL-GWF-MW-100D-3	WL-GW-MW-100D-3
Sample Date:	Groundwater	Groundwater	12/3/2014	8/6/2014	12/3/2014	9/16/2015	9/16/2015	9/16/2015	9/16/2015	9/17/2015	9/17/2015
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury				0.2 UJ	0.2 UJ		0.025 J		0.2 U	0.2 U	
Nickel				2.1	2.8		1.1 J		1.1 J	1 UJ	
Potassium				2410	3180 J		1620 J		1830 J	2970 J	
Selenium				5 U	5 U		5 U		5 U	5 U	
Silver				1 U	1 U		1 U		1 U	1 U	
Sodium				12200	16200		97200		103000	31500	
Vanadium				5 UJ	5 U		5 U		5 U	5 U	
Zinc				10.2	3.9 U		2.3 J		2.8 J	3.3 J	
Inorganics (ug/L)											
Aluminum			152			45.9 J		60.9 J			20 UJ
Antimony			2 U			0.071 J		0.078 J			2 U
Arsenic	10		0.21 J			0.24 J		0.21 J			0.25 J
Barium			21.9			36.3		42.4			19.2
Beryllium			1 U			1 U		1 U			0.054 J
Cadmium			0.4 U			0.054 J		0.097 J			0.03 J
Calcium			12100			26900		26800			30000
Chromium	100		2 U			2 U		2 U			2 U
Chromium, Hexavalent	0.035	100	0.5 U			0.5 U		0.5 U			0.5 U
Cobalt	6		1 U			1 UJ		1 UJ			1 UJ
Copper			0.39 J			2 U		2 U			2 U
Cyanide			1.9 J			10 U		3.9 J			10 U
Iron			200 UJ			200 U		200 U			200 U
Lead	15		0.2 U			1 U		1 U			1 U
Magnesium			4190			5470 J		5410 J			6730 J
Manganese	300		153			13.6 J		42.5 J			3.7 J
Mercury			0.2 UJ			0.2 U		0.2 U			0.2 U
Nickel			3.3			1.1 J		1.3 J			1 UJ
Potassium			3270			1620 J		1890 J			3000 J
Selenium			5 U			5 U		5 U			5 U
Silver			1 U			0.082 J		0.085 J			0.04 J
Sodium			16600			101000		110000			33800
Vanadium			5 U			5 U		5 U			5 U
Zinc			5.5 J			2.1		2.4			2.8
Other											
Dissolved oxygen, field (mg/L)			4.38			0.26		0.39			6.52
ORP, field (mV)			275.1			151.4		127			205
pH, field (S.U.)			5.54			5.92		5.83			5.74
Spec. cond., field (umho/cm)			204			689		731			434
Temperature, field (deg C)			11.58			17.26		18.19			13.32
Turbidity, field (N.T.U.)			3.56			4.07		4.64			0.9

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			MW-100S		MW-101D				MW-		
Sample ID:	Residential	Residential	WL-GWF-MW-100S-3	WL-GW-MW-100S-3	WL-GWF-MW-101D-1	WL-GWF-MW-101D-2	WL-GW-MW-101D-1	WL-GW-MW-101D-2	WL-GWF-MW-101S-1	WL-GWF-MW-101S-2	WL-GWF-MW-101SD-2
Sample Date:	Groundwater	Groundwater	9/17/2015	9/17/2015	8/12/2014	12/8/2014	8/12/2014	12/8/2014	8/12/2014	12/8/2014	12/8/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200			0.5 U			0.5 U	0.16 J			
1,1,2-Trichloroethane				0.5 U			0.5 U	0.5 U			
1,1-Dichloroethane	2.8			0.5 U			0.5 U	0.11 J			
1,1-Dichloroethene				0.5 U			0.5 U	0.5 U			
1,2-Dibromo-3-chloropropane				0.5 U			0.5 U	0.5 U			
1,2-Dichloroethane				0.5 U			0.5 U	0.5 U			
2-Butanone				5 U			5 U	5 U			
Acetone				5 U			5 U	5 U			
Benzene				0.5 U			0.5 U	0.5 U			
Bromodichloromethane				0.5 U			R	0.5 U			
Bromoform				0.5 U			R	0.5 U			
Carbon disulfide				0.5 U			0.5 U	0.5 U			
Chloroethane				0.5 U			0.5 U	0.5 U			
Chloroform				0.5 U			0.5 U	0.5 U			
cis-1,2-Dichloroethene	70			0.5 U			0.5 U	0.5 U			
Cyclohexane				0.5 U			0.5 U	0.5 U			
Ethylbenzene				0.5 U			0.5 U	0.5 U			
Isopropylbenzene				0.5 U			0.5 U	0.5 U			
m,p-Xylene				0.5 U			0.5 U	0.5 U			
Methyl tert-butyl ether				0.5 U			0.5 U	0.5 U			
Methylcyclohexane				0.5 U			0.5 U	0.5 U			
Methylene chloride				0.5 U			0.5 U	0.5 U			
o-Xylene				0.5 U			0.5 U	0.5 U			
Tetrachloroethene				0.5 U			0.5 U	0.5 U			
Toluene				0.5 U			0.5 U	0.5 U			
trans-1,2-Dichloroethene				0.5 U			0.5 U	0.5 U			
Trichloroethene	5	98		0.5 U			0.6	1			
Vinyl chloride	2	7		0.5 U			0.015 U	0.5 U			
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46			0.1 U			0.21				
Inorganics, Dissolved (ug/L)											
Aluminum			150 J		20 U	26.7 J+			400	267 J+	263 J+
Antimony			0.35 J		2 U	2 U			2 U	2 U	2 U
Arsenic	10		0.28 J		0.33 J	1 U			0.34 J	1 U	1 U
Barium			36.7		24.1	23.6			207	107	106
Beryllium			0.11 J		1 U	1 U			0.36 J	1 U	1 U
Cadmium			0.22 J		0.046	0.4 U			0.53	0.4 U	0.4 U
Calcium			3960		24000	21800			17400	12500	12200
Chromium	100		2 U		2400 J	3550			4.8 UJ	2 U	2 U
Chromium, Hexavalent	0.035	100	0.5 U		2570	3420			0.9	0.5 U	0.5 U
Cobalt	6		1 UJ		1 U	1 U			1.3	1 U	1 U
Copper			18.3		2 UJ	2 UJ			3	2.7	2.7
Iron			200 U		493 J	1060			310 J	200 U	200 U
Lead	15		8.3		0.76	0.2 U			0.14 J	0.2 U	0.2 U
Magnesium			933 J		5660	5180			2640	1910	1840
Manganese	300		42.7		12.7 J	14.4			178 J	110	109

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			MW-100S		MW-101D						MW-
Sample ID:	Residential	Residential	WL-GWF-MW-100S-3	WL-GW-MW-100S-3	WL-GWF-MW-101D-1	WL-GWF-MW-101D-2	WL-GW-MW-101D-1	WL-GW-MW-101D-2	WL-GWF-MW-101S-1	WL-GWF-MW-101S-2	WL-GWF-MW-101SD-2
Sample Date:	Groundwater	Groundwater	9/17/2015	9/17/2015	8/12/2014	12/8/2014	8/12/2014	12/8/2014	8/12/2014	12/8/2014	12/8/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate
Parameter	PRGs	PRGs									
Mercury			0.2 U		0.2 UJ	0.2 UJ			0.2 UJ	0.2 UJ	0.2 UJ
Nickel			2.6 J		2.6	1.7			1.5	1.3	1.4
Potassium			1320 J		2300	2540			3540	2730	2700
Selenium			5 U		5 U	5 U			5 U	5 U	5 U
Silver			1 U		1 U	1 UJ			1 U	1 UJ	1 UJ
Sodium			15000		77900	81300			25800	18400	18000
Vanadium			5 U		5 U	5 U			5 U	5 U	5 U
Zinc			44.7 J		9.8	3.2			42.4	17.8	17.5
Inorganics (ug/L)											
Aluminum				158 J			95.4 J	3240			
Antimony				0.34 J			2 U	2 U			
Arsenic	10			0.29 J			1 U	1.7			
Barium				36.3			23.7	36.2			
Beryllium				0.1 J			1 U	1 U			
Cadmium				0.23 J			0.038 J	0.4 U			
Calcium				3830			21500	19700			
Chromium	100			2 U			2510	3350			
Chromium, Hexavalent	0.035	100		0.5 U			2510	3480			
Cobalt	6			1 UJ			0.14 J	1.9			
Copper				20			2 UJ	4.4			
Cyanide				10 U			3.7 J+	2.5 U			
Iron				37.1 J-			854 J	5530			
Lead	15			8.7			0.2 U	4.2			
Magnesium				904 J			5460 J	5830			
Manganese	300			40.9 J			16.6	171			
Mercury				0.2 U			0.2 UJ	0.2 UJ			
Nickel				2.7 J			1.5	5.8			
Potassium				1250 J			2150	2670			
Selenium				5 U			5 U	5 U			
Silver				0.015 J			1 U	1 UJ			
Sodium				14800			71900	75700			
Vanadium				5 U			5 U	5 U			
Zinc				41.1			2.4 J+	13.9 J			
Other											
Dissolved oxygen, field (mg/L)				0.35			3.79	3.69			
ORP, field (mV)				205			285.6	260.5			
pH, field (S.U.)				5.33			5.89	5.86			
Spec. cond., field (umho/cm)				120			563.2	609			
Temperature, field (deg C)				18.3			13.6	12.98			
Turbidity, field (N.T.U.)				0.8			1.8	1.97			

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			101S			MW-102D				MW-	
Sample ID:	Residential	Residential	WL-GW-MW-101S-1	WL-GW-MW-101S-2	WL-GW-MW-101SD-2	WL-GWF-MW-102D-1	WL-GWF-MW-102D-2	WL-GW-MW-102D-1	WL-GW-MW-102D-2	WL-GWF-MW-102S-1	WL-GWF-MW-102S-2
Sample Date:	Groundwater	Groundwater	8/12/2014	12/8/2014	12/8/2014	8/11/2014	12/8/2014	8/11/2014	12/8/2014	8/11/2014	12/8/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Duplicate	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200		0.5 U	0.5 U	0.5 U			28	34		
1,1,2-Trichloroethane			0.5 U	0.5 U	0.5 U			0.5 U	0.5 U		
1,1-Dichloroethane	2.8		R	0.5 U	0.5 U			16	18		
1,1-Dichloroethene			R	0.5 U	0.5 U			16 J	15		
1,2-Dibromo-3-chloropropane			R	0.5 U	0.5 U			0.5 U	0.5 U		
1,2-Dichloroethane			R	0.5 U	0.5 U			0.5 U	0.5 U		
2-Butanone			R	5 U	5 U			5 U	5 U		
Acetone			5 UJ	5 U	5 U			5 UJ	5 U		
Benzene			0.5 U	0.5 U	0.5 U			0.49 J	0.37 J		
Bromodichloromethane			R	0.5 U	0.5 U			R	0.5 U		
Bromoform			R	0.5 U	0.5 U			R	0.5 U		
Carbon disulfide			R	0.5 U	0.5 U			0.5 U	0.5 U		
Chloroethane			R	0.5 U	0.5 U			0.16 J	0.5 U		
Chloroform			R	0.5 U	0.5 U			0.5 U	0.5 U		
cis-1,2-Dichloroethene	70		R	0.5 U	0.5 U			15 J	18		
Cyclohexane			0.5 U	0.5 U	0.5 U			0.5 U	0.5 U		
Ethylbenzene			0.5 U	0.5 U	0.5 U			0.5 U	0.5 U		
Isopropylbenzene			0.5 U	0.5 U	0.5 U			0.5 U	0.5 U		
m,p-Xylene			0.5 U	0.5 U	0.5 U			0.5 U	0.5 U		
Methyl tert-butyl ether			R	0.5 U	0.5 U			0.42 J	0.42 J		
Methylcyclohexane			0.5 U	0.5 U	0.5 U			0.5 U	0.5 U		
Methylene chloride			R	0.5 U	0.5 U			0.5 U	0.5 U		
o-Xylene			0.5 U	0.5 U	0.5 U			0.5 U	0.5 U		
Tetrachloroethene			0.5 U	0.5 U	0.5 U			1.2	1.4		
Toluene			0.5 U	0.5 U	0.5 U			0.5 U	0.5 U		
trans-1,2-Dichloroethene			R	0.5 U	0.5 U			0.5 U	0.17 J		
Trichloroethene	5	98	0.15 U	0.5 U	0.5 U			53	70		
Vinyl chloride	2	7	0.015 U	0.5 U	0.5 U			1.8	1.6		
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46		0.1 U					3.8			
Inorganics, Dissolved (ug/L)											
Aluminum						51.8	29.1 J+			6880	31.2 J+
Antimony						0.46 J	2 U			2 U	2 U
Arsenic	10					1.2	1 U			2.8	1 U
Barium						134	144			228	162
Beryllium						0.19 J+	1 U			0.5 J+	1 U
Cadmium						1	1.1			1.2	0.96
Calcium						70900	73900			30700	27800
Chromium	100					23100 J	16400			4440 J	5730
Chromium, Hexavalent	0.035	100				21500	16000			5300	5720
Cobalt	6					21.7	22.9			5.1	1 U
Copper						4.7	4.3			17	0.6 J
Iron						4660 J	4760			11100 J	1600
Lead	15					0.12 J	0.2 U			9.7	0.2 U
Magnesium						18000	18900			9460	6540
Manganese	300					1960 J	2140			1640 J	1340

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			101S			MW-102D				MW-	
Sample ID:	Residential	Residential	WL-GW-MW-101S-1	WL-GW-MW-101S-2	WL-GW-MW-101SD-2	WL-GWF-MW-102D-1	WL-GWF-MW-102D-2	WL-GW-MW-102D-1	WL-GW-MW-102D-2	WL-GWF-MW-102S-1	WL-GWF-MW-102S-2
Sample Date:	Groundwater	Groundwater	8/12/2014	12/8/2014	12/8/2014	8/11/2014	12/8/2014	8/11/2014	12/8/2014	8/11/2014	12/8/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Duplicate	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury						0.2 UJ	0.2 UJ			0.2 UJ	0.2 UJ
Nickel						23.7	23.4			24.8	15.8
Potassium						8300	7920			4100	3430
Selenium						5 U	5 U			0.44 J	5 U
Silver						1 U	1 UJ			1 U	1 UJ
Sodium						231000	211000			199000	172000
Vanadium						5 U	5 U			5 U	5 U
Zinc						130	144			38.9	7
Inorganics (ug/L)											
Aluminum			447 J	271	290			2250 J	3850		
Antimony			2 U	2 U	2 U			1.5 J	2 U		
Arsenic	10		1 U	1 U	1 U			12.8	1.6		
Barium			216	103	112			150	172		
Beryllium			0.29 J	1 U	1 U			1.4 J+	1 U		
Cadmium			0.54	0.4 U	0.4 U			1.2	0.93 J-		
Calcium			17100	11800	13000			64700	25700		
Chromium	100		4.6 UJ	2 U	2 U			30200	5660		
Chromium, Hexavalent	0.035	100	1.4	0.5 U	0.5 U			21100	16400		
Cobalt	6		1.4	1 U	1 U			23.6	3		
Copper			2 UJ	3.2	3.1			57.6	8.4		
Cyanide			4.8 J+	2.5 U	2.5 U			5.2 J+	3.8 U		
Iron			366 J	200 U	200 U			28400	6630		
Lead	15		0.2 U	0.2 U	0.2 U			5.6	4.6		
Magnesium			2710 J	1790	1950			16400 J	7190		
Manganese	300		191	104	116			2120	1450		
Mercury			0.2 UJ	0.2 UJ	0.2 UJ			0.081 J-	0.2 UJ		
Nickel			1.2	1.5	1.5			25.9	19.2		
Potassium			3560	2640	2840			8000	3520		
Selenium			0.42 J	0.48 J	0.45 J			1.2 J	0.75 J		
Silver			1 U	1 UJ	1 UJ			1 U	1 UJ		
Sodium			25100	18100	19000			214000	173000		
Vanadium			5 U	5 U	5 U			5 U	5 U		
Zinc			42.4 J+	19.4 J	19.4 J			175	20.9 J		
Other											
Dissolved oxygen, field (mg/L)			0.04	2.21				0.06	0.71		
ORP, field (mV)			308	268.4				260.1	280.2		
pH, field (S.U.)			4.96	5.09				6.1	5.91		
Spec. cond., field (umho/cm)			287.3	231				1664	1728		
Temperature, field (deg C)			16.7	11.74				13.5	11.42		
Turbidity, field (N.T.U.)			1.6	1.02				70	84		

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			102S		MW-103D						
Sample ID:	Residential	Residential	WL-GW-MW-102S-1	WL-GW-MW-102S-2	WL-GWF-MW-103D-1	WL-GWF-MW-103DD-1	WL-GWF-MW-103D-2	WL-GW-MW-103D-1	WL-GW-MW-103DD-1	WL-GW-MW-103D-2	WL-GWF-MW-103S-1
Sample Date:	Groundwater	Groundwater	8/11/2014	12/8/2014	8/11/2014	8/11/2014	12/10/2014	8/11/2014	8/11/2014	12/10/2014	8/11/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Duplicate	Field Duplicate	Field Sample	Field Duplicate	Field Duplicate	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200		29	34				0.43 J	0.45 J	3.8	
1,1,2-Trichloroethane			0.5 U	0.5 U				0.5 U	0.5 U	0.5 U	
1,1-Dichloroethane	2.8		18	19				0.83	0.82	8.5	
1,1-Dichloroethene			8.3 J	6.2				0.3 J	0.5 U	2.1	
1,2-Dibromo-3-chloropropane			0.5 U	0.5 U				0.5 U	0.5 U	0.5 U	
1,2-Dichloroethane			0.5 U	0.5 U				0.5 U	0.5 U	0.5 U	
2-Butanone			5 U	5 U				5 U	5 U	5 U	
Acetone			5 UJ	5 U				5 UJ	5 UJ	5 U	
Benzene			0.5 U	0.5 U				0.5 U	0.5 U	0.5 U	
Bromodichloromethane			R	0.5 U				R	R	0.5 U	
Bromoform			R	0.5 U				R	R	0.5 U	
Carbon disulfide			0.5 U	0.5 U				0.5 U	0.5 U	0.5 U	
Chloroethane			0.5 U	0.5 U				0.5 U	0.5 U	0.5 U	
Chloroform			0.5 U	0.5 U				0.5 U	0.5 U	0.5 U	
cis-1,2-Dichloroethene	70		54	63				0.25 J	0.26 J	1.3	
Cyclohexane			0.5 U	0.5 U				0.5 U	0.5 U	0.5 U	
Ethylbenzene			0.5 U	0.5 U				0.5 U	0.5 U	0.5 U	
Isopropylbenzene			0.5 U	0.5 U				0.5 U	0.5 U	0.5 U	
m,p-Xylene			0.5 U	0.5 U				0.5 U	0.5 U	0.5 U	
Methyl tert-butyl ether			0.22 J	0.14 J				0.5 U	0.5 U	0.26 J	
Methylcyclohexane			0.5 U	0.5 U				0.5 U	0.5 U	0.5 U	
Methylene chloride			0.5 U	0.5 U				0.5 U	0.5 U	0.5 U	
o-Xylene			0.5 U	0.5 U				0.5 U	0.5 U	0.5 U	
Tetrachloroethene			1.6	1.2				0.5 U	0.5 U	0.5 U	
Toluene			0.5 U	0.5 U				0.5 U	0.5 U	0.5 U	
trans-1,2-Dichloroethene			0.18 J	0.17 J				0.5 U	0.5 U	0.5 U	
Trichloroethene	5	98	42	47				2.3 J	2.2	9.9	
Vinyl chloride	2	7	0.66	0.32 J				0.015 U	0.015 U	0.5 U	
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46		1.8					0.63	0.55		
Inorganics, Dissolved (ug/L)											
Aluminum					20 UJ	20 UJ	59.6 J+				22.3 U
Antimony					2 UJ	2 UJ	2 U				2 U
Arsenic	10				0.26 J-	0.26 J-	1 U				0.39 J
Barium					15.9 J-	16.6 J-	53.7				87.2
Beryllium					1 UJ	1 UJ	1 U				1 U
Cadmium					0.077 J-	0.066 J-	0.4 U				0.32
Calcium					23500 J-	23900 J-	38600				23900
Chromium	100				582 J	580 J	662				3880 J
Chromium, Hexavalent	0.035	100			558	568	664				3870
Cobalt	6				1 UJ	1 UJ	1 U				5
Copper					2 UJ	2 UJ	2 UJ				2 UJ
Iron					117 J	114 J	200 U				722 J
Lead	15				0.028 J-	0.03 J-	0.37				0.068 J
Magnesium					8330 J-	8230 J-	13400				7210
Manganese	300				12.4 J	12.4 J	80				108 J

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			102S		MW-103D						
Sample ID:	Residential	Residential	WL-GW-MW-102S-1	WL-GW-MW-102S-2	WL-GWF-MW-103D-1	WL-GWF-MW-103DD-1	WL-GWF-MW-103D-2	WL-GW-MW-103D-1	WL-GW-MW-103DD-1	WL-GW-MW-103D-2	WL-GWF-MW-103S-1
Sample Date:	Groundwater	Groundwater	8/11/2014	12/8/2014	8/11/2014	8/11/2014	12/10/2014	8/11/2014	8/11/2014	12/10/2014	8/11/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Duplicate	Field Duplicate	Field Sample	Field Duplicate	Field Duplicate	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury					0.2 UJ	0.2 UJ	0.2 UJ				0.2 UJ
Nickel					2.7 J-	2.6 J-	4.6				10.2
Potassium					2840 J-	2830 J-	4190				4850
Selenium					5 UJ	5 UJ	5 U				5 U
Silver					1 UJ	1 UJ	1 U				1 U
Sodium					30300 J-	30000 J-	49800				79000
Vanadium					5 UJ	5 UJ	5 UJ				5 U
Zinc					3.6 J-	3.6 J-	4.7				11
Inorganics (ug/L)											
Aluminum			103 J	2440				36.6 J	47.6 J	501	
Antimony			2 U	2 U				2 UJ	2 UJ	2 U	
Arsenic	10		1 U	11.3				1 UJ	1 UJ	1 U	
Barium			218	168				17.1 J-	17.3 J-	57.6	
Beryllium			0.1 J+	1.7 J+				1 UJ	1 UJ	1 U	
Cadmium			1.2	1.4 J-				0.062 J-	0.076 J-	0.4 UJ	
Calcium			28500	75300				22600 J-	23300 J-	36800 J	
Chromium	100		4320	25600				555 J-	564 J-	678	
Chromium, Hexavalent	0.035	100	4380	5610				576	573	664	
Cobalt	6		0.62 J	26.2				0.21 J-	0.22 J-	1 U	
Copper			2 UJ	67				2 UJ	2 UJ	2 UJ	
Cyanide			5.7 J+	3.4 U				4.2 J+	4.3 J+	2.5 U	
Iron			1360 J	33800				238 J	261 J	1070	
Lead	15		0.2 U	3.9				0.2 UJ	0.2 UJ	0.61	
Magnesium			6900 J	20000				7440 J	7570 J	13200 J	
Manganese	300		1310	2430				14.1 J-	14.3 J-	94.9	
Mercury			0.2 UJ	0.2 UJ				0.2 UJ	0.2 UJ	0.2 UJ	
Nickel			15.6	28.8				2.6 J-	2.6 J-	5.1	
Potassium			3630	8120				2840 J-	2840 J-	4260	
Selenium			0.34 J	1.2 J				5 UJ	5 UJ	5 U	
Silver			1 U	1 UJ				1 UJ	1 UJ	1 U	
Sodium			208000	199000				29100 J-	29500 J-	49500	
Vanadium			5 U	5 U				5 UJ	5 UJ	R	
Zinc			8.3 J+	199 J				6.3 J	15.1 J	6.7	
Other											
Dissolved oxygen, field (mg/L)			1.17	2.69				3.09		0.32	
ORP, field (mV)			310	256.1				277.5		130.5	
pH, field (S.U.)			5.34	5.25				5.6		5.79	
Spec. cond., field (umho/cm)			1361	1142				377.8		647	
Temperature, field (deg C)			15.8	12.59				13.1		10.93	
Turbidity, field (N.T.U.)			3.95	4.73				3.5		16.1	

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			MW-103S			MW-10D				MW	
Sample ID:	Residential	Residential	WL-GWF-MW-103S-2	WL-GW-MW-103S-1	WL-GW-MW-103S-2	WL-GWF-MW-10D-1	WL-GWF-MW-10D-2	WL-GW-MW-10D-1	WL-GW-MW-10D-2	WL-GWF-MW-10S-1	WL-GWF-MW-10S-2
Sample Date:	Groundwater	Groundwater	12/10/2014	8/11/2014	12/10/2014	8/19/2014	12/16/2014	8/19/2014	12/16/2014	8/20/2014	12/16/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200			8.3	3.6			0.5 U	0.5 U		
1,1,2-Trichloroethane				0.5 U	0.5 U			0.5 U	0.5 U		
1,1-Dichloroethane	2.8			4.8	2.9			0.5 U	0.94		
1,1-Dichloroethene				2.5	1.5			0.5 U	0.5 U		
1,2-Dibromo-3-chloropropane				0.5 U	0.5 U			0.5 U	0.5 U		
1,2-Dichloroethane				0.5 U	0.5 U			0.5 U	0.5 U		
2-Butanone				5 U	5 U			5 U	5 U		
Acetone				5 U	5 U			5 U	5 U		
Benzene				0.5 U	0.5 U			0.5 U	0.5 U		
Bromodichloromethane				R	0.5 U			0.5 U	0.5 U		
Bromoform				R	0.5 U			0.5 U	0.5 U		
Carbon disulfide				0.5 U	0.5 U			0.5 U	0.5 U		
Chloroethane				0.5 U	0.5 U			0.5 U	0.5 U		
Chloroform				0.5 U	0.5 U			0.5 U	0.5 U		
cis-1,2-Dichloroethene	70			5.5	3.7			1.8	1.3		
Cyclohexane				0.5 U	0.5 U			0.5 U	0.5 U		
Ethylbenzene				0.5 U	0.5 U			0.5 U	0.5 U		
Isopropylbenzene				0.5 U	0.5 U			0.5 U	0.5 U		
m,p-Xylene				0.5 U	0.5 U			0.5 U	0.5 U		
Methyl tert-butyl ether				0.5 U	0.5 U			0.5 U	0.5 U		
Methylcyclohexane				0.5 U	0.5 U			0.5 U	0.5 U		
Methylene chloride				0.5 U	0.5 U			0.5 U	0.5 U		
o-Xylene				0.5 U	0.5 U			0.5 U	0.5 U		
Tetrachloroethene				0.5	0.42 J			0.29 J	0.26 J		
Toluene				0.5 U	0.5 U			0.5 U	0.5 U		
trans-1,2-Dichloroethene				0.5 U	0.5 U			0.5 U	0.5 U		
Trichloroethene	5	98		19	20			6.5	16		
Vinyl chloride	2	7		0.038	0.5 U			0.84	0.27 J		
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46			0.57				0.037 J			
Inorganics, Dissolved (ug/L)											
Aluminum			52.3 J+			20 U	20 U			51.9	20.1 U
Antimony			2 U			1.2 J	2 U			3.8	2.7 U
Arsenic	10		1 U			0.2 J	0.23 J			1.1	0.63
Barium			79.5			61.7	75.6			76.3	64.5
Beryllium			1 U			1 U	1 U			1 U	1 U
Cadmium			0.4 U			0.17	0.4 U			0.04 U	0.73
Calcium			24100			24100	12900			33800	29400
Chromium	100		3170			56.2	19.7			51.9	18.3
Chromium, Hexavalent	0.035	100	3130			46.9 J	6.6 J+			1.4 J	1.2 J+
Cobalt	6		5.1			7.1	14			6.3	7.9
Copper			2 UJ			4 UJ	3.5			2 U	25.4
Iron			841			400 U	13.8 J			1710	201
Lead	15		0.2 U			0.031 J	0.2 U			0.38	1.5
Magnesium			6950			3360	2050			4060	3630
Manganese	300		110			105	181			342	235

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			MW-103S			MW-10D				MW
Sample ID:	Residential	Residential	WL-GWF-MW-103S-2	WL-GW-MW-103S-1	WL-GW-MW-103S-2	WL-GWF-MW-10D-1	WL-GWF-MW-10D-2	WL-GW-MW-10D-1	WL-GW-MW-10D-2	WL-GWF-MW-10S-1	WL-GWF-MW-10S-2
Sample Date:	Groundwater	Groundwater	12/10/2014	8/11/2014	12/10/2014	8/19/2014	12/16/2014	8/19/2014	12/16/2014	8/20/2014	12/16/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury			0.2 UJ			0.2 UJ	0.2 UJ			0.2 UJ	0.2 UJ
Nickel			11			2 U	3			5.6	2.7
Potassium			4450			7230	8050			11200	9670
Selenium			5 U			0.25 J	5 U			0.3 J	5 U
Silver			1 U			2 UJ	1 U			1 U	1 U
Sodium			74400			35000	48600			14900	9410
Vanadium			5 UJ			5 U	5 U			5 U	5 U
Zinc			12.9			7.1	12.4			5.2	96.1
Inorganics (ug/L)											
Aluminum				28.2 J	77.6			93.1	31.4		
Antimony				2 U	2 U			1.3 J	2 U		
Arsenic	10			1 U	1 U			0.4 J-	0.18 J		
Barium				93.4	81.7			65.8	65.6		
Beryllium				1 U	1 U			1 U	1 UJ		
Cadmium				0.36	0.4 UJ			0.17	0.4 UJ		
Calcium				23600	23200 J			22800	11800		
Chromium	100			3950	2970			60.4	30.1		
Chromium, Hexavalent	0.035	100		4020	3000			46.5	6.9 J+		
Cobalt	6			5.4	5.4			7.6	11.9		
Copper				2 UJ	2 UJ			2.5	2.9 J-		
Cyanide				7.7 J+	3.4 U			3.7 J+	2.8		
Iron				1140 J	983			227	98.1 J		
Lead	15			0.2 U	0.21 U			0.26	0.27 U		
Magnesium				7060 J	6920 J			3290	2000		
Manganese	300			112	97.6			104	168		
Mercury				0.2 UJ	0.2 UJ			0.2 U	0.2 UJ		
Nickel				10.2	11.2			1.3	2.7		
Potassium				4860	4520			6920	7430		
Selenium				0.46 J	0.48			5 U	5 U		
Silver				1 U	1 U			1 U	1 UJ		
Sodium				78000	75400			34000	46700		
Vanadium				5 U	R			5 U	5 U		
Zinc				11.3 J+	13.3			7.3 J+	11.9		
Other											
Dissolved oxygen, field (mg/L)				0	0.32			0	0.24		
ORP, field (mV)				263.1	211			194	183.8		
pH, field (S.U.)				5.59	5.89			5.79	6.15		
Spec. cond., field (umho/cm)				612	614			382	369		
Temperature, field (deg C)				16	10.01			16.5	12.42		
Turbidity, field (N.T.U.)				0.64	2.67			4.4	3.39		

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			-10S		MW-12D				MW		
Sample ID:	Residential	Residential	WL-GW-MW-10S-1	WL-GW-MW-10S-2	WL-GWF-MW-12D-1	WL-GWF-MW-12D-2	WL-GW-MW-12D-1	WL-GW-MW-12D-2	WL-GWF-MW-12S-1	WL-GWF-MW-12S-2	WL-GWF-MW-12SD-2
Sample Date:	Groundwater	Groundwater	8/20/2014	12/16/2014	8/19/2014	12/15/2014	8/19/2014	12/15/2014	8/19/2014	12/15/2014	12/15/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200		0.5 U	0.22 J			0.5 U	0.5 U			
1,1,2-Trichloroethane			0.5 U	0.5 U			0.5 U	0.5 U			
1,1-Dichloroethane	2.8		0.22 J	0.5 U			0.37 J	0.36 J			
1,1-Dichloroethene			0.5 U	0.5 U			0.35 J	0.5 U			
1,2-Dibromo-3-chloropropane			0.5 U	0.5 U			0.5 U	0.5 U			
1,2-Dichloroethane			0.5 U	0.5 U			0.5 U	0.5 U			
2-Butanone			5 U	5 U			5 U	5 U			
Acetone			5 U	5 U			5 U	5 U			
Benzene			0.5 U	0.5 U			0.5 U	0.5 U			
Bromodichloromethane			0.5 U	0.5 U			0.5 U	0.5 U			
Bromoform			0.5 U	0.5 U			0.5 U	0.5 U			
Carbon disulfide			0.5 U	0.5 U			0.5 U	0.5 U			
Chloroethane			0.5 U	0.5 U			0.5 U	0.5 U			
Chloroform			0.5 U	0.5 U			0.5 U	0.5 U			
cis-1,2-Dichloroethene	70		4.6	1.2			9.3	11			
Cyclohexane			0.5 U	0.5 U			0.5 U	0.5 U			
Ethylbenzene			0.5 U	0.5 U			0.5 U	0.5 U			
Isopropylbenzene			0.5 U	0.5 U			0.5 U	0.5 U			
m,p-Xylene			0.5 U	0.5 U			0.5 U	0.5 U			
Methyl tert-butyl ether			0.5 U	0.5 U			0.5 U	0.14 J			
Methylcyclohexane			0.5 U	0.5 U			0.5 U	0.5 U			
Methylene chloride			0.5 U	0.5 U			0.5 U	0.5 U			
o-Xylene			0.5 U	0.5 U			0.5 U	0.5 U			
Tetrachloroethene			0.5 U	0.23 J			0.23 J	0.22 J			
Toluene			0.5 U	0.5 U			0.5 U	0.5 U			
trans-1,2-Dichloroethene			0.5 U	0.5 U			0.5 U	0.5 U			
Trichloroethene	5	98	1.1 J	8.1			22	26			
Vinyl chloride	2	7	0.32	0.5 U			2.1	1.5			
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46		0.059 J				0.082 J				
Inorganics, Dissolved (ug/L)											
Aluminum					20 U	20 U			28 U	63.8	67
Antimony					2 U	2 U			0.75 J	2 U	2 U
Arsenic	10				2.3	1.9			3.9	2.1	2.2
Barium					48	48.3			227	119	123
Beryllium					1 U	1 U			1 U	1 U	1 U
Cadmium					0.042 U	0.4 U			0.7	0.45	0.48
Calcium					33200	33700			38100	38400	39700
Chromium	100				0.24 J-	0.94 J			52.5	45.2	45.8
Chromium, Hexavalent	0.035	100			0.5 UJ	0.5 U			0.5 UJ	1 J+	1 J+
Cobalt	6				9.2	9.1			24.8	6.2	6.5
Copper					2 UJ	2 UJ			3.6 J	3.9	4.8
Iron					3080	2590			1610	431	455
Lead	15				0.2 U	0.2 U			0.17 J	0.22 U	0.21 U
Magnesium					6110	5850			3640	3610	3770
Manganese	300				844	836			877	514	517

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			-10S		MW-12D				MW		
Sample ID:	Residential	Residential	WL-GW-MW-10S-1	WL-GW-MW-10S-2	WL-GWF-MW-12D-1	WL-GWF-MW-12D-2	WL-GW-MW-12D-1	WL-GW-MW-12D-2	WL-GWF-MW-12S-1	WL-GWF-MW-12S-2	WL-GWF-MW-12SD-2
Sample Date:	Groundwater	Groundwater	8/20/2014	12/16/2014	8/19/2014	12/15/2014	8/19/2014	12/15/2014	8/19/2014	12/15/2014	12/15/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate
Parameter	PRGs	PRGs									
Mercury					0.2 UJ	0.2 UJ			0.2 UJ	0.2 UJ	0.2 UJ
Nickel					1.6	1.5			2.6	1.5	2.3
Potassium					1220	1320			8110	8020	8250
Selenium					5 U	5 U			0.62 J	5 U	5 U
Silver					1 UJ	1 U			1 UJ	1 U	1 U
Sodium					66600	68500			160000	73600	76000
Vanadium					5 U	5 U			5 U	5 U	5 U
Zinc					3.6	2.8 U			22.1	8.5 U	8.4 U
Inorganics (ug/L)											
Aluminum			74.1 J	28.9			52.3	38.9			
Antimony			1.1 J	2.1 U			2 U	2 U			
Arsenic	10		1 U	0.52 J			4.5 J-	2.7			
Barium			77.8	61.7			46.4	45.5			
Beryllium			1 U	1 UJ			1 U	1 UJ			
Cadmium			0.3 J	0.7			0.053	0.4 UJ			
Calcium			33600	28700			32100	32900			
Chromium	100		66.7 J	19.8			5.8 J-	3.3			
Chromium, Hexavalent	0.035	100	1.2	2.7 J+			0.5 U	0.5 U			
Cobalt	6		6.4	7.4			9	8.5			
Copper			7	27.8			2 UJ	2 UJ			
Cyanide			6.1 J+	3.8			4.1 J+	3.6			
Iron			1750	249			3760	3060			
Lead	15		2.3 J	2.5			0.2 U	0.2 U			
Magnesium			4010	3720			5940	6000			
Manganese	300		372	225			808	802			
Mercury			0.2 UJ	0.2 UJ			0.2 U	0.2 UJ			
Nickel			5.6 J	2.7			1.6	1.3			
Potassium			11200	9230			1170	1240			
Selenium			0.47 J	5 U			5 U	5 U			
Silver			1 U	0.02 J			1 U	1 UJ			
Sodium			14900	9390			65800	66900			
Vanadium			5 U	5 U			5 U	5 U			
Zinc			10.4 J	96.6			2.8 U	2.2			
Other											
Dissolved oxygen, field (mg/L)			0.1	0.36			0	0.56			
ORP, field (mV)			-12.3	113.8			60.4	99.7			
pH, field (S.U.)			6.07	6.22			5.95	5.46			
Spec. cond., field (umho/cm)			339.3	250			631	477			
Temperature, field (deg C)			20.4	7.91			15	13.3			
Turbidity, field (N.T.U.)			2.96	1.86			11.49	9.48			

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			-12S			MW-13					
Sample ID:	Residential	Residential	WL-GW-MW-12S-1	WL-GW-MW-12S-2	WL-GW-MW-12SD-2	WL-GWF-MW-13-1	WL-GWF-MW-13-2	WL-GW-MW-13-1	WL-GW-MW-13-2	WL-GWF-MW-14-1	WL-GWF-MW-14-2
Sample Date:	Groundwater	Groundwater	8/19/2014	12/15/2014	12/15/2014	8/5/2014	12/10/2014	8/5/2014	12/10/2014	8/12/2014	12/10/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Duplicate	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200		1500	640	650			0.5 U	0.5 U		
1,1,2-Trichloroethane			10 U	0.5 U	0.5 U			0.5 U	0.5 U		
1,1-Dichloroethane	2.8		390	250	260			0.5 U	0.5 U		
1,1-Dichloroethene			140	39 J	34 J			0.5 U	0.5 U		
1,2-Dibromo-3-chloropropane			10 U	0.5 U	0.5 U			0.5 U	0.5 U		
1,2-Dichloroethane			10 U	0.5 U	0.5 U			0.5 U	0.5 U		
2-Butanone			100 U	5 U	5 U			5 U	5 U		
Acetone			100 U	5 U	5 U			5 U	5 U		
Benzene			10 U	0.5 U	0.5 U			0.5 U	0.5 U		
Bromodichloromethane			10 U	0.5 U	0.5 U			0.5 U	0.5 U		
Bromoform			10 U	0.5 U	0.5 U			0.5 U	0.5 U		
Carbon disulfide			10 U	0.5 U	0.5 U			0.5 U	0.5 U		
Chloroethane			240	62	68			0.5 U	0.5 U		
Chloroform			10 U	0.5 U	0.5 U			0.5 U	0.5 U		
cis-1,2-Dichloroethene	70		190 J	110	110			0.5 U	0.5 U		
Cyclohexane			10 U	0.5 U	0.5 U			0.5 U	0.5 U		
Ethylbenzene			10 U	0.5 U	0.5 U			0.5 U	0.5 U		
Isopropylbenzene			10 U	0.5 U	0.5 U			0.5 U	0.5 U		
m,p-Xylene			10 U	0.5 U	0.5 U			0.5 U	0.5 U		
Methyl tert-butyl ether			10 U	0.5 U	0.5 U			0.5 U	0.5 U		
Methylcyclohexane			10 U	0.5 U	0.5 U			0.5 U	0.5 U		
Methylene chloride			10 U	0.5 U	0.5 U			0.5 U	0.5 U		
o-Xylene			10 U	0.5 U	0.5 U			0.5 U	0.5 U		
Tetrachloroethene			12	5.9	5.1			0.5 U	0.5 U		
Toluene			10 U	0.5 U	0.5 U			0.5 U	0.5 U		
trans-1,2-Dichloroethene			7 J	3.9	3.5			0.5 U	0.5 U		
Trichloroethene	5	98	7.4 J	5.9	5.3			0.15 J	0.5 U		
Vinyl chloride	2	7	33 J	24 J	30			0.015 U	0.5 U		
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46		1					0.1 U			
Inorganics, Dissolved (ug/L)											
Aluminum						45.2	197 J+			44.6	125 J+
Antimony						2 U	2 U			2 U	2 U
Arsenic	10					0.11 J	1 U			0.41 J	1 U
Barium						98.5	212			142	245
Beryllium						0.16 J+	1 U			1 U	1 U
Cadmium						0.081 U	0.4 U			0.75	1.9
Calcium						12800	12000			20300	22700
Chromium	100					944 J	454			2880 J	137
Chromium, Hexavalent	0.035	100				829	475			2910	125
Cobalt	6					1 UJ	1 U			1.6	2.3
Copper						2 U	2 UJ			2 UJ	2 UJ
Iron						251 J	200 U			567 J	200 U
Lead	15					0.2 U	0.2 U			0.13 J	0.2 U
Magnesium						2020 J	1710			3030	2760
Manganese	300					54.8 J	66			216 J	271

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			-12S			MW-13					
Sample ID:	Residential	Residential	WL-GW-MW-12S-1	WL-GW-MW-12S-2	WL-GW-MW-12SD-2	WL-GWF-MW-13-1	WL-GWF-MW-13-2	WL-GW-MW-13-1	WL-GW-MW-13-2	WL-GWF-MW-14-1	WL-GWF-MW-14-2
Sample Date:	Groundwater	Groundwater	8/19/2014	12/15/2014	12/15/2014	8/5/2014	12/10/2014	8/5/2014	12/10/2014	8/12/2014	12/10/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Duplicate	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury						0.2 UJ	0.2 UJ			0.2 UJ	0.2 UJ
Nickel						1.3 UJ	0.68 J			1.4	2.6
Potassium						649	555			3150	2810
Selenium						5 U	5 U			0.32 J	5 U
Silver						1 U	1 U			1 U	1 U
Sodium						130000	157000			422000	599000
Vanadium						5 U	5 UJ			5 U	5 UJ
Zinc						4.6 U	3.2 U			4.7	16.3
Inorganics (ug/L)											
Aluminum			45.5	98.3	88.7			78.5	192		
Antimony			0.72 J	2 U	2 U			2 U	2 U		
Arsenic	10		4.3 J-	2.4	2.3			0.076 J	1 U		
Barium			219	118	119			95.8	227		
Beryllium			1 U	1 UJ	1 U			0.15 J+	1 U		
Cadmium			0.82	0.46	0.45			0.079 U	0.4 UJ		
Calcium			36800	39100	39000			12400	13000 J		
Chromium	100		59.4	50.5	49.1			948	457		
Chromium, Hexavalent	0.035	100	0.5 U	0.8 J+	0.9 J+			858	470		
Cobalt	6		24.6	6.2	6.3 J			1 U	1 U		
Copper			4.1	4.7 J-	6.6			2 U	2 UJ		
Cyanide			3.6 J+	2.4 J	2.5 U			6 J	2.5 U		
Iron			1850	613	572			286	200 U		
Lead	15		0.47	0.5	0.4			0.2 UJ	0.2 U		
Magnesium			3560	3790	3600			1970 J	1900 J		
Manganese	300		817	488	481			56.5	67.5		
Mercury			0.2 U	0.2 UJ	0.2 UJ			0.2 UJ	0.2 UJ		
Nickel			2.6	1.6	1.6 J			1 U	0.63 J		
Potassium			7840	8250	8220			635	567		
Selenium			0.41 J	5 U	5 U			5 U	5 U		
Silver			1 U	1 UJ	1 U			1 U	1 U		
Sodium			167000	77200	73100			137000	161000		
Vanadium			5 U	5 U	5 U			5 U	R		
Zinc			21.3 J+	9.1	8.8 UJ			2.7 U	2.5 U		
Other											
Dissolved oxygen, field (mg/L)			0	0.47				5.85	6.71		
ORP, field (mV)			84.9	124.1				291	217.6		
pH, field (S.U.)			5.59	5.41				4.99	5.02		
Spec. cond., field (umho/cm)			1103	516				762	932		
Temperature, field (deg C)			18.5	8.72				16.9	11.96		
Turbidity, field (N.T.U.)			2.34	4.06				3.1	0.9		

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			MW-14				MW-15				
Sample ID:	Residential	Residential	WL-GWF-MW-14-3	WL-GW-MW-14-1	WL-GW-MW-14-2	WL-GW-MW-14-3	WL-GWF-MW-15-1	WL-GWF-MW-15-2	WL-GW-MW-15-1	WL-GW-MW-15-2	WL-GWF-MW-16-1
Sample Date:	Groundwater	Groundwater	9/22/2015	8/12/2014	12/10/2014	9/22/2015	8/12/2014	12/16/2014	8/12/2014	12/16/2014	8/4/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200			3.5	0.11 J	8.7			39	56	
1,1,2-Trichloroethane				0.5 U	0.5 U	0.5 U			1 U	0.5 U	
1,1-Dichloroethane	2.8			4.4 J	0.5 U	16			28	33	
1,1-Dichloroethene				0.9 J	0.5 U	3.7			9.6	8.2	
1,2-Dibromo-3-chloropropane				R	0.5 U	0.5 U			1 U	0.5 U	
1,2-Dichloroethane				R	0.5 U	0.5 U			1 U	0.5 U	
2-Butanone				R	5 U	5 U			10 U	5 U	
Acetone				R	5 U	5 U			10 U	5 U	
Benzene				0.5 U	0.5 U	0.5 U			1 U	0.5 U	
Bromodichloromethane				R	0.5 U	0.55			R	0.5 U	
Bromoform				R	0.5 U	0.5 U			R	0.5 U	
Carbon disulfide				R	0.5 U	0.5 U			1 U	0.5 U	
Chloroethane				R	0.5 U	0.5 U			1 U	0.5 U	
Chloroform				1.2 UJ	0.5 U	1.5			1 U	0.5 U	
cis-1,2-Dichloroethene	70			0.3 J	0.5 U	0.47 J			130	110	
Cyclohexane				0.5 U	0.5 U	0.5 U			1 U	0.5 U	
Ethylbenzene				0.5 U	0.5 U	0.5 U			1 U	0.5 U	
Isopropylbenzene				0.5 U	0.5 U	0.5 U			1 U	0.5 U	
m,p-Xylene				0.5 U	0.5 U	0.5 U			1 U	0.5 U	
Methyl tert-butyl ether				0.19 J	0.5 U	0.59			1 U	0.5 U	
Methylcyclohexane				0.5 U	0.5 U	0.5 U			1 U	0.5 U	
Methylene chloride				R	0.5 U	0.5 U			1 U	0.5 U	
o-Xylene				0.5 U	0.5 U	0.5 U			1 U	0.5 U	
Tetrachloroethene				0.1 J	0.5 U	0.54			1.1	1	
Toluene				0.5 U	0.5 U	0.5 U			1 U	0.19 J	
trans-1,2-Dichloroethene				R	0.5 U	0.5 U			0.27 J	0.25 J	
Trichloroethene	5	98		4.9	0.16 J	17			40	51	
Vinyl chloride	2	7		0.03	0.5 U	0.5 U			4.3	4.2	
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46			0.75		6			1.9		
Inorganics, Dissolved (ug/L)											
Aluminum			20 U				39.2	20 U			20 U
Antimony			2 U				2 U	2 U			2 U
Arsenic	10		0.16 J				0.38 J	0.12 J			1 U
Barium			27.1				179	74.8			32.9
Beryllium			1 U				1 U	1 U			1 U
Cadmium			0.14 J				0.55	0.4 U			0.04 U
Calcium			3960				19600	10200			9290
Chromium	100		10300				129 J	21.2			50.6
Chromium, Hexavalent	0.035	100	10100				91.6	14.2 J+			48.8
Cobalt	6		1 UJ				4.6	1.6			1 U
Copper			3.8				2 UJ	2 UJ			2 UJ
Iron			3040 J				31.4 J	200 UJ			24.9 J-
Lead	15		1 U				0.067 J	0.2 U			0.036 J
Magnesium			714 J				4030	2210			2880 J
Manganese	300		52.4				870 J	491			2.7

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			MW-14				MW-15				
Sample ID:	Residential	Residential	WL-GWF-MW-14-3	WL-GW-MW-14-1	WL-GW-MW-14-2	WL-GW-MW-14-3	WL-GWF-MW-15-1	WL-GWF-MW-15-2	WL-GW-MW-15-1	WL-GW-MW-15-2	WL-GWF-MW-16-1
Sample Date:	Groundwater	Groundwater	9/22/2015	8/12/2014	12/10/2014	9/22/2015	8/12/2014	12/16/2014	8/12/2014	12/16/2014	8/4/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury			0.2 U				0.2 UJ	0.2 UJ			0.2 UJ
Nickel			1.1				7.5	2.1			0.82 J-
Potassium			991 J				3750	2380			3260 J
Selenium			0.46 J				5 U	5 U			5 U
Silver			1 U				1 U	1 U			1 U
Sodium			159000 J				267000	122000			26900
Vanadium			5 U				5 U	5 U			5 U
Zinc			9.7 J				7.4	18.8			2.6 U
Inorganics (ug/L)											
Aluminum				446 J	142	1070 J			44.5 J	44.9	
Antimony				0.58 J	2 U	2 U			2 U	2 U	
Arsenic	10			1 U	1 U	0.46 J			1 U	0.11 J	
Barium				143	249	31.9			174	75.9	
Beryllium				0.13 J+	1 U	0.084 J			0.1 J+	1 UJ	
Cadmium				0.61	1.5	0.1 J			0.51	0.4 UJ	
Calcium				19100	21800 J	4000			18600	10400	
Chromium	100			2900	153	9480			115	22.7	
Chromium, Hexavalent	0.035	100		2940	121	9930			98.1	14.1 J+	
Cobalt	6			1.7	2.4	0.92 J			4.5	1.5	
Copper				2 UJ	2 UJ	4			2 UJ	0.21 J	
Cyanide				5.3 J+	2.5 U	10 U			3.4 J+	3.1	
Iron				1360 J	200 U	4470 J			200 UJ	65.8 J	
Lead	15			0.67	0.39	2.4			0.2 U	0.28 U	
Magnesium				2980 J	3050 J	1020 J			4030 J	2390	
Manganese	300			224	265	74.6			862	500	
Mercury				0.2 UJ	0.2 UJ	0.2 U			0.2 UJ	0.2 UJ	
Nickel				1.9	2.4	2 J			6.7	2.4	
Potassium				3060	2780	1070			3590	2360	
Selenium				0.6 J	5 U	0.49 J			0.34 J	5 U	
Silver				1 U	1 U	1 U			1 U	1 UJ	
Sodium				437000	563000	170000			235000	130000	
Vanadium				5 U	R	5 U			5 U	5 U	
Zinc				5.5 J+	17.6	12.9 J			6.8 J+	22.4	
Other											
Dissolved oxygen, field (mg/L)				0.92	3.32	1.59			0.11	2.85	
ORP, field (mV)				259.4	235	125			272.3	153.7	
pH, field (S.U.)				5.32	5.45	6.02			5.17	5.58	
Spec. cond., field (umho/cm)				2233	3140	731			1441	350	
Temperature, field (deg C)				20.1	11.96	17.71			17	11.81	
Turbidity, field (N.T.U.)				28.2	-0.33	31.3			0.89	4.2	

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			MW-16					MW-5D			
Sample ID:	Residential	Residential	WL-GWF-MW-16-2	WL-GWF-MW-16D-2	WL-GW-MW-16-1	WL-GW-MW-16-2	WL-GW-MW-16D-2	WL-GWF-MW-5D-1	WL-GWF-MW-5D-2	WL-GW-MW-5D-1	WL-GW-MW-5D-2
Sample Date:	Groundwater	Groundwater	12/2/2014	12/2/2014	8/4/2014	12/2/2014	12/2/2014	8/19/2014	12/9/2014	8/19/2014	12/9/2014
Sample Type:	Drinking Water	Irrigation Well	Field Duplicate	Field Duplicate	Field Sample	Field Duplicate	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200				0.88	2.5	2.6			78	47
1,1,2-Trichloroethane					0.5 U	0.5 U	0.5 U			0.5 U	0.5 U
1,1-Dichloroethane	2.8				0.79	2	2.1			9.8	8.1
1,1-Dichloroethene					0.31 J	0.56 U	0.5 U			12 J	6
1,2-Dibromo-3-chloropropane					0.5 U	0.5 U	0.5 U			0.5 U	0.5 U
1,2-Dichloroethane					0.5 U	0.5 U	0.5 U			0.5 U	0.5 U
2-Butanone					5 U	5 U	5 U			5 U	5 U
Acetone					5 U	5 U	5 U			5 U	5 U
Benzene					0.5 U	0.5 U	0.5 U			0.5 U	0.5 U
Bromodichloromethane					0.5 U	0.5 U	0.5 U			0.5 U	0.5 U
Bromoform					0.5 U	0.5 U	0.5 U			0.5 U	0.5 U
Carbon disulfide					0.5 U	0.5 U	0.5 U			0.5 U	0.5 U
Chloroethane					0.5 U	0.5 U	0.5 U			0.5 U	0.5 U
Chloroform					0.5 U	0.5 U	0.5 U			0.5 U	0.5 U
cis-1,2-Dichloroethene	70				0.59	1.5	1.5			49	34
Cyclohexane					0.5 U	0.5 U	0.5 U			0.5 U	0.5 U
Ethylbenzene					0.5 U	0.5 U	0.5 U			0.5 U	0.5 U
Isopropylbenzene					0.5 U	0.5 U	0.5 U			0.5 U	0.5 U
m,p-Xylene					0.5 U	0.5 U	0.5 U			0.5 U	0.5 U
Methyl tert-butyl ether					0.5 U	0.5 U	0.5 U			0.5 U	0.12 J
Methylcyclohexane					0.5 U	0.5 U	0.5 U			0.5 U	0.5 U
Methylene chloride					0.5 U	0.5 U	0.5 U			0.5 U	0.5 U
o-Xylene					0.5 U	0.5 U	0.5 U			0.5 U	0.5 U
Tetrachloroethene					0.5 U	0.5 U	0.5 U			0.89	0.65
Toluene					0.5 U	0.5 U	0.5 U			0.5 U	0.5 U
trans-1,2-Dichloroethene					0.5 U	0.5 U	0.5 U			0.52 J	0.46 J
Trichloroethene	5	98			4.4	7.8	7.8			130	91
Vinyl chloride	2	7			0.015 U	0.5 U	0.5 U			9.9	5.1
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46				0.1 U					0.45	
Inorganics, Dissolved (ug/L)											
Aluminum			23.8	20 U				20 U	20 U		
Antimony			2 U	2 U				2 U	2 U		
Arsenic	10		0.14 J	0.1 J				4.5	4.9		
Barium			42.4	43.2				51.1	51.9		
Beryllium			1 U	1 U				1 U	1 U		
Cadmium			0.4 U	0.4 U				0.04 U	0.4 U		
Calcium			11600	11700				35000	38100		
Chromium	100		106	111				0.21 J-	2 U		
Chromium, Hexavalent	0.035	100	102	107				0.5 UJ	0.5 U		
Cobalt	6		1 U	1 U				11.8	6		
Copper			2 UJ	2 UJ				2 UJ	2 UJ		
Iron			200 UJ	200 UJ				4310	4270		
Lead	15		0.2 U	0.2 U				0.04 J	0.2 U		
Magnesium			3290	3330				6140	6880		
Manganese	300		3.1 J	3.2 J				953	930		

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			MW-16					MW-5D			
Sample ID:	Residential	Residential	WL-GWF-MW-16-2	WL-GWF-MW-16D-2	WL-GW-MW-16-1	WL-GW-MW-16-2	WL-GW-MW-16D-2	WL-GWF-MW-5D-1	WL-GWF-MW-5D-2	WL-GW-MW-5D-1	WL-GW-MW-5D-2
Sample Date:	Groundwater	Groundwater	12/2/2014	12/2/2014	8/4/2014	12/2/2014	12/2/2014	8/19/2014	12/9/2014	8/19/2014	12/9/2014
Sample Type:	Drinking Water	Irrigation Well	Field Duplicate	Field Duplicate	Field Sample	Field Duplicate	Field Duplicate	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury			0.2 UJ	0.2 UJ				0.2 UJ	0.2 UJ		
Nickel			1	1.1				2.2	1.8		
Potassium			3890 J	3980 J				1270	1340		
Selenium			5 U	5 U				5 U	5 U		
Silver			1 U	1 U				1 UJ	1 UJ		
Sodium			37800	38600				75300	78800		
Vanadium			5 U	5 U				5 U	5 U		
Zinc			2.6 U	2.3 U				7.9	7.4		
Inorganics (ug/L)											
Aluminum					22.1	21.5	21			20 U	153
Antimony					2 U	2 U	2 U			2 U	2 U
Arsenic	10				0.12 J	0.17 J	0.15 J			6.6 J-	9.1
Barium					32.6	40.4	46.8			46.9	51.4
Beryllium					1 U	1 U	1 U			1 U	1 U
Cadmium					0.04 U	0.4 U	0.4 U			0.059	0.4 U
Calcium					9130	11600	13500			34100	37300
Chromium	100				53	108	129			2.2 J-	2 U
Chromium, Hexavalent	0.035	100			49.8	102	102			0.5 U	0.5 U
Cobalt	6				1 U	1 U	1 U			5.9	6
Copper					2 UJ	0.17 J	0.27 J			2 UJ	0.82 J
Cyanide					4.7 J	2 J	2.5 U			3.8 J+	2.5 U
Iron					252 J-	200 UJ	200 UJ			4550	5320
Lead	15				0.56	0.45	0.52			0.2 U	0.65
Magnesium					2810 J	3190	3710			6030	6720
Manganese	300				6.7	5.4	6.2			928	902
Mercury					0.2 UJ	0.2 UJ	0.2 UJ			0.2 U	0.2 UJ
Nickel					0.93 J-	1.1	1.2			1.7	2.5
Potassium					3190 J	3880	4520			1180	1350
Selenium					5 U	5 U	5 U			5 U	5 U
Silver					1 U	1 U	1 U			1 U	1 UJ
Sodium					26800	37500	43900			74100	77600
Vanadium					5 U	5 U	5 U			5 U	5 U
Zinc					2.9 J+	4.7 J	3.2 UJ			7.9 J+	13 J
Other											
Dissolved oxygen, field (mg/L)					3.96	2.71				0.12	1.28
ORP, field (mV)					265.8	267.8				53.8	87.1
pH, field (S.U.)					5.59	5.57				5.82	5.97
Spec. cond., field (umho/cm)					238	302				687	667
Temperature, field (deg C)					13	12.17				14.4	10.65
Turbidity, field (N.T.U.)					1.7	1.85				3.81	4.11

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			MW-5S				MW-6D				
Sample ID:	Residential	Residential	WL-GWF-MW-5S-1	WL-GWF-MW-5S-2	WL-GW-MW-5S-1	WL-GW-MW-5S-2	WL-GWF-MW-6D-1	WL-GWF-MW-6D-2	WL-GW-MW-6D-1	WL-GW-MW-6D-2	WL-GWF-MW-6S-1
Sample Date:	Groundwater	Groundwater	8/19/2014	12/15/2014	8/19/2014	12/15/2014	8/18/2014	12/15/2014	8/18/2014	12/15/2014	8/18/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200				2600	390			16	12	
1,1,2-Trichloroethane					10 U	0.5 U			0.5 U	0.5 U	
1,1-Dichloroethane	2.8				1700	410			24	22	
1,1-Dichloroethene					450	48			3.7 J	2.4	
1,2-Dibromo-3-chloropropane					10 U	0.5 U			0.5 U	0.5 U	
1,2-Dichloroethane					10 U	0.5 U			0.5 U	0.5 U	
2-Butanone					100 U	5 U			5 U	5 U	
Acetone					100 U	5 U			5 U	5 U	
Benzene					10 U	0.5 U			0.5 U	0.5 U	
Bromodichloromethane					10 U	0.5 U			0.5 U	0.5 U	
Bromoform					10 U	0.5 U			0.5 U	0.5 U	
Carbon disulfide					10 U	0.5 U			0.5 U	0.5 U	
Chloroethane					330	84			0.5 U	0.5 U	
Chloroform					10 U	0.5 U			0.5 U	0.5 U	
cis-1,2-Dichloroethene	70				790	170			33	29	
Cyclohexane					10 U	0.5 U			0.5 U	0.5 U	
Ethylbenzene					10 U	0.11 J			0.5 U	0.5 U	
Isopropylbenzene					10 U	0.12 J			0.5 U	0.5 U	
m,p-Xylene					10 U	0.3 J			0.5 U	0.5 U	
Methyl tert-butyl ether					10 U	0.5 U			0.23 J	0.16 J	
Methylcyclohexane					10 U	0.5 U			0.5 U	0.5 U	
Methylene chloride					10 U	0.5 U			0.5 U	0.5 U	
o-Xylene					10 U	0.23 J			0.5 U	0.5 U	
Tetrachloroethene					19	7.7			0.5 U	0.5 U	
Toluene					10 U	1.4			0.5 U	0.5 U	
trans-1,2-Dichloroethene					10 U	0.45 J			0.5 U	0.5 U	
Trichloroethene	5	98			1300	380			3.4	4.2	
Vinyl chloride	2	7			19	3.1			6.9	6.1	
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46				1.4				0.62		
Inorganics, Dissolved (ug/L)											
Aluminum			148	539			20 U	20 U			76.5
Antimony			1.1 J	2 U			2 U	2 U			2 U
Arsenic	10		0.87 J	0.68 J			3.5	4.4			0.86 J
Barium			206	209			69.6	73.7			144
Beryllium			0.25 J+	1 U			1 U	1 U			0.13 J
Cadmium			0.04 U	0.44			0.04 U	0.4 U			0.59
Calcium			18300	24400			33700	37300			25700
Chromium	100		46.2	59.2			0.98 J-	0.62 J			60.4
Chromium, Hexavalent	0.035	100	0.5 UJ	0.5 U			0.5 UJ	0.5 U			0.5 UJ
Cobalt	6		377	488			3.3	3.6			78.5
Copper			2 UJ	25.9			2 UJ	2 UJ			2 UJ
Iron			22000	29000			5330	5970			1720
Lead	15		0.2 U	0.54			0.2 U	0.2 U			0.042 J
Magnesium			3320	4330			5710	5880			3790
Manganese	300		955	1190			940	1000			490

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			MW-5S				MW-6D				
Sample ID:	Residential	Residential	WL-GWF-MW-5S-1	WL-GWF-MW-5S-2	WL-GW-MW-5S-1	WL-GW-MW-5S-2	WL-GWF-MW-6D-1	WL-GWF-MW-6D-2	WL-GW-MW-6D-1	WL-GW-MW-6D-2	WL-GWF-MW-6S-1
Sample Date:	Groundwater	Groundwater	8/19/2014	12/15/2014	8/19/2014	12/15/2014	8/18/2014	12/15/2014	8/18/2014	12/15/2014	8/18/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury			0.2 UJ	0.14 J			0.2 UJ	0.2 UJ			0.049 J-
Nickel			25.7	26.2			1.3	1.5			39.2
Potassium			4020	4120			1130	1270			8220
Selenium			0.34 J	5 U			5 U	5 U			5 U
Silver			1 UJ	1 U			1 UJ	1 U			1 UJ
Sodium			144000	144000			74900	78100			80400
Vanadium			5 U	5 U			0.56 J	5 U			5 U
Zinc			7	42.5			2.3 U	2.8 U			128
Inorganics (ug/L)											
Aluminum					147	2850			155	152	
Antimony					0.99 J	2 U			2 U	2 U	
Arsenic	10				0.65 J-	1.8			11.7	8.8	
Barium					197	215			66.9	74.9	
Beryllium					0.22 J+	1 U			0.14 J	1 U	
Cadmium					0.04 U	2.9			0.04 U	0.4 U	
Calcium					17600	24400			32200	37000	
Chromium	100				52.1	222			5.8 J-	4.7	
Chromium, Hexavalent	0.035	100			0.5 U	0.5 U			0.5 U	0.5 U	
Cobalt	6				357	493 J			3.3	3.7 J	
Copper					2 UJ	178			2 UJ	2 UJ	
Cyanide					17 J+	36.1			3.5 J+	1.8 J	
Iron					22500	48700			7910	7780	
Lead	15				0.2 U	3			0.39	0.46	
Magnesium					3130	4950			5580	5980	
Manganese	300				923	1220			911	1000	
Mercury					0.2 U	0.2 UJ			0.2 U	0.2 UJ	
Nickel					23.3	29 J			1.5	1.7 J	
Potassium					3940	4220			1110	1310	
Selenium					5 U	5 U			5 U	5 U	
Silver					1 U	1 U			1 U	1 U	
Sodium					125000	144000			73500	77900	
Vanadium					5 U	5 U			5 U	5 U	
Zinc					5.3 J+	176 J			2 U	4.6 UJ	
Other											
Dissolved oxygen, field (mg/L)					0.19	0.37			0.19	1.18	
ORP, field (mV)					57.9	-1.3			15.1	40.3	
pH, field (S.U.)					5.26	6.16			5.74	6	
Spec. cond., field (umho/cm)					876	960			690	699	
Temperature, field (deg C)					18.7	8.49			15.1	9.65	
Turbidity, field (N.T.U.)					4.47	729			20.8	17.6	

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			MW-6S			MW-7				MW
Sample ID:	Residential	Residential	WL-GWF-MW-6S-2	WL-GW-MW-6S-1	WL-GW-MW-6S-2	WL-GWF-MW-7-1	WL-GWF-MW-7-2	WL-GW-MW-7-1	WL-GW-MW-7-2	WL-GWF-MW-9D-1	WL-GWF-MW-9D-2
Sample Date:	Groundwater	Groundwater	12/15/2014	8/18/2014	12/15/2014	8/18/2014	12/16/2014	8/18/2014	12/16/2014	8/20/2014	12/17/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200			480	230			0.22 J	0.5 U		
1,1,2-Trichloroethane				5 U	0.5 U			0.5 U	0.5 U		
1,1-Dichloroethane	2.8			120	51			0.5 U	0.5 U		
1,1-Dichloroethene				61 J	23 J			0.5 U	0.5 U		
1,2-Dibromo-3-chloropropane				5 U	0.5 U			0.5 U	0.5 U		
1,2-Dichloroethane				5 U	0.5 U			0.5 U	0.5 U		
2-Butanone				50 U	5 U			5 U	5 U		
Acetone				50 U	5 U			5 U	5 U		
Benzene				5 U	0.5 U			0.5 U	0.5 U		
Bromodichloromethane				5 U	0.5 U			0.5 U	0.5 U		
Bromoform				5 U	0.5 U			0.5 U	0.5 U		
Carbon disulfide				5 U	0.5 U			0.5 U	0.5 U		
Chloroethane				7.5	3.4			0.5 U	0.5 U		
Chloroform				5 U	0.5 U			0.5 U	0.5 U		
cis-1,2-Dichloroethene	70			230	130			0.5 U	0.5 U		
Cyclohexane				5 U	0.5 U			0.5 U	0.5 U		
Ethylbenzene				5 U	0.5 U			0.5 U	0.5 U		
Isopropylbenzene				5 U	0.5 U			0.5 U	0.5 U		
m,p-Xylene				5 U	0.5 U			0.5 U	0.5 U		
Methyl tert-butyl ether				5 U	0.5 U			0.5 U	0.5 U		
Methylcyclohexane				5 U	0.5 U			0.5 U	0.5 U		
Methylene chloride				5 U	0.5 U			0.5 U	0.5 U		
o-Xylene				5 U	0.5 U			0.5 U	0.5 U		
Tetrachloroethene				14	11			0.5 U	0.5 U		
Toluene				5 U	0.5 U			0.5 U	0.5 U		
trans-1,2-Dichloroethene				5 U	0.95			0.5 U	0.5 U		
Trichloroethene	5	98		530	390			0.2 J	0.5 U		
Vinyl chloride	2	7		8.2	4.6			0.015 U	0.5 U		
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46			6.6				0.31			
Inorganics, Dissolved (ug/L)											
Aluminum			67.3			247	158			20 U	20 U
Antimony			2 U			0.61 J	2 U			2 U	2 U
Arsenic	10		0.6 J			0.23 J	0.13 J			1.1	1
Barium			107			10 U	10 U			46.2	38.3
Beryllium			1 U			0.1 J	1 U			0.09 J	1 U
Cadmium			0.54			0.15	0.4 U			0.14	0.4 U
Calcium			28900			7590	8540			28100	31500
Chromium	100		55.6			14700	11500			0.96 J-	0.29 J
Chromium, Hexavalent	0.035	100	0.5 U			13600 J	11500			0.5 UJ	0.5 U
Cobalt	6		78.5			1 U	1.1			10.6	7.2
Copper			1.5 J			76.2	39			2 U	2 UJ
Iron			1490			3130	2780			3390	1650
Lead	15		0.2 U			0.061 J	0.2 U			0.36	0.2 U
Magnesium			4100			1050	1220			5520	5290
Manganese	300		529			163	191			607	596 J

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			MW-6S			MW-7				MW
Sample ID:	Residential	Residential	WL-GWF-MW-6S-2	WL-GW-MW-6S-1	WL-GW-MW-6S-2	WL-GWF-MW-7-1	WL-GWF-MW-7-2	WL-GW-MW-7-1	WL-GW-MW-7-2	WL-GWF-MW-9D-1	WL-GWF-MW-9D-2
Sample Date:	Groundwater	Groundwater	12/15/2014	8/18/2014	12/15/2014	8/18/2014	12/16/2014	8/18/2014	12/16/2014	8/20/2014	12/17/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury			0.2 UJ			0.2 UJ	0.2 UJ			0.09 J-	0.2 UJ
Nickel			29.3			2.8	2.8			2.7	2.2
Potassium			7550			6410	4780			2460	1950 J
Selenium			5 U			0.34 J	5 U			5 U	5 U
Silver			1 U			1 UJ	1 U			1 U	1 U
Sodium			72500			12800	11100			56000	59800
Vanadium			5 U			5 U	5 U			5 U	5 U
Zinc			66.1			26.1	34.9			5.2	6.5 U
Inorganics (ug/L)											
Aluminum				104	79.5			248	230		
Antimony				0.36 J	2 U			0.6 J	2 U		
Arsenic	10			0.98 J-	0.6 J			0.21 J-	0.19 J		
Barium				139	105			10 U	10 U		
Beryllium				0.15 J	1 U			0.12 J	1 U		
Cadmium				1.1	0.58			0.14	0.4 U		
Calcium				24700	29400			7450	8800		
Chromium	100			132	77.4			14200	11800		
Chromium, Hexavalent	0.035	100		0.5 U	0.5 U			13700	11300		
Cobalt	6			75.3	74.9 J			1 U	1.1 J		
Copper				4.3	2 J-			73.3	39.7		
Cyanide				3.3 J+	3.3			2.9 J+	1.8 J		
Iron				1930	1980			3140	2980		
Lead	15			0.39	0.77			0.2 U	0.2 U		
Magnesium				3640	4050			1040	1240		
Manganese	300			468	518			157	191		
Mercury				0.2 U	0.2 UJ			0.2 U	0.2 UJ		
Nickel				37.1	28.4 J			2.7	2.9 J		
Potassium				7850	7820			6350	4890		
Selenium				5 U	5 U			5 U	5 U		
Silver				1 U	1 U			1 U	1 U		
Sodium				78900	71600			12800	11200		
Vanadium				5 U	5 U			5 U	5 U		
Zinc				123	64.7 J			23.8 J+	37.7 J		
Other											
Dissolved oxygen, field (mg/L)				0.4	0.47			0.71	4.07		
ORP, field (mV)				92.4	150.4			362.4	410.1		
pH, field (S.U.)				5.15	5.58			3.6	4.27		
Spec. cond., field (umho/cm)				653	5.87			211.8	178		
Temperature, field (deg C)				17.7	8.38			18.9	9.63		
Turbidity, field (N.T.U.)				3.87	4.83			1.4	3.69		

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			/-9D		MW-9S				PRB-03ED		PRB-
Sample ID:	Residential	Residential	WL-GW-MW-9D-1	WL-GW-MW-9D-2	WL-GWF-MW-9S-1	WL-GWF-MW-9S-2	WL-GW-MW-9S-1	WL-GW-MW-9S-2	WL-GWF-PRB-03ED-3	WL-GW-PRB-03ED-3	WL-GWF-PRB-03ES-3
Sample Date:	Groundwater	Groundwater	8/20/2014	12/17/2014	8/20/2014	12/17/2014	8/20/2014	12/17/2014	9/17/2015	9/17/2015	9/17/2015
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200		0.5 U	0.5 U			0.5 U	0.5 U			
1,1,2-Trichloroethane			0.5 U	0.5 U			0.5 U	0.52			
1,1-Dichloroethane	2.8		0.5 U	0.18 J			0.5 U	0.23 J			
1,1-Dichloroethene			0.5 U	0.5 U			0.5 U	0.5 U			
1,2-Dibromo-3-chloropropane			0.5 U	0.5 U			0.5 U	0.5 U			
1,2-Dichloroethane			0.5 U	0.5 U			0.5 U	0.5 U			
2-Butanone			5 U	5 U			5 U	5 U			
Acetone			5 U	5 U			5 U	5 U			
Benzene			0.5 U	0.5 U			0.18 J	0.43 J			
Bromodichloromethane			0.5 U	0.5 U			0.5 U	0.5 U			
Bromoform			0.5 U	0.5 U			0.5 U	0.5 U			
Carbon disulfide			0.5 U	0.5 U			0.5 U	0.5 U			
Chloroethane			0.5 U	0.5 U			0.5 U	0.5 U			
Chloroform			0.5 U	0.5 U			0.5 U	0.5 U			
cis-1,2-Dichloroethene	70		3.4	3.8			0.16 J	0.21 J			
Cyclohexane			0.5 U	0.5 U			0.54	0.41 J			
Ethylbenzene			0.5 U	0.5 U			0.27 J	0.3 J			
Isopropylbenzene			0.5 U	0.5 U			1.1	0.89			
m,p-Xylene			0.5 U	0.5 U			0.5 U	0.5 U			
Methyl tert-butyl ether			0.5 U	0.12 J			0.5 U	0.5 U			
Methylcyclohexane			0.5 U	0.5 U			1.1	0.49 J			
Methylene chloride			0.5 U	0.5 U			0.5 U	0.5 U			
o-Xylene			0.5 U	0.5 U			0.5 U	0.5 U			
Tetrachloroethene			1.2	1.2			0.5 U	0.5 U			
Toluene			0.5 U	0.5 U			0.59	0.5 U			
trans-1,2-Dichloroethene			0.5 U	0.5 U			0.5 U	0.11 J			
Trichloroethene	5	98	6.2	6.9			0.069 J	0.21 J			
Vinyl chloride	2	7	0.83	0.57			2.5	1			
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46		0.055 J				0.077 J				
Inorganics, Dissolved (ug/L)											
Aluminum					20 U	20 U			20 U		184 J
Antimony					2 U	2 U			2 U		0.082 J
Arsenic	10				5.8	1.5			1 U		0.43 J
Barium					173	140			43.1		58.6
Beryllium					1 U	1 U			1 U		0.058 J
Cadmium					0.04 U	0.49			1 U		0.11 J
Calcium					22600	35600			18100		19200
Chromium	100				13.2 J-	10.5			3070		21
Chromium, Hexavalent	0.035	100			0.5 UJ	0.5 U			2780		0.5 U
Cobalt	6				25.7	351			1 U		1 UJ
Copper					2 U	2.9			2 U		2.1 J
Iron					24700	7390			870		1010 J
Lead	15				0.087 J	0.28 U			1 U		1 U
Magnesium					3220	4420			3720		3670 J
Manganese	300				911	680 J			303		1010

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			/-9D		MW-9S				PRB-03ED		PRB-
Sample ID:	Residential	Residential	WL-GW-MW-9D-1	WL-GW-MW-9D-2	WL-GWF-MW-9S-1	WL-GWF-MW-9S-2	WL-GW-MW-9S-1	WL-GW-MW-9S-2	WL-GWF-PRB-03ED-3	WL-GW-PRB-03ED-3	WL-GWF-PRB-03ES-3
Sample Date:	Groundwater	Groundwater	8/20/2014	12/17/2014	8/20/2014	12/17/2014	8/20/2014	12/17/2014	9/17/2015	9/17/2015	9/17/2015
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury					0.2 UJ	0.2 UJ			0.2 UJ		0.2 U
Nickel					1.5	12.2			1.1		1.5 J
Potassium					13500	17700 J			4190		5400 J
Selenium					5 U	5 U			5 U		0.34 J
Silver					1 U	1 U			1 U		1 UJ
Sodium					41800	46400			51800		45000
Vanadium					5 U	5 U			5 U		5 U
Zinc					2 U	53			4.2		9.3 J
Inorganics (ug/L)											
Aluminum			71.1 J	20 U			20 UJ	109		211 J	
Antimony			2 U	2 U			2 U	2.8 U		2 U	
Arsenic	10		1.2	1			6	1.8		1 U	
Barium			42.4	37.3			179	120		44.8	
Beryllium			1 U	1 U			1 U	1 U		1 U	
Cadmium			0.11 J	0.4 U			0.04 UJ	0.74		1 U	
Calcium			28900	31200			22900	33900		17900 J	
Chromium	100		2 UJ	2			13.9 J	35		3130 J	
Chromium, Hexavalent	0.035	100	0.5 U	2.6 J+			0.5 U	0.5 U		2800	
Cobalt	6		6.9	7.1 J			29.5	635 J		1 U	
Copper			2 U	0.4 J			2 U	21.8		2 U	
Cyanide			3.7 J+	1.4 J			3.8 J+	12		10 U	
Iron			3210	2560			25800	4880		1060 J	
Lead	15		0.63 J	0.25 U			0.31 J	6.1		1 U	
Magnesium			5770	5210			3250	3870		3800 J	
Manganese	300		576	592			955	442		312 J	
Mercury			0.2 UJ	0.2 UJ			0.2 UJ	0.2 UJ		0.2 U	
Nickel			2.5 J	2.1 J			1.4 J	20.1 J		1.2	
Potassium			1730	1880			13800	18400		4180 J	
Selenium			5 U	5 U			5 U	0.36 J		5 U	
Silver			1 U	1 U			1 U	1 U		1 U	
Sodium			56000	59200			42300	44300		52500 J	
Vanadium			5 U	5 U			5 U	5 U		5 U	
Zinc			8.9 J	2.8 UJ			2 UJ	82.2 J		4.1	
Other											
Dissolved oxygen, field (mg/L)			0.06	0.74			2.02	1.33		0.04	
ORP, field (mV)			142.5	68.7			-74.1	50.1		172.1	
pH, field (S.U.)			5.91	5.92			6.46	6.34		5.7	
Spec. cond., field (umho/cm)			578.4	572			505	554		446	
Temperature, field (deg C)			17.1	13.32			21	9.84		17.34	
Turbidity, field (N.T.U.)			3.85	9.3			1.69	6.48		6.08	

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			03ES	PRB-03WD		PRB-03WS				PRB-04E	
Sample ID:	Residential	Residential	WL-GW-PRB-03ES-3	WL-GWF-PRB-03WD-3	WL-GW-PRB-03WD-3	WL-GWF-PRB-03WS-3	WL-GWF-PRB-03WS-3D	WL-GW-PRB-03WS-3	WL-GW-PRB-03WS-3D	WL-GWF-PRB-04E-3	WL-GW-PRB-04E-3
Sample Date:	Groundwater	Groundwater	9/17/2015	9/17/2015	9/17/2015	9/17/2015	9/17/2015	9/17/2015	9/17/2015	9/17/2015	9/17/2015
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate	Field Duplicate	Field Duplicate	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200										
1,1,2-Trichloroethane											
1,1-Dichloroethane	2.8										
1,1-Dichloroethene											
1,2-Dibromo-3-chloropropane											
1,2-Dichloroethane											
2-Butanone											
Acetone											
Benzene											
Bromodichloromethane											
Bromoform											
Carbon disulfide											
Chloroethane											
Chloroform											
cis-1,2-Dichloroethene	70										
Cyclohexane											
Ethylbenzene											
Isopropylbenzene											
m,p-Xylene											
Methyl tert-butyl ether											
Methylcyclohexane											
Methylene chloride											
o-Xylene											
Tetrachloroethene											
Toluene											
trans-1,2-Dichloroethene											
Trichloroethene	5	98									
Vinyl chloride	2	7									
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46										
Inorganics, Dissolved (ug/L)											
Aluminum				20 UJ		35.8	36.1			20 U	
Antimony				2 U		2 U	2 U			2 U	
Arsenic	10			0.12 J		1 U	1 U			1 U	
Barium				78.3		77.9	79.3			137	
Beryllium				0.096 J		1 U	1 U			1 U	
Cadmium				0.12 J		1 U	1 U			1 U	
Calcium				37600		19600	19900			41200	
Chromium	100			14600		122	119			259	
Chromium, Hexavalent	0.035	100		13600		1.33	2.15			110	
Cobalt	6			1 UJ		1.1	1.2			1 U	
Copper				2 U		2 U	2.1			2 U	
Iron				4250		2600	2760			1590	
Lead	15			1 U		1 U	1 U			1 U	
Magnesium				9550 J		3710	3730			5750	
Manganese	300			98.6		294	298			639	

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			03ES	PRB-03WD		PRB-03WS				PRB-04E	
Sample ID:	Residential	Residential	WL-GW-PRB-03ES-3	WL-GWF-PRB-03WD-3	WL-GW-PRB-03WD-3	WL-GWF-PRB-03WS-3	WL-GWF-PRB-03WS-3D	WL-GW-PRB-03WS-3	WL-GW-PRB-03WS-3D	WL-GWF-PRB-04E-3	WL-GW-PRB-04E-3
Sample Date:	Groundwater	Groundwater	9/17/2015	9/17/2015	9/17/2015	9/17/2015	9/17/2015	9/17/2015	9/17/2015	9/17/2015	9/17/2015
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Duplicate	Field Duplicate	Field Duplicate	Field Duplicate	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury				0.2 U		0.2 UJ	0.2 UJ			0.2 UJ	
Nickel				3.1 J		1.2	1.3			1 U	
Potassium				6730 J		3660	3740			6310	
Selenium				5 U		5 U	5 U			5 U	
Silver				1 U		1 U	1 U			1 U	
Sodium				106000		34100	34100			51700	
Vanadium				5 U		5 U	5 U			5 U	
Zinc				7.2 J		11.3	10.6			6.1	
Inorganics (ug/L)											
Aluminum			41.1 J		21.2 J			1420 J	1250 J		67.1 J
Antimony			0.07 J		2 U			2 U	2 U		2 U
Arsenic	10		0.5 J		0.15 J			1 U	1 U		1 U
Barium			55.9		78.8			88.5	86.5		139
Beryllium			1 U		0.063 J			1 U	1 U		1 U
Cadmium			0.13 J		0.17 J			1 U	1 U		1 U
Calcium			18200		37600			20300 J	19800 J		41800 J
Chromium	100		19.5		14800			127 J	127 J		274 J
Chromium, Hexavalent	0.035	100	0.5 U		13700			0.5 U	0.5 U		
Cobalt	6		1 UJ		1 UJ			1.9	1.8		1 U
Copper			2.5		2 U			3.3	3.1		2 U
Cyanide			10 U		10 U			10 U	10 U		10 U
Iron			854		4260			4670 J	4010 J		1730 J
Lead	15		1 U		1 U			2	1.8		1 U
Magnesium			3510 J		9770 J			4200 J	4120 J		5830 J
Manganese	300		951 J		95.4 J			338 J	328 J		658 J
Mercury			0.2 U		0.2 U			0.2 U	0.2 U		0.2 U
Nickel			1.6 J		3 J			5.3	3.4		1 U
Potassium			5080 J		6620 J			3940 J	3850 J		6320 J
Selenium			5 U		5 U			0.39 J	0.45 J		5 U
Silver			1 U		0.067 J			1 U	1 U		1 U
Sodium			44600		109000			34900 J	34200 J		52700 J
Vanadium			5 U		5 U			5 U	5 U		5 U
Zinc			10.7		7.6			16.9	16.8		6.3
Other											
Dissolved oxygen, field (mg/L)			0.09		3.53			0.07			0.13
ORP, field (mV)			52.2		204.2			131.7			55.5
pH, field (S.U.)			5.63		5.6			5.39			6.1
Spec. cond., field (umho/cm)			391		915			357			559
Temperature, field (deg C)			18.84		15.76			18.93			20.74
Turbidity, field (N.T.U.)			2.43		1.88			11.2			3.19

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			PRB-04W		PZ-01D		PZ-01D		PZ-01S		
Sample ID:	Residential	Residential	WL-GWF-PRB-04W-3	WL-GW-PRB-04W-3	WL-GWF-PZ-01D-1	WL-GWF-PZ-01D-2	WL-GW-PZ-01D-1	WL-GW-PZ-01D-2	WL-GWF-PZ-01S-1	WL-GWF-PZ-01S-2	WL-GW-PZ-01S-1
Sample Date:	Groundwater	Groundwater	9/17/2015	9/17/2015	8/13/2014	12/9/2014	8/13/2014	12/9/2014	8/13/2014	12/9/2014	8/13/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200						0.5 U	0.5 UJ			0.5 U
1,1,2-Trichloroethane							0.5 U	0.5 U			0.5 U
1,1-Dichloroethane	2.8						0.5 U	0.5 U			0.5 U
1,1-Dichloroethene							0.5 U	0.5 U			0.5 U
1,2-Dibromo-3-chloropropane							0.5 U	0.5 UJ			0.5 U
1,2-Dichloroethane							0.5 U	0.5 UJ			0.5 U
2-Butanone							5 U	5 U			5 U
Acetone							5 U	5 U			5 U
Benzene							0.5 U	0.5 U			0.5 U
Bromodichloromethane							0.5 U	0.5 U			0.5 U
Bromoform							0.5 U	0.5 U			0.5 U
Carbon disulfide							0.5 U	0.5 U			0.5 U
Chloroethane							0.5 U	0.5 U			0.5 U
Chloroform							0.5 U	0.5 U			0.5 U
cis-1,2-Dichloroethene	70						0.5 U	0.5 U			0.5 U
Cyclohexane							0.5 U	0.5 U			0.5 U
Ethylbenzene							0.5 U	0.5 U			0.5 U
Isopropylbenzene							0.5 U	0.5 U			0.5 U
m,p-Xylene							0.5 U	0.5 U			0.5 U
Methyl tert-butyl ether							0.5 U	0.5 UJ			0.5 U
Methylcyclohexane							0.5 U	0.5 U			0.5 U
Methylene chloride							0.5 U	0.5 UJ			0.5 U
o-Xylene							0.5 U	0.5 U			0.5 U
Tetrachloroethene							0.5 U	0.5 U			0.5 U
Toluene							0.5 U	0.5 U			0.5 U
trans-1,2-Dichloroethene							0.5 U	0.5 U			0.5 U
Trichloroethene	5	98					0.15 U	0.5 U			0.15 U
Vinyl chloride	2	7					0.015 U	0.5 U			0.015 U
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46						0.1 U				0.1 U
Inorganics, Dissolved (ug/L)											
Aluminum			327		20 U	20 U			20 U	20 U	
Antimony			2 U		2 U	2 U			2 U	2 U	
Arsenic	10		1 U		0.32 J	1 U			0.3 J	1 U	
Barium			111		10.7	11.9			13.4	14.6	
Beryllium			1 U		1 U	1 U			1 U	1 U	
Cadmium			1 U		0.034 J	0.4 U			0.025 J	0.4 U	
Calcium			11800		21300	25000			21000	22500	
Chromium	100		6590		2.7 UJ	2 U			2 UJ	2 U	
Chromium, Hexavalent	0.035	100	5850		0.4 J	0.5 U			0.5 U	0.5 U	
Cobalt	6		2.4		1 U	1 U			1 U	1 U	
Copper			2 U		2 UJ	2 UJ			2 UJ	2 UJ	
Iron			1870		19.1 J	200 U			10.8 J	200 U	
Lead	15		1.2		0.2 U	0.2 U			0.2 U	0.2 U	
Magnesium			2830		5550	6500			5150	5500	
Manganese	300		249		3.4 J	1.6 U			1.7 J	1.8 U	

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			PRB-04W		PZ-01D		PZ-01D		PZ-01S		
Sample ID:	Residential	Residential	WL-GWF-PRB-04W-3	WL-GW-PRB-04W-3	WL-GWF-PZ-01D-1	WL-GWF-PZ-01D-2	WL-GW-PZ-01D-1	WL-GW-PZ-01D-2	WL-GWF-PZ-01S-1	WL-GWF-PZ-01S-2	WL-GW-PZ-01S-1
Sample Date:	Groundwater	Groundwater	9/17/2015	9/17/2015	8/13/2014	12/9/2014	8/13/2014	12/9/2014	8/13/2014	12/9/2014	8/13/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury			0.2 UJ		0.2 UJ	0.2 UJ			0.2 UJ	0.2 UJ	
Nickel			1.7		0.58 J	0.73 J			0.61 J	0.9 J	
Potassium			2390		1920	2160			2280	2480	
Selenium			1.3 J		5 U	5 U			5 U	5 U	
Silver			1 U		1 U	1 UJ			1 U	1 UJ	
Sodium			38900		23500	24500			26000	26500	
Vanadium			5 U		5 U	5 U			5 U	5 U	
Zinc			54.5		5.9	2.8			7.5	2 U	
Inorganics (ug/L)											
Aluminum				381 J			20 UJ	20 U			20 UJ
Antimony				2 U			2 U	2 U			2 U
Arsenic	10			1 U			1 U	1 U			1 U
Barium				117			10	12.3			14.3
Beryllium				1 U			1 U	1 U			1 U
Cadmium				1 U			0.034 J	0.4 U			0.017 J
Calcium				12200 J			21000	25300			21000
Chromium	100			6670 J			3.1 UJ	2 U			2 UJ
Chromium, Hexavalent	0.035	100		5960			1	0.5 U			0.4 J
Cobalt	6			2.5			0.11 J	1 U			0.091 J
Copper				2 U			2 UJ	2 UJ			2 UJ
Cyanide				10 U			3.6 U	2.5 U			3.8 U
Iron				1990 J			200 UJ	200 U			200 UJ
Lead	15			1 U			0.2 U	0.2 U			0.2 U
Magnesium				2900 J			5530 J	6650			5350 J
Manganese	300			263 J			1.8	2.5 U			1.7
Mercury				0.2 U			0.2 UJ	0.2 UJ			0.2 UJ
Nickel				1.6			1.7	1 U			0.55 J
Potassium				2450 J			1890	2180			2340
Selenium				1.3 J			5 U	5 U			0.32 J
Silver				1 U			1 U	1 UJ			1 U
Sodium				39900 J			22600	25100			25500
Vanadium				5 U			5 U	5 U			5 U
Zinc				56.7			8.4 J+	2.9 J			6.2 J+
Other											
Dissolved oxygen, field (mg/L)				3.73			4.68	7.11			5.39
ORP, field (mV)				317.1			131.4	198.3			157.6
pH, field (S.U.)				4.71			5.46	5.7			5.5
Spec. cond., field (umho/cm)				341			304	388			312.7
Temperature, field (deg C)				19.58			14.5	10.65			15
Turbidity, field (N.T.U.)				3.46			3.76	0.59			2.66

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:				PZ-02D				PZ-02S			
Sample ID:	Residential	Residential	WL-GW-PZ-01S-2	WL-GWF-PZ-02D-1	WL-GWF-PZ-02D-2	WL-GW-PZ-02D-1	WL-GW-PZ-02D-2	WL-GWF-PZ-02S-1	WL-GWF-PZ-02S1R	WL-GW-PZ-02S-1	WL-GW-PZ-02S-1R
Sample Date:	Groundwater	Groundwater	12/9/2014	8/13/2014	12/8/2014	8/13/2014	12/8/2014	8/13/2014	8/18/2014	8/13/2014	8/18/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
VOCs (ug/L)											
1,1,1-Trichloroethane	200		0.5 U			0.5 U	0.5 U			0.5 U	
1,1,2-Trichloroethane			0.5 U			0.5 U	0.5 U			0.5 U	
1,1-Dichloroethane	2.8		0.5 U			0.5 U	0.5 U			0.5 U	
1,1-Dichloroethene			0.5 U			0.5 U	0.5 U			0.5 U	
1,2-Dibromo-3-chloropropane			0.5 UJ			0.5 U	0.5 U			0.5 U	
1,2-Dichloroethane			0.5 U			0.5 U	0.5 U			0.5 U	
2-Butanone			5 U			5 U	5 U			5 U	
Acetone			5 U			5 U	5 U			5 U	
Benzene			0.5 U			0.5 U	0.5 U			0.5 U	
Bromodichloromethane			0.5 U			0.5 U	0.5 U			0.5 U	
Bromoform			0.5 U			0.5 U	0.5 U			0.5 U	
Carbon disulfide			0.5 U			0.5 U	0.5 U			0.5 U	
Chloroethane			0.5 U			0.5 U	0.5 U			0.5 U	
Chloroform			0.5 U			0.5 U	0.5 U			0.5 U	
cis-1,2-Dichloroethene	70		0.5 U			0.5 U	0.5 U			0.5 U	
Cyclohexane			0.5 U			0.5 U	0.5 U			0.5 U	
Ethylbenzene			0.5 U			0.5 U	0.5 U			0.5 U	
Isopropylbenzene			0.5 U			0.5 U	0.5 U			0.5 U	
m,p-Xylene			0.5 U			0.5 U	0.5 U			0.5 U	
Methyl tert-butyl ether			0.5 U			0.5 U	0.5 U			0.5 U	
Methylcyclohexane			0.5 U			0.5 U	0.5 U			0.5 U	
Methylene chloride			0.5 U			0.5 U	0.5 U			0.5 U	
o-Xylene			0.5 U			0.5 U	0.5 U			0.5 U	
Tetrachloroethene			0.5 U			0.5 U	0.5 U			0.5 U	
Toluene			0.5 U			0.5 U	0.5 U			0.13 J	
trans-1,2-Dichloroethene			0.5 U			0.5 U	0.5 U			0.5 U	
Trichloroethene	5	98	0.5 U			0.15 U	0.5 U			0.15 U	
Vinyl chloride	2	7	0.5 U			0.015 U	0.5 U			0.015 U	
1,4-Dioxane (ug/L)											
1,4-Dioxane	0.46					0.1 U					0.054 J
Inorganics, Dissolved (ug/L)											
Aluminum				20 U	20 U				20 U		
Antimony				2 U	2 U				2 U		
Arsenic	10			0.32 J	1 U				5.2		
Barium				12.7	15.3				21.4		
Beryllium				1 U	1 U				1 U		
Cadmium				0.013 J	0.4 U				0.1 U		
Calcium				20500	24000				4640		
Chromium	100			5.4 UJ	3.7				2 UJ		
Chromium, Hexavalent	0.035	100		4.3	3.9 J+			0.5 U			
Cobalt	6			1 U	1 U				1 U		
Copper				2 UJ	2 UJ				2 UJ		
Iron				2.5 J	200 U				2710		
Lead	15			0.2 U	0.2 U				0.2 U		
Magnesium				5250	5980				1290		
Manganese	300			1.1 J	19.7				112		

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:				PZ-02D				PZ-02S			
Sample ID:	Residential	Residential	WL-GW-PZ-01S-2	WL-GWF-PZ-02D-1	WL-GWF-PZ-02D-2	WL-GW-PZ-02D-1	WL-GW-PZ-02D-2	WL-GWF-PZ-02S-1	WL-GWF-PZ-02S1R	WL-GW-PZ-02S-1	WL-GW-PZ-02S-1R
Sample Date:	Groundwater	Groundwater	12/9/2014	8/13/2014	12/8/2014	8/13/2014	12/8/2014	8/13/2014	8/18/2014	8/13/2014	8/18/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs									
Mercury				0.2 UJ	0.2 UJ				0.2 UJ		
Nickel				0.86 J	0.93 J				1.3		
Potassium				2160	2760				505		
Selenium				5 U	5 U				5 U		
Silver				1 U	1 UJ				1 UJ		
Sodium				26200	28600				11000		
Vanadium				5 U	5 U				0.62 J		
Zinc				9.8	2.5 U				12.4		
Inorganics (ug/L)											
Aluminum			22.6 U			20 UJ	20 U				68.8
Antimony			2 U			2 U	2 U				0.49 J
Arsenic	10		1 U			1 U	1 U				5.5 J-
Barium			13.7			13.1	15.2				21.3
Beryllium			1 U			1 U	1 U				1 U
Cadmium			0.4 U			0.015 J	0.4 U				0.22
Calcium			20600			20700	24100				4250
Chromium	100		2 U			5.3 UJ	3.9				1.1 J-
Chromium, Hexavalent	0.035	100	0.5 U			4.4	3.7 J+			0.5 U	
Cobalt	6		1 U			0.086 J	1 U				1 U
Copper			0.14 J			2 UJ	2 UJ				2 UJ
Cyanide			1.3 J			3.9 U	1.3 J				3.2 U
Iron			200 U			200 UJ	200 U				1360
Lead	15		0.2 U			0.2 U	0.2 U				0.37
Magnesium			5090			5340 J	6050				1130
Manganese	300		2.7 U			1.3	19.8				113
Mercury			0.2 UJ			0.2 UJ	0.2 UJ				0.2 U
Nickel			1 U			0.64 J	1 U				1.4
Potassium			2330			2180	2760				521
Selenium			5 U			5 U	5 U				5 U
Silver			1 UJ			1 U	1 UJ				1 U
Sodium			25000			25700	29000				12800
Vanadium			5 U			5 U	5 U				5 U
Zinc			2.1 UJ			5.7 J+	2 UJ				10.4 J+
Other											
Dissolved oxygen, field (mg/L)			6.46			6	6.31				0.79
ORP, field (mV)			219.3			260	232.5				45.2
pH, field (S.U.)			5.72			5.22	5.82				5
Spec. cond., field (umho/cm)			349			319	320				192
Temperature, field (deg C)			11.67			13	12.63				14.6
Turbidity, field (N.T.U.)			2.03			1	2.11				10.5

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			RCA-19			
Sample ID:	Residential	Residential	WL-GWF-RCA-19-1	WL-GWF-RCA-19-2	WL-GW-RCA-19-1	WL-GW-RCA-19-2
Sample Date:	Groundwater	Groundwater	8/13/2014	12/8/2014	8/13/2014	12/8/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs				
VOCs (ug/L)						
1,1,1-Trichloroethane	200				9.8	9.3
1,1,2-Trichloroethane					0.5 U	0.5 U
1,1-Dichloroethane	2.8				6.8	9.5
1,1-Dichloroethene					2.3	2.6
1,2-Dibromo-3-chloropropane					0.5 U	0.5 U
1,2-Dichloroethane					0.5 U	0.5 U
2-Butanone					5 U	5 U
Acetone					5 U	5 U
Benzene					0.5 U	0.5 U
Bromodichloromethane					0.5 U	0.5 U
Bromoform					0.5 U	0.5 U
Carbon disulfide					0.5 U	0.5 U
Chloroethane					0.5 U	0.5 U
Chloroform					0.5 U	0.5 U
cis-1,2-Dichloroethene	70				9.8	14
Cyclohexane					0.5 U	0.5 U
Ethylbenzene					0.5 U	0.5 U
Isopropylbenzene					0.5 U	0.5 U
m,p-Xylene					0.5 U	0.5 U
Methyl tert-butyl ether					0.16 J	0.18 J
Methylcyclohexane					0.5 U	0.5 U
Methylene chloride					0.5 U	0.5 U
o-Xylene					0.5 U	0.5 U
Tetrachloroethene					0.29 J	0.36 J
Toluene					0.5 U	0.5 U
trans-1,2-Dichloroethene					0.5 U	0.5 U
Trichloroethene	5	98			16	20
Vinyl chloride	2	7			0.069	0.5 U
1,4-Dioxane (ug/L)						
1,4-Dioxane	0.46				0.71	
Inorganics, Dissolved (ug/L)						
Aluminum			278	171		
Antimony			2 U	2 U		
Arsenic	10		0.85 J	1 U		
Barium			478	150		
Beryllium			0.14 J+	1 U		
Cadmium			1.8	0.48		
Calcium			59900	18700		
Chromium	100		8250 J	9400		
Chromium, Hexavalent	0.035	100	7540	9570		
Cobalt	6		1.7	1 U		
Copper			2 UJ	2 UJ		
Iron			1430 J	2810		
Lead	15		0.2 U	0.2 U		
Magnesium			10700	3320		
Manganese	300		390 J	117		

TABLE C-5
COMPARISON OF RI GROUNDWATER ANALYTICAL RESULTS, PHASES 1, 2, AND 3 (DETECTED ANALYTES ONLY) TO PRGS
WALTON LONSBURY SUPERFUND SITE

Location:			RCA-19			
Sample ID:	Residential	Residential	WL-GWF-RCA-19-1	WL-GWF-RCA-19-2	WL-GW-RCA-19-1	WL-GW-RCA-19-2
Sample Date:	Groundwater	Groundwater	8/13/2014	12/8/2014	8/13/2014	12/8/2014
Sample Type:	Drinking Water	Irrigation Well	Field Sample	Field Sample	Field Sample	Field Sample
Parameter	PRGs	PRGs				
Mercury			0.2 UJ	0.2 UJ		
Nickel			4.5	1		
Potassium			6070	3950		
Selenium			0.44 J	5 U		
Silver			1 U	1 UJ		
Sodium			659000	377000		
Vanadium			5 U	5 U		
Zinc			4.9	2.5 U		
Inorganics (ug/L)						
Aluminum					317 J	219
Antimony					2 U	2 U
Arsenic	10				1 U	1 U
Barium					486	143
Beryllium					0.13 J+	1 U
Cadmium					1.8	0.47 J-
Calcium					56900	17900
Chromium	100				7740	9760
Chromium, Hexavalent	0.035	100			7480	9410
Cobalt	6				1.8	1 U
Copper					2 UJ	2 UJ
Cyanide					4.4 J+	2.7
Iron					2280	2940
Lead	15				0.26	0.55
Magnesium					9800 J	3230
Manganese	300				409	113
Mercury					0.2 UJ	0.2 UJ
Nickel					4.4	1.2
Potassium					5960	3840
Selenium					1.1 J	0.47 J
Silver					1 U	1 UJ
Sodium					641000	381000
Vanadium					5 U	5 U
Zinc					4.6 J+	2.9 J
Other						
Dissolved oxygen, field (mg/L)					6.03	5.8
ORP, field (mV)					327.6	290.7
pH, field (S.U.)					5.27	5.61
Spec. cond., field (umho/cm)					3435	1849
Temperature, field (deg C)					14.3	11.85
Turbidity, field (N.T.U.)					3.87	1.26

Residential GW PRG Exceedance
Irrigation GW PRG Exceedance

APPENDIX D – COST ESTIMATES

SOIL ALTERNATIVES

Alternative **S-2**
Institutional Controls on W&L Property

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Implementation of institutional controls to prevent future residential use of the W&L Property and thus prevent the exposure of such receptors to COCs in soil. Assumes 3 parcels impacted.

CAPITAL COSTS

Description		QTY	UNIT	UNIT COST	TOTAL	NOTES
Site Preparation and Management						
Meetings		25	HR	120	$3,000	
					$3,000	
Institutional Controls						
Land use restriction for 3 properties		1	LS	$49,831	$49,831	*See AUL Cost sheet*
					$49,831	
SUBTOTAL					$52,831	
Contingency:	15%				$7,925	
SUBTOTAL [Remedy Implementation]					$60,755	
Project Management	8%				$4,860	
Remedial Design	0%				$0	
Construction Management	0%				$0	
TOTAL CAPITAL COST					$65,616	

Alternative **S-2**
Institutional Controls on W&L Property

COST ESTIMATE SUMMARY

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Five year review (every 5 years until Year 30)	6	ea	$10,000	$60,000	
Update Institutional Controls Plan (Year 5)	1	ea	$4,000	$4,000	
Remedial Action Report (Year 5)	1	ea	$10,000	$10,000	
				$74,000	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor	Present Value	Notes
Capital Cost	0	$65,616	$65,616	1.0	$65,616	
Periodic Cost	5	$24,000	$24,000	0.7%	$23,177	
	10	$10,000	$10,000	0.7%	$9,326	
	15	$10,000	$10,000	0.7%	$9,007	
	20	$10,000	$10,000	0.7%	$8,698	
	25	$10,000	$10,000	0.7%	$8,400	
	30	$10,000	$10,000	0.7%	$8,112	
Total Present Value of Alternative					**$132,335**	

Alternative **S-2**
Submittals

COST WORKSHEET

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Base Year: Mar-19

Work Statement:
The following submittals were considered necessary to be completed prior to implementing site work.

Description	QTY	UNIT	LABOR	EQUIP	MTRL	UNIT TOTAL	TOTAL
HASP/Spill Prevention Plans	0	HR	$120.00	$0.00	$1.00	$121.00	$0.00
Meetings	25	HR	$120.00	$0.00	$1.00	$121.00	$3,025.00
SUBTOTAL							$3,025.00
Subcontractor Overhead & Profit						*15.0%*	$453.75
SUBTOTAL							$3,478.75
TOTAL COST							$3,478.75

Source of Cost Data:
Engineering estimate

Cost Adjustment Factor:

FACTOR:		NOTES:
H&S Productivity (labor & equip)		
Escalation to Base Year		
Area Cost Factor		
Subcontractor Overhead & Prof.		
Prime Contractor Overhead & Pro	X	

COST ESTIMATE AUL FOR ALTERNATIVE S-2

LABOR COST (AECOM AVERAGE TYPICAL RATES BY CATEGORY)

ITEM / Labor Category Hourly Rate	LSP $193.00	Senior Project Eng/Sci $187.00	Project Engineer/ Scientist $145.00	Staff Engineer/ Scientist (CADD) $100.00	Admin. Support $95.00	Total Hours
Task 1 - AUL Preliminary Research						
1.1 - Client and Attorney Communication		10				10
1.2 - Research Existing Deed and Property Plan - Identify Land Type		4				4
1.3 - Procure Surveyor and Attorney/Title Company (Property/\AUL Survey, Legal Descriptions, title rpts)		12	16		2	30
1.4 - Identify Current Record Interest holder - CIHs (Conduct Title Search)		2			4	6
1.5 - Review Survey Plans of Restricted Areas (3 Properties)	2	2				4
					subtotal	54
Task 2 - AUL Document Preparation						
2.1 - Notice of AUL Form 1075		6				6
2.2 - Exhibit A Legal Description of property (from Deed or Surveyor)		3				3
2.3 - Exhibit A-1 Legal Description of portion of property subject to AUL (from surveyor)		3				3
2.4 - Exhibit A-2 Survey Plan of AUL portion		3				3
2.5 - Exhibit B - Sketch Plan - property, site, RAO, AUL boundaries (Not scaled)		3		12		15
2.6 - Exhibit C - AUL Opinion (IC Design Statement, if Federal NAUL template is used)	1	8				9
2.7 - Exhibit D - Signatory Authority		2				2
2.8 - LSP Review AUL Package with PS/TS Closure Document	6	2				8
2.9 - Final Edits (per attorney review and comment) - site specific	2	6				8
2.10 - Additional review/edits to address EPA and MassDEP comments	1	3				4
2.11 - Mailing of Draft Copy of AUL to CIHs (certified mail/return receipt requested)		2			2	4
					subtotal	65
Task 3 - Recordation of AUL documents						
3.1 - Signing of AUL documents assumes signatures will be obtained by EPA		0				
3.2 - Recording at ROD (depends who does). Assume AECOM staff does. Time can vary (2 to 8 hrs)			8			8
3.3 - AUL Recording Fees (assume one) - see below						0
3.4 - Legal Ad prepare and place in Newspaper - Varies by community	1	2			2	5
3.5 - Cert mail copies of Recorded AUL to local officials (letter +AUL)- CMO, BOH, Zoning, Building	1	4			4	9
					subtotal	22
Task 4- Distribution of Recorded AUL						
4.1 - Submittal to MassDEP - Letter plus BWSC Form 113 plus documents	1	8				9
4.2 - Get copy of AUL legal ad publication and submit to MassDEP with BWSC Form.		1			1	2
4.3 - Distribute copies via Email to client, record interest holders, attorneys, EPA, etc.		2				2
					subtotal	13
Total Hours	15	88	24	12	15	154

Total Dollars	$2,895.00	$16,456.00	$3,480.00	$1,200.00	$1,425.00	
					Labor Cost Subtotal	$25,456.00

REIMBURSABLE EXPENSES

ITEM	Units	Unit Cost	Subtotal	Multiplier 10%	Total Cost
1.3 - AUL Survey - 3 Properties	3	$5,000.00	$15,000.00	$0.00	$15,000.00
1.3 - Title Search - Title reports plus one update per property	3	$900.00	$2,700.00	$0.00	$2,700.00
Attorney's Review of AULs	3	$2,000.00	$6,000.00	$0.00	$6,000.00
2.11 - Certified mailing draft AUL to CIHs (Assume at least two)	1	$20.00	$20.00	$0.00	$20.00
3.1 - Travel to client to get signatures - mileage -varies -calculate site-specific	0	$50.00	$0.00	$0.00	$0.00
3.2 - AUL Recordation at ROD ($75 per instrument), plus cost for certified copy ($1.00 per page-assume 20 pages) - project specific - Form 1075 ($75), property plan ($75), AUL survey Plan ($75)	3	$95.00	$285.00	$0.00	$285.00
3.2 - Travel to ROD to record AUL - mileage -varies -calculate site-specific	1	$29.70	$29.70	$0.00	$29.70
3.2 - Parking at ROD (not all but some charge for parking)	1	$0.00	$0.00	$0.00	$0.00
3.4 - Legal Ad Publication (varies 150 to 450) - $300 median price.	1	$300.00	$300.00	$0.00	$300.00
3.5 - Cert Mailing of recorded AUL to CMO, BOH, Zoning & Building Inspection (Assume 4 x $10/each)	1	$40.00	$40.00	$0.00	$40.00
4.1 - MassDEP AUL Fee	0	$2,000.00	$0.00	$0.00	$0.00
				Subtotal	$24,374.70

GRAND TOTAL $49,830.70

LEAD IN SOIL ALTERNATIVES

Alternative **SL-3**
Soil Excavation on Residential Properties with Off-Site Disposal

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Planning level costs consist of the excavation of residential soils containing lead in excess of PRGs.

CAPITAL COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Site Preparation and Management					
Equipment mobilization	1	LS	$20,000	$20,000	Estimated
RA Contractor's Submittals and Plans	1	LS	$17,394	$17,394	*See Submittals Cost Worksheet*
Temporary facilities	1	LS	$10,000	$10,000	Contractor allowance
Erosion control measures	1,400	LF	$4	$5,600	Silt fence perimeter
Clearing and grubbing	1	LS	$4,000	$4,000	Estimated
				$56,994	
Pre-Remedial Soil Sampling					
Preparation of QAPP and HASP	100	HR	$150	$15,000	
Labor to collect, package, and ship samples	15	pds	$1,440	$21,600	Three person team for five field-days
Fixed lab sample analyses					Samples to refine limits of excavation
Lead in soil, ≤ 150 µm	40	ea	$425	$17,000	
Field equipment and expenses	1	ea	$2,500	$2,500	Allowance
Surveying	1	ea	$1,000	$1,000	Allowance - survey new data pts
Data evaluation	50	HR	$145	$7,250	
				$64,350	
Excavate and Backfill					
Excavate soil	307	CY	$12	$3,684	Excavate and load soil
Dust control and air monitoring	1	ea	$2,000	$2,000	Estimated allowance
Post-remedial survey	6	ea	$1,000	$6,000	Allowance per property
Furnish clean fill	184	CY	$40.35	$7,411	Includes 20% compaction factor; *see backfill tab*
Furnish topsoil	185	CY	$34.00	$6,281	Includes 20% compaction factor
Seeding and lawn restoration	8,313	SF	$2	$16,626	
Miscellaneous restoration	6	ea	$2,000	$12,000	Allowance per property
Police detail	12	hr	$120	$1,440	
				$55,441	
Soil Disposal					
T&D non-haz soil	492	ton	$80	$39,360	Assumes disposal in RCRA Subtitle D Facility
Waste Characterization	3	ea	$1,000	$3,000	1 sample/200 tons for 1st 2,000 tons
				$42,360	
Demobilization					
Equipment demobilization	1	LS	$15,000	$15,000	
Reporting	1	LS	$10,000	$10,000	
				$25,000	
SUBTOTAL				$244,145	
Contingency: 30%				$73,244	Higher contingency due to uncertainty of extent of lead contamination.
SUBTOTAL [Remedy Implementation]				$317,389	
Project Management 8%				$25,391	
Remedial Design 15%				$47,608	
Construction Management 10%				$31,739	
				$104,738	
TOTAL CAPITAL COST				**$422,127**	

Alternative SL-3
Contractor Submittals

COST WORKSHEET

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Base Year: 2018

Work Statement:
The following submittals were considered necessary to be completed prior to implementing site work.
These submittals were identified as necessary information beyond the design documents.

Description	QTY	UNIT	LABOR	EQUIP	MTRL	UNIT TOTAL	TOTAL
HASP/Spill Prevention Plans	20	HR	$120.00	$0.00	$1.00	$121.00	$2,420.00
Air Monitoring Plan	20	HR	$120.00	$0.00	$1.00	$121.00	$2,420.00
Excavation Plan	20	HR	$120.00	$0.00	$1.00	$121.00	$2,420.00
Erosion Control Plan	15	HR	$120.00	$0.00	$1.00	$121.00	$1,815.00
Meetings	50	HR	$120.00	$0.00	$1.00	$121.00	$6,050.00
SUBTOTAL							$15,125.00
Subcontractor Overhead & Profit						*15.0%*	$2,268.75
SUBTOTAL							$17,393.75
TOTAL COST							$17,393.75

Source of Cost Data:
Engineering estimate

Cost Adjustment Factor:

FACTOR:		NOTES:
H&S Productivity (labor & equip)		
Escalation to Base Year		
Area Cost Factor		
Subcontractor Overhead & Prof.		
Prime Contractor Overhead & Pro	X	

Alternative SL-3
Clean Backfill

COST WORKSHEET

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Base Year: 2018

Work Statement:
Furnish and install clean backfill and geotextile material, including source testing, density testing in place. This cost is computed as a per CY, with an assumption that an average of 4 lifts will be placed at 6 inches each (based on 500 CY).

Description	QTY	UNIT	LABOR	EQUIP	MTRL	UNIT TOTAL	TOTAL
Furnish backfill	500	CY	$0.00	$0.00	$30.00	$30.00	$15,000.00
Testing of fill (1 per 500 CY)							
metals	1	ea	$0.00	$0.00	$75.00	$75.00	$75.00
VOCs	1	ea	$0.00	$0.00	$85.00	$85.00	$85.00
PAHs	1	ea	$0.00	$0.00	$100.00	$100.00	$100.00
PCBs/Pesticides	1	ea	$0.00	$0.00	$250.00	$250.00	$250.00
Geotech properties	1	ea	$0.00	$0.00	$125.00	$125.00	$125.00
Prepare subbase	375	SY	$0.43	$0.63	$0.00	$1.06	$397.50
Spread and compact (6 inch lifts)	1500	SY	$0.31	$0.59	$0.00	$0.90	$1,350.00
In place density testing	1	ea	$160.00	$0.00	$0.00	$160.00	$160.00

SUBTOTAL (cost per 500 CY)		$17,542.50
Subcontractor Overhead & Profit	*15.0%*	$2,631.38
SUBTOTAL		$20,173.88
TOTAL UNIT COST (per CY)		$40.35 /CY

Source of Cost Data:
Engineering estimate with reference to Means.

Cost Adjustment Factor:

FACTOR:		NOTES:
H&S Productivity (labor & equip)		Level D
Escalation to Base Year		
Area Cost Factor		
Subcontractor Overhead & Prof.		
Prime Contractor Overhead & Pro	X	

LEAD IN SOIL ALTERNATIVES

COST SENSITIVITY ANALYSIS

Alternative **SL-3**
Soil Excavation

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Planning level costs consist of the excavation of residential soils containing lead in excess of PRGs.
-30% total excavation volume

CAPITAL COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Site Preparation and Management					
Equipment mobilization	1	LS	$20,000	$20,000	Estimated
RA Contractor's Submittals and Plans	1	LS	$17,394	$17,394	*See Submittals Cost Worksheet*
Temporary facilities	1	LS	$10,000	$10,000	Contractor allowance
Erosion control measures	1,400	LF	$4	$5,600	Silt fence perimeter
Clearing and grubbing	1	LS	$4,000	$4,000	Estimated
				$56,994	
Pre-Remedial Soil Sampling					
Preparation of QAPP and HASP	100	HR	$150	$15,000	
Labor to collect, package, and ship samples	15	pds	$1,440	$21,600	Three person team for five field-days
Fixed lab sample analyses					Samples to refine limits of excavation
Lead in soil, ≤ 150 µm	40	ea	$425	$17,000	
Field equipment and expenses	1	ea	$2,500	$2,500	Allowance
Surveying	1	ea	$1,000	$1,000	Allowance - survey new data pts
Data evaluation	50	HR	$145	$7,250	
				$64,350	
Excavate and Backfill					
Excavate soil	215	CY	$12	$2,579	Excavate and load soil
Dust control and air monitoring	1	ea	$2,000	$2,000	Estimated allowance
Post-remedial survey	6	ea	$1,000	$6,000	Allowance per property
Furnish clean fill	129	CY	$40.35	$5,187	Includes 20% compaction factor; *see backfill tab*
Furnish topsoil	129	CY	$34.00	$4,397	Includes 20% compaction factor
Seeding and lawn restoration	5,819	SF	$2	$11,638	
Miscellaneous restoration	6	ea	$2,000	$12,000	Allowance per property
Police detail	12	hr	$120	$1,440	
				$45,241	
Soil Disposal					
T&D non-haz soil	344	ton	$80	$27,520	Assumes disposal in RCRA Subtitle D Facility
Waste Characterization	2	ea	$1,000	$2,000	1 sample/200 tons for 1st 2,000 tons
				$29,520	
Demobilization					
Equipment demobilization	1	LS	$15,000	$15,000	
Reporting	1	LS	$10,000	$10,000	
				$25,000	
SUBTOTAL				$221,105	
Contingency: 30%				$66,331	Higher contingency due to uncertainty of extent of lead contamination.
SUBTOTAL [Remedy Implementation]				$287,436	
Project Management 8%				$22,995	
Remedial Design 15%				$43,115	
Construction Management 10%				$28,744	
				$94,854	
TOTAL CAPITAL COST				**$382,290**	

Alternative **SL-3**
Soil Excavation

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Planning level costs consist of the excavation of residential soils containing lead in excess of PRGs.
+50% total excavation volume

CAPITAL COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Site Preparation and Management					
Equipment mobilization	1	LS	$20,000	$20,000	Estimated
RA Contractor's Submittals and Plans	1	LS	$17,394	$17,394	*See Submittals Cost Worksheet*
Temporary facilities	1	LS	$10,000	$10,000	Contractor allowance
Erosion control measures	1,400	LF	$4	$5,600	Silt fence perimeter
Clearing and grubbing	1	LS	$4,000	$4,000	Estimated
				$56,994	
Pre-Remedial Soil Sampling					
Preparation of QAPP and HASP	100	HR	$150	$15,000	
Labor to collect, package, and ship samples	15	pds	$1,440	$21,600	Three person team for five field-days
Fixed lab sample analyses					Samples to refine limits of excavation
Lead in soil, ≤ 150 µm	40	ea	$425	$17,000	
Field equipment and expenses	1	ea	$2,500	$2,500	Allowance
Surveying	1	ea	$1,000	$1,000	Allowance - survey new data pts
Data evaluation	50	HR	$145	$7,250	
				$64,350	
Excavate and Backfill					
Excavate soil	461	CY	$12.00	$5,526	Excavate and load soil
Dust control and air monitoring	1	ea	$2,000	$2,000	Estimated allowance
Post-remedial survey	6	ea	$1,000	$6,000	Allowance per property
Furnish clean fill	276	CY	$40.35	$11,116	Includes 20% compaction factor; *see backfill tab*
Furnish topsoil	277	CY	$34.00	$9,421	Includes 20% compaction factor
Seeding and lawn restoration	12,470	SF	$2.00	$24,939	
Miscellaneous restoration	6	ea	$2,000	$12,000	Allowance per property
Police detail	12	hr	$120	$1,440	
				$72,442	
Soil Disposal					
T&D non-haz soil	737	ton	$80	$58,960	Assumes disposal in RCRA Subtitle D Facility
Waste Characterization	4	ea	$1,000	$4,000	1 sample/200 tons for 1st 2,000 tons
				$62,960	
Demobilization					
Equipment demobilization	1	LS	$15,000	$15,000	
Reporting	1	LS	$10,000	$10,000	
				$25,000	
SUBTOTAL				$281,746	
Contingency: 30%				$84,524	Higher contingency due to uncertainty of extent of lead contamination.
SUBTOTAL [Remedy Implementation]				$366,270	
Project Management 8%				$29,302	
Remedial Design 15%				$54,940	
Construction Management 10%				$36,627	
				$120,869	
TOTAL CAPITAL COST				**$487,139**	

GROUNDWATER/SURFACE WATER ALTERNATIVES

Alternative **GW/SW-2a**

Source Area Removal with In-Situ Soil Treatment and Groundwater Pump and Treat

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, and installation and operation of a groundwater pump and treat system.

CAPITAL COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Pre-Design Investigation Sampling					
Preparation of QAPP and HASP	100	HR	$120	$12,000	
Test pitting	5	day	$2,000	$10,000	Assume 100 CY excavated, assume RCRA hazardous
Drill rig and operator	8	day	$2,000	$16,000	$1,500 drill rig plus $500 for hole saw to drill through building slab
Labor to collect, record, and ship samples	42	pds	$1,440	$60,480	Three person field team for TP and drilling
Fixed lab sample analyses					Delineation of impact samples
Hexavalent chromium	50	ea	$70	$3,500	
Full Waste Characterization Analyses	10	ea	$1,000	$10,000	Subset of delineation samples to refine estimates for off-site disposal
Field equipment	1	ea	$12,500	$12,500	Allowance
Data evaluation	50	HR	$75.00	$3,750	
				$128,230	
Excavate and Backfill Building Slab					
Excavate concrete slab	1	LS	$90,000	$90,000	Excavation and disposal of slab (quote from Costello)
Dust control and air monitoring	1	ea	$2,000	$2,000	Estimated allowance
Furnish clean fill (including for test pits)	1,220	CY	$41.90	$51,118	*See Backfill tab*
Furnish topsoil/gravel	230	CY	$34	$7,820	
Seeding	10,056	SF	$2	$20,112	
				$171,050	
Source Area Removal and ZVI Blending					
Bench test	1	ea	$5,000	$5,000	
Mobilization	1	LS	$10,000	$10,000	
Excavation	7,917	CY	$12	$95,000	Excavate top 15', assume half listed waste/half non-haz
Install temporary shoring	15,900	SF	$30	$477,000	
Dust control and air monitoring	20	wk	$2,000	$40,000	Estimated allowance
ZVI, purchase and deliver	1,583	ton	$1,200	$1,900,000	5% dose 7.5-15' bgs, 10% 15-30' bgs
Sand backfill, purchase and deliver	9,500	CY	$25	$237,500	Includes 20% compaction factor
Blend ZVI and sand	4,750	CY	$6	$28,500	7.5-15' bgs
In-situ soil/ZVI blending	9,500	CY	$6	$57,000	15-30' bgs
Install ZVI/sand blend and clean sand	9,500	CY	$6	$57,000	Clean sand 0-7.5' bgs, sand/ZVI blend 7.5-15' bgs
Furnish and install topsoil	317	CY	$34	$10,767	
Seeding	14,250	SF	$2	$28,500	
				$2,946,267	
Soil Disposal and GW Management					
Dewatering	1	LS	$47,500	$47,500	*See Dewatering Backup Sheet*
Erosion control measures	250	LF	$4	$1,000	
Waste characterization of concrete slab	4	ea	$1,000	$4,000	
Waste characterization of soil stockpiles	32	ea	$1,000	$32,000	
T&D RCRA hazardous soil	6,493	ton	$250	$1,623,333	
T&D non-haz soil	6,333	ton	$80	$506,667	
Police detail	185	hr	$120	$22,200	
				$2,236,700	
Groundwater Pump and Treat System					
Site Preparation and Management					
Obtain land and easements	1	LS	$0	$0	Access agreements (assumed to be handled by EPA)
Building permits and fees	1	LS	$10,000	$10,000	
				$10,000	
Pre-Remedial Study					
Pump Test	1	LS	$50,000	$50,000	One 24 hr test, includes water treatment and disposal
				$50,000	

Alternative **GW/SW-2a**

Source Area Removal with In-Situ Soil Treatment and Groundwater Pump and Treat

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, and installation and operation of a groundwater pump and treat system.

Construct Pump and Treat System						
Treatment plant building construction		1	LS	$100,000	$100,000	
Erosion control measures		300	LF	$4	$1,200	
Drill extraction wells		3	ea	$5,000	$15,000	
Install well vaults		3	ea	$2,500	$7,500	
Influent and effluent tanks		2	ea	$10,000	$20,000	Assume 5000 gallon capacity each
Above ground piping		1	LS	$15,000	$15,000	
Pump, electrical, controls per well		3	ea	$5,000	$15,000	18 gpm each, total 54 gpm
Transfer lines to TP and discharge point		1,600	ft	$20	$32,000	
Install above ground pumps		3	ea	$1,500	$4,500	
Install and test electrical services		1	LS	$30,000	$30,000	
Ion exchange vessels with 1st change		2	ea	$10,200	$20,400	Quote for project from CFS
Bag filter housings		2	ea	$1,300	$2,600	Quote for project from CFS
Deliver equipment, place and fill on site		1	LS	$1,600	$1,600	Quote for project from CFS
Treatment plant controls		1	ea	$25,000	$25,000	
Prove out		1	ea	$10,000	$10,000	
					$299,800	
SUBTOTAL					$5,842,047	
Contingency:	30%				$1,752,614	
SUBTOTAL [Remedy Implementation]					$7,594,661	
Project Management	5%				$379,733	
Remedial Design	8%				$607,573	
Construction Management	6%				$455,680	
Institutional Controls						
Groundwater Ordinance		1	LS	$15,000	$15,000	Support to town to put ordinance in place
Activity and Use Limitations		1	LS	$114,950	$114,950	
					$1,572,936	
TOTAL CAPITAL COST					$9,167,597	

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Five year review (every 5 years until Year 30)	6	ea	$10,000	$60,000	
Update Institutional Controls Plan (Year 5)	1	ea	$4,000	$4,000	
Remedial Action Report (Year 5)	1	ea	$10,000	$10,000	
Indoor air sampling of homes with SSDS (Year 5)	1	ea	$23,400	$23,400	
Inspections of homes (every 5 years until Year 30)	6	ea	$1,000	$6,000	Inspect for change in condition of two additional homes
				$103,400	

Alternative **GW/SW-2a**

Source Area Removal with In-Situ Soil Treatment and Groundwater Pump and Treat

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, and installation and operation of a groundwater pump and treat system.

O&M

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Treatment System Operations and Maintenance					
Treatment system operations	1	year	$25,000	$25,000	Review remote monitoring, weekly inspections, maintenance, troubleshooting, and repairs
Change out ion exchange vessels	4	ea	$7,200	$28,800	2 replacements per vessel per year
Bag filters and other minor supplies	1	year	$5,000	$5,000	
Electricity (heat and power)	12	month	$200	$2,400	
Sampling wells, stream, and discharge point	12	month	$1,500	$18,000	Includes labor and lab analysis
Reporting	4	qtr	$2,500	$10,000	
Equipment replacements	1	year	$2,000	$2,000	Assume $10,000 repair every 5 years
				$91,200	
Groundwater and Surface Water Monitoring					
Annual groundwater monitoring	1	LS	$60,000	$60,000	Annual groundwater sampling program
Annual surface water monitoring	1	LS	$30,000	$30,000	Annual surface water sampling program
				$90,000	
Annual inspections					
Sub-slab depressurization systems inspection	1	LS	$1,500	$1,500	Annual inspection of 3 homes with SSDS
Inspection and maintenance of remedy	1	LS	$12,000	$12,000	Inspection of PRB wall, engineered cover, and capped lagoon
				$13,500	
SUBTOTAL				$194,700	
Contingency: 30%				$58,410	
SUBTOTAL [Remedy Implementation]				$253,110	
Technical Support 30%				$75,933	Increased technical support percentage
Project Management 5%				$12,656	to include data review and reporting
TOTAL O&M COST				$341,699	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor	Present Value	Notes
Capital Cost	0	$9,167,597	$9,167,597	1.0	$9,167,597	
O&M Cost	1 to 30	$10,250,955	$341,699	0.7%	$9,217,196	
Periodic Cost	5	$48,400	$48,400	0.7%	$46,741	
	10	$11,000	$11,000	0.7%	$10,259	
	15	$11,000	$11,000	0.7%	$9,907	
	20	$11,000	$11,000	0.7%	$9,568	
	25	$11,000	$11,000	0.7%	$9,240	
	30	$11,000	$11,000	0.7%	$8,923	
Total Present Value of Alternative					**$18,479,430**	

Alternative **GW/SW-2b**

Source Area Removal with In-Situ Soil Treatment and Groundwater Pump and Treat plus Mid-Plume Treatment

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, installation and operation of a groundwater pump and treat system, and a mid-plume in-situ treatment line.

CAPITAL COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Pre-Design Investigation Sampling					
Preparation of QAPP and HASP	100	HR	$120	$12,000	
Test pitting	5	day	$2,000	$10,000	Assume 100 CY excavated, assume RCRA hazardous
Drill rig and operator	8	day	$2,000	$16,000	$1,500 drill rig plus $500 for hole saw to drill through building slab
Labor to collect, record, and ship samples	42	pds	$1,440	$60,480	Three person field team for TP and drilling
Fixed lab sample analyses					Delineation of impact samples
Hexavalent chromium	50	ea	$70	$3,500	
Full Waste Characterization Analyses	10	ea	$1,000	$10,000	Subset of delineation samples to refine estimates for off-site disposal
Field equipment	1	ea	$12,500	$12,500	Allowance
Data evaluation	50	HR	$75	$3,750	
				$128,230	
Excavate and Backfill Building Slab					
Excavate concrete slab	1	LS	$90,000	$90,000	Excavation and disposal of slab (quote from Costello)
Dust control and air monitoring	1	ea	$2,000	$2,000	Estimated allowance
Furnish clean fill (including for test pits)	1,220	CY	$41.90	$51,118	See Backfill tab
Furnish topsoil/gravel	230	CY	$34	$7,820	
Seeding	10,056	SF	$2	$20,112	
				$171,050	
Source Area Removal and ZVI Blending					
Bench test	1	ea	$5,000	$5,000	
Mobilization	1	LS	$10,000	$10,000	
Excavation	7,917	CY	$12	$95,000	Excavate top 15', assume half listed waste/half non-haz
Install temporary shoring	15,900	SF	$30	$477,000	
Dust control and air monitoring	20	wk	$2,000	$40,000	Estimated allowance
ZVI, purchase and deliver	1,583	ton	$1,200	$1,900,000	5% dose 7.5-15' bgs, 10% 15-30' bgs
Sand backfill, purchase and deliver	9,500	CY	$25	$237,500	Includes 20% compaction factor
Blend ZVI and sand	4,750	CY	$6	$28,500	7.5-15' bgs
In-situ soil/ZVI blending	9,500	CY	$6	$57,000	15-30' bgs
Install ZVI/sand blend and clean sand	9,500	CY	$6	$57,000	Clean sand 0-7.5' bgs, sand/ZVI blend 7.5-15' bgs
Furnish and install topsoil	317	CY	$34	$10,767	
Seeding	14,250	SF	$2	$28,500	
				$2,946,267	
Mid-Plume In-Situ Treatment Line					
Drill 10 inch columns to 40 ft, install ZVI/sand	200	ea	$1,906	$381,250	Quote for project from Glacier Drilling
Purchase and install PVC screen and riser	200	ea	$500	$100,000	
Sand, delivered	133	CY	$50	$6,666	
ZVI, delivered	32	ton	$1,200	$38,397	15% blend based on tonnage of sand
Blend ZVI/sand	133	CY	$6	$800	
Furnish clean fill	28	CY	$41.90	$1,185	
Seeding	109	SF	$2	$218	
				$528,517	
Soil Disposal and GW Management					
Dewatering	1	LS	$52,500	$52,500	*See Dewatering Backup Sheet*
Erosion control measures	500	LF	$4	$2,000	
Waste characterization of concrete slab	4	ea	$1,000	$4,000	
Waste characterization of soil stockpiles	32	ea	$1,000	$32,000	
T&D RCRA hazardous soil	6,623	ton	$250	$1,655,654	Assume 50% hazardous waste in mid-plume line
T&D non-haz soil	6,463	ton	$80	$517,009	
Police detail	190	hr	$120	$22,800	
				$2,285,964	
Groundwater Pump and Treat System					
Site Preparation and Management					
Obtain land and easements	1	LS	$0	$0	Access agreements (assumed to be handled by EPA)
Building permits and fees	1	LS	$10,000	$10,000	
				$10,000	
Pre-Remedial Study					
Pump Test	1	LS	$50,000	$50,000	One 24 hr test, includes water treatment and disposal
				$50,000	

Alternative **GW/SW-2b**

Source Area Removal with In-Situ Soil Treatment and Groundwater Pump and Treat plus Mid-Plume Treatment

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, installation and operation of a groundwater pump and treat system, and a mid-plume in-situ treatment line.

Construct Pump and Treat System						
Treatment plant building construction		1	LS	$100,000	$100,000	
Erosion control measures		300	LF	$4	$1,200	
Drill extraction wells		3	ea	$5,000	$15,000	
Install well vaults		3	ea	$2,500	$7,500	
Influent and effluent tanks		2	ea	$10,000	$20,000	Assume 5000 gallon capacity each
Above ground piping		1	LS	$15,000	$15,000	
Pump, electrical, controls per well		3	ea	$5,000	$15,000	18 gpm each, total 54 gpm
Transfer lines to TP and discharge point		1600	ft	$20	$32,000	
Install above ground pumps		3	ea	$1,500	$4,500	
Install and test electrical services		1	LS	$30,000	$30,000	
Ion exchange vessels with 1st change		2	ea	$10,200	$20,400	
Bag filter housings		2	ea	$1,300	$2,600	
Deliver equipment, place and fill on site		1	LS	$1,600	$1,600	
Treatment plant controls		1	ea	$25,000	$25,000	
Prove out		1	ea	$10,000	$10,000	
					$299,800	
SUBTOTAL					$6,295,347	
Contingency:	30%				$1,888,604	
SUBTOTAL [Remedy Implementation]					$8,183,951	
Project Management	5%				$409,198	
Remedial Design	8%				$654,716	
Construction Management	6%				$491,037	
Institutional Controls						
Groundwater Ordinance		1	LS	$15,000	$15,000	Support to town to put ordinance in place
Activity and Use Limitations		1	LS	$127,165	$127,165	
					$1,697,116	
TOTAL CAPITAL COST					$9,881,067	

Alternative **GW/SW-2b**

Source Area Removal with In-Situ Soil Treatment and Groundwater Pump and Treat plus Mid-Plume Treatment

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, installation and operation of a groundwater pump and treat system, and a mid-plume in-situ treatment line.

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Five year review (every 5 years until Year 30)	6	ea	$10,000	$60,000	
Update Institutional Controls Plan (Year 5)	1	ea	$4,000	$4,000	
Remedial Action Report (Year 5)	1	ea	$10,000	$10,000	
Indoor air sampling of homes with SSDS (Year 5)	1	ea	$23,400	$23,400	
Inspections of homes (every 5 years until Year 30)	6	ea	$1,000	$6,000	Inspect for change in condition of two additional homes
				$103,400	

O&M

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Treatment System Operations and Maintenance					
Treatment system operations	1	year	$25,000	$25,000	Review remote monitoring, weekly inspections, maintenance, troubleshooting, and repairs
Change out ion exchange vessels	4	ea	$7,200	$28,800	
Bag filters and other minor supplies	1	year	$5,000	$5,000	
Electricity (heat and power)	12	month	$200	$2,400	
Sampling wells, stream, and discharge point	12	month	$1,500	$18,000	Includes labor and lab analysis
Reporting	4	qtr	$2,500	$10,000	
Equipment replacements	1	year	$2,000	$2,000	Assume $10,000 repair every 5 years
				$91,200	
Groundwater and Surface Water Monitoring					
Annual groundwater monitoring	1	LS	$60,000	$60,000	Annual groundwater sampling program
Annual surface water monitoring	1	LS	$30,000	$30,000	Annual surface water sampling program
				$90,000	
Annual inspections					
Sub-slab depressurization systems inspection	1	LS	$1,500	$1,500	Annual inspection of 3 homes with SSDS
Inspection and maintenance of remedy	1	LS	$12,000	$12,000	Inspection of PRB wall, engineered cover, and capped lagoon
				$13,500	
SUBTOTAL				$194,700	
Contingency:	30%			$58,410	
SUBTOTAL [Remedy Implementation]				$253,110	
Technical Support	30%			$75,933	Increased technical support percentage
Project Management	5%			$12,656	to include data review and reporting
TOTAL O&M COST				$341,699	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor	Present Value	Notes
Capital Cost	0	$9,881,067	$9,881,067	1.00	$9,881,067	
O&M Cost	1 to 30	$10,250,955	$341,699	0.7%	$9,217,196	
Periodic Cost	5	$48,400	$48,400	0.7%	$46,741	
	10	$11,000	$11,000	0.7%	$10,259	
	15	$11,000	$11,000	0.7%	$9,907	
	20	$11,000	$11,000	0.7%	$9,568	
	25	$11,000	$11,000	0.7%	$9,240	
	30	$11,000	$11,000	0.7%	$8,923	
Total Present Value of Alternative					**$19,192,901**	

Alternative **GW/SW-3a**

Source Area Soil Removal with In-Situ Treatment and Extension of Permeable Reactive Barrier

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, and installation of a permeable reactive barrier along Bliss Brook.

CAPITAL COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Pre-Design Investigation Sampling					
Preparation of QAPP and HASP	100	HR	$120	$12,000	
Test pitting	5	day	$2,000	$10,000	Assume 100 CY excavated, assume RCRA hazardous
Drill rig and operator	8	day	$2,000	$16,000	$1,500 drill rig plus $500 for hole saw to drill through building slab
Labor to collect, record, and ship samples	42	pds	$1,440	$60,480	Three person field team for TP and drilling
Fixed lab sample analyses					Delineation of impact samples
Hexavalent chromium	50	ea	$70	$3,500	
Full Waste Characterization Analyses	10	ea	$1,000	$10,000	Subset of delineation samples to refine estimates for off-site disposal
Field equipment	1	ea	$12,500	$12,500	Allowance
Data evaluation	50	HR	$75	$3,750	
				$128,230	
Excavate and Backfill Building Slab					
Excavate concrete slab	1	LS	$90,000	$90,000	
Dust control and air monitoring	1	ea	$2,000	$2,000	Estimated allowance
Furnish clean fill (including for test pits)	1,220	CY	$42	$51,118	*See Backfill tab*
Furnish topsoil/gravel	230	CY	$34	$7,820	
Seeding	10,056	SF	$2	$20,112	
				$171,050	
Source Area Removal and ZVI Blending					
Bench test	1	ea	$5,000	$5,000	
Mobilization	1	LS	$10,000	$10,000	
Excavation	7,917	CY	$12	$95,000	Excavate top 15', assume half listed waste/half non-haz
Install temporary shoring	15,900	SF	$30	$477,000	
Dust control and air monitoring	20	wk	$2,000	$40,000	Estimated allowance
ZVI, purchase and deliver	1,583	ton	$1,200	$1,900,000	5% dose 7.5-15' bgs, 10% 15-30' bgs
Sand backfill, purchase and deliver	9,500	CY	$25	$237,500	Includes 20% compaction factor
Blend ZVI and sand	4,750	CY	$6	$28,500	7.5-15' bgs
In-situ soil/ZVI blending	9,500	CY	$6	$57,000	15-30' bgs
Install ZVI/sand blend and clean sand	9,500	CY	$6	$57,000	Clean sand 0-7.5' bgs, sand/ZVI blend 7.5-15' bgs
Furnish and install topsoil	317	CY	$34	$10,767	
Seeding	14,250	SF	$2	$28,500	
				$2,946,267	
Soil Disposal and GW Management					
Dewatering	1	LS	$47,500	$47,500	*See Dewatering Backup Sheet*
Erosion control measures	250	LF	$4	$1,000	
Waste characterization of concrete slab	4	ea	$1,000	$4,000	
Waste characterization of soil stockpiles	32	ea	$1,000	$32,000	
T&D RCRA hazardous soil	6,493	ton	$250	$1,623,333	
T&D non-haz soil	6,333	ton	$80	$506,667	
Police detail	185	hr	$120	$22,200	
				$2,236,700	

Alternative **GW/SW-3a**

Source Area Soil Removal with In-Situ Treatment and Extension of Permeable Reactive Barrier

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, and installation of a permeable reactive barrier along Bliss Brook.

Permeable Reactive Barrier near Bliss Brook						
Site Preparation and Management						
Obtain land and easements		1	LS	$0	$0	Access agreements (assumed to be handled by EPA)
Building permits and fees		1	LS	$10,000	$10,000	
					$10,000	
Pre-Remedial Study						
Bench test		1	ea	$5,000	$5,000	Confirm dose and contact time of ZVI type
Predesign study		1	ea	$15,000	$15,000	Confirm length of wall based on groundwater impacts and groundwater concentrations reaching stream
Additional flow modeling		1	LS	$5,000	$5,000	
					$25,000	
Construct PRB Wall						
Mobilization		1	LS	$25,000	$25,000	Includes site prep and erosion controls
Divert stream around work area		1	LS	$50,000	$50,000	
Excavate soil		4,400	CY	$25	$110,000	
Purchase and deliver sand backfill		3,900	CY	$50	$195,000	
Geotextile, installed		8,000	SF	$4	$32,000	
Purchase and deliver river run gravel		500	CY	$30	$15,000	
Purchase and deliver ZVI		354	ton	$1,200	$424,911	*See ZVI dose calculation sheet,* 9% dose
Blend ZVI and sand		3,900	CY	$6	$23,400	
Install ZVI and sand blend		3,900	CY	$6	$23,400	
Install stream bed gravel		500	CY	$10	$5,000	
Stream bank restoration and plantings		800	LF	$5	$4,000	
Demobilize		1	LS	$10,000	$10,000	
					$917,711	
Soil Disposal and GW Management						
Dewatering		1	LS	$42,500	$42,500	Additional operational cost for preexisting dewatering system *(see dewatering backup sheet)*
Waste characterization of soil stockpiles		21	ea	$1,000	$21,000	
T&D RCRA hazardous soil		0	ton	$250	$0	
T&D non-haz soil		7,040	ton	$80	$563,200	
Police detail		166	hr	$120	$19,920	
					$646,620	
SUBTOTAL					$7,081,578	
Contingency:	30%				$2,124,473	
SUBTOTAL [Remedy Implementation]					$9,206,051	
Project Management	5%				$460,303	
Remedial Design	8%				$736,484	
Construction Management	6%				$552,363	
Institutional Controls						
Groundwater Ordinance		1	LS	$15,000	$15,000	Support to town to put ordinance in place
Activity and Use Limitations		1	LS	$114,950	$114,950	
					$1,879,100	
TOTAL CAPITAL COST					$11,085,151	

Alternative **GW/SW-3a**

Source Area Soil Removal with In-Situ Treatment and Extension of Permeable Reactive Barrier

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, and installation of a permeable reactive barrier along Bliss Brook.

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Five year review (every 5 years until Year 30)	6	ea	$10,000	$60,000	
Update Institutional Controls Plan (Year 5)	1	ea	$4,000	$4,000	
Remedial Action Report (Year 5)	1	ea	$10,000	$10,000	
Indoor air sampling of homes with SSDS (Year 5)	1	ea	$23,400	$23,400	
Inspections of homes (every 5 years until Year 30)	6	ea	$1,000	$6,000	Inspect for change in condition of two additional homes
				$103,400	

O&M

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Groundwater and Surface Water Monitoring					
Annual groundwater monitoring	1	LS	$60,000	$60,000	Annual groundwater sampling program
Annual surface water monitoring	1	LS	$30,000	$30,000	Annual surface water sampling program
				$90,000	
Annual inspections					
Sub-slab depressurization systems inspection	1	LS	$1,500	$1,500	Annual inspection of 3 homes with SSDS
Inspection and maintenance of remedy	1	LS	$12,000	$12,000	Inspection of PRB wall, engineered cover, and capped lagoon
				$13,500	
SUBTOTAL				$103,500	
Contingency: 30%				$31,050	
SUBTOTAL [Remedy Implementation]				$134,550	
Technical Support 15%				$20,183	
Project Management 5%				$6,728	
TOTAL O&M COST				$161,460	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor	Present Value	Notes
Capital Cost	0	$11,085,151	$11,085,151	1.00	$11,085,151	
O&M Cost	1 to 30	$4,843,800	$161,460	0.7%	$4,355,326	
Periodic Cost	5	$48,400	$48,400	0.7%	$46,741	
	10	$11,000	$11,000	0.7%	$10,259	
	15	$11,000	$11,000	0.7%	$9,907	
	20	$11,000	$11,000	0.7%	$9,568	
	25	$11,000	$11,000	0.7%	$9,240	
	30	$11,000	$11,000	0.7%	$8,923	
Total Present Value of Alternative					**$15,535,115**	

Alternative **GW/SW-3b**

Source Area Soil Removal with In-Situ Treatment, Extension of Permeable Reactive Barrier, and Mid-Plume Treatment

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, installation of a permeable reactive barrier along Bliss Brook, and a mid-plume in-situ treatment line.

CAPITAL COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Pre-Design Investigation Sampling					
Preparation of QAPP and HASP	100	HR	$120	$12,000	
Test pitting	5	day	$2,000	$10,000	Assume 100 CY excavated, assume RCRA hazardous
Drill rig and operator	8	day	$2,000	$16,000	$1,500 drill rig plus $500 for hole saw to drill through building slab
Labor to collect, record, and ship samples	42	pds	$1,440	$60,480	Three person field team for TP and drilling
Fixed lab sample analyses					Delineation of impact samples
Hexavalent chromium	50	ea	$70	$3,500	
Full Waste Characterization Analyses	10	ea	$1,000	$10,000	Subset of delineation samples to refine estimates for off-site disposal
Field equipment	1	ea	$12,500	$12,500	Allowance
Data evaluation	50	HR	$75	$3,750	
				$128,230	
Excavate and Backfill Building Slab					
Excavate concrete slab	1	LS	$90,000	$90,000	Excavation and disposal of slab (quote from Costello)
Dust control and air monitoring	1	ea	$2,000	$2,000	Estimated allowance
Furnish clean fill (including for test pits)	1,220	CY	$41.90	$51,118	*See Backfill tab*
Furnish topsoil/gravel	230	CY	$34	$7,820	
Seeding	10,056	SF	$2	$20,112	
				$171,050	
Source Area Removal and ZVI Blending					
Bench test	1	ea	$5,000	$5,000	
Mobilization	1	LS	$10,000	$10,000	
Excavation	7,917	CY	$12	$95,000	Excavate top 15', assume half listed waste/half non-haz
Install temporary shoring	15,900	SF	$30	$477,000	
Dust control and air monitoring	20	wk	$2,000	$40,000	Estimated allowance
ZVI, purchase and deliver	1,583	ton	$1,200	$1,900,000	5% dose 7.5-15' bgs, 10% 15-30' bgs
Sand backfill, purchase and deliver	9,500	CY	$25	$237,500	Includes 20% compaction factor
Blend ZVI and sand	4,750	CY	$6	$28,500	7.5-15' bgs
In-situ soil/ZVI blending	9,500	CY	$6	$57,000	15-30' bgs
Install ZVI/sand blend and clean sand	9,500	CY	$6	$57,000	Clean sand 0-7.5' bgs, sand/ZVI blend 7.5-15' bgs
Furnish and install topsoil	317	CY	$34	$10,767	
Seeding	14,250	SF	$2	$28,500	
				$2,946,267	
Mid-Plume In-Situ Treatment Line					
Drill 10 inch columns to 40 ft, install ZVI/sand	200	ea	$1,906	$381,250	Quote for project from Glacier Drilling
Purchase and install PVC screen and riser	200	ea	$500	$100,000	
Sand, delivered	133	CY	$50	$6,666	
ZVI, delivered	32	ton	$1,200	$38,397	15% blend based on tonnage of sand
Blend ZVI/sand	133	CY	$6	$800	
Furnish clean fill	28	CY	$42	$1,185	
Seeding	109	SF	$2	$218	
				$528,517	
Soil Disposal and GW Management					
Dewatering	1	LS	$52,500	$52,500	*See Dewatering Backup Sheet*
Erosion control measures	500	LF	4	$2,000	
Waste characterization of concrete slab	4	ea	$1,000	$4,000	
Waste characterization of soil stockpiles	32	ea	$1,000	$32,000	
T&D RCRA hazardous soil	6,623	ton	$250	$1,655,654	
T&D non-haz soil	6,463	ton	$80	$517,009	Assume 50% listed waste in mid-plume line
Police detail	190	hr	$120	$22,800	
				$2,285,964	
Permeable Reactive Barrier near Bliss Brook					
Site Preparation and Management					
Obtain land and easements	1	LS	$0	$0	Access agreements (assumed to be handled by EPA)
Building permits and fees	1	LS	$10,000	$10,000	
				$10,000	
Pre-Remedial Study					
Bench test	1	ea	$5,000	$5,000	Confirm dose and contact time of ZVI type
Predesign study	1	ea	$15,000	$15,000	Confirm length of wall based on groundwater impacts and groundwater concentrations reaching stream
Additional flow modeling	1	LS	$5,000	$5,000	

Alternative **GW/SW-3b**

Source Area Soil Removal with In-Situ Treatment, Extension of Permeable Reactive Barrier, and Mid-Plume Treatment

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, installation of a permeable reactive barrier along Bliss Brook, and a mid-plume in-situ treatment line.

					$25,000	
Construct PRB Wall						
Mobilization		1	LS	$25,000	$25,000	Includes site prep and erosion controls
Divert stream around work area		1	LS	$50,000	$50,000	
Excavate soil		4,400	CY	$25	$110,000	
Purchase and deliver sand backfill		3,900	CY	$50	$195,000	
Geotextile, installed		8,000	SF	$4	$32,000	
Purchase and deliver river run gravel		500	CY	$30	$15,000	
Purchase and deliver ZVI		354	ton	$1,200	$424,911	*See ZVI dose calculation sheet,* 9% dose
Blend ZVI and sand		3,900	CY	$6	$23,400	
Install ZVI and sand blend		3,900	CY	$6	$23,400	
Install stream bed gravel		500	CY	$10	$5,000	
Stream bank restoration and plantings		800	LF	$5	$4,000	
Demobilize		1	LS	$10,000	$10,000	
					$917,711	
Soil Disposal and GW Management						
Dewatering		1	LS	$42,500	$42,500	Additional operational cost for preexisting dewatering system *(see dewatering backup sheet)*
Waste characterization of soil stockpiles		21	ea	$1,000	$21,000	
T&D RCRA hazardous soil		0	ton	$250	$0	
T&D non-haz soil		7,040	ton	$80	$563,200	
Police detail		166	hr	$120	$19,920	
					$646,620	
SUBTOTAL					$7,659,358	
Contingency:	30%				$2,297,807	
SUBTOTAL [Remedy Implementation]					$9,957,165	
Project Management	5%				$497,858	
Remedial Design	8%				$796,573	
Construction Management	6%				$597,430	
Institutional Controls						
Groundwater Ordinance		1	LS	$15,000	$15,000	Support to town to put ordinance in place
Activity and Use Limitations		1	LS	$127,165	$127,165	
					$2,034,027	
TOTAL CAPITAL COST					$11,991,192	

Alternative **GW/SW-3b**

Source Area Soil Removal with In-Situ Treatment, Extension of Permeable Reactive Barrier, and Mid-Plume Treatment

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, installation of a permeable reactive barrier along Bliss Brook, and a mid-plume in-situ treatment line.

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Five year review (every 5 years until Year 30)	6	ea	$10,000	$60,000	
Update Institutional Controls Plan (Year 5)	1	ea	$4,000	$4,000	
Remedial Action Report (Year 5)	1	ea	$10,000	$10,000	
Indoor air sampling of homes with SSDS (Year 5)	1	ea	$23,400	$23,400	
Inspections of homes (every 5 years until Year 30)	6	ea	$1,000	$6,000	Inspect for change in condition of two additional homes
				$103,400	

O&M

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Groundwater and Surface Water Monitoring					
Annual groundwater monitoring	1	LS	$60,000	$60,000	Annual groundwater sampling program
Annual surface water monitoring	1	LS	$30,000	$30,000	Annual surface water sampling program
				$90,000	
Annual inspections					
Sub-slab depressurization systems inspection	1	LS	$1,500	$1,500	Annual inspection of 3 homes with SSDS
Inspection and maintenance of remedy	1	LS	$12,000	$12,000	Inspection of PRB wall, engineered cover, and capped lagoon
				$13,500	
SUBTOTAL				$103,500	
Contingency:	30%			$31,050	
SUBTOTAL [Remedy Implementation]				$134,550	
Technical Support	15%			$20,183	
Project Management	5%			$6,728	
TOTAL O&M COST				$161,460	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor	Present Value	Notes
Capital Cost	0	11,991,192	$11,991,192	1.00	$11,991,192	
O&M Cost	1 to 30	4,843,800	$161,460	0.7%	$4,355,326	
Periodic Cost	5	48,400	$48,400	0.7%	$46,741	
	10	11,000	$11,000	0.7%	$10,259	
	15	11,000	$11,000	0.7%	$9,907	
	20	11,000	$11,000	0.7%	$9,568	
	25	11,000	$11,000	0.7%	$9,240	
	30	11,000	$11,000	0.7%	$8,923	
Total Present Value of Alternative					**$16,441,155**	

Dewatering backup for GW/SW alternatives

Install and set up	QTY	UNIT	U.P.	E.P.	
frac tanks	3	ea	$1,200	$3,600	
frac tanks, delivered	1	LS	$2,500	$2,500	
2 bag filters	2	ea	$1,300	$2,600	
2 activated carbon vessels	2	ea	$2,000	$4,000	
2 ion exchange vessels	2	ea	$7,400	$14,800	
			total capital cost	$27,500	

Weekly operational cost					total LS per alternative
GWSW a	4	week	$5,000	$20,000	$47,500
GWSW b	5	week	$5,000	$25,000	$52,500
additional operational cost for PRB wall	3	week	$5,000	$15,000	$42,500

Total excavations (CY)	
source area	7,917
Mid plume line	162
PRB extension	4,400

	total CY	wks of op
GWSW a	7,917	3.958333
GWSW b	8,078	4.039136
PRB wall	4,400	2.2

COST SENSITIVITY ANALYSIS

			total CY	wks of op	
	-30		5,542	2.7708333	
	+50		11,875	5.9375	
GWSW -30	3	week	$5,000	$15,000	$42,500
GWSW+50	6	week	$5,000	$30,000	$57,500

ESTIMATED ANNUAL COST FOR LONG-TERM GROUNDWATER MONITORING: GW/SW ALTERNATIVES

	Qty	Unit Price	Unit	Extended Price	Basis
NUMBER OF WELLS (ob wells only, no br wells included)	25	$1,000.00	well	$25,000.00	two wells per person per 10 hour day, $150 per hour, plus $250 per well ODCs (travel, equipment, supplies)
NUMBER OF CR+6 ANALYSES	21	$50.00	ea	$1,050.00	
NUMBER OF VOC ANALYSES	17	$100.00	ea	$1,700.00	
ANNUAL MONITORING REPORT	1	$30,000.00	ea	$30,000.00	200 labor hours at $150 per hour
Annual cost for LTM				$57,750.00	
ROUNDED UP ANNUAL LTM COST (2 sig figs)				**$60,000.00**	

ESTIMATED ANNUAL COST FOR MONITORING OF BLISS BROOK SURFACE WATER (GW/SW ALTERNATIVES)

	Qty	Unit Price	Unit	Extended Price	Basis
LABOR AND ODCS, PER EVENT, 2 EVENTS/YEAR	2	$4,000.00	event	$8,000.00	Each event is five samples and takes one 10 hour day for two persons at $150/person-hour; plus $1000 ODCs (travel, equipment, supplies)
NUMBER OF CR+6 ANALYSES, 5 PER EVENT, 2 EVENTS/YEAR	10	$50.00	ea	$500.00	
QUARTERLY MONITORING REPORT	1	$15,000.00	ea	$15,000.00	100 labor hours at $150 per hour
Annual cost for LTM				$23,500.00	
ROUNDED UP SURFACE WATER ANNUAL LTM COST (2 sig figs)				**$30,000.00**	

MONITORING OF HOMES WITH SUB-SLAB DEPRESSURIZATION SYSTEMS

	Qty	Unit Price	Unit	Extended Price	Basis
ANNUAL INSPECTIONS, 3 HOMES	1	$1,500	ea	$1,500	One technician visits all 3 homes once a year
INDOOR AIR SAMPLING, YEAR 5, 1 ROUND					
Labor	1	$6,000	round	$6,000	One day install, one day retrieve canisters, 2 persons
Analyses, TO-15 Summa canister	12	$200	ea	$2,400	Four samples per home per round and one round
Data Report	1	$15,000	ea	$15,000	Includes justification to shut down SSDS
			Total, Year 5	**$23,400**	

PRB Wall Near Bliss Brook

Estimate ZVI Use Rate and Dose

Parameter	Value	Units	Basis
Flow Rate of Groundwater Into Stream	0.04	cubic feet per second	See flow modeling
Flow into Stream per Year	35723980.8	liters per year	
Average Cr+6 concentration in groundwater entering stream-Year 1	3,000	micrograms per liter	See flow modeling, assuming average of 6,000 over 30 year period, 1/2 inflow is not impacted
Mass Cr+6 Entering the Stream-Year 1	107172	grams per year	
ZVI dose ratio	100	grams ZVI per gram Cr+6	professional judgement, see below
ZVI useage - year 1	10717194.24	grams ZVI per year	
ZVI usage-year 1	11.8	tons per year	
ZVI usage - 30 years	354	tons	

Basis for ZVI dose ratio: Previous bench test with site water and site soil showed a treatment ratio of <23,000 grams ZVI per gram of Cr+6 (no breakthrough) and is considered overly conservative because 1. in same treatability study FeS dose ratio was <26 grams FeS to 1 gram Cr+6 and 2. the stociometric dose for ZVI would be 1.06 to 3.2 grams ZVI to 1 gram Cr+6. A 30 to 100 fold increase over the stociometric ratio to account for competing reactions is a reasonable staring estimation. As part of the pre-design, bench testing specifc ZVI products with sand and site groundwater is recommended.

GW/SW Alternatives

Clean Backfill

COST WORKSHEET

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Base Year: Jul-18

Work Statement:

Furnish and install clean backfill and geotextile material, including source testing, density testing in place. This cost is computed as a per CY, with an assumption that an average of 4 lifts will be placed at 6 inches each (based on 500 CY).

Description	QTY	UNIT	LABOR	EQUIP	MTRL	UNIT TOTAL	TOTAL
Furnish and install backfill	500	CY	$0.00	$0.00	$30.00	$30.00	$15,000.00
Testing of fill (1 per 500 CY)							
RCRA-8 Metals	1	ea	$0.00	$0.00	$75.00	$75.00	$75.00
VOCs	1	ea	$0.00	$0.00	$85.00	$85.00	$85.00
SVOCs	1	ea	$0.00	$0.00	$100.00	$100.00	$100.00
PCBs/Pesticides/Herbicides	1	ea	$0.00	$0.00	$250.00	$250.00	$250.00
Geotech properties	1	ea	$0.00	$0.00	$125.00	$125.00	$125.00
Prepare subbase	375	SY	$0.43	$0.63	$0.00	$1.06	$397.50
Spread and compact (6 inch lifts)	2250	SY	$0.31	$0.59	$0.00	$0.90	$2,025.00
In place density testing	1	ea	$160.00	$0.00	$0.00	$160.00	$160.00

SUBTOTAL (cost per 500 CY)		$18,217.50
Subcontractor Overhead & Profit	*15.0%*	$2,732.63
SUBTOTAL		$20,950.13
TOTAL UNIT COST (per CY)		$41.90 /CY

Source of Cost Data:

Engineering estimate with reference to Means.

Cost Adjustment Factor:

FACTOR:		NOTES:
H&S Productivity (labor & equip)		Level D
Escalation to Base Year		
Area Cost Factor		
Subcontractor Overhead & Prof.		
Prime Contractor Overhead & Prof	X	

COST ESTIMATE AULs FOR ALTERNATIVES GW/SW-2A AND GW/SW-3A (ASSUMES 9 PROPERTIES)

LABOR COST (AECOM AVERAGE TYPICAL RATES BY CATEGORY)

ITEM / Labor Category Hourly Rate	LSP $193.00	Senior Project Eng/Sci $187.00	Project Engineer/ Scientist $145.00	Staff Engineer/ Scientist (CADD) $100.00	Admin. Support $95.00	Total Hours
Task 1 - AUL Preliminary Research						
1.1 - Client and Attorney Communication		10				10
1.2 - Research Existing Deed and Property Plan - Identify Land Type		8				8
1.3 - Procure Surveyor and Attorney/Title Company (Property/AUL Survey, Legal Descriptions, title rpts)		12	16		2	30
1.4 - Identify Current Record Interest holder - CIHs (Attorney to conduct Title Search)		9			2	11
1.5 - Review Survey Plans of Restricted Areas (up to 15 Properties)	6	18				24
					subtotal	83
Task 2 - AUL Document Preparation						
2.1 - Notice of AUL Form 1075 or Federal NAUL form		9				9
2.2 - Exhibit A Legal Description of property (from Deed or Surveyor)		9				9
2.3 - Exhibit A-1 Legal Description of portion of property subject to AUL (from surveyor)		9				9
2.4 - Exhibit A-2 Survey Plan of AUL portion		9				9
2.5 - Exhibit B - Sketch Plan - property, site, RAO, AUL boundaries (Not scaled)		5		9		14
2.6 - Exhibit C - AUL Opinion (IC Design Statement, if Federal NAUL template is used)	5	27				32
2.7 - Exhibit D - Signatory Authority		9				9
2.8 - LSP Review AUL Package with PS/TS Closure Document	5	5				10
2.9 - Edits (per attorney review and comment) - site specific	3	5				8
2.10 - Additional review/edits to address EPA and MassDEP comments	3	9				12
2.11 - Mailing of Draft Copy of AUL to CIHs (certified mail/return receipt requested)		3			3	6
					subtotal	127
Task 3 - Recordation of AUL documents						
3.1 - Signing of AUL documents - assumes signatures obtained by EPA		0				
3.2 - Recording at ROD			8			8
3.3 - AUL Recording Fees (assume one) - see below						0
3.4 - Legal Ad prepare and place in Newspaper - Varies by community	1	2			2	5
3.5 - Cert mail copies of Recorded AUL to local officials (letter +AUL)- CMO, BOH, Zoning, Building	1	4			4	9
					subtotal	22
Task 4- Distribution of Recorded AUL						
4.1 - Submittal to MassDEP - Letter plus BWSC Form 113 plus documents	1	6				7
4.2 - Get copy of AUL legal ad publication and submit to MassDEP with BWSC Form.		1			1	2
4.3 - Distribute copies via Email to client, record interest holders, attorneys, EPA, etc.		3				3
					subtotal	12
Total Hours	25	172	24	9	14	244
Total Dollars	$4,825.00	$32,070.50	$3,480.00	$900.00	$1,330.00	
					Labor Cost Subtotal	$42,605.50

REIMBURSABLE EXPENSES

ITEM	Units	Unit Cost	Subtotal	Multiplier 10%	Total Cost
1.3 - AUL Survey - 3 Properties	9	$5,000.00	$45,000.00	$0.00	$45,000.00
1.3 - Title Search - Title reports plus one update per property	9	$900.00	$8,100.00	$0.00	$8,100.00
Attorney's Review of AULs	9	$2,000.00	$18,000.00	$0.00	$18,000.00
2.11 - Certified mailing draft AUL to CIHs (Assume at least two)	1	$20.00	$20.00	$0.00	$20.00
3.1 - Travel to client to get signatures - mileage -varies -calculate site-specific	0	$50.00	$0.00	$0.00	$0.00
3.2 - AUL Recordation at ROD ($75 per instrument), plus cost for certified copy ($1.00 per page-assume 20	9	$95.00	$855.00	$0.00	$855.00
3.2 - Travel to ROD to record AUL - mileage -varies -calculate site-specific	1	$29.70	$29.70	$0.00	$29.70
3.2 - Parking at ROD (not all but some charge for parking)	1	$0.00	$0.00	$0.00	$0.00
3.4 - Legal Ad Publication (varies 150 to 450) - $300 median price.	1	$300.00	$300.00	$0.00	$300.00
3.5 - Cert Mailing of recorded AUL to CMO, BOH, Zoning & Building Inspection (Assume 4 x $10/each)	1	$40.00	$40.00	$0.00	$40.00
4.1 - MassDEP AUL Fee	0	$2,000.00	$0.00	$0.00	$0.00
				Subtotal	$72,344.70

GRAND TOTAL $114,950.20

COST ESTIMATE AULs FOR ALTERNATIVES GW/SW-2B AND GW/SW-3B (ASSUMES 10 PROPERTIES)

LABOR COST (AECOM AVERAGE TYPICAL RATES BY CATEGORY)

ITEM / Labor Category / Hourly Rate	LSP $193.00	Senior Project Eng/Sci $187.00	Project Engineer/ Scientist $145.00	Staff Engineer/ Scientist (CADD) $100.00	Admin. Support $95.00	Total Hours
Task 1 - AUL Preliminary Research						
1.1 - Client and Attorney Communication		10				10
1.2 - Research Existing Deed and Property Plan - Identify Land Type		8				8
1.3 - Procure Surveyor and Attorney/Title Company (Property/AUL Survey, Legal Descriptions, title rpts)		12	16		2	30
1.4 - Identify Current Record Interest holder - CIHs (Attorney to conduct Title Search)		10			2	12
1.5 - Review Survey Plans of Restricted Areas (up to 15 Properties)	6	20				26
					subtotal	86
Task 2 - AUL Document Preparation						
2.1 - Notice of AUL Form 1075 or Federal NAUL form		10				10
2.2 - Exhibit A Legal Description of property (from Deed or Surveyor)		10				10
2.3 - Exhibit A-1 Legal Description of portion of property subject to AUL (from surveyor)		10				10
2.4 - Exhibit A-2 Survey Plan of AUL portion		10				10
2.5 - Exhibit B - Sketch Plan - property, site, RAO, AUL boundaries (Not scaled)		5		10		15
2.6 - Exhibit C - AUL Opinion (IC Design Statement, if Federal NAUL template is used)	5	30				35
2.7 - Exhibit D - Signatory Authority		15				15
2.8 - LSP Review AUL Package with PS/TS Closure Document	5	5				10
2.9 - Edits (per attorney review and comment) - site specific	4	5				9
2.10 - Additional review/edits to address EPA and MassDEP comments	4	14				18
2.11 - Mailing of Draft Copy of AUL to CIHs (certified mail/return receipt requested)		3			3	6
					subtotal	147
Task 3 - Recordation of AUL documents						
3.1 - Signing of AUL documents - assumes signatures obtained by EPA		0				
3.2 - Recording at ROD			8			8
3.3 - AUL Recording Fees (assume one) - see below						0
3.4 - Legal Ad prepare and place in Newspaper - Varies by community	1	2			2	5
3.5 - Cert mail copies of Recorded AUL to local officials (letter +AUL)- CMO, BOH, Zoning, Building	1	4			4	9
					subtotal	22
Task 4- Distribution of Recorded AUL						
4.1 - Submittal to MassDEP - Letter plus BWSC Form 113 plus documents	1	6				7
4.2 - Get copy of AUL legal ad publication and submit to MassDEP with BWSC Form.		1			1	2
4.3 - Distribute copies via Email to client, record interest holders, attorneys, EPA, etc.		3				3
					subtotal	12
Total Hours	26	193	24	10	14	267
Total Dollars	$5,018.00	$35,997.50	$3,480.00	$1,000.00	$1,330.00	
					Labor Cost Subtotal	$46,825.50

REIMBURSABLE EXPENSES

ITEM	Units	Unit Cost	Subtotal	Multiplier 10%	Total Cost
1.3 - AUL Survey - 3 Properties	10	$5,000.00	$50,000.00	$0.00	$50,000.00
1.3 - Title Search - Title reports plus one update per property	10	$900.00	$9,000.00	$0.00	$9,000.00
Attorney's Review of AULs	10	$2,000.00	$20,000.00	$0.00	$20,000.00
2.11 - Certified mailing draft AUL to CIHs (Assume at least two)	1	$20.00	$20.00	$0.00	$20.00
3.1 - Travel to client to get signatures - mileage -varies -calculate site-specific	0	$50.00	$0.00	$0.00	$0.00
3.2 - AUL Recordation at ROD ($75 per instrument), plus cost for certified copy ($1.00 per page-assume 20 pages) - project specific - Form	10	$95.00	$950.00	$0.00	$950.00
3.2 - Travel to ROD to record AUL - mileage -varies -calculate site-specific	1	$29.70	$29.70	$0.00	$29.70
3.2 - Parking at ROD (not all but some charge for parking)	1	$0.00	$0.00	$0.00	$0.00
3.4 - Legal Ad Publication (varies 150 to 450) - $300 median price.	1	$300.00	$300.00	$0.00	$300.00
3.5 - Cert Mailing of recorded AUL to CMO, BOH, Zoning & Building Inspection (Assume 4 x $10/each)	1	$40.00	$40.00	$0.00	$40.00
4.1 - MassDEP AUL Fee	0	$2,000.00	$0.00	$0.00	$0.00
				Subtotal	$80,339.70

GRAND TOTAL $127,165.20

GROUNDWATER/SURFACE WATER ALTERNATIVES

COST SENSITIVITY ANALYSIS

Alternative **GW/SW-2a**
Source Area Removal with In-Situ Soil Treatment and Groundwater Pump and Treat

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, and installation and operation of a groundwater pump and treat system.
-30% cost sensitivity

CAPITAL COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Pre-Design Investigation Sampling					
Preparation of QAPP and HASP	100	HR	$120	$12,000	
Test pitting	5	day	$2,000	$10,000	Assume 100 CY excavated, assume RCRA hazardous
Drill rig and operator	8	day	$2,000	$16,000	$1,500 drill rig plus $500 for hole saw to drill through building slab
Labor to collect, record, and ship samples	42	pds	$1,440	$60,480	Three person field team for TP and drilling
Fixed lab sample analyses					Delineation of impact samples
Hexavalent chromium	50	ea	$70	$3,500	
Full Waste Characterization Analyses	10	ea	$1,000	$10,000	Subset of delineation samples to refine estimates for off-site disposal
Field equipment	1	ea	$12,500	$12,500	Allowance
Data evaluation	50	HR	$75.00	$3,750	
				$128,230	
Excavate and Backfill Building Slab					
Excavate concrete slab	1	LS	$90,000	$90,000	Excavation and disposal of slab (quote from Costello)
Dust control and air monitoring	1	ea	$2,000	$2,000	Estimated allowance
Furnish clean fill (including for test pits)	1,220	CY	$41.90	$51,118	*See Backfill tab*
Furnish topsoil/gravel	230	CY	$34	$7,820	
Seeding	10,056	SF	$2	$20,112	
				$171,050	
Source Area Removal and ZVI Blending					
Bench test	1	ea	$5,000	$5,000	
Mobilization	1	LS	$10,000	$10,000	
Excavation	5,542	CY	$12	$66,500	Excavate top 15', assume half listed waste/half non-haz
Install temporary shoring	11,130	SF	$30	$333,900	
Dust control and air monitoring	20	wk	$2,000	$40,000	Estimated allowance
ZVI, purchase and deliver	842	ton	$1,200	$1,010,800	5% dose 7.5-15' bgs, 7% 15-30' bgs
Sand backfill, purchase and deliver	6,650	CY	$25	$166,250	Includes 20% compaction factor
Blend ZVI and sand	3,325	CY	$6	$19,950	7.5-15' bgs
In-situ soil/ZVI blending	6,650	CY	$6	$39,900	15-30' bgs
Install ZVI/sand blend and clean sand	6,650	CY	$6	$39,900	Clean sand 0-7.5' bgs, sand/ZVI blend 7.5-15' bgs
Furnish and install topsoil	222	CY	$34	$7,537	
Seeding	9,975	SF	$2	$19,950	
				$1,759,687	
Soil Disposal and GW Management					
Dewatering	1	LS	$42,500	$42,500	*See Dewatering Backup Sheet*
Erosion control measures	250	LF	$4	$1,000	
Waste characterization of concrete slab	4	ea	$1,000	$4,000	
Waste characterization of soil stockpiles	25	ea	$1,000	$25,000	
T&D RCRA hazardous soil	4,593	ton	$250	$1,148,333	
T&D non-haz soil	4,433	ton	$80	$354,667	
Police detail	135	hr	$120	$16,200	
				$1,591,700	
Groundwater Pump and Treat System					
Site Preparation and Management					
Obtain land and easements	1	LS	$0	$0	Access agreements (assumed to be handled by EPA)
Building permits and fees	1	LS	$10,000	$10,000	
				$10,000	
Pre-Remedial Study					
Pump Test	1	LS	$50,000	$50,000	One 24 hr test, includes water treatment and disposal
				$50,000	
Construct Pump and Treat System					
Treatment plant building construction	1	LS	$100,000	$100,000	
Erosion control measures	300	LF	$4	$1,200	
Drill extraction wells	3	ea	$5,000	$15,000	
Install well vaults	3	ea	$2,500	$7,500	
Influent and effluent tanks	2	ea	$10,000	$20,000	Assume 5000 gallon capacity each
Above ground piping	1	LS	$15,000	$15,000	

Alternative **GW/SW-2a**

Source Area Removal with In-Situ Soil Treatment and Groundwater Pump and Treat

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, and installation and operation of a groundwater pump and treat system.
-30% cost sensitivity

Pump, electrical, controls per well		3	ea	$5,000	$15,000	18 gpm each, total 54 gpm
Transfer lines to TP and discharge point		1,600	ft	$20	$32,000	
Install above ground pumps		3	ea	$1,500	$4,500	
Install and test electrical services		1	LS	$30,000	$30,000	
Ion exchange vessels with 1st change		2	ea	$10,200	$20,400	Quote for project from CFS
Bag filter housings		2	ea	$1,300	$2,600	Quote for project from CFS
Deliver equipment, place and fill on site		1	LS	$1,600	$1,600	Quote for project from CFS
Treatment plant controls		1	ea	$25,000	$25,000	
Prove out		1	ea	$10,000	$10,000	
					$299,800	
SUBTOTAL					$4,010,467	
Contingency:	30%				$1,203,140	
SUBTOTAL [Remedy Implementation]					$5,213,607	
Project Management	5%				$260,680	
Remedial Design	8%				$417,089	
Construction Management	6%				$312,816	
Institutional Controls						
Groundwater Ordinance		1	LS	$15,000	$15,000	Support to town to put ordinance in place
Activity and Use Limitations		1	LS	$114,950	$114,950	
					$1,120,536	
TOTAL CAPITAL COST					$6,334,143	

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Five year review (every 5 years until Year 30)	6	ea	$10,000	$60,000	
Update Institutional Controls Plan (Year 5)	1	ea	$4,000	$4,000	
Remedial Action Report (Year 5)	1	ea	$10,000	$10,000	
Indoor air sampling of homes with SSDS (Year 5)	1	ea	$23,400	$23,400	
Inspections of homes (every 5 years until Year 30)	6	ea	$1,000	$6,000	Inspect for change in condition of two additional homes
				$103,400	

Alternative **GW/SW-2a**

Source Area Removal with In-Situ Soil Treatment and Groundwater Pump and Treat

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, and installation and operation of a groundwater pump and treat system.
-30% cost sensitivity

O&M

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Treatment System Operations and Maintenance					
Treatment system operations	1	year	$25,000	$25,000	Review remote monitoring, weekly inspections, maintenance, troubleshooting, and repairs
Change out ion exchange vessels	4	ea	$7,200	$28,800	2 replacements per vessel per year
Bag filters and other minor supplies	1	year	$5,000	$5,000	
Electricity (heat and power)	12	month	$200	$2,400	
Sampling wells, stream, and discharge point	12	month	$1,500	$18,000	Includes labor and lab analysis
Reporting	4	qtr	$2,500	$10,000	
Equipment replacements	1	year	$2,000	$2,000	Assume $10,000 repair every 5 years
				$91,200	
Groundwater and Surface Water Monitoring					
Annual groundwater monitoring	1	LS	$60,000	$60,000	Annual groundwater sampling program
Annual surface water monitoring	1	LS	$30,000	$30,000	Annual surface water sampling program
				$90,000	
Annual inspections					
Sub-slab depressurization systems inspection	1	LS	$1,500	$1,500	Annual inspection of 3 homes with SSDS
Inspection and maintenance of remedy	1	LS	$12,000	$12,000	Inspection of PRB wall, engineered cover, and capped lagoon
				$13,500	
SUBTOTAL				$194,700	
Contingency:	30%			$58,410	
SUBTOTAL [Remedy Implementation]				$253,110	
Technical Support	30%			$75,933	Increased technical support percentage
Project Management	5%			$12,656	to include data review and reporting
TOTAL O&M COST				$341,699	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor	Present Value	Notes
Capital Cost	0	$6,334,143	$6,334,143	1.0	$6,334,143	
O&M Cost	1 to 30	$10,250,955	$341,699	0.7%	$9,217,196	
Periodic Cost	5	$48,400	$48,400	0.7%	$46,741	
	10	$11,000	$11,000	0.7%	$10,259	
	15	$11,000	$11,000	0.7%	$9,907	
	20	$11,000	$11,000	0.7%	$9,568	
	25	$11,000	$11,000	0.7%	$9,240	
	30	$11,000	$11,000	0.7%	$8,923	
Total Present Value of Alternative					**$15,645,976**	

Alternative **GW/SW-2a**
Source Area Removal with In-Situ Soil Treatment and Groundwater Pump and Treat

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, and installation and operation of a groundwater pump and treat system.
+50% cost sensitivity

CAPITAL COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Pre-Design Investigation Sampling					
Preparation of QAPP and HASP	100	HR	$120	$12,000	
Test pitting	5	day	$2,000	$10,000	Assume 100 CY excavated, assume RCRA hazardous
Drill rig and operator	8	day	$2,000	$16,000	$1,500 drill rig plus $500 for hole saw to drill through building slab
Labor to collect, record, and ship samples	42	pds	$1,440	$60,480	Three person field team for TP and drilling
Fixed lab sample analyses					Delineation of impact samples
Hexavalent chromium	50	ea	$70	$3,500	
Full Waste Characterization Analyses	10	ea	$1,000	$10,000	Subset of delineation samples to refine estimates for off-site disposal
Field equipment	1	ea	$12,500	$12,500	Allowance
Data evaluation	50	HR	$75.00	$3,750	
				$128,230	
Excavate and Backfill Building Slab					
Excavate concrete slab	1	LS	$90,000	$90,000	Excavation and disposal of slab (quote from Costello)
Dust control and air monitoring	1	ea	$2,000	$2,000	Estimated allowance
Furnish clean fill (including for test pits)	1,220	CY	$41.90	$51,118	*See Backfill tab*
Furnish topsoil/gravel	230	CY	$34	$7,820	
Seeding	10,056	SF	$2	$20,112	
				$171,050	
Source Area Removal and ZVI Blending					
Bench test	1	ea	$5,000	$5,000	
Mobilization	1	LS	$10,000	$10,000	
Excavation	11,875	CY	$12	$142,500	Excavate top 15', assume half listed waste/half non-haz
Install temporary shoring	23,850	SF	$30	$715,500	
Dust control and air monitoring	20	wk	$2,000	$40,000	Estimated allowance
ZVI, purchase and deliver	3,325	ton	$1,200	$3,990,000	5% dose 7.5-15' bgs, 15% 15-30' bgs
Sand backfill, purchase and deliver	14,250	CY	$25	$356,250	Includes 20% compaction factor
Blend ZVI and sand	7,125	CY	$6	$42,750	7.5-15' bgs
In-situ soil/ZVI blending	14,250	CY	$6	$85,500	15-30' bgs
Install ZVI/sand blend and clean sand	14,250	CY	$6	$85,500	Clean sand 0-7.5' bgs, sand/ZVI blend 7.5-15' bgs
Furnish and install topsoil	475	CY	$34	$16,150	
Seeding	21,375	SF	$2	$42,750	
				$5,531,900	
Soil Disposal and GW Management					
Dewatering	1	LS	$57,500	$57,500	*See Dewatering Backup Sheet*
Erosion control measures	250	LF	$4	$1,000	
Waste characterization of concrete slab	4	ea	$1,000	$4,000	
Waste characterization of soil stockpiles	45	ea	$1,000	$45,000	
T&D RCRA hazardous soil	9,660	ton	$250	$2,415,000	
T&D non-haz soil	9,500	ton	$80	$760,000	
Police detail	265	hr	$120	$31,800	
				$3,314,300	
Groundwater Pump and Treat System					
Site Preparation and Management					
Obtain land and easements	1	LS	$0	$0	Access agreements (assumed to be handled by EPA)
Building permits and fees	1	LS	$10,000	$10,000	
				$10,000	
Pre-Remedial Study					
Pump Test	1	LS	$50,000	$50,000	One 24 hr test, includes water treatment and disposal
				$50,000	
Construct Pump and Treat System					
Treatment plant building construction	1	LS	$100,000	$100,000	
Erosion control measures	300	LF	$4	$1,200	
Drill extraction wells	3	ea	$5,000	$15,000	
Install well vaults	3	ea	$2,500	$7,500	
Influent and effluent tanks	2	ea	$10,000	$20,000	Assume 5000 gallon capacity each
Above ground piping	1	LS	$15,000	$15,000	

Alternative **GW/SW-2a**

Source Area Removal with In-Situ Soil Treatment and Groundwater Pump and Treat

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, and installation and operation of a groundwater pump and treat system.
+50% cost sensitivity

Pump, electrical, controls per well		3	ea	$5,000	$15,000	18 gpm each, total 54 gpm
Transfer lines to TP and discharge point		1,600	ft	$20	$32,000	
Install above ground pumps		3	ea	$1,500	$4,500	
Install and test electrical services		1	LS	$30,000	$30,000	
Ion exchange vessels with 1st change		2	ea	$10,200	$20,400	Quote for project from CFS
Bag filter housings		2	ea	$1,300	$2,600	Quote for project from CFS
Deliver equipment, place and fill on site		1	LS	$1,600	$1,600	Quote for project from CFS
Treatment plant controls		1	ea	$25,000	$25,000	
Prove out		1	ea	$10,000	$10,000	
					$299,800	
SUBTOTAL					$9,505,280	
Contingency:	30%				$2,851,584	
SUBTOTAL [Remedy Implementation]					$12,356,864	
Project Management	5%				$617,843	
Remedial Design	8%				$988,549	
Construction Management	6%				$741,412	
Institutional Controls						
Groundwater Ordinance		1	LS	$15,000	$15,000	Support to town to put ordinance in place
Activity and Use Limitations		1	LS	$114,950	$114,950	
					$2,477,754	
TOTAL CAPITAL COST					$14,834,619	

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Five year review (every 5 years until Year 30)	6	ea	$10,000	$60,000	
Update Institutional Controls Plan (Year 5)	1	ea	$4,000	$4,000	
Remedial Action Report (Year 5)	1	ea	$10,000	$10,000	
Indoor air sampling of homes with SSDS (Year 5)	1	ea	$23,400	$23,400	
Inspections of homes (every 5 years until Year 30)	6	ea	$1,000	$6,000	Inspect for change in condition of two additional homes
				$103,400	

Alternative **GW/SW-2a**
Source Area Removal with In-Situ Soil Treatment and Groundwater Pump and Treat

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, and installation and operation of a groundwater pump and treat system.
+50% cost sensitivity

O&M

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Treatment System Operations and Maintenance					
Treatment system operations	1	year	$25,000	$25,000	Review remote monitoring, weekly inspections, maintenance, troubleshooting, and repairs
Change out ion exchange vessels	4	ea	$7,200	$28,800	2 replacements per vessel per year
Bag filters and other minor supplies	1	year	$5,000	$5,000	
Electricity (heat and power)	12	month	$200	$2,400	
Sampling wells, stream, and discharge point	12	month	$1,500	$18,000	Includes labor and lab analysis
Reporting	4	qtr	$2,500	$10,000	
Equipment replacements	1	year	$2,000	$2,000	Assume $10,000 repair every 5 years
				$91,200	
Groundwater and Surface Water Monitoring					
Annual groundwater monitoring	1	LS	$60,000	$60,000	Annual groundwater sampling program
Annual surface water monitoring	1	LS	$30,000	$30,000	Annual surface water sampling program
				$90,000	
Annual inspections					
Sub-slab depressurization systems inspection	1	LS	$1,500	$1,500	Annual inspection of 3 homes with SSDS
Inspection and maintenance of remedy	1	LS	$12,000	$12,000	Inspection of PRB wall, engineered cover, and capped lagoon
				$13,500	
SUBTOTAL				$194,700	
Contingency: 30%				$58,410	
SUBTOTAL [Remedy Implementation]				$253,110	
Technical Support 30%				$75,933	Increased technical support percentage
Project Management 5%				$12,656	to include data review and reporting
TOTAL O&M COST				$341,699	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor	Present Value	Notes
Capital Cost	0	$14,834,619	$14,834,619	1.0	$14,834,619	
O&M Cost	1 to 30	$10,250,955	$341,699	0.7%	$9,217,196	
Periodic Cost	5	$48,400	$48,400	0.7%	$46,741	
	10	$11,000	$11,000	0.7%	$10,259	
	15	$11,000	$11,000	0.7%	$9,907	
	20	$11,000	$11,000	0.7%	$9,568	
	25	$11,000	$11,000	0.7%	$9,240	
	30	$11,000	$11,000	0.7%	$8,923	
Total Present Value of Alternative					**$24,146,452**	

Alternative **GW/SW-2b**

Source Area Removal with In-Situ Soil Treatment and Groundwater Pump and Treat plus Mid-Plume Treatment

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, installation and operation of a groundwater pump and treat system, and a mid-plume in-situ treatment line.
-30% cost sensitivity

CAPITAL COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Pre-Design Investigation Sampling					
Preparation of QAPP and HASP	100	HR	$120	$12,000	
Test pitting	5	day	$2,000	$10,000	Assume 100 CY excavated, assume RCRA hazardous
Drill rig and operator	8	day	$2,000	$16,000	$1,500 drill rig plus $500 for hole saw to drill through building slab
Labor to collect, record, and ship samples	42	pds	$1,440	$60,480	Three person field team for TP and drilling
Fixed lab sample analyses					Delineation of impact samples
Hexavalent chromium	50	ea	$70	$3,500	
Full Waste Characterization Analyses	10	ea	$1,000	$10,000	Subset of delineation samples to refine estimates for off-site disposal
Field equipment	1	ea	$12,500	$12,500	Allowance
Data evaluation	50	HR	$75	$3,750	
				$128,230	
Excavate and Backfill Building Slab					
Excavate concrete slab	1	LS	$90,000	$90,000	Excavation and disposal of slab (quote from Costello)
Dust control and air monitoring	1	ea	$2,000	$2,000	Estimated allowance
Furnish clean fill (including for test pits)	1,220	CY	$41.90	$51,118	See Backfill tab
Furnish topsoil/gravel	230	CY	$34	$7,820	
Seeding	10,056	SF	$2	$20,112	
				$171,050	
Source Area Removal and ZVI Blending					
Bench test	1	ea	$5,000	$5,000	
Mobilization	1	LS	$10,000	$10,000	
Excavation	5,542	CY	$12	$66,500	Excavate top 15', assume half listed waste/half non-haz
Install temporary shoring	11,130	SF	$30	$333,900	
Dust control and air monitoring	20	wk	$2,000	$40,000	Estimated allowance
ZVI, purchase and deliver	842	ton	$1,200	$1,010,800	5% dose 7.5-15' bgs, 10% 15-30' bgs
Sand backfill, purchase and deliver	6,650	CY	$25	$166,250	Includes 20% compaction factor
Blend ZVI and sand	3,325	CY	$6	$19,950	7.5-15' bgs
In-situ soil/ZVI blending	6,650	CY	$6	$39,900	15-30' bgs
Install ZVI/sand blend and clean sand	6,650	CY	$6	$39,900	Clean sand 0-7.5' bgs, sand/ZVI blend 7.5-15' bgs
Furnish and install topsoil	222	CY	$34	$7,537	
Seeding	9,975	SF	$2	$19,950	
				$1,759,687	
Mid-Plume In-Situ Treatment Line					
Drill 10 inch columns to 40 ft, install ZVI/sand	200	ea	$1,906	$381,250	Quote for project from Glacier Drilling
Purchase and install PVC screen and riser	200	ea	$500	$100,000	
Sand, delivered	133	CY	$50	$6,666	
ZVI, delivered	21	ton	$1,200	$25,598	10% blend based on tonnage of sand
Blend ZVI/sand	133	CY	$6	$800	
Furnish clean fill	28	CY	$41.90	$1,185	
Seeding	109	SF	$2	$218	
				$515,717	
Soil Disposal and GW Management					
Dewatering	1	LS	$42,500	$42,500	*See Dewatering Backup Sheet*
Erosion control measures	500	LF	$4	$2,000	
Waste characterization of concrete slab	4	ea	$1,000	$4,000	
Waste characterization of soil stockpiles	32	ea	$1,000	$32,000	
T&D RCRA hazardous soil	4,723	ton	$250	$1,180,654	Assume 50% hazardous waste in mid-plume line
T&D non-haz soil	4,563	ton	$80	$365,009	
Police detail	140	hr	$120	$16,800	
				$1,642,964	
Groundwater Pump and Treat System					
Site Preparation and Management					
Obtain land and easements	1	LS	$0	$0	Access agreements (assumed to be handled by EPA)
Building permits and fees	1	LS	$10,000	$10,000	
				$10,000	
Pre-Remedial Study					
Pump Test	1	LS	$50,000	$50,000	One 24 hr test, includes water treatment and disposal
				$50,000	

Alternative **GW/SW-2b**

Source Area Removal with In-Situ Soil Treatment and Groundwater Pump and Treat plus Mid-Plume Treatment

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, installation and operation of a groundwater pump and treat system, and a mid-plume in-situ treatment line.
-30% cost sensitivity

Construct Pump and Treat System						
Treatment plant building construction		1	LS	$100,000	$100,000	
Erosion control measures		300	LF	$4	$1,200	
Drill extraction wells		3	ea	$5,000	$15,000	
Install well vaults		3	ea	$2,500	$7,500	
Influent and effluent tanks		2	ea	$10,000	$20,000	Assume 5000 gallon capacity each
Above ground piping		1	LS	$15,000	$15,000	
Pump, electrical, controls per well		3	ea	$5,000	$15,000	18 gpm each, total 54 gpm
Transfer lines to TP and discharge point		1600	ft	$20	$32,000	
Install above ground pumps		3	ea	$1,500	$4,500	
Install and test electrical services		1	LS	$30,000	$30,000	
Ion exchange vessels with 1st change		2	ea	$10,200	$20,400	
Bag filter housings		2	ea	$1,300	$2,600	
Deliver equipment, place and fill on site		1	LS	$1,600	$1,600	
Treatment plant controls		1	ea	$25,000	$25,000	
Prove out		1	ea	$10,000	$10,000	
					$299,800	
SUBTOTAL					$4,452,968	
Contingency:	30%				$1,335,890	
SUBTOTAL [Remedy Implementation]					$5,788,858	
Project Management	5%				$289,443	
Remedial Design	8%				$463,109	
Construction Management	6%				$347,332	
Institutional Controls						
Groundwater Ordinance		1	LS	$15,000	$15,000	Support to town to put ordinance in place
Activity and Use Limitations		1	LS	$127,165	$127,165	
					$1,242,048	
TOTAL CAPITAL COST					$7,030,907	

Alternative **GW/SW-2b**

Source Area Removal with In-Situ Soil Treatment and Groundwater Pump and Treat plus Mid-Plume Treatment

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, installation and operation of a groundwater pump and treat system, and a mid-plume in-situ treatment line.
-30% cost sensitivity

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Five year review (every 5 years until Year 30)	6	ea	$10,000	$60,000	
Update Institutional Controls Plan (Year 5)	1	ea	$4,000	$4,000	
Remedial Action Report (Year 5)	1	ea	$10,000	$10,000	
Indoor air sampling of homes with SSDS (Year 5)	1	ea	$23,400	$23,400	
Inspections of homes (every 5 years until Year 30)	6	ea	$1,000	$6,000	Inspect for change in condition of two additional homes
				$103,400	

O&M

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Treatment System Operations and Maintenance					
Treatment system operations	1	year	$25,000	$25,000	Review remote monitoring, weekly inspections, maintenance, troubleshooting, and repairs
Change out ion exchange vessels	4	ea	$7,200	$28,800	
Bag filters and other minor supplies	1	year	$5,000	$5,000	
Electricity (heat and power)	12	month	$200	$2,400	
Sampling wells, stream, and discharge point	12	month	$1,500	$18,000	Includes labor and lab analysis
Reporting	4	qtr	$2,500	$10,000	
Equipment replacements	1	year	$2,000	$2,000	Assume $10,000 repair every 5 years
				$91,200	
Groundwater and Surface Water Monitoring					
Annual groundwater monitoring	1	LS	$60,000	$60,000	Annual groundwater sampling program
Annual surface water monitoring	1	LS	$30,000	$30,000	Annual surface water sampling program
				$90,000	
Annual inspections					
Sub-slab depressurization systems inspection	1	LS	$1,500	$1,500	Annual inspection of 3 homes with SSDS
Inspection and maintenance of remedy	1	LS	$12,000	$12,000	Inspection of PRB wall, engineered cover, and capped lagoon
				$13,500	
SUBTOTAL				$194,700	
Contingency: 30%				$58,410	
SUBTOTAL [Remedy Implementation]				$253,110	
Technical Support 30%				$75,933	Increased technical support percentage
Project Management 5%				$12,656	to include data review and reporting
TOTAL O&M COST				$341,699	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor	Present Value	Notes
Capital Cost	0	$7,030,907	$7,030,907	1.00	$7,030,907	
O&M Cost	1 to 30	$10,250,955	$341,699	0.7%	$9,217,196	
Periodic Cost	5	$48,400	$48,400	0.7%	$46,741	
	10	$11,000	$11,000	0.7%	$10,259	
	15	$11,000	$11,000	0.7%	$9,907	
	20	$11,000	$11,000	0.7%	$9,568	
	25	$11,000	$11,000	0.7%	$9,240	
	30	$11,000	$11,000	0.7%	$8,923	
Total Present Value of Alternative					**$16,342,740**	

Alternative **GW/SW-2b**

Source Area Removal with In-Situ Soil Treatment and Groundwater Pump and Treat plus Mid-Plume Treatment

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, installation and operation of a groundwater pump and treat system, and a mid-plume in-situ treatment line.
+50% cost sensitivity

CAPITAL COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Pre-Design Investigation Sampling					
Preparation of QAPP and HASP	100	HR	$120	$12,000	
Test pitting	5	day	$2,000	$10,000	Assume 100 CY excavated, assume RCRA hazardous
Drill rig and operator	8	day	$2,000	$16,000	$1,500 drill rig plus $500 for hole saw to drill through building slab
Labor to collect, record, and ship samples	42	pds	$1,440	$60,480	Three person field team for TP and drilling
Fixed lab sample analyses					Delineation of impact samples
Hexavalent chromium	50	ea	$70	$3,500	
Full Waste Characterization Analyses	10	ea	$1,000	$10,000	Subset of delineation samples to refine estimates for off-site disposal
Field equipment	1	ea	$12,500	$12,500	Allowance
Data evaluation	50	HR	$75	$3,750	
				$128,230	
Excavate and Backfill Building Slab					
Excavate concrete slab	1	LS	$90,000	$90,000	Excavation and disposal of slab (quote from Costello)
Dust control and air monitoring	1	ea	$2,000	$2,000	Estimated allowance
Furnish clean fill (including for test pits)	1,220	CY	$41.90	$51,118	See Backfill tab
Furnish topsoil/gravel	230	CY	$34	$7,820	
Seeding	10,056	SF	$2	$20,112	
				$171,050	
Source Area Removal and ZVI Blending					
Bench test	1	ea	$5,000	$5,000	
Mobilization	1	LS	$10,000	$10,000	
Excavation	11,875	CY	$12	$142,500	Excavate top 15', assume half listed waste/half non-haz
Install temporary shoring	23,850	SF	$30	$715,500	
Dust control and air monitoring	20	wk	$2,000	$40,000	Estimated allowance
ZVI, purchase and deliver	3,325	ton	$1,200	$3,990,000	5% dose 7.5-15' bgs, 15% 15-30' bgs
Sand backfill, purchase and deliver	14,250	CY	$25	$356,250	Includes 20% compaction factor
Blend ZVI and sand	7,125	CY	$6	$42,750	7.5-15' bgs
In-situ soil/ZVI blending	14,250	CY	$6	$85,500	15-30' bgs
Install ZVI/sand blend and clean sand	14,250	CY	$6	$85,500	Clean sand 0-7.5' bgs, sand/ZVI blend 7.5-15' bgs
Furnish and install topsoil	475	CY	$34	$16,150	
Seeding	21,375	SF	$2	$42,750	
				$5,531,900	
Mid-Plume In-Situ Treatment Line					
Drill 10 inch columns to 40 ft, install ZVI/sand	200	ea	$1,906	$381,250	Quote for project from Glacier Drilling
Purchase and install PVC screen and riser	200	ea	$500	$100,000	
Sand, delivered	133	CY	$50	$6,666	
ZVI, delivered	32	ton	$1,200	$38,397	15% blend based on tonnage of sand
Blend ZVI/sand	133	CY	$6	$800	
Furnish clean fill	28	CY	$41.90	$1,185	
Seeding	109	SF	$2	$218	
				$528,517	
Soil Disposal and GW Management					
Dewatering	1	LS	$57,500	$57,500	*See Dewatering Backup Sheet*
Erosion control measures	500	LF	$4	$2,000	
Waste characterization of concrete slab	4	ea	$1,000	$4,000	
Waste characterization of soil stockpiles	32	ea	$1,000	$32,000	
T&D RCRA hazardous soil	9,789	ton	$250	$2,447,321	Assume 50% hazardous waste in mid-plume line
T&D non-haz soil	9,629	ton	$80	$770,343	
Police detail	265	hr	$120	$31,800	
				$3,344,964	
Groundwater Pump and Treat System					
Site Preparation and Management					
Obtain land and easements	1	LS	$0	$0	Access agreements (assumed to be handled by EPA)
Building permits and fees	1	LS	$10,000	$10,000	
				$10,000	
Pre-Remedial Study					
Pump Test	1	LS	$50,000	$50,000	One 24 hr test, includes water treatment and disposal
				$50,000	

Alternative **GW/SW-2b**

Source Area Removal with In-Situ Soil Treatment and Groundwater Pump and Treat plus Mid-Plume Treatment

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, installation and operation of a groundwater pump and treat system, and a mid-plume in-situ treatment line.
+50% cost sensitivity

Construct Pump and Treat System						
Treatment plant building construction		1	LS	$100,000	$100,000	
Erosion control measures		300	LF	$4	$1,200	
Drill extraction wells		3	ea	$5,000	$15,000	
Install well vaults		3	ea	$2,500	$7,500	
Influent and effluent tanks		2	ea	$10,000	$20,000	Assume 5000 gallon capacity each
Above ground piping		1	LS	$15,000	$15,000	
Pump, electrical, controls per well		3	ea	$5,000	$15,000	18 gpm each, total 54 gpm
Transfer lines to TP and discharge point		1600	ft	$20	$32,000	
Install above ground pumps		3	ea	$1,500	$4,500	
Install and test electrical services		1	LS	$30,000	$30,000	
Ion exchange vessels with 1st change		2	ea	$10,200	$20,400	
Bag filter housings		2	ea	$1,300	$2,600	
Deliver equipment, place and fill on site		1	LS	$1,600	$1,600	
Treatment plant controls		1	ea	$25,000	$25,000	
Prove out		1	ea	$10,000	$10,000	
					$299,800	
SUBTOTAL					$9,939,980	
Contingency:	30%				$2,981,994	
SUBTOTAL [Remedy Implementation]					$12,921,975	
Project Management	5%				$646,099	
Remedial Design	8%				$1,033,758	
Construction Management	6%				$775,318	
Institutional Controls						
Groundwater Ordinance		1	LS	$15,000	$15,000	Support to town to put ordinance in place
Activity and Use Limitations		1	LS	$127,165	$127,165	
					$2,597,340	
TOTAL CAPITAL COST					$15,519,315	

Alternative **GW/SW-2b**

Source Area Removal with In-Situ Soil Treatment and Groundwater Pump and Treat plus Mid-Plume Treatment

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, installation and operation of a groundwater pump and treat system, and a mid-plume in-situ treatment line.
+50% cost sensitivity

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Five year review (every 5 years until Year 30)	6	ea	$10,000	$60,000	
Update Institutional Controls Plan (Year 5)	1	ea	$4,000	$4,000	
Remedial Action Report (Year 5)	1	ea	$10,000	$10,000	
Indoor air sampling of homes with SSDS (Year 5)	1	ea	$23,400	$23,400	
Inspections of homes (every 5 years until Year 30)	6	ea	$1,000	$6,000	Inspect for change in condition of two additional homes
				$103,400	

O&M

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Treatment System Operations and Maintenance					
Treatment system operations	1	year	$25,000	$25,000	Review remote monitoring, weekly inspections, maintenance, troubleshooting, and repairs
Change out ion exchange vessels	4	ea	$7,200	$28,800	
Bag filters and other minor supplies	1	year	$5,000	$5,000	
Electricity (heat and power)	12	month	$200	$2,400	
Sampling wells, stream, and discharge point	12	month	$1,500	$18,000	Includes labor and lab analysis
Reporting	4	qtr	$2,500	$10,000	
Equipment replacements	1	year	$2,000	$2,000	Assume $10,000 repair every 5 years
				$91,200	
Groundwater and Surface Water Monitoring					
Annual groundwater monitoring	1	LS	$60,000	$60,000	Annual groundwater sampling program
Annual surface water monitoring	1	LS	$30,000	$30,000	Annual surface water sampling program
				$90,000	
Annual inspections					
Sub-slab depressurization systems inspection	1	LS	$1,500	$1,500	Annual inspection of 3 homes with SSDS
Inspection and maintenance of remedy	1	LS	$12,000	$12,000	Inspection of PRB wall, engineered cover, and capped lagoon
				$13,500	
SUBTOTAL				$194,700	
Contingency: 30%				$58,410	
SUBTOTAL [Remedy Implementation]				$253,110	
Technical Support 30%				$75,933	Increased technical support percentage
Project Management 5%				$12,656	to include data review and reporting
TOTAL O&M COST				$341,699	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor	Present Value	Notes
Capital Cost	0	$15,519,315	$15,519,315	1.00	$15,519,315	
O&M Cost	1 to 30	$10,250,955	$341,699	0.7%	$9,217,196	
Periodic Cost	5	$48,400	$48,400	0.7%	$46,741	
	10	$11,000	$11,000	0.7%	$10,259	
	15	$11,000	$11,000	0.7%	$9,907	
	20	$11,000	$11,000	0.7%	$9,568	
	25	$11,000	$11,000	0.7%	$9,240	
	30	$11,000	$11,000	0.7%	$8,923	
Total Present Value of Alternative					**$24,831,148**	

Alternative **GW/SW-3a**

Source Area Soil Removal with In-Situ Treatment and Extension of Permeable Reactive Barrier

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, and installation of a permeable reactive barrier along Bliss Brook.
-30% cost sensitivity

CAPITAL COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Pre-Design Investigation Sampling					
Preparation of QAPP and HASP	100	HR	$120	$12,000	
Test pitting	5	day	$2,000	$10,000	Assume 100 CY excavated, assume RCRA hazardous
Drill rig and operator	8	day	$2,000	$16,000	$1,500 drill rig plus $500 for hole saw to drill through building slab
Labor to collect, record, and ship samples	42	pds	$1,440	$60,480	Three person field team for TP and drilling
Fixed lab sample analyses					Delineation of impact samples
Hexavalent chromium	50	ea	$70	$3,500	
Full Waste Characterization Analyses	10	ea	$1,000	$10,000	Subset of delineation samples to refine estimates for off-site disposal
Field equipment	1	ea	$12,500	$12,500	Allowance
Data evaluation	50	HR	$75	$3,750	
				$128,230	
Excavate and Backfill Building Slab					
Excavate concrete slab	1	LS	$90,000	$90,000	
Dust control and air monitoring	1	ea	$2,000	$2,000	Estimated allowance
Furnish clean fill (including for test pits)	1,220	CY	$42	$51,118	*See Backfill tab*
Furnish topsoil/gravel	230	CY	$34	$7,820	
Seeding	10,056	SF	$2	$20,112	
				$171,050	
Source Area Removal and ZVI Blending					
Bench test	1	ea	$5,000	$5,000	
Mobilization	1	LS	$10,000	$10,000	
Excavation	5,542	CY	$12	$66,500	Excavate top 15', assume half listed waste/half non-haz
Install temporary shoring	11,130	SF	$30	$333,900	
Dust control and air monitoring	20	wk	$2,000	$40,000	Estimated allowance
ZVI, purchase and deliver	842	ton	$1,200	$1,010,800	5% dose 7.5-15' bgs, 7% 15-30' bgs
Sand backfill, purchase and deliver	6,650	CY	$25	$166,250	Includes 20% compaction factor
Blend ZVI and sand	3,325	CY	$6	$19,950	7.5-15' bgs
In-situ soil/ZVI blending	6,650	CY	$6	$39,900	15-30' bgs
Install ZVI/sand blend and clean sand	6,650	CY	$6	$39,900	Clean sand 0-7.5' bgs, sand/ZVI blend 7.5-15' bgs
Furnish and install topsoil	222	CY	$34	$7,537	
Seeding	9,975	SF	$2	$19,950	
				$1,759,687	
Soil Disposal and GW Management					
Dewatering	1	LS	$42,500	$42,500	*See Dewatering Backup Sheet*
Erosion control measures	250	LF	$4	$1,000	
Waste characterization of concrete slab	4	ea	$1,000	$4,000	
Waste characterization of soil stockpiles	25	ea	$1,000	$25,000	
T&D RCRA hazardous soil	4,593	ton	$250	$1,148,333	
T&D non-haz soil	4,433	ton	$80	$354,667	
Police detail	135	hr	$120	$16,200	
				$1,591,700	

Alternative **GW/SW-3a**

Source Area Soil Removal with In-Situ Treatment and Extension of Permeable Reactive Barrier

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, and installation of a permeable reactive barrier along Bliss Brook.
-30% cost sensitivity

Permeable Reactive Barrier near Bliss Brook						
Site Preparation and Management						
Obtain land and easements		1	LS	$0	$0	Access agreements (assumed to be handled by EPA)
Building permits and fees		1	LS	$10,000	$10,000	
					$10,000	
Pre-Remedial Study						
Bench test		1	ea	$5,000	$5,000	Confirm dose and contact time of ZVI type
Predesign study		1	ea	$15,000	$15,000	Confirm length of wall based on groundwater impacts and groundwater concentrations reaching stream
Additional flow modeling		1	LS	$5,000	$5,000	
					$25,000	
Construct PRB Wall						
Mobilization		1	LS	$25,000	$25,000	Includes site prep and erosion controls
Divert stream around work area		1	LS	$50,000	$50,000	
Excavate soil		4,400	CY	$25	$110,000	
Purchase and deliver sand backfill		3,900	CY	$50	$195,000	
Geotextile, installed		8,000	SF	$4	$32,000	
Purchase and deliver river run gravel		500	CY	$30	$15,000	
Purchase and deliver ZVI		354	ton	$1,200	$424,911	*See ZVI dose calculation sheet,* 9% dose
Blend ZVI and sand		3,900	CY	$6	$23,400	
Install ZVI and sand blend		3,900	CY	$6	$23,400	
Install stream bed gravel		500	CY	$10	$5,000	
Stream bank restoration and plantings		800	LF	$5	$4,000	
Demobilize		1	LS	$10,000	$10,000	
					$917,711	
Soil Disposal and GW Management						
Dewatering		1	LS	$42,500	$42,500	Additional operational cost for preexisting dewatering system *(see dewatering backup sheet)*
Waste characterization of soil stockpiles		21	ea	$1,000	$21,000	
T&D RCRA hazardous soil		0	ton	$250	$0	
T&D non-haz soil		7,040	ton	$80	$563,200	
Police detail		166	hr	$120	$19,920	
					$646,620	
SUBTOTAL					$5,249,998	
Contingency:	30%				$1,574,999	
SUBTOTAL [Remedy Implementation]					$6,824,997	
Project Management	5%				$341,250	
Remedial Design	8%				$546,000	
Construction Management	6%				$409,500	
Institutional Controls						
Groundwater Ordinance		1	LS	$15,000	$15,000	Support to town to put ordinance in place
Activity and Use Limitations		1	LS	$114,950	$114,950	
					$1,426,700	
TOTAL CAPITAL COST					$8,251,697	

Alternative **GW/SW-3a**

Source Area Soil Removal with In-Situ Treatment and Extension of Permeable Reactive Barrier

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, and installation of a permeable reactive barrier along Bliss Brook.
-30% cost sensitivity

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Five year review (every 5 years until Year 30)	6	ea	$10,000	$60,000	
Update Institutional Controls Plan (Year 5)	1	ea	$4,000	$4,000	
Remedial Action Report (Year 5)	1	ea	$10,000	$10,000	
Indoor air sampling of homes with SSDS (Year 5)	1	ea	$23,400	$23,400	
Inspections of homes (every 5 years until Year 30)	6	ea	$1,000	$6,000	Inspect for change in condition of two additional homes
				$103,400	

O&M

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Groundwater and Surface Water Monitoring					
Annual groundwater monitoring	1	LS	$60,000	$60,000	Annual groundwater sampling program
Annual surface water monitoring	1	LS	$30,000	$30,000	Annual surface water sampling program
				$90,000	
Annual inspections					
Sub-slab depressurization systems inspection	1	LS	$1,500	$1,500	Annual inspection of 3 homes with SSDS
Inspection and maintenance of remedy	1	LS	$12,000	$12,000	Inspection of PRB wall, engineered cover, and capped lagoon
				$13,500	
SUBTOTAL				$103,500	
Contingency:	30%			$31,050	
SUBTOTAL [Remedy Implementation]				$134,550	
Technical Support	15%			$20,183	
Project Management	5%			$6,728	
TOTAL O&M COST				$161,460	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor	Present Value	Notes
Capital Cost	0	$8,251,697	$8,251,697	1.00	$8,251,697	
O&M Cost	1 to 30	$4,843,800	$161,460	0.7%	$4,355,326	
Periodic Cost	5	$48,400	$48,400	0.7%	$46,741	
	10	$11,000	$11,000	0.7%	$10,259	
	15	$11,000	$11,000	0.7%	$9,907	
	20	$11,000	$11,000	0.7%	$9,568	
	25	$11,000	$11,000	0.7%	$9,240	
	30	$11,000	$11,000	0.7%	$8,923	
Total Present Value of Alternative					**$12,701,660**	

Alternative **GW/SW-3a**

Source Area Soil Removal with In-Situ Treatment and Extension of Permeable Reactive Barrier

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, and installation of a permeable reactive barrier along Bliss Brook.
+50% cost sensitivity

CAPITAL COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Pre-Design Investigation Sampling					
Preparation of QAPP and HASP	100	HR	$120	$12,000	
Test pitting	5	day	$2,000	$10,000	Assume 100 CY excavated, assume RCRA hazardous
Drill rig and operator	8	day	$2,000	$16,000	$1,500 drill rig plus $500 for hole saw to drill through building slab
Labor to collect, record, and ship samples	42	pds	$1,440	$60,480	Three person field team for TP and drilling
Fixed lab sample analyses					Delineation of impact samples
Hexavalent chromium	50	ea	$70	$3,500	
Full Waste Characterization Analyses	10	ea	$1,000	$10,000	Subset of delineation samples to refine estimates for off-site disposal
Field equipment	1	ea	$12,500	$12,500	Allowance
Data evaluation	50	HR	$75	$3,750	
				$128,230	
Excavate and Backfill Building Slab					
Excavate concrete slab	1	LS	$90,000	$90,000	
Dust control and air monitoring	1	ea	$2,000	$2,000	Estimated allowance
Furnish clean fill (including for test pits)	1,220	CY	$42	$51,118	*See Backfill tab*
Furnish topsoil/gravel	230	CY	$34	$7,820	
Seeding	10,056	SF	$2	$20,112	
				$171,050	
Source Area Removal and ZVI Blending					
Bench test	1	ea	$5,000	$5,000	
Mobilization	1	LS	$10,000	$10,000	
Excavation	11,875	CY	$12	$142,500	Excavate top 15', assume half listed waste/half non-haz
Install temporary shoring	23,850	SF	$30	$715,500	
Dust control and air monitoring	20	wk	$2,000	$40,000	Estimated allowance
ZVI, purchase and deliver	3,325	ton	$1,200	$3,990,000	5% dose 7.5-15' bgs, 15% 15-30' bgs
Sand backfill, purchase and deliver	14,250	CY	$25	$356,250	Includes 20% compaction factor
Blend ZVI and sand	7,125	CY	$6	$42,750	7.5-15' bgs
In-situ soil/ZVI blending	14,250	CY	$6	$85,500	15-30' bgs
Install ZVI/sand blend and clean sand	14,250	CY	$6	$85,500	Clean sand 0-7.5' bgs, sand/ZVI blend 7.5-15' bgs
Furnish and install topsoil	475	CY	$34	$16,150	
Seeding	21,375	SF	$2	$42,750	
				$5,531,900	
Soil Disposal and GW Management					
Dewatering	1	LS	$57,500	$57,500	*See Dewatering Backup Sheet*
Erosion control measures	250	LF	$4	$1,000	
Waste characterization of concrete slab	4	ea	$1,000	$4,000	
Waste characterization of soil stockpiles	45	ea	$1,000	$45,000	
T&D RCRA hazardous soil	9,660	ton	$250	$2,415,000	
T&D non-haz soil	9,500	ton	$80	$760,000	
Police detail	265	hr	$120	$31,800	
				$3,314,300	

Alternative **GW/SW-3a**

Source Area Soil Removal with In-Situ Treatment and Extension of Permeable Reactive Barrier

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, and installation of a permeable reactive barrier along Bliss Brook.
+50% cost sensitivity

Permeable Reactive Barrier near Bliss Brook						
Site Preparation and Management						
Obtain land and easements		1	LS	$0	$0	Access agreements (assumed to be handled by EPA)
Building permits and fees		1	LS	$10,000	$10,000	
					$10,000	
Pre-Remedial Study						
Bench test		1	ea	$5,000	$5,000	Confirm dose and contact time of ZVI type
Predesign study		1	ea	$15,000	$15,000	Confirm length of wall based on groundwater impacts and groundwater concentrations reaching stream
Additional flow modeling		1	LS	$5,000	$5,000	
					$25,000	
Construct PRB Wall						
Mobilization		1	LS	$25,000	$25,000	Includes site prep and erosion controls
Divert stream around work area		1	LS	$50,000	$50,000	
Excavate soil		4,400	CY	$25	$110,000	
Purchase and deliver sand backfill		3,900	CY	$50	$195,000	
Geotextile, installed		8,000	SF	$4	$32,000	
Purchase and deliver river run gravel		500	CY	$30	$15,000	
Purchase and deliver ZVI		354	ton	$1,200	$424,911	*See ZVI dose calculation sheet,* 9% dose
Blend ZVI and sand		3,900	CY	$6	$23,400	
Install ZVI and sand blend		3,900	CY	$6	$23,400	
Install stream bed gravel		500	CY	$10	$5,000	
Stream bank restoration and plantings		800	LF	$5	$4,000	
Demobilize		1	LS	$10,000	$10,000	
					$917,711	
Soil Disposal and GW Management						
Dewatering		1	LS	$42,500	$42,500	Additional operational cost for preexisting dewatering system *(see dewatering backup sheet)*
Waste characterization of soil stockpiles		21	ea	$1,000	$21,000	
T&D RCRA hazardous soil		0	ton	$250	$0	
T&D non-haz soil		7,040	ton	$80	$563,200	
Police detail		166	hr	$120	$19,920	
					$646,620	
SUBTOTAL					$10,744,811	
Contingency:	30%				$3,223,443	
SUBTOTAL [Remedy Implementation]					$13,968,254	
Project Management	5%				$698,413	
Remedial Design	8%				$1,117,460	
Construction Management	6%				$838,095	
Institutional Controls						
Groundwater Ordinance		1	LS	$15,000	$15,000	Support to town to put ordinance in place
Activity and Use Limitations		1	LS	$114,950	$114,950	
					$2,783,919	
TOTAL CAPITAL COST					$16,752,173	

Alternative **GW/SW-3a**

Source Area Soil Removal with In-Situ Treatment and Extension of Permeable Reactive Barrier

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, and installation of a permeable reactive barrier along Bliss Brook.
+50% cost sensitivity

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Five year review (every 5 years until Year 30)	6	ea	$10,000	$60,000	
Update Institutional Controls Plan (Year 5)	1	ea	$4,000	$4,000	
Remedial Action Report (Year 5)	1	ea	$10,000	$10,000	
Indoor air sampling of homes with SSDS (Year 5)	1	ea	$23,400	$23,400	
Inspections of homes (every 5 years until Year 30)	6	ea	$1,000	$6,000	Inspect for change in condition of two additional homes
				$103,400	

O&M

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Groundwater and Surface Water Monitoring					
Annual groundwater monitoring	1	LS	$60,000	$60,000	Annual groundwater sampling program
Annual surface water monitoring	1	LS	$30,000	$30,000	Annual surface water sampling program
				$90,000	
Annual inspections					
Sub-slab depressurization systems inspection	1	LS	$1,500	$1,500	Annual inspection of 3 homes with SSDS
Inspection and maintenance of remedy	1	LS	$12,000	$12,000	Inspection of PRB wall, engineered cover, and capped lagoon
				$13,500	
SUBTOTAL				$103,500	
Contingency:	30%			$31,050	
SUBTOTAL [Remedy Implementation]				$134,550	
Technical Support	15%			$20,183	
Project Management	5%			$6,728	
TOTAL O&M COST				$161,460	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor	Present Value	Notes
Capital Cost	0	$16,752,173	$16,752,173	1.00	$16,752,173	
O&M Cost	1 to 30	$4,843,800	$161,460	0.7%	$4,355,326	
Periodic Cost	5	$48,400	$48,400	0.7%	$46,741	
	10	$11,000	$11,000	0.7%	$10,259	
	15	$11,000	$11,000	0.7%	$9,907	
	20	$11,000	$11,000	0.7%	$9,568	
	25	$11,000	$11,000	0.7%	$9,240	
	30	$11,000	$11,000	0.7%	$8,923	
Total Present Value of Alternative					**$21,202,137**	

Alternative **GW/SW-3b**

Source Area Soil Removal with In-Situ Treatment, Extension of Permeable Reactive Barrier, and Mid-Plume Treatment

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, installation of a permeable reactive barrier along Bliss Brook, and a mid-plume in-situ treatment line.
-30% cost sensitivity

CAPITAL COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Pre-Design Investigation Sampling					
Preparation of QAPP and HASP	100	HR	$120	$12,000	
Test pitting	5	day	$2,000	$10,000	Assume 100 CY excavated, assume RCRA hazardous
Drill rig and operator	8	day	$2,000	$16,000	$1,500 drill rig plus $500 for hole saw to drill through building slab
Labor to collect, record, and ship samples	42	pds	$1,440	$60,480	Three person field team for TP and drilling
Fixed lab sample analyses					Delineation of impact samples
Hexavalent chromium	50	ea	$70	$3,500	
Full Waste Characterization Analyses	10	ea	$1,000	$10,000	Subset of delineation samples to refine estimates for off-site disposal
Field equipment	1	ea	$12,500	$12,500	Allowance
Data evaluation	50	HR	$75	$3,750	
				$128,230	
Excavate and Backfill Building Slab					
Excavate concrete slab	1	LS	$90,000	$90,000	Excavation and disposal of slab (quote from Costello)
Dust control and air monitoring	1	ea	$2,000	$2,000	Estimated allowance
Furnish clean fill (including for test pits)	1,220	CY	$41.90	$51,118	*See Backfill tab*
Furnish topsoil/gravel	230	CY	$34	$7,820	
Seeding	10,056	SF	$2	$20,112	
				$171,050	
Source Area Removal and ZVI Blending					
Bench test	1	ea	$5,000	$5,000	
Mobilization	1	LS	$10,000	$10,000	
Excavation	5,542	CY	$12	$66,500	Excavate top 15', assume half listed waste/half non-haz
Install temporary shoring	11,130	SF	$30	$333,900	
Dust control and air monitoring	20	wk	$2,000	$40,000	Estimated allowance
ZVI, purchase and deliver	842	ton	$1,200	$1,010,800	5% dose 7.5-15' bgs, 7% 15-30' bgs
Sand backfill, purchase and deliver	6,650	CY	$25	$166,250	Includes 20% compaction factor
Blend ZVI and sand	3,325	CY	$6	$19,950	7.5-15' bgs
In-situ soil/ZVI blending	6,650	CY	$6	$39,900	15-30' bgs
Install ZVI/sand blend and clean sand	6,650	CY	$6	$39,900	Clean sand 0-7.5' bgs, sand/ZVI blend 7.5-15' bgs
Furnish and install topsoil	222	CY	$34	$7,537	
Seeding	9,975	SF	$2	$19,950	
				$1,759,687	
Mid-Plume In-Situ Treatment Line					
Drill 10 inch columns to 40 ft, install ZVI/sand	200	ea	$1,906	$381,250	Quote for project from Glacier Drilling
Purchase and install PVC screen and riser	200	ea	$500	$100,000	
Sand, delivered	133	CY	$50	$6,666	
ZVI, delivered	21	ton	$1,200	$25,598	10% blend based on tonnage of sand
Blend ZVI/sand	133	CY	$6	$800	
Furnish clean fill	28	CY	$42	$1,185	
Seeding	109	SF	$2	$218	
				$515,717	
Soil Disposal and GW Management					
Dewatering	1	LS	$42,500	$42,500	*See Dewatering Backup Sheet*
Erosion control measures	500	LF	4	$2,000	
Waste characterization of concrete slab	4	ea	$1,000	$4,000	
Waste characterization of soil stockpiles	32	ea	$1,000	$32,000	
T&D RCRA hazardous soil	4,723	ton	$250	$1,180,654	
T&D non-haz soil	4,563	ton	$80	$365,009	Assume 50% listed waste in mid-plume line
Police detail	140	hr	$120	$16,800	
				$1,642,964	
Permeable Reactive Barrier near Bliss Brook					
Site Preparation and Management					
Obtain land and easements	1	LS	$0	$0	Access agreements (assumed to be handled by EPA)
Building permits and fees	1	LS	$10,000	$10,000	
				$10,000	
Pre-Remedial Study					
Bench test	1	ea	$5,000	$5,000	Confirm dose and contact time of ZVI type
Predesign study	1	ea	$15,000	$15,000	Confirm length of wall based on groundwater impacts and groundwater concentrations reaching stream
Additional flow modeling	1	LS	$5,000	$5,000	

Alternative **GW/SW-3b**

Source Area Soil Removal with In-Situ Treatment, Extension of Permeable Reactive Barrier, and Mid-Plume Treatment

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, installation of a permeable reactive barrier along Bliss Brook, and a mid-plume in-situ treatment line.
-30% cost sensitivity

					$25,000	
Construct PRB Wall						
Mobilization		1	LS	$25,000	$25,000	Includes site prep and erosion controls
Divert stream around work area		1	LS	$50,000	$50,000	
Excavate soil		4,400	CY	$25	$110,000	
Purchase and deliver sand backfill		3,900	CY	$50	$195,000	
Geotextile, installed		8,000	SF	$4	$32,000	
Purchase and deliver river run gravel		500	CY	$30	$15,000	
Purchase and deliver ZVI		354	ton	$1,200	$424,911	*See ZVI dose calculation sheet,* 9% dose
Blend ZVI and sand		3,900	CY	$6	$23,400	
Install ZVI and sand blend		3,900	CY	$6	$23,400	
Install stream bed gravel		500	CY	$10	$5,000	
Stream bank restoration and plantings		800	LF	$5	$4,000	
Demobilize		1	LS	$10,000	$10,000	
					$917,711	
Soil Disposal and GW Management						
Dewatering		1	LS	$42,500	$42,500	Additional operational cost for preexisting dewatering system *(see dewatering backup sheet)*
Waste characterization of soil stockpiles		21	ea	$1,000	$21,000	
T&D RCRA hazardous soil		0	ton	$250	$0	
T&D non-haz soil		7,040	ton	$80	$563,200	
Police detail		166	hr	$120	$19,920	
					$646,620	
SUBTOTAL					$5,816,979	
Contingency:	30%				$1,745,094	
SUBTOTAL [Remedy Implementation]					$7,562,072	
Project Management	5%				$378,104	
Remedial Design	8%				$604,966	
Construction Management	6%				$453,724	
Institutional Controls						
Groundwater Ordinance		1	LS	$15,000	$15,000	Support to town to put ordinance in place
Activity and Use Limitations		1	LS	$127,165	$127,165	
					$1,578,959	
TOTAL CAPITAL COST					$9,141,031	

Alternative **GW/SW-3b**

Source Area Soil Removal with In-Situ Treatment, Extension of Permeable Reactive Barrier, and Mid-Plume Treatment

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, installation of a permeable reactive barrier along Bliss Brook, and a mid-plume in-situ treatment line.
-30% cost sensitivity

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Five year review (every 5 years until Year 30)	6	ea	$10,000	$60,000	
Update Institutional Controls Plan (Year 5)	1	ea	$4,000	$4,000	
Remedial Action Report (Year 5)	1	ea	$10,000	$10,000	
Indoor air sampling of homes with SSDS (Year 5)	1	ea	$23,400	$23,400	
Inspections of homes (every 5 years until Year 30)	6	ea	$1,000	$6,000	Inspect for change in condition of two additional homes
				$103,400	

O&M

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Groundwater and Surface Water Monitoring					
Annual groundwater monitoring	1	LS	$60,000	$60,000	Annual groundwater sampling program
Annual surface water monitoring	1	LS	$30,000	$30,000	Annual surface water sampling program
				$90,000	
Annual inspections					
Sub-slab depressurization systems inspection	1	LS	$1,500	$1,500	Annual inspection of 3 homes with SSDS
Inspection and maintenance of remedy	1	LS	$12,000	$12,000	Inspection of PRB wall, engineered cover, and capped lagoon
				$13,500	
SUBTOTAL				$103,500	
Contingency:	30%			$31,050	
SUBTOTAL [Remedy Implementation]				$134,550	
Technical Support	15%			$20,183	
Project Management	5%			$6,728	
TOTAL O&M COST				$161,460	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor	Present Value	Notes
Capital Cost	0	9,141,031	$9,141,031	1.00	$9,141,031	
O&M Cost	1 to 30	4,843,800	$161,460	0.7%	$4,355,326	
Periodic Cost	5	48,400	$48,400	0.7%	$46,741	
	10	11,000	$11,000	0.7%	$10,259	
	15	11,000	$11,000	0.7%	$9,907	
	20	11,000	$11,000	0.7%	$9,568	
	25	11,000	$11,000	0.7%	$9,240	
	30	11,000	$11,000	0.7%	$8,923	
Total Present Value of Alternative					**$13,590,995**	

Alternative **GW/SW-3b**

Source Area Soil Removal with In-Situ Treatment, Extension of Permeable Reactive Barrier, and Mid-Plume Treatment

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, installation of a permeable reactive barrier along Bliss Brook, and a mid-plume in-situ treatment line.
+50% cost sensitivity

CAPITAL COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Pre-Design Investigation Sampling					
Preparation of QAPP and HASP	100	HR	$120	$12,000	
Test pitting	5	day	$2,000	$10,000	Assume 100 CY excavated, assume RCRA hazardous
Drill rig and operator	8	day	$2,000	$16,000	$1,500 drill rig plus $500 for hole saw to drill through building slab
Labor to collect, record, and ship samples	42	pds	$1,440	$60,480	Three person field team for TP and drilling
Fixed lab sample analyses					Delineation of impact samples
Hexavalent chromium	50	ea	$70	$3,500	
Full Waste Characterization Analyses	10	ea	$1,000	$10,000	Subset of delineation samples to refine estimates for off-site disposal
Field equipment	1	ea	$12,500	$12,500	Allowance
Data evaluation	50	HR	$75	$3,750	
				$128,230	
Excavate and Backfill Building Slab					
Excavate concrete slab	1	LS	$90,000	$90,000	Excavation and disposal of slab (quote from Costello)
Dust control and air monitoring	1	ea	$2,000	$2,000	Estimated allowance
Furnish clean fill (including for test pits)	1,220	CY	$41.90	$51,118	*See Backfill tab*
Furnish topsoil/gravel	230	CY	$34	$7,820	
Seeding	10,056	SF	$2	$20,112	
				$171,050	
Source Area Removal and ZVI Blending					
Bench test	1	ea	$5,000	$5,000	
Mobilization	1	LS	$10,000	$10,000	
Excavation	11,875	CY	$12	$142,500	Excavate top 15', assume half listed waste/half non-haz
Install temporary shoring	23,850	SF	$30	$715,500	
Dust control and air monitoring	20	wk	$2,000	$40,000	Estimated allowance
ZVI, purchase and deliver	3,325	ton	$1,200	$3,990,000	5% dose 7.5-15' bgs, 15% 15-30' bgs
Sand backfill, purchase and deliver	14,250	CY	$25	$356,250	Includes 20% compaction factor
Blend ZVI and sand	7,125	CY	$6	$42,750	7.5-15' bgs
In-situ soil/ZVI blending	14,250	CY	$6	$85,500	15-30' bgs
Install ZVI/sand blend and clean sand	14,250	CY	$6	$85,500	Clean sand 0-7.5' bgs, sand/ZVI blend 7.5-15' bgs
Furnish and install topsoil	475	CY	$34	$16,150	
Seeding	21,375	SF	$2	$42,750	
				$5,531,900	
Mid-Plume In-Situ Treatment Line					
Drill 10 inch columns to 40 ft, install ZVI/sand	200	ea	$1,906	$381,250	Quote for project from Glacier Drilling
Purchase and install PVC screen and riser	200	ea	$500	$100,000	
Sand, delivered	133	CY	$50	$6,666	
ZVI, delivered	32	ton	$1,200	$38,397	15% blend based on tonnage of sand
Blend ZVI/sand	133	CY	$6	$800	
Furnish clean fill	28	CY	$42	$1,185	
Seeding	109	SF	$2	$218	
				$528,517	
Soil Disposal and GW Management					
Dewatering	1	LS	$57,500	$57,500	*See Dewatering Backup Sheet*
Erosion control measures	500	LF	4	$2,000	
Waste characterization of concrete slab	4	ea	$1,000	$4,000	
Waste characterization of soil stockpiles	32	ea	$1,000	$32,000	
T&D RCRA hazardous soil	9,789	ton	$250	$2,447,321	
T&D non-haz soil	9,629	ton	$80	$770,343	Assume 50% hazardous waste in mid-plume line
Police detail	265	hr	$120	$31,800	
				$3,344,964	
Permeable Reactive Barrier near Bliss Brook					
Site Preparation and Management					
Obtain land and easements	1	LS	$0	$0	Access agreements (assumed to be handled by EPA)
Building permits and fees	1	LS	$10,000	$10,000	
				$10,000	
Pre-Remedial Study					
Bench test	1	ea	$5,000	$5,000	Confirm dose and contact time of ZVI type
Predesign study	1	ea	$15,000	$15,000	Confirm length of wall based on groundwater impacts and groundwater concentrations reaching stream
Additional flow modeling	1	LS	$5,000	$5,000	

Alternative **GW/SW-3b**

Source Area Soil Removal with In-Situ Treatment, Extension of Permeable Reactive Barrier, and Mid-Plume Treatment

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, installation of a permeable reactive barrier along Bliss Brook, and a mid-plume in-situ treatment line.
+50% cost sensitivity

					$25,000	
Construct PRB Wall						
Mobilization		1	LS	$25,000	$25,000	Includes site prep and erosion controls
Divert stream around work area		1	LS	$50,000	$50,000	
Excavate soil		4,400	CY	$25	$110,000	
Purchase and deliver sand backfill		3,900	CY	$50	$195,000	
Geotextile, installed		8,000	SF	$4	$32,000	
Purchase and deliver river run gravel		500	CY	$30	$15,000	
Purchase and deliver ZVI		354	ton	$1,200	$424,911	*See ZVI dose calculation sheet,* 9% dose
Blend ZVI and sand		3,900	CY	$6	$23,400	
Install ZVI and sand blend		3,900	CY	$6	$23,400	
Install stream bed gravel		500	CY	$10	$5,000	
Stream bank restoration and plantings		800	LF	$5	$4,000	
Demobilize		1	LS	$10,000	$10,000	
					$917,711	
Soil Disposal and GW Management						
Dewatering		1	LS	$42,500	$42,500	Additional operational cost for preexisting dewatering system *(see dewatering backup sheet)*
Waste characterization of soil stockpiles		21	ea	$1,000	$21,000	
T&D RCRA listed soil		0	ton	$250	$0	
T&D non-haz soil		7,040	ton	$80	$563,200	
Police detail		166	hr	$120	$19,920	
					$646,620	
SUBTOTAL					$11,303,991	
Contingency:	30%				$3,391,197	
SUBTOTAL [Remedy Implementation]					$14,695,189	
Project Management	5%				$734,759	
Remedial Design	8%				$1,175,615	
Construction Management	6%				$881,711	
Institutional Controls						
Groundwater Ordinance		1	LS	$15,000	$15,000	Support to town to put ordinance in place
Activity and Use Limitations		1	LS	$127,165	$127,165	
					$2,934,251	
TOTAL CAPITAL COST					$17,629,440	

Alternative **GW/SW-3b**

Source Area Soil Removal with In-Situ Treatment, Extension of Permeable Reactive Barrier, and Mid-Plume Treatment

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: Mar-19

Description: Combination of soil excavation and in-situ treatment within the source area, soil blending to incorporate ZVI into saturated soils to bedrock, installation of a permeable reactive barrier along Bliss Brook, and a mid-plume in-situ treatment line.
+50% cost sensitivity

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Five year review (every 5 years until Year 30)	6	ea	$10,000	$60,000	
Update Institutional Controls Plan (Year 5)	1	ea	$4,000	$4,000	
Remedial Action Report (Year 5)	1	ea	$10,000	$10,000	
Indoor air sampling of homes with SSDS (Year 5)	1	ea	$23,400	$23,400	
Inspections of homes (every 5 years until Year 30)	6	ea	$1,000	$6,000	Inspect for change in condition of two additional homes
				$103,400	

O&M

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Groundwater and Surface Water Monitoring					
Annual groundwater monitoring	1	LS	$60,000	$60,000	Annual groundwater sampling program
Annual surface water monitoring	1	LS	$30,000	$30,000	Annual surface water sampling program
				$90,000	
Annual inspections					
Sub-slab depressurization systems inspection	1	LS	$1,500	$1,500	Annual inspection of 3 homes with SSDS
Inspection and maintenance of remedy	1	LS	$12,000	$12,000	Inspection of PRB wall, engineered cover, and capped lagoon
				$13,500	
SUBTOTAL				$103,500	
Contingency: 30%				$31,050	
SUBTOTAL [Remedy Implementation]				$134,550	
Technical Support 15%				$20,183	
Project Management 5%				$6,728	
TOTAL O&M COST				$161,460	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor	Present Value	Notes
Capital Cost	0	17,629,440	$17,629,440	1.00	$17,629,440	
O&M Cost	1 to 30	4,843,800	$161,460	0.7%	$4,355,326	
Periodic Cost	5	48,400	$48,400	0.7%	$46,741	
	10	11,000	$11,000	0.7%	$10,259	
	15	11,000	$11,000	0.7%	$9,907	
	20	11,000	$11,000	0.7%	$9,568	
	25	11,000	$11,000	0.7%	$9,240	
	30	11,000	$11,000	0.7%	$8,923	
Total Present Value of Alternative					**$22,079,403**	

BEDROCK ALTERNATIVES

Alternatives **BR-2, BR-3, BR-4, BR-5**
Institutional Controls

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: May-19

Description: Implementation of institutional controls to prevent installation of non-drinking water wells (irrigation wells) within the plume boundary, with contingency to include drinking water wells based on the pre-design investigation.

CAPITAL COSTS

Description		QTY	UNIT	UNIT COST	TOTAL	NOTES
Pre-Design Investigation Sampling						
Submittals		1	LS	$12,920	$12,920	
Installation of new bedrock monitoring wells		1	LS	$620,000	$620,000	*See Bedrock Long-Term Monitoring Sheet*
Labor to collect, package, and ship samples		25	pds	$1,440	$36,000	Five person field team for five days
Fixed lab sample analyses						Delineation of impact samples
VOCs		39	ea	$85	$3,315	
Metals		39	ea	$100	$3,900	
Field equipment and temporary facilities		1	ea	$12,500	$12,500	Allowance
Data evaluation		50	HR	$75	$3,750	
					$692,385	
SUBTOTAL					$692,385	
Contingency:	15%				$103,858	
SUBTOTAL [Remedy Implementation]					$796,243	
Project Management	5%				$39,812	
Remedial Design	8%				$63,699	
Construction Management	6%				$47,775	
Institutional Controls						
Groundwater ordinance		1	LS	$15,000	$15,000	Support to town for filing ordinance (preparing maps, etc.)
					$166,286	
TOTAL CAPITAL COST					$962,529	

Alternatives **BR-2, BR-3, BR-4, BR-5**
Institutional Controls

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: May-19

Description: Implementation of institutional controls to prevent installation of non-drinking water wells (irrigation wells) within the plume boundary, with contingency to include drinking water wells based on the pre-design investigation.

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Five year review (every 5 years until Year 30)	6	ea	$10,000	$60,000	
Update Institutional Controls Plan (Year 5)	1	ea	$4,000	$4,000	
Remedial Action Report (Year 5)	1	ea	$10,000	$10,000	
				$74,000	

O&M

Description		QTY	UNIT	UNIT COST	TOTAL	NOTES
Groundwater Monitoring						
Annual bedrock groundwater monitoring		1	LS	$90,000	$90,000	Annual bedrock groundwater sampling program
					$90,000	
SUBTOTAL					$90,000	
Contingency:	15%				$13,500	
SUBTOTAL [Remedy Implementation]					$103,500	
Technical Support	15%				$15,525	
Project Management	5%				$5,175	
TOTAL O&M COST					$124,200	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor	Present Value	Notes
Capital Cost	0	$962,529	$962,529	1.0	$962,529	
O&M Cost	1 to 30	$3,726,000	$124,200	0.7%	$3,350,251	
Periodic Cost	5	$24,000	$24,000	0.7%	$23,177	
	10	$10,000	$10,000	0.7%	$9,326	
	15	$10,000	$10,000	0.7%	$9,007	
	20	$10,000	$10,000	0.7%	$8,698	
	25	$10,000	$10,000	0.7%	$8,400	
	30	$10,000	$10,000	0.7%	$8,112	
Total Present Value of Alternative					**$4,379,499**	

Note: The costs for Alternative BR-2 are also applicable as the baseline (initial) costs for Alternatives BR-3, BR-4, and BR-5. The contingency cost for Alternative BR-2 includes a more extensive groundwater City ordinance, which would not result in a change in cost than the one presented above.

Alternative **BR-3 (contingency items)**
Focused In-Situ Injections West of North Avenue

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: May-19

Description: Installation of a PRB wall by injection of ZVI solution into bedrock wells along North Avenue

CAPITAL COSTS

Description		QTY	UNIT	UNIT COST	TOTAL	NOTES
Pre-Remedial Study						
Pilot test		1	LS	$100,000	$100,000	
					$100,000	
In-Situ ZVI Injections						
Installation of 13 injection wells		1	LS	$94,697	$94,697	Quote for project from Glacier Drilling
Erosion control measures		250	LF	$4	$1,000	
Purchase and deliver ZVI solution		10,000	gal	$10	$100,000	
Injection of solution		1	LS	$30,000	$30,000	
Monitoring of injection effectiveness		1	LS	$35,000	$35,000	During and immediately after injection
					$260,697	
SUBTOTAL					$360,697	
Contingency:	30%				$108,209	
SUBTOTAL [Remedy Implementation]					$468,906	
Project Management	5%				$23,445	
Remedial Design	8%				$37,512	
Construction Management	6%				$28,134	
Institutional Controls						
Activity and Use Limitations		1	LS	$49,831	$49,831	
					$138,923	
TOTAL CAPITAL COST					$607,829	

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Reinject wells with ZVI solution (every 5 years)	6	ea	$60,000	$360,000	
				$360,000	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor	Present Value	Notes
Capital Cost	0	$607,829	$607,829	1.0	$607,829	
Periodic Cost	5	$60,000	$60,000	0.7%	$57,943	
	10	$60,000	$60,000	0.7%	$55,957	
	15	$60,000	$60,000	0.7%	$54,039	
	20	$60,000	$60,000	0.7%	$52,187	
	25	$60,000	$60,000	0.7%	$50,398	
	30	$60,000	$60,000	0.7%	$48,671	
Total Present Value of Alternative					**$927,024**	

Alternative **BR-4 (contingency items)**
Pump and Treat

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: May-19

Description: Installation and operation of a bedrock groundwater extraction and treatment process

CAPITAL COSTS

Description		QTY	UNIT	UNIT COST	TOTAL	NOTES
Pre-Remedial Study						
Pump Test		1	LS	$50,000	$50,000	One 24 hr test, includes water treatment and disposal
					$50,000	
Construct Pump and Treat System						
Treatment plant building construction		1	LS	$100,000	$100,000	
Erosion control measures		300	LF	$4	$1,200	
Drill extraction wells		2	ea	$15,000	$30,000	
Install well vaults		2	ea	$2,500	$5,000	
Influent and effluent tanks		2	ea	$10,000	$20,000	Assume 5000 gallon capacity each
Above ground piping		1	LS	$15,000	$15,000	
Pump, electrical, controls per well		2	ea	$5,000	$10,000	3 gpm each, total 6 gpm
Transfer lines to TP and discharge point		1600	ft	$20	$32,000	
Install above ground pumps		2	ea	$1,500	$3,000	
Install and test electrical services		1	LS	$30,000	$30,000	
Ion exchange vessels with 1st change		2	ea	$1,200	$2,400	Quote for project from CFS
Bag filter housings		2	ea	$700	$1,400	Quote for project from CFS
Deliver equipment, place and fill on site		1	LS	$550	$550	Quote for project from CFS
Treatment plant controls		1	ea	$25,000	$25,000	
Prove out		1	ea	$10,000	$10,000	
					$285,550	
SUBTOTAL					$335,550	
Contingency:	30%				$100,665	
SUBTOTAL [Remedy Implementation]					$436,215	
Project Management	5%				$21,811	
Remedial Design	8%				$34,897	
Construction Management	6%				$26,173	
Institutional Controls						
Activity and Use Limitations		1	LS	$49,831	$49,831	
					$132,712	
TOTAL CAPITAL COST					$568,927	

Alternative BR-4 (contingency items)
Pump and Treat

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: May-19
Description: Installation and operation of a bedrock groundwater extraction and treatment process

O&M

Description		QTY	UNIT	UNIT COST	TOTAL	NOTES
Treatment System Operations and Maintenance						
Treatment system operations		1	year	$25,000	$25,000	Review remote monitoring, weekly inspections, maintenance, troubleshooting, and repairs
Change out ion exchange vessels		2	ea	$2,625	$5,250	2 replacements for both vessels per year, quote from CFS
Bag filters and other minor supplies		1	year	$5,000	$5,000	
Electricity (heat and power)		12	month	$200	$2,400	
Sampling wells, stream, and discharge point		12	month	$1,500	$18,000	Includes labor and lab analysis
Reporting		4	qtr	$2,500	$10,000	
Equipment replacements		1	year	$2,000	$2,000	Assume $10,000 repair every 5 years
					$67,650	
SUBTOTAL					$67,650	
Contingency:	20%				$13,530	
SUBTOTAL [Remedy Implementation]					$81,180	
Technical Support	15%				$12,177	
Project Management	5%				$4,059	
TOTAL O&M COST					$97,416	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor	Present Value	Notes
Capital Cost	0	$568,927	$568,927	1.0	$568,927	
O&M Cost	1 to 30	$2,922,480	$97,416	0.7%	$2,627,762	
Total Present Value of Alternative					**$3,196,689**	

Alternative **BR-5 (contingency items)**
Enhanced (Deeper) Permeable Reactive Barrier

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: May-19

Description: Installation of a PRB wall by injection of ZVI solution into bedrock wells along Bliss Brook

CAPITAL COSTS

Description		QTY	UNIT	UNIT COST	TOTAL	NOTES
Pre-Remedial Study						
Pilot test		1	LS	$100,000	$100,000	Confirm dose and contact time of ZVI type
					$100,000	
In-Situ ZVI Injections						
Installation of 20 injection wells		1	LS	$153,670	$153,670	Quote for project from Glacier Drilling
Erosion control measures		350	LF	$4	$1,400	
Purchase and deliver ZVI solution		10,000	gal	$10	$100,000	
Injection of solution		1	LS	$30,000	$30,000	
Monitoring of injection effectiveness		1	LS	$35,000	$35,000	During and immediately after injection
					$320,070	
SUBTOTAL					$420,070	
Contingency:	30%				$126,021	
SUBTOTAL [Remedy Implementation]					$546,091	
Project Management	5%				$27,304.55	
Remedial Design	8%				$43,687	
Construction Management	6%				$32,765	
Institutional Controls						
Activity and Use Limitations		1	LS	$49,831	$49,831	
					$153,588	
TOTAL CAPITAL COST					$699,679	

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Reinject wells with ZVI solution (every 5 years)	6	ea	$60,000	$360,000	
				$360,000	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor	Present Value	Notes
Capital Cost	0	$699,679	$699,679	1.00	$699,679	
Periodic Cost	5	$60,000	$60,000	0.7%	$57,943	
	10	$60,000	$60,000	0.7%	$55,957	
	15	$60,000	$60,000	0.7%	$54,039	
	20	$60,000	$60,000	0.7%	$52,187	
	25	$60,000	$60,000	0.7%	$50,398	
	30	$60,000	$60,000	0.7%	$48,671	
Total Present Value of Alternative					**$1,018,875**	

BR Alternatives
Submittals

COST WORKSHEET

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Base Year: Mar-19

Work Statement:
The following submittals were considered necessary to be completed prior to implementing site work.

Description	QTY	UNIT	LABOR	EQUIP	MTRL	UNIT TOTAL	TOTAL
HASP	20	HR	$75.00	$0.00	$1.00	$76.00	$1,520.00
QAPP	100	HR	$75.00	$0.00	$1.00	$76.00	$7,600.00
Meetings	50	HR	$75.00	$0.00	$1.00	$76.00	$3,800.00

SUBTOTAL	$12,920.00
Subcontractor Overhead & Profit	$0.00
SUBTOTAL	$12,920.00
TOTAL COST	$12,920.00

Source of Cost Data:
Engineering estimate

Cost Adjustment Factor:

FACTOR:		NOTES:
H&S Productivity (labor & equip)		
Escalation to Base Year		
Area Cost Factor		
Subcontractor Overhead & Prof.		
Prime Contractor Overhead & Pro	X	

ESTIMATED ANNUAL COST FOR LONG-TERM GROUNDWATER MONITORING: BEDROCK ALTERNATIVES BR-2, BR-3, BR-4, AND BR-5

	Qty	Unit Price	Unit	Extended Price	Basis
NUMBER OF WELLS TO BE SAMPLED	53	$1,000.00	well	$53,000.00	two wells per person per 10 hour day, $150 per hour, plus $250 per well ODCs (travel, equipment, supplies)
NUMBER OF CR+6 ANALYSES	53	$50.00	ea	$2,650.00	
NUMBER OF VOC ANALYSES	15	$100.00	ea	$1,500.00	
ANNUAL MONITORING REPORT	1	$30,000.00	ea	$30,000.00	200 labor hours at $150 per hour
Annual cost for LTM				$87,150.00	
ROUNDED ANNUAL LTM COST (2 sig figs)				**$90,000.00**	

ESTIMATED COST TO INSTALL THE 12 NEW MULTI-LEVEL SOLINST CMT BEDROCK WELLS (CAPITAL COST THAT WILL BE PART OF EVERY BR ALTERNATIVE) - SUMMARY

ITEM	COST	BASIS
GEOLOGIST OVERSIGHT LABOR	$91,500	48 FIELD DAYS DRILLING AND GEOPHYSICS OVERSIGHT, 12 FIELD DAYS DEVELOPMENT, 1 FIELD DAY IDW DISPOSAL
ODCS	$21,350	$350 PER FIELD DAY
DRILLING SUBCONTRACTOR	$452,860	480 FEET OF OVERBURDEN DRILLING AND 1800 FEET OF BEDROCK CORING FOR 12 MULTI-LEVEL SOLINST CMT WELLS - BIDS FROM PAST SITE WORK
IDW SUBCONTRACTOR	$14,300	5000 GALLONS OF DEVELOPMENT WATER AND 48 DRUMS OF SOLID IDW - COST ESTIMATE FOR PAST SITE WORK
GEOPHYSICAL SUBCONTRACTOR	$36,000	12 BOREHOLES AT $3000 PER BOREHOLE
TOTAL	$616,010	
TOTAL ROUNDED (2 sig figs)	**$620,000**	

MODIFIED QUOTE FOR ALTERNATIVE BR-3

Glacier Drilling, LLC 75 Commerce Circle, Durham, CT 06422

Date:	7/9/2018	**Cost Proposal**			
For:		**Using a Sonic Rig, 8140LS, install 13 (4") open hole bedrock**			
		wells to ~ 62' in area 1, seating 4" Casing 5', into rock, anticipating			
AECOM		**bedrock at ~ 27', and in area 2 install 20 (4") open hole bedrock**			
250 Apollo Drive		**wells also seating 4" casing 5' into rock which is anticiapted at**			
Chelmsford, MA 01824		**~ 50' and finish with 12" Road Boxes at a site in**			
Phone: 978-905-2582		**Attleboro, MA.**			
Fax: 978-905-2101					
Cell: 401-787-0649					
		Note: Understand that we do not have to pre-clear, air vac, these			
Attn: Abigail Brakenwagen,		**borings or drum any excess materials.**			

Quantity	DESCRIPTION		CHARGES	TOTAL
13	Sonic Rig / 2 man crew / day		5,750.00	74,750.00
	(includes Per Diem / day)			0.00
1	Mob. & Demob. - Sonic Rig charge		1,750.00	1,750.00
				0.00
				0.00
520	4" FJ Steel Casing / ft.		24.75	12,870.00
				0.00
520	Grouting / ft.		5.00	2,600.00
				0.00
13	6" Expandable Gripper		33.75	438.75
				0.00
13	12" Road Boxes		150.00	1,950.00
				0.00
26	Cement Mix / 80 lb bags		13.00	338.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
Additional Comments:				.
a) This cost estimate will be adjusted for actual quantities required.				.
b) Overtime, if required after 8 hrs. on site, would be billed at $675./hr.				
Prepared by: Reuben R. Schock, Phone: 860-349-0397				.
E-mail address: rschock@glacierdrilling.com			***Total service charges:***	**94,696.75**
			Price valid until:	10/9/2018

MODIFIED QUOTE FOR ALTERNATIVE BR-5

Glacier Drilling, LLC 75 Commerce Circle, Durham, CT 06422

Date:	7/9/2018	**Cost Proposal**			
For:		**Using a Sonic Rig, 8140LS, install 13 (4") open hole bedrock**			
		wells to ~ 62' in area 1, seating 4" Casing 5', into rock, anticipating			
AECOM		**bedrock at ~ 27', and in area 2 install 20 (4") open hole bedrock**			
250 Apollo Drive		**wells also seating 4" casing 5' into rock which is anticiapted at**			
Chelmsford, MA 01824		**~ 50' and finish with 12" Road Boxes at a site in**			
Phone: 978-905-2582		**Attleboro, MA.**			
Fax: 978-905-2101					
Cell: 401-787-0649					
		Note: Understand that we do not have to pre-clear, air vac, these			
Attn: Abigail Brakenwagen,		**borings or drum any excess materials.**			

Quantity	DESCRIPTION		CHARGES	TOTAL
20	Sonic Rig / 2 man crew / day		5,750.00	115,000.00
	(includes Per Diem / day)			0.00
1	Mob. & Demob. - Sonic Rig charge		1,750.00	1,750.00
				0.00
				0.00
1100	4" FJ Steel Casing / ft.		24.75	27,225.00
				0.00
1100	Grouting / ft.		5.00	5,500.00
				0.00
20	6" Expandable Gripper		33.75	675.00
				0.00
20	12" Road Boxes		150.00	3,000.00
				0.00
40	Cement Mix / 80 lb bags		13.00	520.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
Additional Comments:				.
a) This cost estimate will be adjusted for actual quantities required.				.
b) Overtime, if required after 8 hrs. on site, would be billed at $675./hr.				
Prepared by: Reuben R. Schock, Phone: 860-349-0397				.
E-mail address: rschock@glacierdrilling.com			***Total service charges:***	**153,670.00**
			Price valid until:	10/9/2018

COST ESTIMATE AULs FOR ALTERNATIVES BR-3 AND BR-4 (ASSUMES 3 PROPERTIES)

LABOR COST (AECOM AVERAGE TYPICAL RATES BY CATEGORY)

ITEM / Labor Category / Hourly Rate	LSP $193.00	Senior Project Eng/Sci $187.00	Project Engineer/ Scientist $145.00	Staff Engineer/ Scientist (CADD) $100.00	Admin. Support $95.00	Total Hours
Task 1 - AUL Preliminary Research						
1.1 - Client and Attorney Communication		10				10
1.2 - Research Existing Deed and Property Plan - Identify Land Type		4				4
1.3 - Procure Surveyor and Attorney/Title Company (Property/\AUL Survey, Legal Descriptions, title rpts)		12	16		2	30
1.4 - Identify Current Record Interest holder - CIHs (Attorney to conduct Title Search)		2			4	6
1.5 - Review Survey Plans of Restricted Areas (up to 2 Properties)	2	2				4
					subtotal	54
Task 2 - AUL Document Preparation						
2.1 - Notice of AUL Form 1075 or Federal NAUL form		6				6
2.2 - Exhibit A Legal Description of property (from Deed or Surveyor)		3				3
2.3 - Exhibit A-1 Legal Description of portion of property subject to AUL (from surveyor)		3				3
2.4 - Exhibit A-2 Survey Plan of AUL portion		3				3
2.5 - Exhibit B - Sketch Plan - property, site, RAO, AUL boundaries (Not scaled)		3		12		15
2.6 - Exhibit C - AUL Opinion (IC Design Statement, if Federal NAUL template is used)	1	8				9
2.7 - Exhibit D - Signatory Authority		2				2
2.8 - LSP Review AUL Package with PS/TS Closure Document	6	2				8
2.9 - Edits (per attorney review and comment) - site specific	2	6				8
2.10 - Additional review/edits to address EPA and MassDEP comments	1	3				4
2.11 - Mailing of Draft Copy of AUL to CIHs (certified mail/return receipt requested)		2			2	4
					subtotal	65
Task 3 - Recordation of AUL documents						
3.1 - Signing of AUL documents - assumes signatures obtained by EPA		0				
3.2 - Recording at ROD (depends who does). Assume AECOM staff does. Time can vary (2 to 8 hrs)			8			8
3.3 - AUL Recording Fees (assume one) - see below						0
3.4 - Legal Ad prepare and place in Newspaper - Varies by community	1	2			2	5
3.5 - Cert mail copies of Recorded AUL to local officials (letter +AUL)- CMO, BOH, Zoning, Building	1	4			4	9
					subtotal	22
Task 4- Distribution of Recorded AUL						
4.1 - Submittal to MassDEP - Letter plus BWSC Form 113 plus documents	1	8				9
4.2 - Get copy of AUL legal ad publication and submit to MassDEP with BWSC Form.		1			1	2
4.3 - Distribute copies via Email to client, record interest holders, attorneys, EPA, etc.		2				2
					subtotal	13
Total Hours	15	88	24	12	15	154
Total Dollars	$2,895.00	$16,456.00	$3,480.00	$1,200.00	$1,425.00	
					Labor Cost Subtotal	$25,456.00

REIMBURSABLE EXPENSES

ITEM	Units	Unit Cost	Subtotal	Multiplier 10%	Total Cost
1.3 - AUL Survey - 2 Properties	3	$5,000.00	$15,000.00	$0.00	$15,000.00
1.3 - Title Search - Title reports plus one update per property	3	$900.00	$2,700.00	$0.00	$2,700.00
Attorney's Review of AULs	3	$2,000.00	$6,000.00	$0.00	$6,000.00
2.11 - Certified mailing draft AUL to CIHs (Assume at least two)	1	$20.00	$20.00	$0.00	$20.00
3.1 - Travel to client to get signatures - mileage -varies -calculate site-specific	0	$50.00	$0.00	$0.00	$0.00
3.2 - AUL Recordation at ROD ($75 per instrument), plus cost for certified copy ($1.00 per page-assume 20	3	$95.00	$285.00	$0.00	$285.00
3.2 - Travel to ROD to record AUL - mileage -varies -calculate site-specific	1	$29.70	$29.70	$0.00	$29.70
3.2 - Parking at ROD (not all but some charge for parking)	1	$0.00	$0.00	$0.00	$0.00
3.4 - Legal Ad Publication (varies 150 to 450) - $300 median price.	1	$300.00	$300.00	$0.00	$300.00
3.5 - Cert Mailing of recorded AUL to CMO, BOH, Zoning & Building Inspection (Assume 4 x $10/each)	1	$40.00	$40.00	$0.00	$40.00
4.1 - MassDEP AUL Fee	0	$2,000.00	$0.00	$0.00	$0.00
				Subtotal	$24,374.70

GRAND TOTAL $49,830.70

BEDROCK ALTERNATIVES

COST SENSITIVITY ANALYSIS

Alternative **BR-3 (contingency items)**
Focused In-Situ Injections West of North Avenue

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: May-19

Description: Installation of a PRB wall by injection of ZVI solution into bedrock wells along North Avenue

-30% cost sensitivity

CAPITAL COSTS

Description		QTY	UNIT	UNIT COST	TOTAL	NOTES
Pre-Remedial Study						
Pilot test		1	LS	$100,000	$100,000	
					$100,000	
In-Situ ZVI Injections						
Installation of 13 injection wells		1	LS	$94,697	$94,697	Quote for project from Glacier Drilling
Erosion control measures		250	LF	$4	$1,000	
Purchase and deliver ZVI solution		7,000	gal	$10	$70,000	
Injection of solution		1	LS	$30,000	$30,000	
Monitoring of injection effectiveness		1	LS	$35,000	$35,000	During and immediately after injection
					$230,697	
SUBTOTAL					$330,697	
Contingency:	30%				$99,209	
SUBTOTAL [Remedy Implementation]					$429,906	
Project Management	5%				$21,495	
Remedial Design	8%				$34,392	
Construction Management	6%				$25,794	
Institutional Controls						
Activity and Use Limitations		1	LS	$49,831	$49,831	
					$131,513	
TOTAL CAPITAL COST					$561,419	

Alternative **BR-3 (contingency items)**
Focused In-Situ Injections West of North Avenue

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: May-19

Description: Installation of a PRB wall by injection of ZVI solution into bedrock wells along North Avenue

-30% cost sensitivity

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Reinject wells with ZVI solution (every 5 years)	6	ea	$60,000	$360,000	
				$360,000	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor	Present Value	Notes
Capital Cost	0	$561,419	$561,419	1.0	$561,419	
Periodic Cost	5	$60,000	$60,000	0.7%	$57,943	
	10	$60,000	$60,000	0.7%	$55,957	
	15	$60,000	$60,000	0.7%	$54,039	
	20	$60,000	$60,000	0.7%	$52,187	
	25	$60,000	$60,000	0.7%	$50,398	
	30	$60,000	$60,000	0.7%	$48,671	
Total Present Value of Alternative					**$880,614**	

Alternative **BR-3 (contingency items)**
Focused In-Situ Injections West of North Avenue

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: May-19

Description: Installation of a PRB wall by injection of ZVI solution into bedrock wells along North Avenue

+50% cost sensitivity

CAPITAL COSTS

Description		QTY	UNIT	UNIT COST	TOTAL	NOTES
Pre-Remedial Study						
Pilot test		1	LS	$100,000	$100,000	
					$100,000	
In-Situ ZVI Injections						
Installation of 13 injection wells		1	LS	$94,697	$94,697	Quote for project from Glacier Drilling
Erosion control measures		250	LF	$4	$1,000	
Purchase and deliver ZVI solution		15,000	gal	$10	$150,000	
Injection of solution		1	LS	$30,000	$30,000	
Monitoring of injection effectiveness		1	LS	$35,000	$35,000	During and immediately after injection
					$310,697	
SUBTOTAL					$410,697	
Contingency:	30%				$123,209	
SUBTOTAL [Remedy Implementation]					$533,906	
Project Management	5%				$26,695	
Remedial Design	8%				$42,712	
Construction Management	6%				$32,034	
Institutional Controls						
Activity and Use Limitations		1	LS	$49,831	$49,831	
					$151,273	
TOTAL CAPITAL COST					$685,179	

Alternative **BR-3 (contingency items)**
Focused In-Situ Injections West of North Avenue

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: May-19

Description: Installation of a PRB wall by injection of ZVI solution into bedrock wells along North Avenue

+50% cost sensitivity

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Reinject wells with ZVI solution (every 5 years)	6	ea	$60,000	$360,000	
				$360,000	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor	Present Value	Notes
Capital Cost	0	$685,179	$685,179	1.0	$685,179	
Periodic Cost	5	$60,000	$60,000	0.7%	$57,943	
	10	$60,000	$60,000	0.7%	$55,957	
	15	$60,000	$60,000	0.7%	$54,039	
	20	$60,000	$60,000	0.7%	$52,187	
	25	$60,000	$60,000	0.7%	$50,398	
	30	$60,000	$60,000	0.7%	$48,671	
Total Present Value of Alternative					**$1,004,374**	

Alternative **BR-5 (contingency items)**
Enhanced (Deeper) Permeable Reactive Barrier

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: May-19

Description: Installation of a PRB wall by injection of ZVI solution into bedrock wells along Bliss Brook

-30% cost sensitivity

CAPITAL COSTS

Description		QTY	UNIT	UNIT COST	TOTAL	NOTES
Pre-Remedial Study						
Pilot test		1	LS	$100,000	$100,000	Confirm dose and contact time of ZVI type
					$100,000	
In-Situ ZVI Injections						
Installation of 20 injection wells		1	LS	$153,670	$153,670	Quote for project from Glacier Drilling
Erosion control measures		350	LF	$4	$1,400	
Purchase and deliver ZVI solution		7,000	gal	$10	$70,000	
Injection of solution		1	LS	$30,000	$30,000	
Monitoring of injection effectiveness		1	LS	$35,000	$35,000	During and immediately after injection
					$290,070	
SUBTOTAL					$390,070	
Contingency:	30%				$117,021	
SUBTOTAL [Remedy Implementation]					$507,091	
Project Management	5%				$25,354.55	
Remedial Design	8%				$40,567	
Construction Management	6%				$30,425	
Institutional Controls						
Activity and Use Limitations		1	LS	$49,831	$49,831	
					$146,178	
TOTAL CAPITAL COST					$653,269	

Alternative **BR-5 (contingency items)**
Enhanced (Deeper) Permeable Reactive Barrier

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: May-19

Description: Installation of a PRB wall by injection of ZVI solution into bedrock wells along Bliss Brook

-30% cost sensitivity

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Reinject wells with ZVI solution (every 5 years)	6	ea	$60,000	$360,000	
				$360,000	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor	Present Value	Notes
Capital Cost	0	$653,269	$653,269	1.00	$653,269	
Periodic Cost	5	$60,000	$60,000	0.7%	$57,943	
	10	$60,000	$60,000	0.7%	$55,957	
	15	$60,000	$60,000	0.7%	$54,039	
	20	$60,000	$60,000	0.7%	$52,187	
	25	$60,000	$60,000	0.7%	$50,398	
	30	$60,000	$60,000	0.7%	$48,671	
Total Present Value of Alternative					**$972,465**	

Alternative **BR-5 (contingency items)**
Enhanced (Deeper) Permeable Reactive Barrier

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: May-19

Description: Installation of a PRB wall by injection of ZVI solution into bedrock wells along Bliss Brook

+50% cost sensitivity

CAPITAL COSTS

Description		QTY	UNIT	UNIT COST	TOTAL	NOTES
Pre-Remedial Study						
Pilot test		1	LS	$100,000	$100,000	Confirm dose and contact time of ZVI type
					$100,000	
In-Situ ZVI Injections						
Installation of 20 injection wells		1	LS	$153,670	$153,670	Quote for project from Glacier Drilling
Erosion control measures		350	LF	$4	$1,400	
Purchase and deliver ZVI solution		15,000	gal	$10	$150,000	
Injection of solution		1	LS	$30,000	$30,000	
Monitoring of injection effectiveness		1	LS	$35,000	$35,000	During and immediately after injection
					$370,070	
SUBTOTAL					$470,070	
Contingency:	30%				$141,021	
SUBTOTAL [Remedy Implementation]					$611,091	
Project Management	5%				$30,554.55	
Remedial Design	8%				$48,887	
Construction Management	6%				$36,665	
Institutional Controls						
Activity and Use Limitations		1	LS	$49,831	$49,831	
					$165,938	
TOTAL CAPITAL COST					$777,029	

Alternative **BR-5 (contingency items)**
Enhanced (Deeper) Permeable Reactive Barrier

COST ESTIMATE SUMMARY

Site: Walton & Lonsbury Superfund Site
Location: Attleboro, MA
Phase: RI/FS
Date: May-19

Description: Installation of a PRB wall by injection of ZVI solution into bedrock wells along Bliss Brook

+50% cost sensitivity

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	TOTAL	NOTES
Reinject wells with ZVI solution (every 5 years)	6	ea	$60,000	$360,000	
				$360,000	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost Per Year	Discount Factor	Present Value	Notes
Capital Cost	0	$777,029	$777,029	1.00	$777,029	
Periodic Cost	5	$60,000	$60,000	0.7%	$57,943	
	10	$60,000	$60,000	0.7%	$55,957	
	15	$60,000	$60,000	0.7%	$54,039	
	20	$60,000	$60,000	0.7%	$52,187	
	25	$60,000	$60,000	0.7%	$50,398	
	30	$60,000	$60,000	0.7%	$48,671	
Total Present Value of Alternative					**$1,096,225**	

COST ESTIMATE BACKUP

COSTELLO
DISMANTLING

March 14th, 2018

ATTN: Ms. Abagail Brakenwagen
AECOM
250 Apollo Dr.
Chelmsford, MA 01824

P: 978-905-2582
C: 401-781-0649
abigail.brakenwagen@aecom.com

FROM: John Costello
Costello Dismantling Co., Inc.
45 Kings Highway
West Wareham, MA 02576

C: 508-958-9242
P: 508-291-2324
F: 508-291-2325
E-mail: john@costellodismantling.com

Slab Removal, 78 North Ave. Attleboro

Scope of Work:
Removal and Disposal of ~730 cu yds of concrete slab and walls.

Demolition Narrative:
Work will take place on a site with suspected soil contamination. All workers shall have current HAZWOPER certificates as well as minimum 10-hr OSHA for Construction training and any other licenses or certificates needed to perform this scope of work.

For the purposes of this scope, pricing includes in-state disposal/recycling of unpainted, uncontaminated concrete. Painted surfaces or environmental contaminants could greatly increase the cost of material management.

Lump Sum Price: Fifty-Five Thousand Dollars ($55,000.00)

Estimate is based on normal working hours of 7-3:30, Monday-Friday. Contaminated soils can be priced for disposal based upon testing and analysis. Asbestos and PCB testing will be required prior to demolition

John Costello
Costello Dismantling Co., Inc.

Brakenwagen, Abigail

From: John Costello <john@costellodismantling.com>
Sent: Wednesday, June 20, 2018 1:38 PM
To: Brakenwagen, Abigail
Subject: RE: AECOM Slab Removal Attleboro

Again, I apologize for the delay. I can issue a more formal proposal this week, but if we're assuming that about 20% of the concrete, or about 300 tons, would have to go to a subtitle D landfill vs. local recycling, it's going to add $30-45,000 to the total price. I would carry the higher number to be safe.

I'll revise and send a proposal out by the end of the week

From: Brakenwagen, Abigail <Abigail.Brakenwagen@aecom.com>
Sent: Wednesday, June 20, 2018 12:59 PM
To: John Costello <john@costellodismantling.com>
Subject: RE: AECOM Slab Removal Attleboro

Hi John, just want to follow up on this? It's getting to be crunch time as we have an internal deadline of the end of June.

From: Brakenwagen, Abigail
Sent: Friday, June 08, 2018 8:31 AM
To: 'John Costello'
Subject: RE: AECOM Slab Removal Attleboro

Hi John, it's no problem at all. The major contaminant on site is hex chrome, but we would expect some impact from lead and cVOCs as well. The only criteria for vendors is that they have to be acceptable to receive waste from CERCLA sites.

Thanks,
Abby

From: John Costello [mailto:john@costellodismantling.com]
Sent: Thursday, June 07, 2018 8:42 AM
To: Brakenwagen, Abigail
Subject: RE: AECOM Slab Removal Attleboro

Abby, I'm so sorry for not getting back to you sooner on this! I was out in the field the past few weeks and I'm just getting caught up.

I'm happy to revisit the pricing on this project. So I can be accurate, what are you assuming the contaminants to be on this project, and are there any other disposal criteria? (approved vendors, etc…)

Thanks!
John Costello

Project Manager
COSTELLO DISMANTLING CO., INC.

Celebrating our 32nd year!

45 Kings Highway| West Wareham, MA | 02576
Ph: 508.291.2324 | C: 508.958.9242 | Fax: 508.291.2325
john@costellodismantling.com
www.costellodismantling.com

Proud Winners of:
2013, 2011 & 2009 World Demolition Award: Environmental and Recycling, Collaboration
2014, 2013 & 2012 National Demolition Association's "Environmental Excellence Award"

"Our mission is to continue as a leader in the dismantling industry by embracing a culture of innovation, safety, integrity and respect for our employees, clients and the environment."

From: Brakenwagen, Abigail <Abigail.Brakenwagen@aecom.com>
Sent: Tuesday, May 22, 2018 3:11 PM
To: John Costello <john@costellodismantling.com>
Subject: RE: AECOM Slab Removal Attleboro

Hi John,

We had put this work on hold but are picking it up again so I'm revisiting costs I've already gotten. Could you please amend this quote to reflect 20% RCRA haz waste removal/disposal?

Thank you,
Abby

From: Brakenwagen, Abigail
Sent: Thursday, March 15, 2018 11:41 AM
To: 'John Costello'
Subject: RE: AECOM Slab Removal Attleboro

Great, thanks John!

From: John Costello [mailto:john@costellodismantling.com]
Sent: Thursday, March 15, 2018 9:05 AM
To: Brakenwagen, Abigail
Subject: AECOM Slab Removal Attleboro

Abby, sorry for the delay with this proposal. Please let me know if you have any questions or would like me to revise the scope.

Thanks!

John Costello

Project Manager
COSTELLO DISMANTLING CO., INC.

Celebrating our 32nd year!

45 Kings Highway| West Wareham, MA | 02576
Ph: 508.291.2324 | C: 508.958.9242 | Fax: 508.291.2325
john@costellodismantling.com
www.costellodismantling.com

Proud Winners of:
2013, 2011 & 2009 World Demolition Award: Environmental and Recycling, Collaboration
2014, 2013 & 2012 National Demolition Association's "Environmental Excellence Award"

"Our mission is to continue as a leader in the dismantling industry by embracing a culture of innovation, safety, integrity and respect for our employees, clients and the environment."

SAMPLE ANALYSES AND QUANTITIES FOR WALTON AND LONSBURY ASOW
TASK 4 - REVISED COST ESTIMATE
DAS AND SUBCONTRACT ANALYTICAL LABORATORY COSTS

5/21/2018

	Turn Around Times[2]	No. of Soil Samples	No. of Groundwater Samples	Unit Cost	Total Screening Cost	Total RAS Cost	Total DAS/Sub Cost
SCREENING-TYPE LABORATORY SAMPLE ANALYSIS (Task 4.1)							
Not Tasked							
RAS, RAS MODIFIED, OEME ANALYSES (Task 4.2)							
TAL Metals	21 days	63		$0.00	$0.00		
TAL Metals, Total	21 days		20	$0.00	$0.00		
TAL Metals, Dissolved	21 days		20	$0.00	$0.00		
DAS ANALYSIS (Task 4.3)							
Cr6+, Total	21 days		21	$60.00			
Cr6+, Dissolved	21 days		20	$60.00			
Cr6+[1]	21 days	69		$171.25			**$11,816.25**
(auxiliary analysis for Cr6+ MS)[3]		6		$120.00			**$720.00**
Lead[4]	14 days	0		$75.00			**$0.00**
Lead in soil ≤ 150 µm[4]	14 days	63		$675.00			**$42,525.00**
in vitro bioavailability of lead[4]	14 days[2]	63		$350.00			**$22,050.00**
SUBCONTRACT TOXICITY TESTS (Task 4.3) - none							
				GRAND TOTAL:	**$0.00**	**$0.00**	**$77,111.25**

Notes:

1 - Costs are based on current DAS pricing for D-160.2 from only qualified bidder and include analysis of pH and ORP for all soil samples.

2 - Turn around time calculated from the time of sample receipt with the exception of *in vitro* bioavailability of lead. TAT is calculated from the date of notice to proceed with analysis from AECOM.
3 - If matrix spike recovery fails, analysis of the matrix spike sample for TOC, ferrous iron and sulfide is used to assess the potential cause of spike failure. Costs assume six matrix spikes will be required and that all will require the auxiliary analyses to avoid data rejection.
4- Costs for lead, lead in sieved soil and IVBA lead are estimates based on discussions with multiple DAS labs and Test America Laboratories (Dr. Bruce). Costs for lead in soil ≤ 150 µm includes estimated cost for sample archival for period of 6 months.

Revisions after fact finding

Costs for total lead in soil (un-sieved and ≤150 µm) revised to remove cost for total lead analysis (estimated to be $75 per sample) and allocate sample preparation cost fully to the ≤150 µm lead unit cost.

Matrix /Analysis	Method[1]	Analyte List	Unit Price								
			Level 2 HDD			Level 3 HDD			Level 4 HDD		
			1-10 Samples	11-50 Samples	51+ Samples	1-10 Samples	11-50 Samples	51+ Samples	1-10 Samples	11-50 Samples	51+ Samples
Aqueous											
Volatile Organic Compounds (TCL, full scan)	SW-846 8260C	CLP SOM02.3 TCL	46	44	42	48	46	44	48	46	44
Volatile Organic Compounds (TCL, full scan, trace conc.)	SW-846 8260C	CLP SOM02.3 TCL	46	44	42	48	46	44	48	46	44
Volatile Organic Compounds (SIM, 1-3 compounds)	SW-846 8260C	1-3 compounds from CLP SOM02.3 TCL	44	42	40	45	43	41	45	43	41
Volatile Organic Compounds (TCL, full scan trace plus SIM for 1-3 cmpds)	SW-846 8260C	CLP SOM02.3 TCL	44	42	40	45	43	41	45	43	41
Volatile Organic Compounds (TICs for up to 20 peaks)	SW-846 8260C	--	10	10	9	12	11	11	12	11	11
Semivolatile Organic Compounds (TCL, full scan)	SW-846 8270D	CLP SOM02.3 TCL	115	110	105	120	114	109	120	114	109
Semivolatile Organic Compounds (PAHs, full scan)	SW-846 8270D	17 PAHs	85	81	77	90	86	82	90	86	82
Semivolatile Organic Compounds (PAHs, SIM)	SW-846 8270D	17 PAHs	85	81	77	90	86	82	90	86	82
Semivolatile Organic Compounds (TCL full scan + 17 SIM PAHs)	SW-846 8270D	CLP SOM02.3 TCL plus SIM 17 PAHs	150	143	136	155	148	141	155	148	141
Semivolatile Organic Compounds (TICs for up to 20 peaks)	SW-846 8270D	Tentatively Identified Compounds (up to 20 peaks)	10	10	9	12	11	11	12	11	11
Organochlorine Pesticides	SW-846 8081B	CLP SOM02.3 TCL	65	62	59	68	65	62	68	65	62
PCB Aroclors	SW-846 8082A	CLP SOM02.3 TCL	45	43	41	42	40	38	42	40	38
Organophosphorous Compounds (KAS Note: Subcontracted)	SW-846 8141B	Appendix C List	135	135	130	135	135	130	135	135	130
Chlorinated Herbicides	SW-846 8151A	Appendix C List	120	114	109	120	114	109	120	114	109
Metals (ICP-AES/CVAA)	SW-846 6010D/7470A	CLP ISM02.3 TAL	115	110	105	120	114	109	120	114	109
Metals (ICP-AES/MS/CVAA)	SW-846 6010D (major cations)/6020B/7470A	CLP ISM02.3 TAL	115	110	105	120	114	109	120	114	109
Metals (RCRA 8)	SW-846 6010D/7470A	RCRA 8 Metals	72	69	65	75	71	68	75	71	68
Metals (Individual ICP-AES w/digestion)	SW-846 6010D	Single ICP-AES Metal (with digestion)	10	10	9	12	11	11	12	11	11
Mercury	SW-846 7470A	Mercury	15	14	14	15	14	14	15	14	14
PFCs (tap water only) (KAS Note: Subcontracted)*	EPA 537, Revision 1.1	Perfluorooctanesulfonic acid (PFOS), Perfluorooctanoic acid (PFOA), Perfluorobutanesulfonic acid (PFBS)	350	350	350	350	350	350	350	350	350
PFCs (tap water only) (KAS Note: Subcontracted)*	EPA 537, Revision 1.1	Method 537, Section 1.1 Table	400	400	400	400	400	400	400	400	400
Perchlorate (KAS Note: Subbed)	SW-846 6850	--	130	125	125	130	125	125	130	125	125
Nitroaromatics, Nitramines and Nitrate Esters by HPLC	SW-846 3535A/8330B	Appendix C List	78	74	71	80	76	73	80	76	73
Nitroaromatics, Nitramines and Nitrate Esters by HPLC (subbed)	SW-846 3535A/8330B[2]	JBCC 2012 QAPP[2]	130	130	130	130	130	130	130	130	130
Hexavalent Chromium	SW-846 7196A	--	25	24	23	25	24	23	25	24	23
TPH-DIESEL to OIL RANGE (C28-C44)	SW-846 8015D Modified	--	76	72	69	80	76	73	80	76	73
TPH-DIESEL to OIL RANGE (C10-C28)	SW-846 8015D Modified	--	75	71	68	75	71	68	75	71	68
TPH-GASOLINE RANGE (C6-C12)	SW-846 8015D Modified	--	40	38	36	44	42	40	44	42	40
Alkalinity	SM 2320B	--	14	13	13	15	14	14	15	14	14
Anions (Chloride, Fluoride, Nitrate, Nitrite, Ortho-phosphate-P, Sulfate)	SW-846 9056A	Chloride, Fluoride, Nitrate, Nitrite, Ortho-phosphate-P, Sulfate	44	42	40	48	46	44	48	46	44
Anions (MNA suite Chloride, Nitrate, Nitrite, Sulfate)	SW-846 9056A	Chloride, Nitrate, Nitrite, Sulfate	32	30	29	36	34	33	36	34	33
Anions (separately)	SW-846 9056A	--	12	11	11	15	14	14	15	14	14
Total Organic Carbon	SW-846 9060A	--	20	19	18	22	21	20	22	21	20
Total Organic Carbon	SM 5310B	--	20	19	18	22	21	20	22	21	20
Methane/Ethane/Ethene	RSK-175	--	68	65	62	70	67	64	70	67	64
Total Suspended Solids	SM 2540 D	--	12	11	11	15	14	14	15	14	14
Total Dissolved Solids	SM 2540 C	--	10	10	9	12	11	11	12	11	11
Biological Oxygen Demand	SM 5210 B	--	35	33	32	35	33	32	35	33	32
Hardness	SM 2340 B (Calculated)	--	12	11	11	15	14	14	15	14	14
Nitrite-Nitrate as N	EPA 353.2	--	12	11	11	15	14	14	15	14	14
Sulfite	SM 4500 SO3 B	--	12	11	11	15	14	14	15	14	14
Sulfate	ASTM D516-02	--	12	11	11	15	14	14	15	14	14
Ferrous Iron	SM 3500Fe D	--	20	19	18	22	21	20	22	21	20
Chloride	SM 4500 CL E	--	12	11	11	15	14	14	15	14	14

Matrix / Analysis	Method[1]	Analyte List	Unit Price								
			Level 2 HDD			Level 3 HDD			Level 4 HDD		
			1-10 Samples	11-50 Samples	51+ Samples	1-10 Samples	11-50 Samples	51+ Samples	1-10 Samples	11-50 Samples	51+ Samples
Chemical Oxygen Demand	EPA 410.4	--	22	21	20	25	24	23	25	24	23
pH	SM 4500H B	--	5	5	5	5	5	5	5	5	5
Oxidation Reduction Potential	SM 2580 B	--	10	10	9	12	11	11	12	11	11
Corrosivity (as pH)	SW-846 9045C	--	5	5	5	5	5	5	5	5	5
Ignitability	SW-846 1010A	--	25	24	23	25	24	23	25	24	23
Reactivity (Cyanide and Sulfide)	SW-846 Ch. 7.3.1.2	--	44	42	40	48	46	44	48	46	44
Soil / Sediment											
Volatile Organic Compounds (TCL, full scan)	SW-846 8260C	CLP SOM02.3 TCL	55	52	50	58	55	53	58	55	53
Volatile Organic Compounds (TCL, full scan, trace conc.)	SW-846 8260C	CLP SOM02.3 TCL	55	52	50	58	55	53	58	55	53
Volatile Organic Compounds (SIM, 1-3 compounds)	SW-846 8260C	1-3 TCL Compounds	52	50	47	55	52	50	55	52	50
Volatile Organic Compounds (TCL, full scan trace plus SIM for 1-3 cmpds)	SW-846 8260C	CLP SOM02.3 TCL plus SIM 1-3 Compounds	52	50	47	55	52	50	55	52	50
Volatile Organic Compounds (TICs for up to 20 peaks)	SW-846 8260C	Tentatively Identified Compounds (up to 20 peaks)	10	10	9	12	11	11	12	11	11
Semivolatile Organic Compounds (TCL, full scan)	SW-846 8270D	CLP SOM02.3 TCL	115	110	105	120	114	109	120	114	109
Semivolatile Organic Compounds (PAHs, full scan)	SW-846 8270D	17 PAHs	85	81	77	90	86	82	90	86	82
Semivolatile Organic Compounds (PAHs, SIM)	SW-846 8270D	17 PAHs	85	81	77	90	86	82	90	86	82
Semivolatile Organic Compounds (TCL full scan + 17 SIM PAHs)	SW-846 8270D	CLP SOM02.3 TCL plus SIM 17 PAHs	150	143	136	155	148	141	155	148	141
Semivolatile Organic Compounds (TICs for up to 20 peaks)	SW-846 8270D	Tentatively Identified Compounds (up to 20 peaks)	10	10	9	12	11	11	12	11	11
Organochlorine Pesticides	SW-846 8081B	CLP SOM02.3 TCL	65	62	59	68	65	62	68	65	62
PCB Aroclors	SW-846 8082A	CLP SOM02.3 TCL	45	43	41	42	40	38	42	40	38
Organophosphorous Compounds (KAS Note: subcontracted)	SW-846 8141B	Appendix C List	135	135	130	135	135	130	135	135	130
Chlorinated Herbicides	SW-846 8151A	Appendix C List	120	114	109	120	114	109	120	114	109
Metals (ICP-AES/CVAA)	SW-846 6010D/7471B	CLP ISM02.3 TAL	115	110	105	120	114	109	120	114	109
Metals (ICP-AES/MS/CVAA)	SW-846 6010D (major cations)/6020B/7471B	CLP ISM02.3 TAL	115	110	105	120	114	109	120	114	109
Metals (RCRA 8)	SW-846 6010D/7471B	RCRA 8 Metals	72	69	65	75	71	68	75	71	68
Metals (Individual ICP-AES w/digestion)	SW-846 6010D	Single ICP-AES Metal (with digestion)	10	10	9	12	11	11	12	11	11
Mercury	SW-846 7471B	Mercury	15	14	14	15	14	14	15	14	14
Hexavalent Chromium (w/pH, ORP)	SW-846 3060/7196A	Hexavalent Chromium, pH/Eh	60	57	55	65	62	59	65	62	59
Hexavalent Chromium (supporting analyses Ferrous Iron, Sulfide, TOC)	--	Supporting Analyses (Ferrous Iron, Sulfide, TOC)	165	160	160	165	160	150	165	160	160
TPH-DIESEL to OIL RANGE (C28-C44)	SW-846 8015D Modified	--	76	72	69	80	76	73	80	76	73
TPH-DIESEL to OIL RANGE (C10-C28)	SW-846 8015D Modified	--	75	71	68	75	71	68	75	71	68
TPH-GASOLINE RANGE (C6-C12)	SW-846 8015D Modified	--	40	38	36	44	42	40	44	42	40
Total Organic Carbon	SW-846 9060A Modified	--	35	33	32	40	38	36	40	38	36
Total Organic Carbon	Lloyd Kahn	--	25	24	23	30	29	27	30	29	27
ASTM D 422-63	Grain Size (Sieve Only)	--	70	67	64	70	67	64	70	67	64
ASTM D 2937-04 (KAS Note: Subcontracted)	Bulk Density	--	35	35	35	35	35	35	35	35	35
ASTM D 854-06 – Method B (KAS Note: Subcontracted)	Total Porosity (Calc. From Bulk Density and Specific Gravity)	--	80	80	80	80	80	80	80	80	80
Acid Volatile Sulfide/Simultaneously Extracted Metals	EPA 821/R-91-100	AVS, Cd, Cu, Pb, Hg, Ni, Zn	170	162	155	175	167	159	175	167	159
Corrosivity (as pH)	SW-846 9045C	--	5	5	5	5	5	5	5	5	5
Ignitability	SW-846 1010A	--	25	24	23	25	24	23	25	24	23
Reactivity (Cyanide and Sulfide)	SW-846 Ch. 7.3.1.2	--	50	48	45	50	48	45	50	48	45
Paint Filter Test	SW-846 9095	--	20	19	18	20	19	18	20	19	18
TCLP Prep	SW-846 1311	--	40	38	36	40	38	36	40	38	36
Zero-headspace prep (for TCLP VOCs)	SW-846 1311	--	25	24	23	25	24	23	25	24	23
TCLP VOA	SW-846 8260C	RCRA VOCs	44	42	40	46	44	42	46	44	42

USACE NAD HTRW
Master Service Agreement for Laboratory Services

Matrix /Analysis	Method[1]	Analyte List	Unit Price								
			Level 2 HDD			Level 3 HDD			Level 4 HDD		
			1-10 Samples	11-50 Samples	51+ Samples	1-10 Samples	11-50 Samples	51+ Samples	1-10 Samples	11-50 Samples	51+ Samples
TCLP SVOA	SW-846 8270D	RCRA SVOCs	100	95	91	105	100	95	105	100	95
TCLP Pesticides	SW-846 8081B	RCRA Pesticides	55	52	50	60	57	55	60	57	55
TCLP Herbicides	SW-846 8151A	RCRA Herbicides	110	105	100	115	110	105	115	110	105
TCLP Metals	SW-846 6010D/7470A	RCRA Metals	65	62	59	70	67	64	70	67	64
SPLP Prep	SW-846 1312	--	40	38	36	40	38	36	40	38	36
Turn-Around-Time Multipliers			**Unit Price**								
			Level 2 HDD			**Level 3 HDD**			**Level 4 HDD**		
			1-10 Samples	11-50 Samples	51+ Samples	1-10 Samples	11-50 Samples	51+ Samples	1-10 Samples	11-50 Samples	51+ Samples
24 - Hour preliminary results (HDD and EDD in 10 BD)	NA		1.9	1.85	1.8	1.9	1.85	1.8	1.9	1.85	1.8
48 - Hour preliminary results (HDD and EDD in 10 BD)	NA		1.75	1.7	1.65	1.75	1.7	1.65	1.75	1.7	1.65
72 - Hour preliminary results (HDD and EDD in 10 BD)	NA		1.6	1.55	1.5	1.6	1.55	1.5	1.6	1.55	1.5
7 Calendar Day	NA		1.25	1.2	1.15	1.25	1.2	1.15	1.25	1.2	1.15
14 Calendar Day	NA		0	0	0	0	0	0	0	0	0
21 Calendar Day	NA		0	0	0	0	0	0	0	0	0

Notes:
(1) All analyes must be performed in accordance with DoD QSM v5.0 and the published method specified. All QA/QC criteria must be as specified in the DoD/DOE QSM v5.0 and the published method specified. Variances, deviations or clarifications associated with the pricing presented must be submitted on a per analysis basis for the analyses listed above.
(2) Analysis conducted in accordance with the *Final Generic Quality Assurance Project Plan for Impact Area Groundwater Study Program* (February 2012), prepared for USACE- NAD and Army National Guard, Camp Edwards, Massachusetts (Joint Base Cape Cod) modified for the quality control limits specified in DoD/DOE QSM v5.0.

Appendix C - the list of analytes presented for the analytical method cited in Appendix C of the DoD/ DOE QSM v5.0.
CLP - Contract Laboratory Program
CLP ISM02.3 TAL - the analytes listed on the Target Analyte List specified in the USEPA Contract Laboratory Program Statement of Work (CLP SOW) ISM02.3
CLP SOM02.3 TCL - the Target Compound List specified in the USEPA Contract Laboratory Program Statement of Work (CLP SOW) SOM02.3
NA - Not applicable

All prices must be shown in U.S. dollars and remain valid until March 3, 2021. Pricing must include all taxes any other costs which may be involved in the normal course of performing this work

Bidder's Signature
This signature means that the bidder has read and understands this bid package and is willing to execute an AECOM subcontracting agreement. **The signatory must have the authority to bind the bidding company.** The signature also means that all statements in this bid are accurate and truthful. Prices must be all inclusive, in the format shown. AECOM will not pay any costs outside of the prices shown

Katahdin Analytical Services
Bidding Company's Name

22-Jun-16
Bidder's Signature — Date

Gregory Lull / Federal Programs Manager
Bidder's Printed Name and Title

KAS Note regarding PFC analysis by EPA 537 - the method specifies that field reagent blanks be collected with each sample. These will be billed out at unit rates and are not included here.

Glacier Drilling, LLC 75 Commerce Circle, Durham, CT 06422

Date: 6/15/2018 **Cost Proposal**

For:

AECOM
250 Apollo Drive
Chelmsford, MA 01824
Phone: 978-905-2582
Fax: 978-905-2101
Cell: 401-787-0649

Attn: Abigail Brakenwagen,

In response to your discussions with Mark Schock with reference to drilling holes next to each other and backfill with ZVI mixture material, we've prepared the following cost estimate.
We would advance 10" Casing to 40', leave that casing in place, move ahead next to Casing and advance a different string of tooling also to 40', When both casing are in ground, use slide base on drill rig to reconnect and backfill 1st hole with mixture while extracting tooling. Repeat "leapfrog" process until complete for 200 borings to 40'. for a project in Attleboro, MA.
Note: Understand that we do not have to pre-clear, air vac, these borings.

Quantity	DESCRIPTION	CHARGES	TOTAL
66.00	Sonic Rig / 2 man crew / day	5,750.00	379,500.00
	(inlcudes Per Diem / day)		
1.00	Mob. & Demob. - Sonic Rig charge	1,750.00	1,750.00
Additional Comments:			.
a) This cost estimate will be adjusted for actual quantities required.			.
b) Overtime, if required after 8 hrs. on site, would be billed at $675./hr.			
Prepared by: Reuben R. Schock, Phone: 860-349-0397			.

E-mail address: rschock@glacierdrilling.com

Total service charges: **381,250.00**

Price valid until: 9/15/2018

Glacier Drilling, LLC 75 Commerce Circle, Durham, CT 06422

Date:	7/9/2018	**Cost Proposal**			
For:		**Using a Sonic Rig, 8140LS, install 13 (4") open hole bedrock**			
		wells to ~ 62' in area 1, seating 4" Casing 5', into rock, anticipating			
AECOM		**bedrock at ~ 27', and in area 2 install 20 (4") open hole bedrock**			
250 Apollo Drive		**wells also seating 4" casing 5' into rock which is anticiapted at**			
Chelmsford, MA 01824		**~ 50' and finish with 12" Road Boxes at a site in**			
Phone: 978-905-2582		**Attleboro, MA.**			
Fax: 978-905-2101					
Cell: 401-787-0649					
		Note: Understand that we do not have to pre-clear, air vac, these			
Attn: Abigail Brakenwagen,		**borings or drum any excess materials.**			

Quantity	DESCRIPTION		CHARGES	TOTAL
33.00	Sonic Rig / 2 man crew / day		5,750.00	189,750.00
	(inlcudes Per Diem / day)			0.00
1.00	Mob. & Demob. - Sonic Rig charge		1,750.00	1,750.00
				0.00
				0.00
1620.00	4" FJ Steel Casing / ft.		24.75	40,095.00
				0.00
1620.00	Grouting / ft.		5.00	8,100.00
				0.00
33.00	6" Expandable Gripper		33.75	1,113.75
				0.00
33.00	12" Road Boxes		150.00	4,950.00
				0.00
66.00	Cement Mix / 80 lb bags		13.00	858.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
				0.00
Additional Comments:				.
a) This cost estimate will be adjusted for actual quantities required.				.
b) Overtime, if required after 8 hrs. on site, would be billed at $675./hr.				
Prepared by: Reuben R. Schock, Phone: 860-349-0397				.
E-mail address: rschock@glacierdrilling.com			***Total service charges:***	**246,616.75**
			Price valid until:	10/9/2018

CARBON FILTRATION SYSTEMS INC.
68 Mill Street, Johnston, RI 02919
Tel: 401-946-7838
Tim@carbonfiltrationsystems.com
www.carbonfiltrationsystems.com

Date: July12, 2018

To:
Ms. Abigail Brakenwagen
AECOM
Ph 978-9052582
E-mail:
Abigail.brakenwagen@aecom.com

From: Tim Rutherford

RE: ***Filtration Equipment-Attleboro, MA*** – Hex Chrome

Equipment:

Qty	Description	Unit Price	Total
2	**Pressure Vessels –** fiberglass composite pressure vessels, 30" diameter x 72" ht., 80" Overall ht with base, 2" Inlet/Outlet, each vessel filled with 20 cubic feet each anion exchange resin, includes gravel underbedding.	$10,200	$20,400.00 – Purchase
2	**Bag Filter Housings**– size P2, SS304 construction, 2" FNPT inlet/outlet, 100 PSI, CFS proposes 2 in series	$1,300	$2,600.00
1	Deliver Equipment, Place, and Fill on site – Attleboro, MA	$1600	$1,600.00
	Options:		
1	Plumb In Equipment on site		Additional
---	Replacement bag filters – 5,10,25,50,100 micron – 50/case	$5.00 each	
1	Ion Exchange Resin Replacement – vacuum removal of used resin and replace with new resin. Used resin to be drummed and left on site for disposal by others. • One Vessel – 20 cubic feet		$7,200.00
	Thank you for allowing CFS to quote our products and services.		

PROPOSAL ACCEPTANCE

Your signature below signifies the acceptance of the specifications, terms, and conditions of this proposal. Please sign and return one copy of this proposal and retain a copy for your record. Also, please include a formal purchase order or purchase order number if required.

_____ Authorized Signature

_____ Date

_____ Purchase Order #

CARBON FILTRATION SYSTEMS INC.
68 Mill Street, Johnston, RI 02919
Tel: 401-946-7838
Tim@carbonfiltrationsystems.com
www.carbonfiltrationsystems.com

Date: July12, 2018

To:
Ms. Abigail Brakenwagen
AECOM
Ph 978-9052582
E-mail:
Abigail.brakenwagen@aecom.com

From: Tim Rutherford

RE: ***Filtration Equipment-Attleboro, MA*** – Hex Chrome

Equipment:

Qty	Description	Unit Price	Total
2	**Pressure Vessels(6 GPM) –** fiberglass composite pressure vessels, 13" diameter x 54" ht., 56" Overall ht with base, 1" Inlet/Outlet, each vessel filled with 3 cubic feet each anion exchange resin, includes gravel underbedding.	$1,200	$2,400.00 – Purchase
1	**Bag Filter Housings**– size P4, SS304 construction, 1" FNPT inlet/outlet, 100 PSI, CFS proposes 2 in series	$700	$700.00
1	Deliver Equipment, Place, and Fill on site – Attleboro, MA	$550	$550.00
	Options:		
1	Plumb In Equipment on site		Additional
---	Replacement bag filters – 5,10,25,50,100 micron – 50/case	$5.00 each	
1	Ion Exchange Resin Replacement – vacuum removal of used resin and replace with new resin. Used resin to be drummed and left on site for disposal by others. • 2x3 cubit foot vessels		$2,625.00
	Thank you for allowing CFS to quote our products and services.		

PROPOSAL ACCEPTANCE

Your signature below signifies the acceptance of the specifications, terms, and conditions of this proposal. Please sign and return one copy of this proposal and retain a copy for your record. Also, please include a formal purchase order or purchase order number if required.

_____ Authorized Signature

_____ Date

_____ Purchase Order #

Brakenwagen, Abigail

From: Bruce Hillman <bhillman@capitolenv.com>
Sent: Monday, June 04, 2018 2:10 PM
To: Brakenwagen, Abigail
Cc: MacPhee, Craig
Subject: FW: another project for soil estimates

Hi Abby,

I forgot to mention the MA Transporter fee and VID fee that would be charged for all hazardous waste shipments out of MA that are not exempt. (usually only projects paid for using public money, federal/state/municipality).

So for any D code or F code soil not exempt you would need to add the following to the estimates I gave you: $52.80/ton MA Haz fee and $3.44/ton MA VID fee.

Let me know if you have any questions,

Bruce Hillman
Senior Business Manager
Capitol Environmental Services, Inc.
Mobile – 860-601-0387
eFax – 860-469-4043
www.capitolenv.com

From: Bruce Hillman
Sent: Monday, June 04, 2018 1:58 PM
To: 'Brakenwagen, Abigail'
Cc: Craig MacPhee (Craig.MacPhee@aecom.com)
Subject: RE: another project for soil estimates

Hello Abby,

Below in red are "ballpark T&D rates for various options for the removal of chrome contaminated soil at your site in Attleboro, MA. As the project gets closer and the timing and analytical data fills in I would be happy to fine tune these for you. Please feel free to reach out should you require additional information or have any questions at all.

Thanks again and hope to talk soon,

Bruce Hillman
Senior Business Manager
Capitol Environmental Services, Inc.
Mobile – 860-601-0387
eFax – 860-469-4043
www.capitolenv.com

From: Brakenwagen, Abigail [mailto:Abigail.Brakenwagen@aecom.com]
Sent: Wednesday, May 30, 2018 5:29 PM
To: Bruce Hillman
Subject: RE: another project for soil estimates

Hi Bruce,

We are costing out an FS and one element is a ZVI barrier wall. The excavation for the wall will result in ~5280 tons (3300CY*1.6) of soil for T&D. There has not been extensive sampling done in the area so the following are the potential options that Craig sees in terms of characterizing the soil:

1. Nonhaz (Cr+6 ~4ppm) $60.00/ton T&D
2. Fails Cr+6 TCLP (D007) $250.00/ton T&D
3. Passes TCLP but generator applies F code $250.00/ton T&D

Could you please provide a unit cost for T&D of the three possibilities and which facility they would go to? Please let me know if you would like any further information.

Thanks,
Abby

Abigail Brakenwagen, EIT
Project Engineer, Environment
D: 978.905.2582
M: 401.787.0649
abigail.brakenwagen@aecom.com

AECOM
250 Apollo Drive
Chelmsford, MA 01824
T: 978.905.2100 F: 978.905.2101
www.aecom.com

Built to deliver a better world

LinkedIn Twitter Facebook Instagram

From: MacPhee, Craig
Sent: Wednesday, May 30, 2018 4:09 PM
To: Bruce Hillman
Cc: Brakenwagen, Abigail
Subject: another project for soil estimates

Hi Bruce

We are very busy lately with projects and feasibility studies. I am hoping you can find a little time to help Abby Brakenwagen with some numbers for Cr+6 impacted soil coming out of Attleboro, MA. Abby will send you details.

Appreciate the assistance.

Craig

Craig W. MacPhee, P.E.
Director of Engineering
Environment
D 978-905-2299
C 978-758-6174
craig.macphee@aecom.com

AECOM
250 Apollo Drive
Chelmsford, MA 01824
T 978.905.2100 F 978.905.2101
www.aecom.com

Brakenwagen, Abigail

From: Glen Wilkinson <gwilkinson@cleanearthinc.com>
Sent: Monday, June 11, 2018 9:52 AM
To: Brakenwagen, Abigail
Subject: RE: soil quotes

1. Offsite Treatment NH
    a. Thermal Treatment – Approximately $80 per ton T&D
2. RCRA Characteristic (D007)
    a. Offsite - $290 per ton T&D Kearny, NJ
    b. On Site; ex situ - $110 per ton T&D
        i. Subtitle D disposal $115 (+tax?)
        ii. Thermal treatment $80 per ton.
3. No price for this option.

That should get you most of the way.

Glen Wilkinson
Technical Sales Representative

Clean Earth, Inc.
58 North Washington Street, Plainville, CT 06062
T 877.445.3478;2013 | C 603.770.8195 | F 215-734-1417
gwilkinson@cleanearthinc.com | www.cleanearthinc.com

From: Brakenwagen, Abigail [mailto:Abigail.Brakenwagen@aecom.com]
Sent: Monday, June 11, 2018 9:34 AM
To: Glen Wilkinson <gwilkinson@cleanearthinc.com>
Subject: RE: soil quotes

Hi Glen,

Hope you had a nice weekend. I just wanted to follow up on this as we are getting into crunch time with the FS. Please let me know if you have any questions.

Thanks,
Abby

From: Brakenwagen, Abigail
Sent: Wednesday, May 30, 2018 5:28 PM
To: 'Glen Wilkinson'
Subject: RE: soil quotes

Hi Glen,

We are costing out an FS and one element is a ZVI barrier wall. The excavation for the wall will result in ~5280 tons (3300CY*1.6) of soil for T&D. There has not been extensive sampling done in the area so the following are the potential options that Craig sees in terms of characterizing the soil:

1. Nonhaz (Cr+6 ~4ppm)
2. Fails Cr+6 TCLP (D007)

3. Passes TCLP but generator applies F code

Could you please provide a unit cost for T&D of the three possibilities and which facility they would go to? Please let me know if you would like any further information.

Thanks,
Abby

Abigail Brakenwagen, EIT
Project Engineer, Environment
D: 978.905.2582
M: 401.787.0649
abigail.brakenwagen@aecom.com

AECOM
250 Apollo Drive
Chelmsford, MA 01824
T: 978.905.2100 F: 978.905.2101
www.aecom.com

Built to deliver a better world

LinkedIn Twitter Facebook Instagram

From: Glen Wilkinson [mailto:gwilkinson@cleanearthinc.com]
Sent: Wednesday, May 30, 2018 4:17 PM
To: MacPhee, Craig
Cc: Brakenwagen, Abigail
Subject: Re: soil quotes

Not a problem.

We are starting a Cr6 conversion project this week.

Glen Wilkinson
Technical Service Representative

gwilkinson@cleanearthinc.com
(603) 770-8195

From: MacPhee, Craig <Craig.MacPhee@aecom.com>
Sent: Wednesday, May 30, 2018 4:10:36 PM
To: Glen Wilkinson
Cc: Brakenwagen, Abigail
Subject: soil quotes

Hi Glen

We are very busy lately with projects and feasibility studies. I am hoping you can find a little time to help Abby Brakenwagen with some numbers for Cr+6 impacted soil coming out of Attleboro, MA. Abby will send you details.

Appreciate the assistance.

Craig

Craig W. MacPhee, P.E.
Director of Engineering
Environment
D 978-905-2299
C 978-758-6174
craig.macphee@aecom.com

AECOM
250 Apollo Drive
Chelmsford, MA 01824
T 978.905.2100 F 978.905.2101
www.aecom.com

CONNELLY – GPM, INC.

ESTABLISHED 1875
3154 SOUTH CALIFORNIA AVENUE CHICAGO, ILLINOIS 60608-5176
PHONE: (773) 247-7231 • www.ConnellyGPM.com • FAX: (773) 247-7239

Sent via Email: craig.MacPhee@aecom.com

May 31, 2018

Mr. Craig MacPhee
Director of Engineering
AECOM
250 Apollo Drive
Chelmsford, MA 01824 Ph: 978.905.2100

Re: Approximately 300 Net Tons (200-3,000 Lb. Bulk Bags) Iron Aggregate ETI CC-1004 for Attleboro, MA

Dear Craig:

Thank you for allowing us to bid on your upcoming (2019/2020) project in Attleboro, MA. Following is current pricing and information for our ETI CC-1004 Iron Aggregate.

Pricing:

	CURRENT PRICING
Iron Aggregate ETI CC-1004 (-8 +50 mesh)	$820.80/NT
3000 Lb. Bulk Bags (1.5NT per Bulk Bag) ($21.00 ea)	$ 14.00/NT
42" x 42" Pallets - Reconditioned ($7.80 ea)	$ 5.20/NT
Total/NT, F.O.B. Chicago, IL:	$840.00/NT

Our material is shipped F.O.B., our plant, Chicago, IL. Freight is billed to you separately by the carrier of your choice (see *Freight* on Page 3)

All taxes are the responsibility of the purchaser.

If stored outside, bulk bags must remain under tarp and dry at all times.

The pricing quoted above is guaranteed based on receipt of your 25% deposit and purchase order by 6/29/18, and shipments beginning 7/16/18. We usually keep several truckloads of ETI CC-1004 in inventory; essentially, shipments could begin any time following your payment.

Terms of Purchase:

Upon receipt of your purchase order and 25% deposit, we will initiate our production scheduling and provide you with a best-case/worst-case ship date. Should, however, the schedule we discuss not meet with your approval, we would immediately refund your deposit and cancel your purchase order. (Please understand that we are working on a first come-first serve basis. Receipt of your purchase order and 25% deposit will ensure placement into our production schedule.)

Payment for the balance of the material would be due one week prior to shipment. Pro-Forma Invoices will be provided to assist you in preparing your deposit and payment balance.

Schedule/Delivery: Our practice is to keep several truckloads of ETI CC-1004 in inventory.

Shipment of 300 Net Tons of ETI CC-1004 would require 13 full flats bed loads (292.5NT) and 1 partial van (7.5NT). We usually load 4 to 6 truckloads per day, so 14 loads could ship within 3 days.

We will work together with all parties involved and provide the high level of service that the industry has come to expect from us. We have already supplied many of the largest sites to date using Iron Aggregate for groundwater remediation, including one over 10,000NT. In completing those orders, we met or exceeded all planned production and delivery expectations.

It is our policy that we cannot accept iron back once it has been shipped; however, we always work closely with our customers to avoid supplying excess material. We recommend holding the last one or two truckloads for you at our plant to ensure that over-shipment does not occur. When your construction starts, and you begin getting your installation results, you can then take time to recalculate your iron needs. Should you require the additional tonnage we are holding for you at our plant, we would ship the material at once upon your release. If you do not require the last one or two truckloads (or just a portion), we would immediately refund the balance of your deposit for any unshipped material.

We also realize more tonnage may be required to complete your project. We always regard the project under construction as a priority; therefore, should additional iron be required, we would send you a Pro-Forma Invoice for the amount needed, and upon receipt of your payment, we would immediately begin production of that material.

Force Majeure:

Your P.O. must include the following language: *"Connelly-GPM, Inc. shall not be liable for any failure or delay or interruption in performance under this Agreement to the extent said failure or delay is caused by causes beyond its control, including, without limitation, failure of suppliers, subcontractors or carriers, equipment failures, labor disputes, acts of God, force majeure, government restrictions, civil unrest, terrorism, embargoes and the like. As a condition to a claim of non-liability, Connelly-GPM shall give the customer prompt written notice, with full details following the occurrence of the cause relied upon. Dates by which performance obligations are scheduled to be met will be extended for a period of time equal to the time lost due to any delay so caused."*

Storage of Material:

The Iron Aggregate should be kept dry at all times. We recommend storing the bulk bags in a dry (warehouse) environment. If stored outside, the bulk bags must remain under tarp. Connelly-GPM, Inc. offers a unique tarp system; each tarp will cover up to 96NT (or 64 bulk bags). In addition, the tarps could ship on the same truck as your Iron Aggregate, thus avoiding any additional freight cost to you. For more information, please see attached Tarp Specification.

Specifications and Pre-Shipment Samples:

Connelly-GPM, Inc. is only an iron grinder. We claim no expertise in the use of our products for water purification. While our customers have been very pleased with the performance of our product for the removal of a variety of organic and inorganic contaminants, that effectiveness has been established through their research and testing, not ours. We guarantee only to produce an oil-free Iron Aggregate conforming to a specified particle size distribution range and bulk density.

We take great pride in the quality and consistency of our product, but we are not in a position to test for or guarantee the specific results of the use of that iron for groundwater remediation. We recommend that our customers test the suitability of our iron for their proposed application. Accordingly, your Purchase Order should not stipulate water purification performance or effectiveness. We are, however, willing to discuss providing pre-shipment samples for testing and approval prior to shipment.

Quality Control and Certification:

Connelly-GPM, Inc.'s Quality Control process is considered to be the industry standard for ground Iron Aggregate, and has allowed us to maintain the highest standards of quality while fulfilling the largest orders in the history of this groundwater remediation technology.

These procedures begin with analytical selection of cast iron sources along with screening and approval of every individual truckload of raw iron delivered to the plant. The iron sources are then blended to provide the proper mixture to feed into the production process. The finished product is sampled at regular intervals, and those samples are grouped to provide a combined representative sample, which more accurately represents the contents of a group of bags than any individual sample would. These samples are continuously taken, combined, and tested during the production process.

Upon request, Connelly-GPM will furnish Certificates of Analysis for each truckload of material certifying that the material shipped meets all specifications as outlined above (*Specifications and Pre-Shipment Samples*).

Freight:

Our material is sold *F.O.B. Chicago, IL* – freight is billed directly to you by the carrier. We will investigate freight rates for you or contact the carrier of your choice for pick-up. We will work closely with that carrier throughout the shipment process to ensure your installation schedule is met.

The best freight rate we found from Chicago, IL to Attleboro, MA is as follows. (Rate is good for 30 days)

Flatbed Over-The-Road Truck — We received a freight rate of **$3,900/Truckload**, which includes fuel surcharge, tarp and tolls. A flatbed will carry 15-3000# bulk bags, for a payload of 22.5NT of material, which would be a **freight cost of $173.33/NT**. A flatbed is ideal for installation sites as it can be unloaded with a forklift from either side, directly from the ground. A total of 13 full flat beds (292.5NT) and a partial van load (7.5NT) would be required to transport 300NT, however, since partial rates fluctuate weekly, we would provide you with a partial rate just prior to your start-up.

Be advised that, due to the current fuel prices, any freight quotes are subject to a fuel surcharge that varies from week to week. They have gone as high as 25% (and could go even higher), so keep this in mind when planning your budget. Freight rate information given to you by Connelly-GPM, Inc. is our understanding of the freight charges in effect at that time. Connelly-GPM takes no responsibility for the completeness or accuracy of such information and you are encouraged to obtain confirmation of freight rates on your own. Connelly-GPM, Inc. cannot guarantee truck availability.

Support Documentation:

Attached is our Iron Aggregate Label with the World Logo, a News Release on Ground Water Remediation with Zero-Valent Iron, a Screen Specification on ETI CC-1004, a Material Safety Data Sheet on Iron Aggregate, and our company background.

Summation:

Connelly-GPM, Inc. has been in business since 1875, and we take pride in being the world's largest manufacturer of Iron Aggregate. We can custom grind to meet your needs. We have provided the majority of Iron Aggregate to sites around the world; many over 2,000 Net Tons, a few over 3,500 Net Tons, and the largest site to date of over 10,000 Net Tons. Our record of delivering orders on time and within specifications has made us the supplier of choice for this rapidly growing technology.

The terms and conditions outlined in this quotation have been our standard for many years, and have been the criteria governing purchases with all of our customers. Especially during these times of uncertainty, it is imperative that we maintain our policies, which allow us to respond intelligently and accurately to market conditions. These business practices are also a direct benefit to our customers. If we were to set firm pricing months in advance of purchase and extend credit terms, it would necessitate incorporating risks into that pricing; thereby setting higher pricing at the time of quotation to account for the uncertainties in the marketplace.

Thank you for the opportunity to provide you with this quotation, and if you have any questions, please feel free to contact me.

Sincerely,

CONNELLY-GPM, INC.
THE IRON AGGREGATE PEOPLE™

Amy Marchefka
Sales Manager

Attachments

D:\WORD\WT\AthruD\AECOM\ATTLEBORO MA CC1004 300NT QTE 053118

CONNELLY – GPM, INC.

ESTABLISHED 1875
3154 SOUTH CALIFORNIA AVENUE CHICAGO, ILLINOIS 60608-5176
PHONE: (773) 247-7231 • www.ConnellyGPM.com • FAX: (773) 247-7239

Sent via Email: craig.MacPhee@aecom.com

May 31, 2018

Mr. Craig MacPhee
Director of Engineering
AECOM
250 Apollo Drive
Chelmsford, MA 01824 Ph: 978.905.2100

Re: Approximately 300 Net Tons Iron Aggregate CC-1200 for Attleboro, MA

Dear Craig:

Thank you for allowing us to bid on your upcoming (2019/2020) project in Attleboro, MA. Following is current pricing and information for our CC-1200 Iron Aggregate.

Pricing:

	CURRENT PRICING
Iron Aggregate CC-1200 (-50/-60 mesh)	$1,220.80/NT
3000 Lb. Bulk Bags (1.5NT per Bulk Bag) ($21.00 ea)	$ 14.00/NT
42" x 42" Pallets - Reconditioned ($7.80 ea)	$ 5.20/NT
Total/NT, F.O.B. Chicago, IL:	$1,240.00/NT

Our material is shipped F.O.B., our plant, Chicago, IL. Freight is billed to you separately by the carrier of your choice (see *Freight* on Page 3)

All taxes are the responsibility of the purchaser.

If stored outside, bulk bags must remain under tarp and dry at all times.

The pricing quoted above is guaranteed based on receipt of your 25% deposit and irrevocable purchase order by 6/29/18, and shipments beginning 7/16/18. Shipments would continue on a weekly basis (1 truck per week) until all material is produced and shipped. 14 trucks would be needed to haul 300 net tons. At any time prior to your project start-up, we will be pleased to provide you with updated quotes.

Terms of Purchase:

Upon receipt of your irrevocable purchase order and 25% deposit, we will initiate our production scheduling and provide you with a best-case/worst-case ship date. Should, however, the schedule we discuss not meet with your approval, we would immediately refund your deposit and cancel your purchase order. (Please understand that we are working on a first come-first serve basis. Receipt of your irrevocable purchase order and 25% deposit will ensure placement into our production schedule.)

Payment for the balance of the material would be due one week prior to start of shipment. Pro-Forma Invoices will be provided to assist you in preparing your deposit and payment balance.

Schedule/Delivery: Our CC-1200 has a long production timeframe. We can produce approximately 22.5NT / 1 truckload per week.

Based on receipt of your payment and irrevocable purchase order by 6/15/18, 300 Net Tons of CC-1200 could start shipping 7/16/18 and complete by 10/22/18. Of course, we would do everything possible to better this timeframe.

We will work together with all parties involved and provide the high level of service that the industry has come to expect from us. We have already supplied many of the largest sites to date using Iron Aggregate for groundwater remediation, including one over 10,000NT. In completing those orders, we met or exceeded all planned production and delivery expectations.

It is our policy that we cannot accept iron back once it has been shipped.

Our CC-1200 is considered a special order item. Accordingly, if you were forced to cancel your order, although we would immediately cease production, you would be responsible for any material already produced.

We also realize more tonnage may be required to complete your project. We always regard the project under construction as a priority; therefore, should additional iron be required, we would send you a Pro-Forma Invoice for the amount needed, and upon receipt of your payment, we would immediately begin production of that material.

Force Majeure:

Your P.O. must include the following language: *"Connelly-GPM, Inc. shall not be liable for any failure or delay or interruption in performance under this Agreement to the extent said failure or delay is caused by causes beyond its control, including, without limitation, failure of suppliers, subcontractors or carriers, equipment failures, labor disputes, acts of God, force majeure, government restrictions, civil unrest, terrorism, embargoes and the like. As a condition to a claim of non-liability, Connelly-GPM shall give the customer prompt written notice, with full details following the occurrence of the cause relied upon. Dates by which performance obligations are scheduled to be met will be extended for a period of time equal to the time lost due to any delay so caused."*

Storage of Material:

The Iron Aggregate should be kept dry at all times. We recommend storing the bulk bags in a dry (warehouse) environment. If stored outside, the bulk bags must remain under tarp. Connelly-GPM, Inc. offers a unique tarp system; each tarp will cover up to 96NT (or 64 bulk bags). In addition, the tarps could ship on the same truck as your Iron Aggregate, thus avoiding any additional freight cost to you. For more information, please see attached Tarp Specification.

Specifications and Pre-Shipment Samples:

Connelly-GPM, Inc. is only an iron grinder. We claim no expertise in the use of our products for water purification. While our customers have been very pleased with the performance of our product for the removal of a variety of organic and inorganic contaminants, that effectiveness has been established through their research and testing, not ours. We guarantee only to produce an oil-free Iron Aggregate conforming to a specified particle size distribution range and bulk density.

We take great pride in the quality and consistency of our product, but we are not in a position to test for or guarantee the specific results of the use of that iron for groundwater remediation. We recommend that our customers test the suitability of our iron for their proposed application. Accordingly, your Purchase Order should not stipulate water purification performance or effectiveness. We are, however, willing to discuss providing pre-shipment samples for testing and approval prior to shipment.

Quality Control and Certification:

Connelly-GPM, Inc.'s Quality Control process is considered to be the industry standard for ground Iron Aggregate, and has allowed us to maintain the highest standards of quality while fulfilling the largest orders in the history of this groundwater remediation technology.

These procedures begin with analytical selection of cast iron sources along with screening and approval of every individual truckload of raw iron delivered to the plant. The iron sources are then blended to provide the proper mixture to feed into the production process. The finished product is sampled at regular intervals, and those samples are grouped to provide a combined representative sample, which more accurately represents the contents of a group of bags than any individual sample would. These samples are continuously taken, combined, and tested during the production process.

Upon request, Connelly-GPM will furnish Certificates of Analysis for each truckload of material certifying that the material shipped meets all specifications as outlined above (*Specifications and Pre-Shipment Samples*).

Freight:

Our material is sold *F.O.B. Chicago, IL* – freight is billed directly to you by the carrier. We will investigate freight rates for you or contact the carrier of your choice for pick-up. We will work closely with that carrier throughout the shipment process to ensure your installation schedule is met.

The best freight rate we found from Chicago, IL to Attleboro, MA is as follows. (Rate is good for 30 days)

Flatbed Over-The-Road Truck — We received a freight rate of **$3,900/Truckload**, which includes fuel surcharge, tarp and tolls. A flatbed will carry 15-3000# bulk bags, for a payload of 22.5NT of material, which would be a **freight cost of $173.33/NT**. A flatbed is ideal for installation sites as it can be unloaded with a forklift from either side, directly from the ground. A total of 13 full flat bed loads (292.5NT) and a partial van load (7.5NT) would be required to transport 300NT, however, since partial rates fluctuate weekly, we would provide you with a partial rate just prior to your start-up.

Be advised that, due to the current fuel prices, any freight quotes are subject to a fuel surcharge that varies from week to week. They have gone as high as 25% (and could go even higher), so keep this in mind when planning your budget. Freight rate information given to you by Connelly-GPM, Inc. is our understanding of the freight charges in effect at that time. Connelly-GPM takes no responsibility for the completeness or accuracy of such information and you are encouraged to obtain confirmation of freight rates on your own. Connelly-GPM, Inc. cannot guarantee truck availability.

Support Documentation:

Attached is our Iron Aggregate Label with the World Logo, a News Release on Ground Water Remediation with Zero-Valent Iron, a Screen Specification on CC-1200, a Material Safety Data Sheet on Iron Aggregate, and our company background.

Summation:

Connelly-GPM, Inc. has been in business since 1875, and we take pride in being the world's largest manufacturer of Iron Aggregate. We can custom grind to meet your needs. We have provided the majority of Iron Aggregate to sites around the world; many over 2,000 Net Tons, a few over 3,500 Net Tons, and the largest site to date of over 10,000 Net Tons. Our record of delivering orders on time and within specifications has made us the supplier of choice for this rapidly growing technology.

The terms and conditions outlined in this quotation have been our standard for many years, and have been the criteria governing purchases with all of our customers. Especially during these times of uncertainty, it is imperative that we maintain our policies, which allow us to respond intelligently and accurately to market conditions. These business practices are also a direct benefit to our customers. If we were to set firm pricing months in advance of purchase and extend credit terms, it would necessitate incorporating risks into that pricing; thereby setting higher pricing at the time of quotation to account for the uncertainties in the marketplace.

Thank you for the opportunity to provide you with this quotation, and if you have any questions, please feel free to contact me.

Sincerely,

CONNELLY-GPM, INC.
THE IRON AGGREGATE PEOPLE™

Amy Marchefka
Sales Manager

Attachments

D:\WORD\WT\AthruD\AECOM\ATTLEBORO MA CC1200 300NT QTE 053118

APPENDIX E – ARARs TABLES

TABLE E-1
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE S-1: NO ACTION
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Human Health Assessment Cancer Slope Factors (CSFs)	None	To Be Considered	CSFs are estimates of the upper-bound probability of an individual developing cancer as a result of a lifetime exposure to a particular concentration of a potential carcinogen.	Alternative S-1 will not achieve carcinogenic risk-based standards calculated using this guidance.
EPA Risk Reference Doses (RfDs)	None	To Be Considered	Guidance used to compute human health hazard resulting from exposure to non-carcinogens in site media. RfDs are considered to be the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime.	Alternative S-1 will not achieve non-carcinogenic risk-based standards calculated using this guidance.
Guidelines for Carcinogenic Risk Assessment	EPA/630/P-03/001F (March 2005)	To Be Considered	These guidelines provide guidance on conducting risk assessments involving carcinogens.	Alternative S-1 will not achieve carcinogenic risk-based standards calculated using this guidance.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F(March 2005)	To Be Considered	This provides guidance on assessing risk to children from carcinogens.	Alternative S-1 will not achieve carcinogenic risk-based standards for children using this guidance.
Updated Scientific Considerations for Lead in Soil Cleanups	OLEM Directive 9200.2-167	To Be Considered	Memorandum providing information related to blood lead levels to be considered during risk evaluations of lead.	Alternative S-1 will not achieve risk-based standards calculated using this guidance

There are no Location-Specific or Action-Specific ARARs for the No Action alternative.

TABLE E-2a
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE S-2: INSTITUTIONAL CONTROLS ON W&L PROPERTY
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Human Health Assessment Cancer Slope Factors (CSFs)	None	To Be Considered	CSFs are estimates of the upper-bound probability of an individual developing cancer as a result of a lifetime exposure to a particular concentration of a potential carcinogen.	Alternative S-2 will achieve carcinogenic risk-based standards calculated using this guidance.
EPA Risk Reference Doses (RfDs)	None	To Be Considered	Guidance used to compute human health hazard resulting from exposure to non-carcinogens in site media. RfDs are considered to be the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime.	Alternative S-2 will achieve non-carcinogenic risk-based standards calculated using this guidance.
Guidelines for Carcinogenic Risk Assessment	EPA/630/P-03/001F (March 2005)	To Be Considered	These guidelines provide guidance on conducting risk assessments involving carcinogens.	Alternative S-2 will achieve carcinogenic risk-based standards calculated using this guidance.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F(March 2005)	To Be Considered	This provides guidance on assessing risk to children from carcinogens.	Alternative S-2 will achieve carcinogenic risk-based standards for children using this guidance.
Updated Scientific Considerations for Lead in Soil Cleanups	OLEM Directive 9200.2-167	To Be Considered	Memorandum providing information related to blood lead levels to be considered during risk evaluations of lead.	Alternative S-2 will achieve risk-based standards calculated using this guidance.

TABLE E-2b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE S-2: INSTITUTIONAL CONTROLS ON W&L PROPERTY
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Historic Sites Act of 1935; National Historic Landmarks	16 USC 469 *et seq.*; 36 CFR Part 65	Applicable	The purpose of the National Historic Landmarks program is to identify and designate National Historic Landmarks and encourage the long-range preservation of nationally significant properties that illustrate or commemorate the history and prehistory of the United States.	Features with potential historical/cultural significance will be evaluated during the remedial design phase. Should this alternative impact historical properties/structures determined to be protected by these standards activities will be coordinated with the Department of the Interior.
National Historical Preservation Act	16 USC 470 *et seq.*; 36 CFR Part 800	Applicable	When a federal agency finds, or is notified, that its activities may cause irreparable loss or destruction of significant scientific, pre-historical, historical, archeological data, such agency shall consult with relevant federal and State officials to address the preservation of such data or other forms of mitigation, as necessary.	If it is determined that this alternative may cause irreparable loss or destruction of significant scientific, pre-historical, historical, or archaeological data, EPA will consult with federal and State officials and implement preservation and/or mitigation measures, as necessary.
State				
Antiquities Act and Regulation; Protection of Properties included in the State Register of Historic Places	Mass. Gen. Laws ch. 9 §§ 26-27; 950 CMR § 71.00	Relevant and Appropriate	Projects which are state-funded or state-licensed or which are on state property must eliminate, minimize or mitigate for adverse effects to properties that are listed in the register of historic places.	Features with potential historical/cultural significance on the state register will be evaluated during the remedial design phase. Should this alternative impact historical properties/structures determined to be protected by these standards, activities will be coordinated with the Massachusetts Historical Commission.

Key:
ARAR = Applicable or Relevant and Appropriate Requirement
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
TBC = To Be Considered
USC = United States Code

TABLE E-2c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE S-2: INSTITUTIONAL CONTROLS ON W&L PROPERTY
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal Standards				
None				
State Standards				
None				

Key:
ARAR = Applicable or Relevant and Appropriate Requirement

TABLE E-3
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE SL-1: NO ACTION
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Updated Scientific Considerations for Lead in Soil Cleanups	OLEM Directive 9200.2-167	To Be Considered	Memorandum providing information related to blood lead levels to be considered during risk evaluations of lead.	This alternative would not prevent exposure to lead in soil which contributes to a calculated risk, developed using this guidance.

There are no Location-Specific or Action-Specific ARARs for the No Action alternative.

TABLE E-4a
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE SL-3: SOIL EXCAVATION ON RESIDENTIAL PROPERTIES WITH OFF-SITE DISPOSAL
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Updated Scientific Considerations for Lead in Soil Cleanups	OLEM Directive 9200.2-167	To Be Considered	Memorandum providing information related to blood lead levels to be considered during risk evaluations of lead.	Alternative SL-3 will achieve risk-based standards calculated using this guidance.

TABLE E-4b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE SL-3: SOIL EXCAVATION ON RESIDENTIAL PROPERTIES WITH OFF-SITE DISPOSAL
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Protection of Wetlands (Executive Order 11990)	44 CFR Part 9	Relevant and Appropriate	Per the FEMA regulations (44 CFR Part 9; incorporating requirements under Executive Order 11990), federal agencies are required to avoid adversely impacting federal jurisdictional wetlands unless there is no practicable alternative with lesser effects and the proposed action includes all practicable measures to minimize harm to federal jurisdictional wetlands that may result from such use.	To the extent federal jurisdictional wetlands exist within areas to be altered by pre-design soil borings or access ways, action to be taken will minimize alterations to protected resource areas. Mitigation measures, as required, will be taken to compensate for resource areas impacted by remedial actions.
Floodplain Management (Executive Order 11988)	44 CFR Part 9	Relevant and Appropriate	Per the FEMA regulations (44 CFR Part 9; incorporating requirements under Executive Order 11988), federal agencies are required to avoid long-and short-term adverse impacts associated with the occupancy and modification of federally-designated 100-year and 500-year floodplain wherever there is a practicable alternative.	Soil excavation is anticipated to be conducted within the 100-year and 500-year floodplain under this alternative. Available practicable means will be used to reduce the risk of flood loss during the remedial action. Because the original grade will be restored at the completion of the remedial action, there will be no occupancy or modification of the floodplain.
Clean Water Act, Guidelines for Specification of Disposal Sites for Dredged or Fill Material	33 U.S.C. § 1344; § 404(b)(1); 40 CFR Part 230, 231, and 33 CFR Parts 320-323	Applicable	Controls discharges of dredged or fill material to protect aquatic ecosystem. This alternative includes work to be performed in a wetland. Under this requirement no activity that adversely affects a wetland shall be permitted if a practicable alternative with lesser effects is available. If activity takes place, impacts must be minimized to the maximum extent. Sets standards for restoration and mitigation required as a result of unavoidable impacts to wetland and aquatic resources. EPA must determine which alternative is the “Least Environmentally Damaging Practicable Alternative” (LEDPA) to protect wetland and aquatic resources.	This alternative includes excavation and filling within federal jurisdictional wetlands. Work will be done to minimize and mitigate for any impacts to wetland resources. EPA will solicit public comment as to whether this alternative is the Least Environmentally Damaging Practicable Alternative.

TABLE E-4b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE SL-3: SOIL EXCAVATION ON RESIDENTIAL PROPERTIES WITH OFF-SITE DISPOSAL
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Management of Undesirable Plants	7 U.S.C. § 2814	Relevant and Appropriate	Regulations calling for federal actions to contain or control undesirable plant species or group of species using all available methods, including: (A) preventive measures; (B) physical or mechanical methods; (C) biological agents; (D) herbicide methods; and (E) general land management practices.	Measures will be taken to prevent the establishment of undesirable plant species (*i.e.*, non-native and invasive species) as part of any wetlands/habitat restoration conducted as part of this alterative.
Historic Sites Act of 1935; National Historic Landmarks	16 USC 469 *et seq.*; 36 CFR Part 65	Applicable	The purpose of the National Historic Landmarks program is to identify and designate National Historic Landmarks and encourage the long-range preservation of nationally significant properties that illustrate or commemorate the history and prehistory of the United States.	Features with potential historical/cultural significance will be evaluated during the remedial design phase. Should this alternative impact historical properties/structures determined to be protected by these standards activities will be coordinated with the Department of the Interior.
National Historical Preservation Act	16 USC 470 *et seq.*; 36 CFR Part 800	Applicable	When a federal agency finds, or is notified, that its activities may cause irreparable loss or destruction of significant scientific, pre-historical, historical, archeological data, such agency shall consult with relevant federal and State officials to address the preservation of such data or other forms of mitigation, as necessary.	If it is determined that this alternative may cause irreparable loss or destruction of significant scientific, pre-historical, historical, or archaeological data, EPA will consult with federal and State officials and implement preservation and/or mitigation measures, as necessary.
Endangered Species Act	16 USC 1531 *et seq.*; 50 CFR Part 402	Applicable	If a location contains a federal endangered or threatened species or its critical habitat, and an action may impact the species or its habitat, the U.S. Fish & Wildlife Service or the National Marine Fisheries Service must be consulted.	Southeastern Massachusetts is located within the range of the federally endangered Northern Long-Eared Bat. This requirement may be applicable if tree removal is needed during remedial activities. Consultation with the U.S. Fish & Wildlife Service will occur during the planning process to determine if the project is near known hibernacula or known maternity roost trees so that activities do not adversely impact bat populations or habitat. Tree cutting may need to be restricted to timeframes outside of the summer season.

TABLE E-4b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE SL-3: SOIL EXCAVATION ON RESIDENTIAL PROPERTIES WITH OFF-SITE DISPOSAL
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
State				
Wetlands Protection Act	Mass. Gen. Laws ch. 131, §40; Wetlands Protection Regulations (310 CMR §10.00)	Applicable	Sets performance standards for dredging, filling, altering of inland wetland resource areas and sets buffer zones within 100 feet of a vegetated wetland and 200 feet from a perennial stream. The standards include mitigation requirements for alteration of regulated wetland resource areas. Resource areas at the site covered by the regulations include banks, bordering vegetated wetlands, land under bodies of water, land subject to flooding, and riverfront.	The site includes state regulated wetland resource areas. Alternatives requiring that work be completed within 100 feet of a state regulated wetland or 200 feet of a perennial waterway, will comply with these regulations. Mitigation of impacts on wetlands due to excavation and pre-design activities will be addressed.
Antiquities Act and Regulation; Protection of Properties included in the State Register of Historic Places	Mass. Gen. Laws ch. 9 §§ 26-27; 950 CMR § 71.00	Relevant and Appropriate	Projects which are state-funded or state-licensed or which are on state property must eliminate, minimize or mitigate for adverse effects to properties that are listed in the register of historic places.	Features with potential historical/cultural significance on the state register will be evaluated during the remedial design phase. Should this alternative impact historical properties/structures determined to be protected by these standards, activities will be coordinated with the Massachusetts Historical Commission.

Key:
ARAR = Applicable or Relevant and Appropriate Requirement
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
TBC = To Be Considered
USC = United States Code

TABLE E-4c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE SL-3: SOIL EXCAVATION ON RESIDENTIAL PROPERTIES WITH OFF-SITE DISPOSAL
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal Standards				
Resource Conservation and Recovery Act (RCRA) Subtitle C; Hazardous Waste Identification and Listing Regulations; Generator and Handler Requirements	42 USC §6904 *et seq.*; 40 CFR Parts 260-262	Applicable to any action that generates a hazardous waste	Federal standards used to identify, manage, and dispose of hazardous waste. Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State.	Any wastes generated by remedial activity will be analyzed under these standards to determine whether they are characteristic hazardous waste. Non-hazardous materials will be disposed appropriately. All contaminated soil meeting characteristic hazardous waste standards will be excavated and disposed of off-site at a licensed facility. The soils excavated under this alternative are not expected to be hazardous waste.
Clean Water Act; National Pollutant Discharge Elimination System (NPDES)	40 CFR Parts 122 and 125	Applicable	Establishes the specifications for discharging pollutants from any point source into the waters of the U.S. Also, includes stormwater standards for activities disturbing more than one acre.	Any water generated during excavation or soil dewatering activities (if required) will be treated to meet these standards before discharge to surface waters. Storm water standard will be met if there is over one acre of construction.
Clean Water Act, National Recommend Water Quality Criteria (NRWQC)	33 U.S.C. § 1314, 40 CFR Part 131	Relevant and Appropriate	NRWQC are health-based criteria developed for chemical constituents in surface water. They have been developed to protect aquatic life and human health from harmful effects due to exposure to chemically impacted surface water. Performance standards to be used for monitoring surface water and sediment during remedial activities.	Will be used as performance standards to monitor surface water and sediments in the adjacent wetlands, if required, during the remedial action.
Clean Air Act (CAA), Hazardous Air Pollutants; National Emission Standards for Hazardous Air Pollutants (NESHAPS)	42 USC §112(b)(1); 40 CFR Part 61	Applicable	The regulations establish emissions standards for 189 hazardous air pollutants. Standards set for dust and other release sources.	Remedial activities, including excavation and management of soil, will be implemented in accordance with these rules. No air emissions from remedial activities will cause air quality standards to be exceeded. Dust standards will be complied with during excavation and management of materials.
Generation of investigation derived waste.	USEPA OSWER Publication 9345.3-03 FS (January 1992)	To Be Considered	Guidance on the management of Investigation Derived Waste (IDW) in a manner that ensures protection of human health and the environment.	IDW generated as part of this remedial alternative will be managed based on guidance standards.

TABLE E-4c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE SL-3: SOIL EXCAVATION ON RESIDENTIAL PROPERTIES WITH OFF-SITE DISPOSAL
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
State Standards				
Solid Waste Management Facility Regulations	310 CMR 19.00	Applicable	The regulations contain requirements for disposal of solid wastes.	Any wastes generated by remedial activity that are determined to not be hazardous wastes will be managed in accordance with this regulation.
Massachusetts Hazardous Waste Rules for Identification and Listing of Hazardous Wastes	310 CMR 30.100	Applicable	Massachusetts is delegated to administer RCRA through its State regulations. These regulations establish requirements for determining whether wastes are characteristic hazardous waste.	Any wastes generated by remedial activity will be analyzed under these standards to determine whether they are characteristic hazardous waste. Non-hazardous materials will be disposed appropriately. All contaminated soil meeting characteristic hazardous waste standards will be excavated and disposed of off-site at a licensed facility. The soils excavated under this alternative are not expected to be hazardous waste.
Massachusetts Hazardous Waste Management Rules – Requirements for Generators	310 CMR 30.300	Applicable	These regulations contain requirements for generators of hazardous waste. The regulations apply to generators of sampling waste and also apply to the accumulation of waste prior to off-site disposal.	If any remedial activity generates hazardous wastes, the waste will be managed in accordance with the substantive requirements of these regulations.
Massachusetts Hazardous Waste Management Rules – General standards for hazardous waste facilities	310 CMR 30.500	Relevant and Appropriate	General facility requirements for waste analysis, security measures, inspections, and training requirements. Section 30.580 addresses closure and Section 30.590 post-closure of hazardous waste facilities.	Remedial activities to address hazardous wastes will be conducted in accordance with this requirement. Specifically, storage of wastes on site will be conducted in accordance with this regulation. All workers will be properly trained. Closure/post-closure standards will be met since all wastes will be excavated and removed from the site.
Massachusetts Hazardous Waste Rules - Containers	310 CMR 30.680	Applicable	Establishes requirements for the management of containers, such as drums, that would hold field-generated hazardous wastes.	If any remedial activity generates hazardous wastes that will be stored in containers, the containers will be managed in accordance with the substantive requirements of these regulations.
Massachusetts Hazardous Waste Rules - Management, Storage, and Treatment in Tanks	310 CMR 30.690	Applicable	These standards specify requirements for tank systems used to store or treat hazardous waste. Provides specifications for design and installation of tank systems. Requires secondary containment, leak detection systems, and inspections. Identifies general operating	If any remedial activity generates hazardous wastes that will be stored in tanks, the tanks will be managed in accordance with the substantive requirements of these regulations.

TABLE E-4c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE SL-3: SOIL EXCAVATION ON RESIDENTIAL PROPERTIES WITH OFF-SITE DISPOSAL
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
			requirements, and closure and post-closure care.	
Massachusetts Clean Water Act; Surface Water Discharge Permit Regulations	314 CMR 3.00	Applicable	These regulations provide that discharges to waters of the Commonwealth shall not result in exceedances of MA Surface Water Quality Standards (MSWQS).	Any water generated during excavation or soil dewatering activities (if required) will be treated to meet discharge standards if the water is to be discharged to surface waters.
Massachusetts Clean Water Act; MA Surface Water Quality Standards (MSWQS)	314 CMR 4.00	Relevant and Appropriate	These standards designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained, or protected. Minimum water quality criteria required to sustain the designated uses are established.	Will be used as performance standards to monitor surface water and sediments in the adjacent wetlands, if required, during the remedial action.
Massachusetts Ambient Air Quality Standards	310 CMR 6.00	Applicable	Sets primary and secondary standards for emissions of certain contaminants, including particulate matter.	Remedial activities, including excavation and management of soil will be implemented in accordance with these rules. No air emissions from remedial activities will cause air quality standards to be exceeded. Dust standards will be complied with during excavation and management of materials at the Site.
Massachusetts Air Pollution Control Regulations	310 CMR 7.00	Applicable	These regulations set emission limits necessary to attain ambient air quality standards.	Remedial activities, including excavation and management of soil will be implemented in accordance with these rules. No air emissions from remedial activities will cause air quality standards to be exceeded.
Erosion and Sediment Control Guidance	None	To Be Considered	Guidance on preventing erosion and sedimentation.	Remedial actions will be managed to control erosion and sedimentation.

Key:
ARAR = Applicable or Relevant and Appropriate Requirement
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
MGL = Massachusetts General Laws
TBC = To Be Considered
USC = United States Code

TABLE E-5
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-1: NO ACTION
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Human Health Assessment Cancer Slope Factors (CSFs)	None	To Be Considered	CSFs are estimates of the upper-bound probability of an individual developing cancer as a result of a lifetime exposure to a particular concentration of a potential carcinogen.	Alternative GW/SW-1 will not achieve carcinogenic risk-based standards calculated using this guidance.
EPA Risk Reference Doses (RfDs)	None	To Be Considered	Guidance used to compute human health hazard resulting from exposure to non-carcinogens in site media. RfDs are considered to be the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime.	Alternatives GW/SW-1 will not achieve non-carcinogenic risk-based standards calculated using this guidance.
Guidelines for Carcinogenic Risk Assessment	EPA/630/P-03/001F (March 2005)	To Be Considered	These guidelines provide guidance on conducting risk assessments involving carcinogens.	Alternatives GW/SW-1 will not achieve carcinogenic risk-based standards calculated using this guidance.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F(March 2005)	To Be Considered	This provides guidance on assessing risk to children from carcinogens.	Alternatives GW/SW-1 will not achieve carcinogenic risk-based standards for children calculated using this guidance.
Clean Water Act; National Recommended Water Quality Criteria ("NRWQC")	33 U.S.C. § 1251 et seq.; 40 C.F.R. § 122.44	Relevant and Appropriate	NRWQC establish water quality standards for the protection of human health and aquatic life.	These surface water standards used to derive ecological cleanup standards in surface water in Bliss Brook that will not be achieved through either Alternative GW/SW-1.

TABLE E-5
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-1: NO ACTION
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
State				
Massachusetts Clean Water Act; MA Surface Water Quality Standards (MSWQS)	314 CMR 4.00	Relevant and Appropriate	These standards designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained, or protected. Minimum water quality criteria required to sustain the designated uses are established.	These surface water standards, when more stringent than federal standards, used to derive ecological cleanup standards for surface water in Bliss Brook that will not be achieved through either Alternative GW/SW-1.

There are no Location-Specific or Action-Specific ARARs for the No Action alternative.

TABLE E-6a
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-2a: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT
ALTERNATIVE GW/SW-2b: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Human Health Assessment Cancer Slope Factors (CSFs)	None	To Be Considered	CSFs are estimates of the upper-bound probability of an individual developing cancer as a result of a lifetime exposure to a particular concentration of a potential carcinogen.	Alternatives GW/SW-2a and GW/SW-2b will achieve carcinogenic risk-based standards calculated using this guidance.
EPA Risk Reference Doses (RfDs)	None	To Be Considered	Guidance used to compute human health hazard resulting from exposure to non-carcinogens in site media. RfDs are considered to be the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime.	Alternatives GW/SW-2a and GW/SW-2b will achieve non-carcinogenic risk-based standards calculated using this guidance.
Guidelines for Carcinogenic Risk Assessment	EPA/630/P-03/001F (March 2005)	To Be Considered	These guidelines provide guidance on conducting risk assessments involving carcinogens.	Alternatives GW/SW-2a and GW/SW-2b will achieve carcinogenic risk-based standards calculated using this guidance.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F(March 2005)	To Be Considered	This provides guidance on assessing risk to children from carcinogens.	Alternatives GW/SW-2a and GW/SW-2b will achieve carcinogenic risk-based standards for children calculated using this guidance.
Clean Water Act; National Recommended Water Quality Criteria ("NRWQC")	33 U.S.C. § 1251 et seq.; 40 C.F.R. § 122.44	Relevant and Appropriate	NRWQC establish water quality standards for the protection of human health and aquatic life.	These surface water standards used to derive ecological cleanup standards in surface water in Bliss Brook that will be achieved through either Alternative GW/SW-2a or Alternative GW/SW-2b.
State				
Massachusetts Clean Water Act; MA Surface Water Quality Standards (MSWQS)	314 CMR 4.00	Relevant and Appropriate	These standards designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained, or protected. Minimum water quality criteria required to sustain the designated uses are established.	These surface water standards, when more stringent than federal standards, used to derive ecological cleanup standards for surface water in Bliss Brook that will be achieved through either Alternative GW/SW-2a or Alternative GW/SW-2b.

TABLE E-6b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-2a: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT
ALTERNATIVE GW/SW-2b: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Protection of Wetlands (Executive Order 11990)	44 CFR Part 9	Relevant and Appropriate	Per the FEMA regulations (44 CFR Part 9; incorporating requirements under Executive Order 11990), federal agencies are required to avoid adversely impacting federal jurisdictional wetlands unless there is no practicable alternative with lesser effects and the proposed action includes all practicable measures to minimize harm to federal jurisdictional wetlands that may result from such use.	To the extent federal jurisdictional wetlands exist within areas where installation/operation/maintenance of the groundwater pump and treat system, source area soil removal/in-situ treatment, installation of the mid-plume in-situ treatment line (Alternative GW/SW-2b only), and monitoring activities will occur under this alternative, action to be taken will minimize alterations to protected resource areas. Mitigation measures, as required, will be taken to compensate for resource areas impacted by remedial actions.
Floodplain Management (Executive Order 11988)	44 CFR Part 9	Relevant and Appropriate	Per the FEMA regulations (44 CFR Part 9; incorporating requirements under Executive Order 11988), federal agencies are required to avoid long-and short-term adverse impacts associated with the occupancy and modification of federally-designated 100-year and 500-year floodplain wherever there is a practicable alternative.	Excavation and well installation activities associated with installation of groundwater pump and treat system infrastructure and possibly source area removal and in-situ treatment, may be conducted within the 100-year or 500-year floodplain under this alternative. Available practicable means will be used to reduce the risk of flood loss during the remedial action. Because the original grade will be restored at the completion of the remedial action, there will be no occupancy or modification of the floodplain.
Clean Water Act, Guidelines for Specification of Disposal Sites for Dredged or Fill Material	33 USC § 1344; § 404(b)(1); 40 CFR Parts 230, 231 and 33 CFR Parts 320-323	Applicable	Controls discharges of dredged or fill material to protect aquatic ecosystem. This alternative includes work to be performed in a wetland. Under this requirement no activity that adversely affects a wetland shall be permitted if a practicable alternative with lesser effects is available. If activity takes place, impacts must be minimized to the maximum extent. Sets standards for	This alternative includes excavation and filling within federal jurisdictional wetlands related to installation and maintenance of groundwater extraction wells and piping and work along the stream to extend the discharge from the pump and treat system to the stream. Work will be done to minimize and mitigate for any impacts to wetland and aquatic resources. EPA will solicit public comment as to whether this alternative is the Least Environmentally Damaging Practicable Alternative.

TABLE E-6b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-2a: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT
ALTERNATIVE GW/SW-2b: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
			restoration and mitigation required as a result of unavoidable impacts to wetland and aquatic resources. EPA must determine which alternative is the "Least Environmentally Damaging Practicable Alternative" (LEDPA) to protect wetland and aquatic resources.	
Management of Undesirable Plants	7 U.S.C. § 2814	Relevant and Appropriate	Regulations calling for federal actions to contain or control undesirable plant species or group of species using all available methods, including: (A) preventive measures; (B) physical or mechanical methods; (C) biological agents; (D) herbicide methods; and (E) general land management practices.	Measures will be taken to prevent the establishment of undesirable plant species (i.e., non-native and invasive species) as part of any wetlands/habitat restoration conducted as part of this alterative.
Fish and Wildlife Coordination Act	16 USC Part 661 *et. seq.*	Applicable	This regulation requires that any federal agency proposing to modify a body of water must consult with the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service, and other related state agencies. That federal agency must consult with the appropriate government entity and also take action to prevent, mitigate, or compensate for project-related losses of endangered species, fish and wildlife resources.	Alternatives may modify potential, fish and wildlife habitats. All appropriate state and federal agencies, such as the USFWS, will be consulted to ensure that losses of these resources will be prevented, mitigated, or compensated.
Resource Conservation and Recovery Act; Hazardous Waste Facility Standards Within a Floodplain	43 USC §6901 *et seq*.; 40 CFR 264.18(b)	Relevant and Appropriate	Any hazardous waste facility within the 100-year floodplain must be designed, constructed, and maintained to prevent the release of hazardous waste during up to a 100-year flood event.	Any remedial structures utilized by this alternative to treat, contain, or dispose of hazardous waste (including the permeable reactive barrier) within the 100-year floodplain will be designed, constructed, and maintained to prevent a release of hazardous waste within the protected resource area.

TABLE E-6b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-2a: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT
ALTERNATIVE GW/SW-2b: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Historic Sites Act of 1935; National Historic Landmarks	16 USC 469 *et seq.*; 36 CFR Part 65	Applicable	The purpose of the National Historic Landmarks program is to identify and designate National Historic Landmarks and encourage the long-range preservation of nationally significant properties that illustrate or commemorate the history and prehistory of the United States.	Features with potential historical/cultural significance will be evaluated during the remedial design phase. Should this alternative impact historical properties/structures determined to be protected by these standards activities will be coordinated with the Department of the Interior.
National Historical Preservation Act	16 USC 470 *et seq.*; 36 CFR Part 800	Applicable	When a federal agency finds, or is notified, that its activities may cause irreparable loss or destruction of significant scientific, pre-historical, historical, archeological data, such agency shall consult with relevant federal and State officials to address the preservation of such data or other forms of mitigation, as necessary.	If it is determined that this alternative may cause irreparable loss or destruction of significant scientific, pre-historical, historical, or archaeological data, EPA will consult with federal and State officials and implement preservation and/or mitigation measures, as necessary.
Endangered Species Act	16 USC 1531 *et seq.*; 50 CFR Part 402	Applicable	If a location contains a federal endangered or threatened species or its critical habitat, and an action may impact the species or its habitat, the U.S. Fish & Wildlife Service or the National Marine Fisheries Service must be consulted.	Southeastern Massachusetts is located within the range of the federally endangered Northern Long-Eared Bat. This requirement may be applicable if tree removal is needed during remedial activities. Consultation with the U.S. Fish & Wildlife Service will occur during the planning process to determine if the project is near known hibernacula or known maternity roost trees so that activities do not adversely impact bat populations or habitat. Tree cutting may need to be restricted to timeframes outside of the summer season.

TABLE E-6b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-2a: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT
ALTERNATIVE GW/SW-2b: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
State				
Wetlands Protection Act	Mass. Gen. Laws ch. 131, §40; Wetlands Protection Regulations (310 CMR §10.00)	Applicable	Sets performance standards for dredging, filling, altering of inland wetland resource areas and sets buffer zones within 100 feet of a vegetated wetland and 200 feet from a perennial stream. The standards include mitigation requirements for alteration of regulated wetland resource areas. Resource areas at the site covered by the regulations include banks, bordering vegetated wetlands, land under bodies of water, land subject to flooding, and riverfront.	Under this alternative, installation/operation/maintenance of the groundwater pump and treat system, source area soil removal/in-situ treatment, installation of the mid-plume in-situ treatment line (Alternative GW/SW-2b only), and monitoring activities may possibly impact wetland resource areas and buffer zones. Alternatives requiring that work be completed within 100 feet of a state regulated wetland or 200 feet of a perennial waterway, will comply with these regulations. Mitigation of impacts on wetlands will be addressed.
Massachusetts Hazardous Waste Rules, Facility Location Standards	310 CMR 40.700	Relevant and Appropriate	Sets forth criteria for siting hazardous waste facilities within Land Subject to Flooding (as defined under the Massachusetts Wetland Protection Act standards); surface water supplies; and actual, planned, or potential public water supplies.	Any remedial structures utilized by this alternative to treat, contain, or dispose of hazardous waste (including the permeable reactive barrier) within the 100-year floodplain, will be designed, constructed, and maintained to prevent a release of hazardous waste within the protected resource area.
Antiquities Act and Regulation; Protection of Properties included in the State Register of Historic Places	Mass. Gen. Laws ch. 9 §§ 26-27; 950 CMR § 71.00	Relevant and Appropriate	Projects which are state-funded or state-licensed or which are on state property must eliminate, minimize or mitigate for adverse effects to properties that are listed in the register of historic places.	Features with potential historical/cultural significance on the state register will be evaluated during the remedial design phase. Should this alternative impact historical properties/structures determined to be protected by these standards, activities will be coordinated with the Massachusetts Historical Commission.

Key:
ARAR = Applicable or Relevant and Appropriate Requirement
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
TBC = To Be Considered
USC = United States Code

TABLE E-6c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-2a: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT
ALTERNATIVE GW/SW-2b: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal Standards				
Resource Conservation and Recovery Act (RCRA) Subtitle C; Hazardous Waste Identification and Listing Regulations; Generator and Handler Requirements	42 USC §6904 *et seq.*; 40 CFR Parts 260-262	Applicable to any action that generates a hazardous waste	Federal standards used to identify, manage, and dispose of hazardous waste. Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State.	Any wastes generated by remedial activity will be analyzed under these standards to determine whether they are characteristic hazardous waste. Non-hazardous materials will be disposed appropriately. All contaminated soil meeting characteristic hazardous waste standards will be excavated and disposed of off-site at a licensed facility.
RCRA Subtitle C; Landfill Closure and Post-Closure Care	40 CFR Part 264.310	Relevant and Appropriate	Federal standards for closure and post-closure care of landfills containing hazardous waste. Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State.	Inspections and maintenance of the existing engineered cover system (including permeable reactive barrier) and long-term groundwater and surface water monitoring would be conducted to meet relevant post-closure requirements.
RCRA, Air Emission Standards for Process Vents	40 CFR, Part 264, Subpart AA	Applicable, if volatile organic compounds (VOC) emissions of 10 ppm or greater; Relevant and Appropriate, if less than 10 ppm	RCRA emissions standards not delegated to the State. Standards for process vents for air treatment systems for RCRA wastes that have total organic concentrations of 10 ppm or greater.	Emission standards for any process vents, if present, will be achieved.

TABLE E-6c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-2a: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT
ALTERNATIVE GW/SW-2b: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
RCRA, Air Emission Standards for Equipment Leaks	40 CFR, Part 264, Subpart BB	Applicable, if VOC emissions of 10 ppm or greater; Relevant and Appropriate, if less than 10 ppm	RCRA emissions standards not delegated to the State. Standards for preventing air equipment leaks for systems that treat RCRA wastes that have total organic concentrations of 10 ppm or greater.	Standards for preventing air emission leaks from treatment systems for VOCs will be achieved.
Clean Water Act; National Pollutant Discharge Elimination System (NPDES)	40 CFR Parts 122 and 125	Applicable	Establishes the specifications for discharging pollutants from any point source into the waters of the U.S. Also, includes stormwater standards for activities disturbing more than one acre.	Any water generated during excavation and soil dewatering activities, well installation, installation/operation/maintenance of the groundwater pump and treat system, and *in-situ* soil treatment. Maintenance, or sampling (plus mid-plume *in-situ* soil treatment for Alternative GW/SW-2b only) will be treated to meet these standards before discharge to surface waters. Storm water standards will be met if there is over one acre of construction.
Clean Water Act, National Recommend Water Quality Criteria (NRWQC)	33 U.S.C. § 1314, 40 CFR Part 131	Relevant and Appropriate	NRWQC are health-based criteria developed for chemical constituents in surface water. They have been developed to protect aquatic life and human health from harmful effects due to exposure to chemically impacted surface water. Performance standards to be used for monitoring surface water and sediment during remedial activities and long-term monitoring.	Will be used as performance standards to monitor surface water and sediments, if required, during the remedial action.
Underground Injection Control Program	40 CFR 144, 146, 147 (Subpart EE)	Applicable	Regulations established to assure that underground injection will not endanger drinking water sources.	Alternative GW/SW-2b, mid-plume *in-situ* soil treatment will be implemented in compliance with these standards.

TABLE E-6c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-2a: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT
ALTERNATIVE GW/SW-2b: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
RCRA, Interim Status Treatment, Storage, and Disposal Facility Standards, Chemical, Physical and Biological Treatment: 40 C.F.R. Part 265 Subpart Q	40 CFR, Part 265 Subpart Q	Relevant and Appropriate	Standards for operating chemical, physical and biological treatment systems, including the proper handling of reagents, system maintenance, and closure procedures.	*In-situ* soil treatment under Alternatives GW/SW-2a and GW/SW-2b and mid-plume *in-situ* soil treatment under Alternative GW/SW-2b will be implemented in compliance with these standards.
Clean Air Act (CAA), Hazardous Air Pollutants; National Emission Standards for Hazardous Air Pollutants (NESHAPS)	42 USC §112(b)(1); 40 CFR Part 61	Applicable	The regulations establish emissions standards for 189 hazardous air pollutants. Standards set for dust and other release sources.	Remedial activities, including excavation and management of soil, will be implemented in accordance with these rules. No air emissions from remedial activities will cause air quality standards to be exceeded. Dust standards will be complied with during excavation and management of materials.
Generation of investigation derived waste.	USEPA OSWER Publication 9345.3-03 FS (January 1992)	To Be Considered	Guidance on the management of Investigation Derived Waste (IDW) in a manner that ensures protection of human health and the environment.	IDW generated as part of this remedial alternative will be managed based on guidance standards.
OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air	OSWER Publication 9200.2-154 (June 2015)	To Be Considered	EPA guidance for addressing vapor intrusion issues at CERCLA sites.	Existing residential sub-slab depressurization systems will be monitored to ensure their protectiveness. Institutional controls pertaining to vapor intrusion will be implemented and maintained utilizing these guidance standards until such time as it is determined they are no longer needed.
State Standards				
Certification of Operators of Wastewater Treatment Facilities	257 CMR 2.00	Applicable	These regulations set forth contain requirements for evaluation and certification of operators of wastewater treatment facilities.	The groundwater treatment facility will be operated by a licensed operator with a grade level consistent with the requirements of this regulation.
Solid Waste Management Facility Regulations	310 CMR 19.00	Applicable	The regulations contain requirements for disposal of solid wastes.	Any wastes generated by remedial activity that are determined to not be hazardous wastes will be managed in accordance with this regulation.

TABLE E-6c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-2a: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT
ALTERNATIVE GW/SW-2b: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Underground Injection Control	310 CMR 27.00	Applicable	These regulations protect underground sources of drinking water by regulating the underground injection of hazardous wastes, fluids used for extraction of minerals, oil, and energy and any other fluids having potential to contaminate groundwater as required by the Federal Safe Drinking Water Act.	Alternative GW/SW-3b, mid-plume *in-situ* soil treatment will be implemented in compliance with these standards.
Massachusetts Hazardous Waste Rules for Identification and Listing of Hazardous Wastes	310 CMR 30.100	Applicable	Massachusetts is delegated to administer RCRA through its State regulations. These regulations establish requirements for determining whether wastes are characteristic hazardous waste.	Any wastes generated by remedial activity will be analyzed under these standards to determine whether they are characteristic hazardous waste. Non-hazardous materials will be disposed appropriately. All contaminated soil meeting characteristic hazardous waste standards will be excavated and disposed of off-site at a licensed facility.
Massachusetts Hazardous Waste Management Rules – Requirements for Generators	310 CMR 30.300	Applicable	These regulations contain requirements for generators of hazardous waste. The regulations apply to generators of sampling waste and also apply to the accumulation of waste prior to off-site disposal.	If any remedial activity generates hazardous wastes, the waste will be managed in accordance with the substantive requirements of these regulations.
Massachusetts Hazardous Waste Management Rules – General standards for hazardous waste facilities	310 CMR 30.500	Relevant and Appropriate	General facility requirements for waste analysis, security measures, inspections, and training requirements. Section 30.580 addresses closure and Section 30.590 post-closure of hazardous waste facilities.	Remedial activities to address hazardous wastes will be conducted in accordance with this requirement. Specifically, storage of wastes on site will be conducted in accordance with this regulation. All workers will be properly trained. The existing engineered cover meets closure standards by maintaining the engineered cover, institutional controls, and long-term monitoring.

TABLE E-6c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-2a: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT
ALTERNATIVE GW/SW-2b: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Massachusetts Hazardous Waste Rules: Landfill Closure/Post-Closure Care	310 CMR 30.633	Relevant and Appropriate	At final closure of the landfill the owner or operator shall cover the landfill with a final cover designed and constructed to: (a) Provide long-term minimization of migration of liquids through the closed landfill; (b) Function with minimum maintenance; (c) Promote drainage and minimize erosion or abrasion of the cover; (d) Accommodate settling and subsidence so that the cover's integrity is maintained. After final closure of the landfill the owner or operator shall comply with all post-closure requirements set forth in 310 CMR 30.590, including, without limitation, maintenance and monitoring throughout the post-closure care period as specified pursuant to 310 CMR 30.592. The owner or operator shall: Maintain the integrity and effectiveness of the final cover, including making repairs to the cap to correct the effects of settling, subsidence, erosion or other events and maintain and monitor the groundwater monitoring system and comply with all other applicable requirements of 310 CMR 30.660; (e) prevent run-off and run-on from eroding or otherwise damaging the final cover; and protect and maintain surveyed benchmarks used in complying with 310 CMR 30.626.	The existing engineered cover system which meets these performance standards will be monitored and maintained to continue to meet these standards.
Massachusetts Hazardous Waste Rules - Containers	310 CMR 30.680	Applicable	Establishes requirements for the management of containers, such as drums, that would hold field-generated hazardous wastes.	If any remedial activity generates hazardous wastes that will be stored in containers, the containers will be managed in accordance with the substantive requirements of these regulations.

TABLE E-6c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-2a: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT
ALTERNATIVE GW/SW-2b: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Massachusetts Hazardous Waste Rules - Management, Storage, and Treatment in Tanks	310 CMR 30.690	Applicable	These standards specify requirements for tank systems used to store or treat hazardous waste. Provides specifications for design and installation of tank systems. Requires secondary containment, leak detection systems, and inspections. Identifies general operating requirements, and closure and post-closure care.	If any remedial activity generates hazardous wastes that will be stored in tanks, the tanks will be managed in accordance with the substantive requirements of these regulations.
Massachusetts Supplemental Requirements for Hazardous Waste Management Facilities	314 CMR 8.03	Relevant and Appropriate	This regulation outlines the additional requirements that must be satisfied in order for a RCRA facility to comply with the NPDES regulation.	Any water generated during operation of the pump and treat system or during extraction/monitoring well drilling or maintenance that meets hazardous waste standards will be treated to meet NPDES standards, if the water is to be discharged to surface waters.
Massachusetts Clean Water Act; Surface Water Discharge Permit Regulations	314 CMR 3.00	Applicable	These regulations provide that discharges to waters of the Commonwealth shall not result in exceedances of MA Surface Water Quality Standards (MSWQS).	Any water generated during excavation and soil dewatering activities, well installation, installation/operation/maintenance of the groundwater pump and treat system, and *in-situ* soil treatment, maintenance, or sampling (plus mid-plume *in-situ* soil treatment for Alternative GW/SW-2b only) will be treated to meet discharge standards if the water is to be discharged to surface waters.
Massachusetts Clean Water Act; MA Surface Water Quality Standards (MSWQS)	314 CMR 4.00	Relevant and Appropriate	These standards designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained, or protected. Minimum water quality criteria required to sustain the designated uses are established.	Will be used as performance standards to monitor surface water and sediments, if required, during the remedial action.

TABLE E-6c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-2a: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT
ALTERNATIVE GW/SW-2b: SOURCE AREA SOIL REMOVAL WITH IN-SITU SOIL TREATMENT AND GROUNDWATER PUMP AND TREAT WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Massachusetts Ambient Air Quality Standards	310 CMR 6.00	Applicable	Sets primary and secondary standards for emissions of certain contaminants, including particulate matter.	Remedial activities, including excavation and management of soil will be implemented in accordance with these rules. No air emissions from remedial activities will cause air quality standards to be exceeded. Dust standards will be complied with during excavation and management of materials at the Site.
Massachusetts Air Pollution Control Regulations	310 CMR 7.00	Applicable	These regulations set emission limits necessary to attain ambient air quality standards.	Remedial activities, including excavation and management of soil will be implemented in accordance with these rules. No air emissions from remedial activities will cause air quality standards to be exceeded.
Erosion and Sediment Control Guidance	None	To Be Considered	Guidance on preventing erosion and sedimentation.	Remedial actions will be managed to control erosion and sedimentation.

Key:
ARAR = Applicable or Relevant and Appropriate Requirement
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
MGL = Massachusetts General Laws
TBC = To Be Considered
USC = United States Code

TABLE E-7a
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-3a: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER
ALTERNATIVE GW/SW-3b: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Human Health Assessment Cancer Slope Factors (CSFs)	None	To Be Considered	CSFs are estimates of the upper-bound probability of an individual developing cancer as a result of a lifetime exposure to a particular concentration of a potential carcinogen.	Alternatives GW/SW-3a and GW/SW-3b will achieve carcinogenic risk-based standards calculated using this guidance.
EPA Risk Reference Doses (RfDs)	None	To Be Considered	Guidance used to compute human health hazard resulting from exposure to non-carcinogens in site media. RfDs are considered to be the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime.	Alternatives GW/SW-3a and GW/SW-3b will achieve non-carcinogenic risk-based standards calculated using this guidance.
Guidelines for Carcinogenic Risk Assessment	EPA/630/P-03/001F (March 2005)	To Be Considered	These guidelines provide guidance on conducting risk assessments involving carcinogens.	Alternatives GW/SW-3a and GW/SW-3b will achieve carcinogenic risk-based standards calculated using this guidance.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F(March 2005)	To Be Considered	This provides guidance on assessing risk to children from carcinogens.	Alternatives GW/SW-3a and GW/SW-3b will achieve carcinogenic risk-based standards for children calculated using this guidance.
Clean Water Act; National Recommended Water Quality Criteria (“NRWQC”)	33 U.S.C. § 1251 et seq.; 40 C.F.R. § 122.44	Relevant and Appropriate	NRWQC establish water quality standards for the protection of human health and aquatic life.	These surface water standards used to derive ecological cleanup standards in surface water in Bliss Brook that will be achieved through either Alternative GW/SW-3a or Alternative GW/SW-3b.
State				
Massachusetts Clean Water Act; MA Surface Water Quality Standards (MSWQS)	314 CMR 4.00	Relevant and Appropriate	These standards designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained, or protected. Minimum water quality criteria required to sustain the designated uses are established.	These surface water standards, when more stringent than federal standards, used to derive ecological cleanup standards for surface water in Bliss Brook that will be achieved through either Alternative GW/SW-3a or Alternative GW/SW-3b.

TABLE E-7b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-3a: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER
ALTERNATIVE GW/SW-3b: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Protection of Wetlands (Executive Order 11990)	44 CFR Part 9	Relevant and Appropriate	Per the FEMA regulations (44 CFR Part 9; incorporating requirements under Executive Order 11990), federal agencies are required to avoid adversely impacting federal jurisdictional wetlands unless there is no practicable alternative with lesser effects and the proposed action includes all practicable measures to minimize harm to federal jurisdictional wetlands that may result from such use.	To the extent federal jurisdictional wetlands exist within areas where extension of the permeable reactive barrier, source area soil removal/in-situ treatment, installation of the mid-plume in-situ treatment line (Alternative GW/SW-3b only), and monitoring activities will occur under this alternative, action to be taken will minimize alterations to protected resource areas. Mitigation measures, as required, will be taken to compensate for resource areas impacted by remedial actions.
Floodplain Management (Executive Order 11988)	44 CFR Part 9	Relevant and Appropriate	Per the FEMA regulations (44 CFR Part 9; incorporating requirements under Executive Order 11988), federal agencies are required to avoid long-and short-term adverse impacts associated with the occupancy and modification of federally-designated 100-year and 500-year floodplain wherever there is a practicable alternative.	Remedial activities associated with extension of the permeable reactive barrier and possibly source area removal and in-situ treatment, may be conducted within the 100-year or 500-year floodplain under this alternative. Available practicable means will be used to reduce the risk of flood loss during the remedial action. Because the original grade will be restored at the completion of the remedial action, there will be no occupancy or modification of the floodplain.
Clean Water Act, Guidelines for Specification of Disposal Sites for Dredged or Fill Material	33 U.S.C. § 1344; § 404(b)(1); 40 CFR Part 230, 231, and 33 CFR Parts 320-323	Applicable	Controls discharges of dredged or fill material to protect aquatic ecosystem. This alternative includes work to be performed in a wetland. Under this requirement no activity that adversely affects a wetland shall be permitted if a practicable alternative with lesser effects is available. If activity takes place, impacts must be minimized to the maximum extent. Sets standards for restoration and mitigation required as a	This alternative includes excavation and filling within federal jurisdictional wetlands. Work will be done to minimize and mitigate for any impacts to wetland resources. EPA will solicit public comment as to whether this alternative is the Least Environmentally Damaging Practicable Alternative.

TABLE E-7b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-3a: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER
ALTERNATIVE GW/SW-3b: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
			result of unavoidable impacts to wetland and aquatic resources. EPA must determine which alternative is the "Least Environmentally Damaging Practicable Alternative" (LEDPA) to protect wetland and aquatic resources.	
Management of Undesirable Plants	7 U.S.C. § 2814	Relevant and Appropriate	Regulations calling for federal actions to contain or control undesirable plant species or group of species using all available methods, including: (A) preventive measures; (B) physical or mechanical methods; (C) biological agents; (D) herbicide methods; and (E) general land management practices.	Measures will be taken to prevent the establishment of undesirable plant species (i.e., non-native and invasive species) as part of any wetlands/habitat restoration conducted as part of this alterative.
Fish and Wildlife Coordination Act	16 USC Part 661 *et. seq.*	Applicable	This regulation requires that any federal agency proposing to modify a body of water must consult with the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service, and other related state agencies. That federal agency must consult with the appropriate government entity and also take action to prevent, mitigate, or compensate for project-related losses of endangered species, fish and wildlife resources.	Alternatives may modify potential, fish and wildlife habitats. All appropriate state and federal agencies, such as the USFWS, will be consulted to ensure that losses of these resources will be prevented, mitigated, or compensated.
Resource Conservation and Recovery Act; Hazardous Waste Facility Standards Within a Floodplain	43 USC §6901 *et seq*.; 40 CFR 264.18(b)	Relevant and Appropriate	Any hazardous waste facility with the 100-year floodplain must be designed, constructed, and maintained to prevent the release of hazardous waste during up to a 100-year flood event.	Any remedial structures utilized by this alternative to treat, contain, or dispose of hazardous waste (including the permeable reactive barrier) within the 100-year floodplain, will be designed, constructed, and maintained to prevent a release of hazardous waste within the protected resource area.

TABLE E-7b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-3a: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER
ALTERNATIVE GW/SW-3b: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Historic Sites Act of 1935; National Historic Landmarks	16 USC 469 *et seq.*; 36 CFR Part 65	Applicable	The purpose of the National Historic Landmarks program is to identify and designate National Historic Landmarks and encourage the long-range preservation of nationally significant properties that illustrate or commemorate the history and prehistory of the United States.	Features with potential historical/cultural significance will be evaluated during the remedial design phase. Should this alternative impact historical properties/structures determined to be protected by these standards activities will be coordinated with the Department of the Interior.
National Historical Preservation Act	16 USC 470 *et seq.*; 36 CFR, Part 800	Applicable	When a federal agency finds, or is notified, that its activities may cause irreparable loss or destruction of significant scientific, pre-historical, historical, archeological data, such agency shall consult with relevant federal and State officials to address the preservation of such data or other forms of mitigation, as necessary.	If it is determined that this alternative may cause irreparable loss or destruction of significant scientific, pre-historical, historical, or archaeological data, EPA will consult with federal and State officials and implement preservation and/or mitigation measures, as necessary.
Endangered Species Act	16 USC 1531 *et seq.*; 50 CFR Part 402	Applicable	If a location contains a federal endangered or threatened species or its critical habitat, and an action may impact the species or its habitat, the U.S. Fish & Wildlife Service or the National Marine Fisheries Service must be consulted.	Southeastern Massachusetts is located within the range of the federally endangered Northern Long-Eared Bat. This requirement may be applicable if tree removal is needed during remedial activities. Consultation with the U.S. Fish & Wildlife Service will occur during the planning process to determine if the project is near known hibernacula or known maternity roost trees so that activities do not adversely impact bat populations or habitat. Tree cutting may need to be restricted to timeframes outside of the summer season.

TABLE E-7b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-3a: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER
ALTERNATIVE GW/SW-3b: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
State				
Wetlands Protection Act	Mass. Gen. Laws ch. 131, §40; Wetlands Protection Regulations (310 CMR §10.00)	Applicable	Sets performance standards for dredging, filling, altering of inland wetland resource areas and sets buffer zones within 100 feet of a vegetated wetland and 200 feet from a perennial stream. The standards include mitigation requirements for alteration of regulated wetland resource areas. Resource areas at the site covered by the regulations include banks, bordering vegetated wetlands, land under bodies of water, land subject to flooding, and riverfront.	Under this alternative, extension of the permeable reactive barrier, source area soil removal/in-situ treatment, installation of the mid-plume in-situ treatment line (Alternative GW/SW-3b only), and monitoring activities may possibly impact wetland resource areas and buffer zones. Alternatives requiring that work be completed within 100 feet of a state regulated wetland or 200 feet of a perennial waterway, will comply with these regulations. Mitigation of impacts on wetlands will be addressed.
Massachusetts Hazardous Waste Rules, Facility Location Standards	310 CMR 40.700	Relevant and Appropriate	Sets forth criteria for siting hazardous waste facilities within Land Subject to Flooding (as defined under the Massachusetts Wetland Protection Act standards); surface water supplies; and actual, planned, or potential public water supplies.	Any remedial structures utilized by this alternative to treat, contain, or dispose of hazardous waste (including the permeable reactive barrier) within the 100-year floodplain, will be designed, constructed, and maintained to prevent a release of hazardous waste within the protected resource area.
Antiquities Act and Regulation; Protection of Properties included in the State Register of Historic Places	Mass. Gen. Laws ch. 9 §§ 26-27; 950 CMR § 71.00	Relevant and Appropriate	Projects which are state-funded or state-licensed or which are on state property must eliminate, minimize or mitigate for adverse effects to properties that are listed in the register of historic places.	Features with potential historical/cultural significance on the state register will be evaluated during the remedial design phase. Should this alternative impact historical properties/structures determined to be protected by these standards, activities will be coordinated with the Massachusetts Historical Commission.

Key:
ARAR = Applicable or Relevant and Appropriate Requirement
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
TBC = To Be Considered
USC = United States Code

TABLE E-7c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-3a: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER
ALTERNATIVE GW/SW-3b: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal Standards				
Resource Conservation and Recovery Act (RCRA) Subtitle C; Hazardous Waste Identification and Listing Regulations; Generator and Handler Requirements	42 USC §6904 *et seq.*; 40 CFR Parts 260-262	Applicable to any action that generates a hazardous waste	Federal standards used to identify, manage, and dispose of hazardous waste. Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State.	Any wastes generated by remedial activity will be analyzed under these standards to determine whether they are characteristic hazardous waste. Non-hazardous materials will be disposed appropriately. All contaminated soil meeting characteristic hazardous waste standards will be excavated and disposed of off-site at a licensed facility.
RCRA Subtitle C; Landfill Closure and Post-Closure Care	40 CFR Part 264.310	Relevant and Appropriate	Federal standards for closure and post-closure care of landfills containing hazardous waste. Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State.	Inspections and maintenance of the existing engineered cover system (including permeable reactive barrier) and long-term groundwater and surface water monitoring would be conducted to meet relevant post-closure requirements.
Clean Water Act; National Pollutant Discharge Elimination System (NPDES)	40 CFR Parts 122 and 125	Applicable	Establishes the specifications for discharging pollutants from any point source into the waters of the U.S. Also, includes stormwater standards for activities disturbing more than one acre.	Any water generated during excavation and soil dewatering activities, well installation, *in-situ* soil treatment, maintenance, or sampling (for Alternative GW/SW-3a) and for the same activities, plus mid-plume *in-situ* soil treatment (for Alternative GW/SW-3b) will be treated to meet these standards before discharge to surface waters. Storm water standards will be met if there is over one acre of construction.
Clean Water Act, National Recommend Water Quality Criteria (NRWQC)	33 U.S.C. § 1314, 40 CFR Part 131	Relevant and Appropriate	NRWQC are health-based criteria developed for chemical constituents in surface water. They have been developed to protect aquatic life and human health from harmful effects due to exposure to chemically impacted surface water. Performance standards to be used for monitoring surface water and sediment during remedial activities and long-term monitoring.	Will be used as performance standards to monitor surface water and sediments, if required, during the remedial action.

TABLE E-7c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-3a: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER
ALTERNATIVE GW/SW-3b: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Clean Air Act (CAA), Hazardous Air Pollutants; National Emission Standards for Hazardous Air Pollutants (NESHAPS)	42 USC §112(b)(1); 40 CFR Part 61	Applicable	The regulations establish emissions standards for 189 hazardous air pollutants. Standards set for dust and other release sources.	Remedial activities, including excavation and management of soil, will be implemented in accordance with these rules. No air emissions from remedial activities will cause air quality standards to be exceeded. Dust standards will be complied with during excavation and management of materials.
Underground Injection Control Program	40 CFR 144, 146, 147 (Subpart EE)	Applicable	Regulations established to assure that underground injection will not endanger drinking water sources.	Alternative GW/SW-3b, mid-plume *in-situ* soil treatment, will be implemented in compliance with these standards.
RCRA, Interim Status Treatment, Storage, and Disposal Facility Standards, Chemical, Physical and Biological Treatment: 40 C.F.R. Part 265 Subpart Q	40 CFR, Part 265 Subpart Q	Relevant and Appropriate	Standards for operating chemical, physical and biological treatment systems, including the proper handling of reagents, system maintenance, and closure procedures.	*In-situ* soil treatment under Alternatives GW/SW-3a and GW/SW-3b and mid-plume *in-situ* soil treatment under Alternative GW/SW-3b will be implemented in compliance with these standards.
Generation of investigation derived waste.	USEPA OSWER Publication 9345.3-03 FS (January 1992)	To Be Considered	Guidance on the management of Investigation Derived Waste (IDW) in a manner that ensures protection of human health and the environment.	IDW generated as part of this remedial alternative will be managed based on guidance standards.
OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air	OSWER Publication 9200.2-154 (June 2015)	To Be Considered	EPA guidance for addressing vapor intrusion issues at CERCLA sites.	Existing residential sub-slab depressurization systems will be monitored to ensure their protectiveness. Institutional controls pertaining to vapor intrusion will be implemented and maintained utilizing these guidance standards until such time as it is determined they are no longer needed.
State Standards				
Solid Waste Management Facility Regulations	310 CMR 19.00	Applicable	The regulations contain requirements for disposal of solid wastes.	Any wastes generated by remedial activity that are determined to not be hazardous wastes will be managed in accordance with this regulation.

TABLE E-7c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-3a: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER
ALTERNATIVE GW/SW-3b: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Underground Injection Control	310 CMR 27.00	Applicable	These regulations protect underground sources of drinking water by regulating the underground injection of hazardous wastes, fluids used for extraction of minerals, oil, and energy and any other fluids having potential to contaminate groundwater as required by the Federal Safe Drinking Water Act.	Alternative GW/SW-3b, mid-plume *in-situ* soil treatment, will be implemented in compliance with these standards.
Massachusetts Hazardous Waste Rules for Identification and Listing of Hazardous Wastes	310 CMR 30.100	Applicable	Massachusetts is delegated to administer RCRA through its State regulations. These regulations establish requirements for determining whether wastes are characteristic hazardous waste.	Any wastes generated by remedial activity will be analyzed under these standards to determine whether they are characteristic hazardous waste. Non-hazardous materials will be disposed appropriately. All contaminated soil meeting characteristic hazardous waste standards will be excavated and disposed of off-site at a licensed facility.
Massachusetts Hazardous Waste Management Rules – Requirements for Generators	310 CMR 30.300	Applicable	These regulations contain requirements for generators of hazardous waste. The regulations apply to generators of sampling waste and also apply to the accumulation of waste prior to off-site disposal.	If any remedial activity generates hazardous wastes, the waste will be managed in accordance with the substantive requirements of these regulations.
Massachusetts Hazardous Waste Management Rules – General standards for hazardous waste facilities	310 CMR 30.500	Relevant and Appropriate	General facility requirements for waste analysis, security measures, inspections, and training requirements. Section 30.580 addresses closure and Section 30.590 post-closure of hazardous waste facilities.	Remedial activities to address hazardous wastes will be conducted in accordance with this requirement. Specifically, storage of wastes on site will be conducted in accordance with this regulation. All workers will be properly trained. The existing engineered cover meets closure standards by maintaining the engineered cover, institutional controls, and long-term monitoring.

TABLE E-7c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-3a: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER
ALTERNATIVE GW/SW-3b: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Massachusetts Hazardous Waste Rules: Landfill Closure/Post-Closure Care	310 CMR 30.633	Relevant and Appropriate	At final closure of the landfill the owner or operator shall cover the landfill with a final cover designed and constructed to: (a) Provide long-term minimization of migration of liquids through the closed landfill; (b) Function with minimum maintenance; (c) Promote drainage and minimize erosion or abrasion of the cover; (d) Accommodate settling and subsidence so that the cover's integrity is maintained. After final closure of the landfill the owner or operator shall comply with all post-closure requirements set forth in 310 CMR 30.590, including, without limitation, maintenance and monitoring throughout the post-closure care period as specified pursuant to 310 CMR 30.592. The owner or operator shall: Maintain the integrity and effectiveness of the final cover, including making repairs to the cap to correct the effects of settling, subsidence, erosion or other events and maintain and monitor the groundwater monitoring system and comply with all other applicable requirements of 310 CMR 30.660; (e) prevent run-off and run-on from eroding or otherwise damaging the final cover; and protect and maintain surveyed benchmarks used in complying with 310 CMR 30.626.	The existing engineered cover system which meets these performance standards will be monitored and maintained to continue to meet these standards.
Massachusetts Hazardous Waste Rules - Containers	310 CMR 30.680	Applicable	Establishes requirements for the management of containers, such as drums, that would hold field-generated hazardous wastes.	If any remedial activity generates hazardous wastes that will be stored in containers, the containers will be managed in accordance with the substantive requirements of these regulations.

TABLE E-7c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-3a: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER
ALTERNATIVE GW/SW-3b: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Massachusetts Hazardous Waste Rules - Management, Storage, and Treatment in Tanks	310 CMR 30.690	Applicable	These standards specify requirements for tank systems used to store or treat hazardous waste. Provides specifications for design and installation of tank systems. Requires secondary containment, leak detection systems, and inspections. Identifies general operating requirements, and closure and post-closure care.	If any remedial activity generates hazardous wastes that will be stored in tanks, the tanks will be managed in accordance with the substantive requirements of these regulations.
Massachusetts Clean Water Act; Surface Water Discharge Permit Regulations	314 CMR 3.00	Applicable	These regulations provide that discharges to waters of the Commonwealth shall not result in exceedances of MA Surface Water Quality Standards (MSWQS).	Any water generated during excavation and soil dewatering activities, well installation, *in-situ* soil treatment, maintenance, or sampling (for Alternative GW/SW-3a) and for the same activities, plus mid-plume *in-situ* soil treatment (for Alternative GW/SW-3b), will be treated to meet discharge standards if the water is to be discharged to surface waters.
Massachusetts Clean Water Act; MA Surface Water Quality Standards (MSWQS)	314 CMR 4.00	Relevant and Appropriate	These standards designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained, or protected. Minimum water quality criteria required to sustain the designated uses are established.	Will be used as performance standards to monitor surface water and sediments, if required, during the remedial action.
Massachusetts Ambient Air Quality Standards	310 CMR 6.00	Applicable	Sets primary and secondary standards for emissions of certain contaminants, including particulate matter.	Remedial activities, including excavation and management of soil will be implemented in accordance with these rules. No air emissions from remedial activities will cause air quality standards to be exceeded. Dust standards will be complied with during excavation and management of materials at the Site.
Massachusetts Air Pollution Control Regulations	310 CMR 7.00	Applicable	These regulations set emission limits necessary to attain ambient air quality standards.	Remedial activities, including excavation and management of soil will be implemented in accordance with these rules. No air emissions from remedial activities will cause air quality standards to be exceeded.

TABLE E-7c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE GW/SW-3a: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER
ALTERNATIVE GW/SW-3b: SOURCE AREA SOIL REMOVAL WITH *IN-SITU* SOIL TREATMENT AND EXTENSION OF PERMEABLE REACTIVE BARRIER WITH MID-PLUME TREATMENT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Erosion and Sediment Control Guidance	None	To Be Considered	Guidance on preventing erosion and sedimentation.	Remedial actions will be managed to control erosion and sedimentation.

Key:
ARAR = Applicable or Relevant and Appropriate Requirement
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
MGL = Massachusetts General Laws
TBC = To Be Considered
USC = United States Code

TABLE E-8
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-1: NO ACTION
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Human Health Assessment Cancer Slope Factors (CSFs)	None	To Be Considered	CSFs are estimates of the upper-bound probability of an individual developing cancer as a result of a lifetime exposure to a particular concentration of a potential carcinogen.	Alternative BR-1 will not achieve carcinogenic risk-based standards calculated using this guidance.
EPA Risk Reference Doses (RfDs)	None	To Be Considered	Guidance used to compute human health hazard resulting from exposure to non-carcinogens in site media. RfDs are considered to be the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime.	Alternative BR-1 will not achieve non-carcinogenic risk-based standards calculated using this guidance.
Guidelines for Carcinogenic Risk Assessment	EPA/630/P-03/001F (March 2005)	To Be Considered	These guidelines provide guidance on conducting risk assessments involving carcinogens.	Alternative BR-1 will not achieve carcinogenic risk-based standards calculated using this guidance.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F(March 2005)	To Be Considered	This provides guidance on assessing risk to children from carcinogens.	Alternative BR-1 will not achieve carcinogenic risk-based standards for children calculated using this guidance.
Safe Drinking Water Act, National Primary Drinking Water Regulations - Maximum Contaminant Levels (MCLs)	40 Code of Federal Regulations (CFR) 141 Subpart G	Relevant and Appropriate	Establishes maximum contaminant levels (MCLs) for common organic and inorganic contaminants applicable to public drinking water supplies. Used as relevant and appropriate cleanup standards for aquifers and surface water bodies that are potential drinking water sources.	This alternative would not prevent exposure to groundwater concentrations from drinking water exposures exceeding MCLs, where higher than risk-based goals. These standards apply only to the Bungay River Resource Protection District (BRWRPD).
Safe Drinking Water Act, National Primary Drinking Water Regulations – Maximum	40 CFR 141 Subpart F	Relevant and Appropriate (non-zero MCLGs only)	Establishes maximum contaminant level goals (MCLGs) for public water supplies. MCLGs are health goals for drinking water sources. These unenforceable health goals are available for a number of organic and inorganic compounds.	This alternative would not prevent exposure to groundwater concentrations from drinking water exposures exceeding MCLGs, where higher than risk-based goals. These standards apply only to the BRWRPD.

TABLE E-8
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-1: NO ACTION
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Contaminant Level Goals (MCLGs)				
Drinking Water Health Advisory for Manganese (EPA Office of Drinking Water), 2004	None	To Be Considered	Health advisories are estimates of risk from consumption of contaminated drinking water. They consider non-carcinogenic effects only. To be considered for contaminants in groundwater that may be used for drinking water purposes, where the standard is more conservative than either federal or state statutory or regulatory standards. The Advisory standard for manganese is 0.3 mg/L.	Alternative BR-1 will not achieve risk-based standards calculated using this guidance.
State				
Massachusetts Drinking Water Regulations	310 CMR 22.00	Relevant and Appropriate	These standards establish Massachusetts Maximum Contaminant Levels (MA MCLs) for organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water supply systems.	This alternative would not prevent exposure to groundwater concentrations from drinking water exposures exceeding MA MCLs, where higher than risk-based goals. These standards apply only to the BRWRPD.

There are no Location-Specific or Action-Specific ARARs for the No Action alternative.

TABLE E-9a
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-2: INSTITUTIONAL CONTROLS
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Human Health Assessment Cancer Slope Factors (CSFs)	None	To Be Considered	CSFs are estimates of the upper-bound probability of an individual developing cancer as a result of a lifetime exposure to a particular concentration of a potential carcinogen.	Alternative BR-2 will achieve carcinogenic risk-based standards calculated using this guidance.
EPA Risk Reference Doses (RfDs)	None	To Be Considered	Guidance used to compute human health hazard resulting from exposure to non-carcinogens in site media. RfDs are considered to be the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime.	Alternative BR-2 will achieve non-carcinogenic risk-based standards calculated using this guidance.
Guidelines for Carcinogenic Risk Assessment	EPA/630/P-03/001F (March 2005)	To Be Considered	These guidelines provide guidance on conducting risk assessments involving carcinogens.	Alternative BR-2 will achieve carcinogenic risk-based standards calculated using this guidance.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F(March 2005)	To Be Considered	This provides guidance on assessing risk to children from carcinogens.	Alternative BR-2 will achieve carcinogenic risk-based standards for children calculated using this guidance.
Safe Drinking Water Act, National Primary Drinking Water Regulations - Maximum Contaminant Levels (MCLs)	40 Code of Federal Regulations (CFR) 141 Subpart G	Applicable	Establishes maximum contaminant levels (MCLs) for common organic and inorganic contaminants applicable to public drinking water supplies. Used as relevant and appropriate cleanup standards for aquifers and surface water bodies that are potential drinking water sources.	These drinking water standards will be achieved within the Bungay River Resource Protection District (BRWRPD) through natural processes.

TABLE E-9a
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-2: INSTITUTIONAL CONTROLS
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Safe Drinking Water Act, National Primary Drinking Water Regulations – Maximum Contaminant Level Goals (MCLGs)	40 CFR 141 Subpart F	Applicable (non-zero MCLGs only)	Establishes maximum contaminant level goals (MCLGs) for public water supplies. MCLGs are health goals for drinking water sources. These unenforceable health goals are available for a number of organic and inorganic compounds.	These drinking water standards will be achieved within the BRWRPD through natural processes.
Drinking Water Health Advisory for Manganese (EPA Office of Drinking Water), 2004	None	To Be Considered	Health advisories are estimates of risk from consumption of contaminated drinking water. They consider non-carcinogenic effects only. To be considered for contaminants in groundwater that may be used for drinking water purposes, where the standard is more conservative than either federal or state statutory or regulatory standards. The Advisory standard for manganese is 0.3 mg/L.	Alternative BR-2 will achieve risk-based standards calculated using this guidance.
State				
Massachusetts Drinking Water Regulations	310 CMR 22.00	Relevant and Appropriate	These standards establish Massachusetts Maximum Contaminant Levels (MA MCLs) for organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water supply systems.	These drinking water standards will be achieved within the BRWRPD through natural processes.

TABLE E-9b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-2: INSTITUTIONAL CONTROLS
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Protection of Wetlands (Executive Order 11990)	44 CFR Part 9	Relevant and Appropriate	Per the FEMA regulations (44 CFR Part 9; incorporating requirements under Executive Order 11990), federal agencies are required to avoid adversely impacting federal jurisdictional wetlands unless there is no practicable alternative with lesser effects and the proposed action includes all practicable measures to minimize harm to federal jurisdictional wetlands that may result from such use.	To the extent federal jurisdictional wetlands exist within areas to be altered by monitoring well installation, maintenance or sampling, action to be taken will minimize alterations to protected resource areas. Mitigation measures, as required, will be taken to compensate for resource areas impacted by remedial actions.
Floodplain Management (Executive Order 11988)	44 CFR Part 9	Relevant and Appropriate	Per the FEMA regulations (44 CFR Part 9; incorporating requirements under Executive Order 11988), federal agencies are required to avoid long-and short-term adverse impacts associated with the occupancy and modification of federally-designated 100-year and 500-year floodplain wherever there is a practicable alternative.	Remedial activities associated with monitoring well installation, maintenance or sampling may be conducted within the 100-year or 500-year floodplain under this alternative. Available practicable means will be used to reduce the risk of flood loss during the remedial action. Because the original grade will be restored at the completion of the remedial action, there will be no occupancy or modification of the floodplain.
Clean Water Act, Guidelines for Specification of Disposal Sites for Dredged or Fill Material	33 U.S.C. § 1344; § 404(b)(1); 40 CFR Part 230, 231, and 33 CFR Parts 320-323	Applicable	Controls discharges of dredged or fill material to protect aquatic ecosystem. This alternative includes work to be performed in a wetland. Under this requirement no activity that adversely affects a wetland shall be permitted if a practicable alternative with lesser effects is available. If activity takes place, impacts must be minimized to the maximum extent. Sets standards for restoration and mitigation required as a result of unavoidable impacts to wetland and aquatic resources. EPA must determine which alternative is the “Least Environmentally Damaging Practicable Alternative” (LEDPA) to protect wetland and aquatic resources	This alternative may include monitoring well installation, maintenance or sampling within federal jurisdictional wetlands. Work will be done to minimize and mitigate for any impacts to wetland resources. EPA will solicit public comment as to whether this alternative is the Least Environmentally Damaging Practicable Alternative.

TABLE E-9b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-2: INSTITUTIONAL CONTROLS
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Management of Undesirable Plants	7 U.S.C. § 2814	Relevant and Appropriate	Regulations calling for federal actions to contain or control undesirable plant species or group of species using all available methods, including: (A) preventive measures; (B) physical or mechanical methods; (C) biological agents; (D) herbicide methods; and (E) general land management practices.	Measures will be taken to prevent the establishment of undesirable plant species (i.e., non-native and invasive species) as part of any wetlands/habitat restoration conducted as part of this alterative.
Historic Sites Act of 1935; National Historic Landmarks	16 USC 469 *et seq.*; 36 CFR Part 65	Applicable	The purpose of the National Historic Landmarks program is to identify and designate National Historic Landmarks and encourage the long-range preservation of nationally significant properties that illustrate or commemorate the history and prehistory of the United States.	Features with potential historical/cultural significance will be evaluated during the remedial design phase. Should this alternative impact historical properties/structures determined to be protected by these standards activities will be coordinated with the Department of the Interior.
National Historical Preservation Act	16 USC 470 *et seq.*; 36 CFR, Part 800	Applicable	When a federal agency finds, or is notified, that its activities may cause irreparable loss or destruction of significant scientific, pre-historical, historical, archeological data, such agency shall consult with relevant federal and State officials to address the preservation of such data or other forms of mitigation, as necessary.	If it is determined that this alternative may cause irreparable loss or destruction of significant scientific, pre-historical, historical, or archaeological data, EPA will consult with federal and State officials and implement preservation and/or mitigation measures, as necessary.
Endangered Species Act	16 USC 1531 *et seq.*; 50 CFR Part 402	Applicable	If a location contains a federal endangered or threatened species or its critical habitat, and an action may impact the species or its habitat, the U.S. Fish & Wildlife Service or the National Marine Fisheries Service must be consulted.	Southeastern Massachusetts is located within the range of the federally endangered Northern Long-Eared Bat. This requirement may be applicable if tree removal is needed during remedial activities. Consultation with the U.S. Fish & Wildlife Service will occur during the planning process to determine if the project is near known hibernacula or known maternity roost trees so that activities do not adversely impact bat populations or habitat. Tree cutting may need to be restricted to timeframes outside of the summer season.

TABLE E-9b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-2: INSTITUTIONAL CONTROLS
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
State				
Wetlands Protection Act	Mass. Gen. Laws ch. 131, §40; Wetlands Protection Regulations (310 CMR §10.00)	Applicable	Sets performance standards for dredging, filling, altering of inland wetland resource areas and sets buffer zones within 100 feet of a vegetated wetland and 200 feet from a perennial stream. The standards include mitigation requirements for alteration of regulated wetland resource areas. Resource areas at the site covered by the regulations include banks, bordering vegetated wetlands, land under bodies of water, land subject to flooding, and riverfront.	Monitoring well installation, maintenance or sampling, including access ways, may possibly impact wetland resource areas and buffer zones. Alternatives requiring that work be completed within 100 feet of a state regulated wetland or 200 feet of a perennial waterway, will comply with these regulations. Mitigation of impacts on wetlands will be addressed.
Antiquities Act and Regulation; Protection of Properties included in the State Register of Historic Places	Mass. Gen. Laws ch. 9 §§ 26-27; 950 CMR § 71.00	Relevant and Appropriate	Projects which are state-funded or state-licensed or which are on state property must eliminate, minimize or mitigate for adverse effects to properties that are listed in the register of historic places.	Features with potential historical/cultural significance on the state register will be evaluated during the remedial design phase. Should this alternative impact historical properties/structures determined to be protected by these standards, activities will be coordinated with the Massachusetts Historical Commission.

Key:
ARAR = Applicable or Relevant and Appropriate Requirement
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
TBC = To Be Considered
USC = United States Code

TABLE E-9c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-2: INSTITUTIONAL CONTROLS
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal Standards				
Resource Conservation and Recovery Act (RCRA) Subtitle C; Hazardous Waste Identification and Listing Regulations; Generator and Handler Requirements	42 USC §6904 *et seq.*; 40 CFR Parts 260-262	Applicable to any action that generates a hazardous waste	Federal standards used to identify, manage, and dispose of hazardous waste. Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State.	Any wastes generated by remedial activities including drilling for well installation and groundwater monitoring will be analyzed under these standards to determine whether they are characteristic hazardous waste. Non-hazardous materials will be disposed appropriately. Contaminated soil from well drilling, as well as any groundwater removed, meeting characteristic hazardous waste standards will be disposed of off-site at a licensed facility.
Clean Water Act; National Pollutant Discharge Elimination System (NPDES)	40 CFR Parts 122 and 125	Applicable	Establishes the specifications for discharging pollutants from any point source into the waters of the U.S. Also, includes stormwater standards for activities disturbing more than one acre.	Any water generated during drilling for monitoring well installation, maintenance or sampling will be treated to meet these standards before discharge to surface waters.
Safe Drinking Water Act, National Primary Drinking Water Regulations – Maximum Contaminant Levels (MCLs)	40 CFR 141 Subpart G	Applicable	Establishes maximum contaminant levels (MCLs) for common organic and inorganic contaminants applicable to public drinking water supplies. Used as relevant and appropriate cleanup standards for aquifers and surface water bodies that are potential drinking water sources.	Groundwater monitoring using these standards will ensure that contamination present in the non-potable aquifer does not migrate into the downgradient drinking water aquifer within the Bungay River Resource Protection District (BRWRPD). Groundwater within the BRWRPD will be monitored to determine when natural processes have achieved these standards.
Safe Drinking Water Act, National Primary Drinking Water Regulations – Maximum Contaminant Level Goals (MCLGs)	40 CFR 141 Subpart F	Applicable (non-zero MCLGs only)	Establishes maximum contaminant level goals (MCLGs) for public water supplies. MCLGs are health goals for drinking water sources. These unenforceable health goals are available for a number of organic and inorganic compounds.	Groundwater monitoring using these standards will ensure that contamination present in the non-potable aquifer does not migrate into the downgradient drinking water aquifer within the BRWRPD. Groundwater within the BRWRPD will be monitored to determine when natural processes have achieved these standards.

TABLE E-9c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-2: INSTITUTIONAL CONTROLS
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
EPA Groundwater Protection Strategy	August 1984; NCP Preamble, Vol. 55, No. 46, March 8, 1990, 40 CFR 300, p. 8733); Guidelines for Ground-Water Classification (November 1986)	To Be Considered	The Groundwater Protection Strategy provides a common reference for preserving clean groundwater and protecting the public health against the effects of past contamination. Guidelines for consistency in groundwater protection programs focus on the highest beneficial use of a groundwater aquifer.	Institutional controls will prohibit use of site bedrock groundwater for non-drinking water (irrigation well) uses throughout the area where non-drinking water cleanup standards are exceeded in the underlying groundwater aquifer and natural processes will work to reduce COC concentrations over time. If drinking water cleanup standards are found to be exceeded within the area of Bungay River Resource Protection District (BRWRPD), the contingency portion of this alternative will implemented, including 1) ICs to prohibit use of bedrock groundwater as drinking water within that BRWRPD area; and 2) expansion of the monitoring program area to include impacted groundwater within the BRWRPD. This alternative will attain groundwater cleanup standards within the BRWRPD within a reasonable time period.
Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites	OSWER Directive 9200.4-17P (April 21, 1999)	To Be Considered	EPA guidance regarding the use of monitored natural attenuation for the cleanup of contaminated soil and groundwater. In particular, a reasonable timeframe to achieve cleanup standards through monitored attenuation would be comparable to that achieved by active restoration.	The effectiveness of this alternative will be assessed under a monitoring plan that meets these guidance standards during each five-year review to ensure groundwater cleanup within the BRWRPD occurs within a reasonable time period.
Generation of investigation derived waste.	USEPA OSWER Publication 9345.3-03 FS (January 1992)	To Be Considered	Guidance on the management of Investigation Derived Waste (IDW) in a manner that ensures protection of human health and the environment.	IDW generated as part of this remedial alternative will be managed based on guidance standards.
State Standards				
Massachusetts Drinking Water Regulations	310 CMR 22.00	Relevant and Appropriate	These standards establish Massachusetts Maximum Contaminant Levels (MA MCLs) for organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water supply	Groundwater monitoring using these standards will ensure that contamination present in the non-potable aquifer does not migrate into the downgradient drinking water aquifer within the BRWRPD. Groundwater within the BRWRPD will be monitored to determine when natural

TABLE E-9c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-2: INSTITUTIONAL CONTROLS
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
			systems.	processes have achieved these standards.
Massachusetts Hazardous Waste Rules for Identification and Listing of Hazardous Wastes	310 CMR 30.100	Applicable	Massachusetts is delegated to administer RCRA through its State regulations. These regulations establish requirements for determining whether wastes are characteristic hazardous waste.	Any wastes generated by remedial activities including drilling for well installation and groundwater monitoring will be analyzed under these standards to determine whether they are characteristic hazardous waste. Non-hazardous materials will be disposed appropriately. Contaminated soil from well drilling, as well as any groundwater removed, meeting characteristic hazardous waste standards will be disposed of off-site at a licensed facility.
Massachusetts Hazardous Waste Management Rules – Requirements for Generators	310 CMR 30.300	Applicable	These regulations contain requirements for generators of hazardous waste. The regulations apply to generators of sampling waste and also apply to the accumulation of waste prior to off-site disposal.	Wastes generated during remedial actions that are determined to be hazardous would be managed in accordance with these requirements.
Massachusetts Hazardous Waste Rules - Containers	310 CMR 30.680	Applicable	Establishes requirements for the management of containers, such as drums, that would hold field-generated hazardous wastes.	If any remedial activity generates hazardous wastes that will be stored in containers, the containers will be managed in accordance with the substantive requirements of these regulations.
Massachusetts Hazardous Waste Rules - Management, Storage, and Treatment in Tanks	310 CMR 30.690	Applicable	These standards specify requirements for tank systems used to store or treat hazardous waste. Provides specifications for design and installation of tank systems. Requires secondary containment, leak detection systems, and inspections. Identifies general operating requirements, and closure and post-closure care.	If any remedial activity generates hazardous wastes that will be stored in tanks, the tanks will be managed in accordance with the substantive requirements of these regulations.
Massachusetts Clean Water Act; Surface Water Discharge Permit Regulations	314 CMR 3.00	Applicable	These regulations provide that discharges to waters of the Commonwealth shall not result in exceedances of MA Surface Water Quality Standards (MSWQS).	Any water generated during drilling for well installation and groundwater monitoring will be treated to meet discharge standards if the water is to be discharged to surface waters.

TABLE E-9c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-2: INSTITUTIONAL CONTROLS
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Massachusetts Clean Water Act; MA Surface Water Quality Standards (MSWQS)	314 CMR 4.00	Relevant and Appropriate	These standards designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained, or protected. Minimum water quality criteria required to sustain the designated uses are established.	Will be used as performance standards to monitor surface water and sediments, if required, during the remedial action.

Key:
ARAR = Applicable or Relevant and Appropriate Requirement
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
TBC = To Be Considered
USC = United States Code

TABLE E-10a
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-3: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF FOCUSED IN-SITU INJECTIONS (WEST OF NORTH AVENUE)
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Human Health Assessment Cancer Slope Factors (CSFs)	None	To Be Considered	CSFs are estimates of the upper-bound probability of an individual developing cancer as a result of a lifetime exposure to a particular concentration of a potential carcinogen.	Alternative BR-3 (including the contingency for focused *in-situ* chemical reduction treatment if needed) will achieve carcinogenic risk-based standards calculated using this guidance.
EPA Risk Reference Doses (RfDs)	None	To Be Considered	Guidance used to compute human health hazard resulting from exposure to non-carcinogens in site media. RfDs are considered to be the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime.	Alternative BR-3 (including the contingency for focused *in-situ* chemical reduction treatment if needed) will achieve non-carcinogenic risk-based standards calculated using this guidance.
Guidelines for Carcinogenic Risk Assessment	EPA/630/P-03/001F (March 2005)	To Be Considered	These guidelines provide guidance on conducting risk assessments involving carcinogens.	Alternative BR-3 (including the contingency for focused *in-situ* chemical reduction treatment if needed) will achieve carcinogenic risk-based standards calculated using this guidance.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F(March 2005)	To Be Considered	This provides guidance on assessing risk to children from carcinogens.	Alternative BR-3 (including the contingency for focused *in-situ* chemical reduction treatment if needed) will achieve carcinogenic risk-based standards for children calculated using this guidance.
Safe Drinking Water Act, National Primary Drinking Water Regulations - Maximum Contaminant Levels (MCLs)	40 Code of Federal Regulations (CFR) 141 Subpart G	Relevant and Appropriate	Establishes maximum contaminant levels (MCLs) for common organic and inorganic contaminants applicable to public drinking water supplies. Used as relevant and appropriate cleanup standards for aquifers and surface water bodies that are potential drinking water sources.	These drinking water standards will be achieved within the Bungay River Resource Protection District (BRWRPD) through natural processes (with a contingency for focused *in-situ* chemical reduction treatment).

TABLE E-10a
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-3: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF FOCUSED IN-SITU INJECTIONS (WEST OF NORTH AVENUE)
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Safe Drinking Water Act, National Primary Drinking Water Regulations – Maximum Contaminant Level Goals (MCLGs)	40 CFR 141 Subpart F	Relevant and Appropriate (non-zero MCLGs only)	Establishes maximum contaminant level goals (MCLGs) for public water supplies. MCLGs are health goals for drinking water sources. These unenforceable health goals are available for a number of organic and inorganic compounds.	These drinking water standards will be achieved within the BRWRPD through natural processes (with a contingency for focused *in-situ* chemical reduction treatment).
Drinking Water Health Advisory for Manganese (EPA Office of Drinking Water), 2004	None	To Be Considered	Health advisories are estimates of risk from consumption of contaminated drinking water. They consider non-carcinogenic effects only. To be considered for contaminants in groundwater that may be used for drinking water purposes, where the standard is more conservative than either federal or state statutory or regulatory standards. The Advisory standard for manganese is 0.3 mg/L.	Alternative BR-3 (including the contingency for focused *in-situ* chemical reduction treatment if needed) will achieve risk-based standards calculated using this guidance.
State				
Massachusetts Drinking Water Regulations	310 CMR 22.00	Relevant and Appropriate	These standards establish Massachusetts Maximum Contaminant Levels (MA MCLs) for organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water supply systems.	These drinking water standards will be achieved within the BRWRPD through natural processes (with a contingency for focused *in-situ* chemical reduction treatment).

TABLE E-10b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-3: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF FOCUSED IN-SITU INJECTIONS (WEST OF NORTH AVENUE)
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Protection of Wetlands (Executive Order 11990)	44 CFR Part 9	Relevant and Appropriate	Per the FEMA regulations (44 CFR Part 9; incorporating requirements under Executive Order 11990), federal agencies are required to avoid adversely impacting federal jurisdictional wetlands unless there is no practicable alternative with lesser effects and the proposed action includes all practicable measures to minimize harm to federal jurisdictional wetlands that may result from such use.	To the extent federal jurisdictional wetlands exist within areas to be altered by monitoring well installation, maintenance or sampling or by the *in-situ* bedrock injections contingency, if needed, action to be taken will minimize alterations to protected resource areas. Mitigation measures, as required, will be taken to compensate for resource areas impacted by remedial actions.
Floodplain Management (Executive Order 11988)	44 CFR Part 9	Relevant and Appropriate	Per the FEMA regulations (44 CFR Part 9; incorporating requirements under Executive Order 11988), federal agencies are required to avoid long-and short-term adverse impacts associated with the occupancy and modification of federally-designated 100-year and 500-year floodplain wherever there is a practicable alternative.	Remedial activities associated with monitoring well installation, maintenance or sampling or with the *in-situ* bedrock injections contingency, if needed, may be conducted within the 100-year or 500-year floodplain under this alternative. Available practicable means will be used to reduce the risk of flood loss during the remedial action. Because the original grade will be restored at the completion of the remedial action, there will be no occupancy or modification of the floodplain.
Clean Water Act, Guidelines for Specification of Disposal Sites for Dredged or Fill Material	33 U.S.C. § 1344; § 404(b)(1); 40 CFR Part 230, 231, and 33 CFR Parts 320-323	Applicable	Controls discharges of dredged or fill material to protect aquatic ecosystem. This alternative includes work to be performed in a wetland. Under this requirement no activity that adversely affects a wetland shall be permitted if a practicable alternative with lesser effects is available. If activity takes place, impacts must be minimized to the maximum extent. Sets standards for restoration and mitigation required as a result of unavoidable impacts to wetland and aquatic resources. EPA must determine which alternative is the "Least Environmentally Damaging Practicable	This alternative may include monitoring well installation, maintenance or sampling within federal jurisdictional wetlands. Work will be done to minimize and mitigate for any impacts to wetland resources. EPA will solicit public comment as to whether this alternative is the Least Environmentally Damaging Practicable Alternative.

TABLE E-10b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-3: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF FOCUSED IN-SITU INJECTIONS (WEST OF NORTH AVENUE)
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
			Alternative" (LEDPA) to protect wetland and aquatic resources	
Management of Undesirable Plants	7 U.S.C. § 2814	Relevant and Appropriate	Regulations calling for federal actions to contain or control undesirable plant species or group of species using all available methods, including: (A) preventive measures; (B) physical or mechanical methods; (C) biological agents; (D) herbicide methods; and (E) general land management practices.	Measures will be taken to prevent the establishment of undesirable plant species (i.e., non-native and invasive species) as part of any wetlands/habitat restoration conducted as part of this alterative.
Historic Sites Act of 1935; National Historic Landmarks	16 USC 469 *et seq.*; 36 CFR Part 65	Applicable	The purpose of the National Historic Landmarks program is to identify and designate National Historic Landmarks and encourage the long-range preservation of nationally significant properties that illustrate or commemorate the history and prehistory of the United States.	Features with potential historical/cultural significance will be evaluated during the remedial design phase. Should this alternative impact historical properties/structures determined to be protected by these standards activities will be coordinated with the Department of the Interior.
National Historical Preservation Act	16 USC 470 *et seq.*; 36 CFR, Part 800	Applicable	When a federal agency finds, or is notified, that its activities may cause irreparable loss or destruction of significant scientific, pre-historical, historical, archeological data, such agency shall consult with relevant federal and State officials to address the preservation of such data or other forms of mitigation, as necessary.	If it is determined that this alternative may cause irreparable loss or destruction of significant scientific, pre-historical, historical, or archaeological data, EPA will consult with federal and State officials and implement preservation and/or mitigation measures, as necessary.
Endangered Species Act	16 USC 1531 *et seq.*; 50 CFR Part 402	Applicable	If a location contains a federal endangered or threatened species or its critical habitat, and an action may impact the species or its habitat, the U.S. Fish & Wildlife Service or the National Marine Fisheries Service must be consulted.	Southeastern Massachusetts is located within the range of the federally endangered Northern Long-Eared Bat. This requirement may be applicable if tree removal is needed during remedial activities. Consultation with the U.S. Fish & Wildlife Service will occur during the planning process to determine if the project is near known hibernacula or known maternity roost trees so that activities do not adversely impact bat populations or habitat. Tree

TABLE E-10b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-3: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF FOCUSED IN-SITU INJECTIONS (WEST OF NORTH AVENUE)
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
				cutting may need to be restricted to timeframes outside of the summer season.
State				
Wetlands Protection Act	Mass. Gen. Laws ch. 131, §40; Wetlands Protection Regulations (310 CMR §10.00)	Applicable	Sets performance standards for dredging, filling, altering of inland wetland resource areas and sets buffer zones within 100 feet of a vegetated wetland and 200 feet from a perennial stream. The standards include mitigation requirements for alteration of regulated wetland resource areas. Resource areas at the site covered by the regulations include banks, bordering vegetated wetlands, land under bodies of water, land subject to flooding, and riverfront.	Monitoring well installation, maintenance or sampling or the *in-situ* bedrock injections contingency, if needed, including access ways, may possibly impact wetland resource areas and buffer zones. Alternatives requiring that work be completed within 100 feet of a state regulated wetland or 200 feet of a perennial waterway, will comply with these regulations. Mitigation of impacts on wetlands will be addressed.
Antiquities Act and Regulation; Protection of Properties included in the State Register of Historic Places	Mass. Gen. Laws ch. 9 §§ 26-27; 950 CMR § 71.00	Relevant and Appropriate	Projects which are state-funded or state-licensed or which are on state property must eliminate, minimize or mitigate for adverse effects to properties that are listed in the register of historic places.	Features with potential historical/cultural significance on the state register will be evaluated during the remedial design phase. Should this alternative impact historical properties/structures determined to be protected by these standards, activities will be coordinated with the Massachusetts Historical Commission.

Key:
ARAR = Applicable or Relevant and Appropriate Requirement
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
TBC = To Be Considered
USC = United States Code

TABLE E-10c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-3: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF FOCUSED IN-SITU INJECTIONS (WEST OF NORTH AVENUE)
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal Standards				
Resource Conservation and Recovery Act (RCRA) Subtitle C; Hazardous Waste Identification and Listing Regulations; Generator and Handler Requirements	42 USC §6904 *et seq.*; 40 CFR Parts 260-262	Applicable to any action that generates a hazardous waste	Federal standards used to identify, manage, and dispose of hazardous waste. Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State.	Any wastes generated by remedial activities including drilling for well installation and groundwater monitoring or drilling for bedrock injections, if the contingency component is needed, will be analyzed under these standards to determine whether they are characteristic hazardous waste. Non-hazardous materials will be disposed appropriately. Contaminated soil from well drilling, as well as any groundwater removed, meeting characteristic hazardous waste standards will be disposed of off-site at a licensed facility.
Clean Water Act; National Pollutant Discharge Elimination System (NPDES)	40 CFR Parts 122 and 125	Applicable	Establishes the specifications for discharging pollutants from any point source into the waters of the U.S. Also, includes stormwater standards for activities disturbing more than one acre.	Any water generated during drilling for monitoring well installation, maintenance or sampling or during *in-situ* bedrock injection, if the contingency component is needed, will be treated to meet these standards before discharge to surface waters.
Safe Drinking Water Act, National Primary Drinking Water Regulations – Maximum Contaminant Levels (MCLs)	40 CFR 141 Subpart G	Applicable	Establishes maximum contaminant levels (MCLs) for common organic and inorganic contaminants applicable to public drinking water supplies. Used as relevant and appropriate cleanup standards for aquifers and surface water bodies that are potential drinking water sources.	Groundwater monitoring using these standards will ensure that contamination present in the non-potable aquifer does not migrate into the downgradient drinking water aquifer within the Bungay River Resource Protection District (BRWRPD). Groundwater within the BRWRPD will be monitored to determine when natural processes and the in-situ chemical reduction treatment contingency, if needed, have achieved these standards.
Safe Drinking Water Act, National Primary Drinking Water Regulations – Maximum Contaminant Level Goals (MCLGs)	40 CFR 141 Subpart F	Applicable (non-zero MCLGs only)	Establishes maximum contaminant level goals (MCLGs) for public water supplies. MCLGs are health goals for drinking water sources. These unenforceable health goals are available for a number of organic and inorganic compounds.	Groundwater monitoring using these standards will ensure that contamination present in the non-potable aquifer does not migrate into the downgradient drinking water aquifer within the BRWRPD. Groundwater within the BRWRPD will be monitored to determine when natural processes or in-situ chemical reduction treatment, if the contingency component is needed, have achieved these standards.

TABLE E-10c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-3: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF FOCUSED IN-SITU INJECTIONS (WEST OF NORTH AVENUE)
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Underground Injection Control Program	40 CFR 144, 146, 147 (Subpart EE)	Applicable	Regulations established to assure that underground injection will not endanger drinking water sources.	If the contingency component of this alternative is needed, *in-situ* treatment will be implemented in compliance with these standards.
RCRA, Interim Status Treatment, Storage, and Disposal Facility Standards, Chemical, Physical and Biological Treatment: 40 C.F.R. Part 265 Subpart Q	40 CFR, Part 265 Subpart Q	Relevant and Appropriate	Standards for operating chemical, physical and biological treatment systems, including the proper handling of reagents, system maintenance, and closure procedures.	If the contingency component of this alternative is needed, *in-situ* treatment will be implemented in compliance with these standards.
EPA Groundwater Protection Strategy	August 1984; NCP Preamble, Vol. 55, No. 46, March 8, 1990, 40 CFR 300, p. 8733); Guidelines for Ground-Water Classification (November 1986)	To Be Considered	The Groundwater Protection Strategy provides a common reference for preserving clean groundwater and protecting the public health against the effects of past contamination. Guidelines for consistency in groundwater protection programs focus on the highest beneficial use of a groundwater aquifer.	Institutional controls will prohibit use of site bedrock groundwater for non-drinking water (irrigation well) uses throughout the area where non-drinking water cleanup standards are exceeded in the underlying groundwater aquifer and natural processes will work to reduce COC concentrations over time. If drinking water cleanup standards are found to be exceeded within the area of Bungay River Resource Protection District (BRWRPD), the contingency portion of this alternative will implemented, including 1) ICs to prohibit use of bedrock groundwater as drinking water within that BRWRPD area; 2) expansion of the monitoring area to include impacted groundwater within the BRWRPD; and 3) *in-situ* bedrock injections to further work to reduce COC concentrations over time. This alternative will attain groundwater cleanup standards within the BRWRPD within a reasonable time period.
Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites	OSWER Directive 9200.4-17P (April 21, 1999)	To Be Considered	EPA guidance regarding the use of monitored natural attenuation for the cleanup of contaminated soil and groundwater. In particular, a reasonable timeframe to achieve cleanup standards through monitored attenuation would be comparable to that achieved by active	The effectiveness of this alternative will be assessed under a monitoring plan that meets these guidance standards during each five-year review to ensure groundwater cleanup within the BRWRPD occurs within a reasonable time period.

TABLE E-10c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-3: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF FOCUSED IN-SITU INJECTIONS (WEST OF NORTH AVENUE)
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
			restoration.	
Generation of investigation derived waste.	USEPA OSWER Publication 9345.3-03 FS (January 1992)	To Be Considered	Guidance on the management of Investigation Derived Waste (IDW) in a manner that ensures protection of human health and the environment.	IDW generated as part of this remedial alternative will be managed based on guidance standards.
State Standards				
Solid Waste Management Facility Regulations	310 CMR 19.00	Applicable	The regulations contain requirements for disposal of solid wastes.	Any wastes generated by remedial activity that are determined to not be hazardous wastes will be managed in accordance with this regulation.
Massachusetts Drinking Water Regulations	310 CMR 22.00	Relevant and Appropriate	These standards establish Massachusetts Maximum Contaminant Levels (MA MCLs) for organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water supply systems.	Groundwater monitoring using these standards will ensure that contamination present in the non-potable aquifer does not migrate into the downgradient drinking water aquifer within the BRWRPD. Groundwater within the BRWRPD will be monitored to determine when natural processes or in-situ chemical reduction treatment, if the contingency component is needed, have achieved these standards.
Underground Injection Control	310 CMR 27.00	Applicable	These regulations protect underground sources of drinking water by regulating the underground injection of hazardous wastes, fluids used for extraction of minerals, oil, and energy and any other fluids having potential to contaminate groundwater as required by the Federal Safe Drinking Water Act.	If the contingency component of this alternative is needed, *in-situ* treatment will be implemented in compliance with these standards.
Massachusetts Hazardous Waste Rules for Identification and Listing of Hazardous Wastes	310 CMR 30.100	Applicable	Massachusetts is delegated to administer RCRA through its State regulations. These regulations establish requirements for determining whether wastes are characteristic hazardous waste.	Any wastes generated by remedial activities including drilling for well installation and groundwater monitoring or drilling for bedrock injections, if the contingency component is needed, will be analyzed under these standards to determine whether they are characteristic hazardous waste. Non-hazardous materials will be disposed appropriately. Contaminated soil from well drilling, as well as any groundwater removed, meeting characteristic hazardous waste standards

TABLE E-10c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-3: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF FOCUSED IN-SITU INJECTIONS (WEST OF NORTH AVENUE)
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
				will be disposed of off-site at a licensed facility.
Massachusetts Hazardous Waste Management Rules – Requirements for Generators	310 CMR 30.300	Applicable	These regulations contain requirements for generators of hazardous waste. The regulations apply to generators of sampling waste and also apply to the accumulation of waste prior to off-site disposal.	Wastes generated during remedial actions that are determined to be hazardous would be managed in accordance with these requirements.
Massachusetts Hazardous Waste Rules - Containers	310 CMR 30.680	Applicable	Establishes requirements for the management of containers, such as drums, that would hold field-generated hazardous wastes.	If any remedial activity generates hazardous wastes that will be stored in containers, the containers will be managed in accordance with the substantive requirements of these regulations.
Massachusetts Hazardous Waste Rules - Management, Storage, and Treatment in Tanks	310 CMR 30.690	Applicable	These standards specify requirements for tank systems used to store or treat hazardous waste. Provides specifications for design and installation of tank systems. Requires secondary containment, leak detection systems, and inspections. Identifies general operating requirements, and closure and post-closure care.	If any remedial activity generates hazardous wastes that will be stored in tanks, the tanks will be managed in accordance with the substantive requirements of these regulations.
Massachusetts Clean Water Act; Surface Water Discharge Permit Regulations	314 CMR 3.00	Applicable	These regulations provide that discharges to waters of the Commonwealth shall not result in exceedances of MA Surface Water Quality Standards (MSWQS).	Any water generated during drilling for well installation and groundwater monitoring or during *in-situ* bedrock injection, if the contingency component is needed, will be treated to meet discharge standards if the water is to be discharged to surface waters.
Massachusetts Clean Water Act; MA Surface Water Quality Standards (MSWQS)	314 CMR 4.00	Relevant and Appropriate	These standards designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained, or protected. Minimum water quality criteria required to sustain the designated uses are established.	Will be used as performance standards to monitor surface water and sediments, if required, during the remedial action.

Key:

ARAR = Applicable or Relevant and Appropriate Requirement
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
USC = United States Code
TBC = To Be Considered

TABLE E-11a
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-4: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF PUMP AND TREAT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Human Health Assessment Cancer Slope Factors (CSFs)	None	To Be Considered	CSFs are estimates of the upper-bound probability of an individual developing cancer as a result of a lifetime exposure to a particular concentration of a potential carcinogen.	Alternative BR-4 (including the contingency for pump and treat if needed) will achieve carcinogenic risk-based standards calculated using this guidance.
EPA Risk Reference Doses (RfDs)	None	To Be Considered	Guidance used to compute human health hazard resulting from exposure to non-carcinogens in site media. RfDs are considered to be the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime.	Alternative BR-4 (including the contingency for pump and treat if needed) will achieve non-carcinogenic risk-based standards calculated using this guidance.
Guidelines for Carcinogenic Risk Assessment	EPA/630/P-03/001F (March 2005)	To Be Considered	These guidelines provide guidance on conducting risk assessments involving carcinogens.	Alternative BR-4 (including the contingency for pump and treat if needed) will achieve carcinogenic risk-based standards calculated using this guidance.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F(March 2005)	To Be Considered	This provides guidance on assessing risk to children from carcinogens.	Alternative BR-4 (including the contingency for pump and treat if needed) will achieve carcinogenic risk-based standards for children calculated using this guidance.
Safe Drinking Water Act, National Primary Drinking Water Regulations - Maximum Contaminant Levels (MCLs)	40 Code of Federal Regulations (CFR) 141 Subpart G	Relevant and Appropriate	Establishes maximum contaminant levels (MCLs) for common organic and inorganic contaminants applicable to public drinking water supplies. Used as relevant and appropriate cleanup standards for aquifers and surface water bodies that are potential drinking water sources.	These drinking water standards will be achieved within the Bungay River Resource Protection District (BRWRPD) through natural processes (with a contingency for pump and treat).
Safe Drinking	40 CFR 141	Relevant	Establishes maximum contaminant level	These drinking water standards will be

TABLE E-11a
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-4: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF PUMP AND TREAT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Water Act, National Primary Drinking Water Regulations – Maximum Contaminant Level Goals (MCLGs)	Subpart F	and Appropriate (non-zero MCLGs only)	goals (MCLGs) for public water supplies. MCLGs are health goals for drinking water sources. These unenforceable health goals are available for a number of organic and inorganic compounds.	achieved within the BRWRPD through natural processes (with a contingency for pump and treat).
Drinking Water Health Advisory for Manganese (EPA Office of Drinking Water), 2004	None	To Be Considered	Health advisories are estimates of risk from consumption of contaminated drinking water. They consider non-carcinogenic effects only. To be considered for contaminants in groundwater that may be used for drinking water purposes, where the standard is more conservative than either federal or state statutory or regulatory standards. The Advisory standard for manganese is 0.3 mg/L.	Alternative BR-4 (including the contingency for pump and treat if needed) will achieve risk-based standards calculated using this guidance.
State				
Massachusetts Drinking Water Regulations	310 CMR 22.00	Relevant and Appropriate	These standards establish Massachusetts Maximum Contaminant Levels (MA MCLs) for organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water supply systems.	These drinking water standards will be achieved within the BRWRPD through natural processes (with a contingency for pump and treat).

TABLE E-11b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-4: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF PUMP AND TREAT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Protection of Wetlands (Executive Order 11990)	44 CFR Part 9	Relevant and Appropriate	Per the FEMA regulations (44 CFR Part 9; incorporating requirements under Executive Order 11990), federal agencies are required to avoid adversely impacting federal jurisdictional wetlands unless there is no practicable alternative with lesser effects and the proposed action includes all practicable measures to minimize harm to federal jurisdictional wetlands that may result from such use.	To the extent federal jurisdictional wetlands exist within areas to be altered by monitoring well installation, maintenance or sampling or by installation/operation/maintenance of the bedrock groundwater pump and treat system contingency, if needed, action to be taken will minimize alterations to protected resource areas. Mitigation measures, as required, will be taken to compensate for resource areas impacted by remedial actions.
Floodplain Management (Executive Order 11988)	44 CFR Part 9	Relevant and Appropriate	Per the FEMA regulations (44 CFR Part 9; incorporating requirements under Executive Order 11988), federal agencies are required to avoid long-and short-term adverse impacts associated with the occupancy and modification of federally-designated 100-year and 500-year floodplain wherever there is a practicable alternative.	Remedial activities associated with monitoring well installation, maintenance or sampling or with extraction well installation and maintenance as part of the groundwater pump and treat system contingency, if needed, may be conducted within the 100-year or 500-year floodplain under this alternative. Available practicable means will be used to reduce the risk of flood loss during the remedial action. Because the original grade will be restored at the completion of the remedial action, there will be no occupancy or modification of the floodplain.
Clean Water Act, Guidelines for Specification of Disposal Sites for Dredged or Fill Material	33 USC § 1344; § 404(b)(1); 40 CFR Parts 230, 231 and 33 CFR Parts 320-323	Applicable	Controls discharges of dredged or fill material to protect aquatic ecosystem. This alternative includes work to be performed in a wetland. Under this requirement no activity that adversely affects a wetland shall be permitted if a practicable alternative with lesser effects is available. If activity takes place, impacts must be minimized to the maximum extent. Sets standards for restoration and mitigation required as a result of unavoidable impacts to wetland and aquatic resources. EPA must determine which alternative is the “Least	This alternative may include monitoring well installation, maintenance or sampling or additional activity related to the groundwater pump and treat system contingency (extraction well and piping installation and maintenance), if needed, within federal jurisdictional wetlands. Work will be done to minimize and mitigate for any impacts to wetland and aquatic resources. EPA will solicit public comment as to whether this alternative is the Least Environmentally Damaging Practicable Alternative.

TABLE E-11b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-4: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF PUMP AND TREAT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
			Environmentally Damaging Practicable Alternative" (LEDPA) to protect wetland and aquatic resources	
Management of Undesirable Plants	7 U.S.C. § 2814	Relevant and Appropriate	Regulations calling for federal actions to contain or control undesirable plant species or group of species using all available methods, including: (A) preventive measures; (B) physical or mechanical methods; (C) biological agents; (D) herbicide methods; and (E) general land management practices.	Measures will be taken to prevent the establishment of undesirable plant species (i.e., non-native and invasive species) as part of any wetlands/habitat restoration conducted as part of this alterative.
Fish and Wildlife Coordination Act	16 USC Part 661 *et. seq.*	Applicable	This regulation requires that any federal agency proposing to modify a body of water must consult with the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service, and other related state agencies. That federal agency must consult with the appropriate government entity and also take action to prevent, mitigate, or compensate for project-related losses of endangered species, fish and wildlife resources.	Alternatives may modify potential, fish and wildlife habitats. All appropriate state and federal agencies, such as the USFWS, will be consulted to ensure that losses of these resources will be prevented, mitigated, or compensated.
Historic Sites Act of 1935; National Historic Landmarks	16 USC 469 *et seq.*; 36 CFR Part 65	Applicable	The purpose of the National Historic Landmarks program is to identify and designate National Historic Landmarks and encourage the long-range preservation of nationally significant properties that illustrate or commemorate the history and prehistory of the United States.	Features with potential historical/cultural significance will be evaluated during the remedial design phase. Should this alternative impact historical properties/structures determined to be protected by these standards activities will be coordinated with the Department of the Interior.
National Historical Preservation Act	16 USC 470 *et seq.*; 36 CFR,	Applicable	When a federal agency finds, or is notified, that its activities may cause	If it is determined that this alternative may cause irreparable loss or destruction of significant

TABLE E-11b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-4: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF PUMP AND TREAT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
	Part 800		irreparable loss or destruction of significant scientific, pre-historical, historical, archeological data, such agency shall consult with relevant federal and State officials to address the preservation of such data or other forms of mitigation, as necessary.	scientific, pre-historical, historical, or archaeological data, EPA will consult with federal and State officials and implement preservation and/or mitigation measures, as necessary.
Endangered Species Act	16 USC 1531 *et seq.*; 50 CFR Part 402	Applicable	If a location contains a federal endangered or threatened species or its critical habitat, and an action may impact the species or its habitat, the U.S. Fish & Wildlife Service or the National Marine Fisheries Service must be consulted.	Southeastern Massachusetts is located within the range of the federally endangered Northern Long-Eared Bat. This requirement may be applicable if tree removal is needed during remedial activities. Consultation with the U.S. Fish & Wildlife Service will occur during the planning process to determine if the project is near known hibernacula or known maternity roost trees so that activities do not adversely impact bat populations or habitat. Tree cutting may need to be restricted to timeframes outside of the summer season.
State				
Wetlands Protection Act	Mass. Gen. Laws ch. 131, §40; Wetlands Protection Regulations (310 CMR §10.00)	Applicable	Sets performance standards for dredging, filling, altering of inland wetland resource areas and sets buffer zones within 100 feet of a vegetated wetland and 200 feet from a perennial stream. The standards include mitigation requirements for alteration of regulated wetland resource areas. Resource areas at the site covered by the regulations include banks, bordering vegetated wetlands, land under bodies of water, land subject to flooding, and riverfront.	Monitoring well installation, maintenance, or sampling, or installation/operation/maintenance of the bedrock groundwater pump and treat system contingency, if needed, including access ways, may possibly impact wetland resource areas and buffer zones. Alternatives requiring that work be completed within 100 feet of a state regulated wetland or 200 feet of a perennial waterway, will comply with these regulations. Mitigation of impacts on wetlands will be addressed.
Antiquities Act and Regulation; Protection of	Mass. Gen. Laws ch. 9 §§ 26-27; 950 CMR § 71.00	Relevant and Appropriate	Projects which are state-funded or state-licensed or which are on state property must eliminate, minimize or mitigate for	Features with potential historical/cultural significance on the state register will be evaluated during the remedial design phase. Should this

TABLE E-11b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-4: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF PUMP AND TREAT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Properties included in the State Register of Historic Places			adverse effects to properties that are listed in the register of historic places.	alternative impact historical properties/structures determined to be protected by these standards, activities will be coordinated with the Massachusetts Historical Commission.

Key:
ARAR = Applicable or Relevant and Appropriate Requirement
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
TBC = To Be Considered
USC = United States Code

TABLE E-11c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-4: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF PUMP AND TREAT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal Standards				
Resource Conservation and Recovery Act (RCRA) Subtitle C; Hazardous Waste Identification and Listing Regulations; Generator and Handler Requirements	42 USC §6904 *et seq.*; 40 CFR Parts 260-262	Applicable to any action that generates a hazardous waste	Federal standards used to identify, manage, and dispose of hazardous waste. Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State.	Any wastes generated by remedial activities including drilling for well installation and groundwater monitoring or operation of the groundwater pump and treat system, if the contingency component is needed, will be analyzed under these standards to determine whether they are characteristic hazardous waste. Non-hazardous materials will be disposed appropriately. Wastes meeting characteristic hazardous waste standards will be disposed of off-site at a licensed facility.
RCRA, Air Emission Standards for Process Vents	40 CFR, Part 264, Subpart AA	Applicable, if volatile organic compounds (VOC) emissions of 10 ppm or greater; Relevant and Appropriate, if less than 10 ppm	RCRA emissions standards not delegated to the State. Standards for process vents for air treatment systems for RCRA wastes that have total organic concentrations of 10 ppm or greater.	If the contingency component of this alternative is needed, emission standards for any process vents, if present, will be achieved.
RCRA, Air Emission Standards for Equipment Leaks	40 CFR, Part 264, Subpart BB	Applicable, if VOC emissions of 10 ppm or greater; Relevant and Appropriate, if less than 10 ppm	RCRA emissions standards not delegated to the State. Standards for preventing air equipment leaks for systems that treat RCRA wastes that have total organic concentrations of 10 ppm or greater.	If the contingency component of this alternative is needed, standards for preventing air emission leaks from treatment systems for VOCs will be achieved.
Clean Water Act; National	40 CFR Parts	Applicable	Establishes the specifications for	Any water generated during monitoring well

TABLE E-11c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-4: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF PUMP AND TREAT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Pollutant Discharge Elimination System (NPDES)	122 and 125		discharging pollutants from any point source into the waters of the U.S. Also, includes stormwater standards for activities disturbing more than one acre.	maintenance or sampling or during operation and maintenance of the pump and treat system, if the contingency component is needed, will be treated to meet these standards if the water is to be discharged to surface waters.
Safe Drinking Water Act, National Primary Drinking Water Regulations – Maximum Contaminant Levels (MCLs)	40 CFR 141 Subpart G	Applicable	Establishes maximum contaminant levels (MCLs) for common organic and inorganic contaminants applicable to public drinking water supplies. Used as relevant and appropriate cleanup standards for aquifers and surface water bodies that are potential drinking water sources.	Groundwater monitoring using these standards will ensure that contamination present in the non-potable aquifer does not migrate into the downgradient drinking water aquifer within the Bungay River Resource Protection District (BRWRPD). Groundwater within the BRWRPD will be monitored to determine when natural processes and the pump and treat contingency, if needed, have achieved these standards.
Safe Drinking Water Act, National Primary Drinking Water Regulations – Maximum Contaminant Level Goals (MCLGs)	40 CFR 141 Subpart F	Applicable (non-zero MCLGs only)	Establishes maximum contaminant level goals (MCLGs) for public water supplies. MCLGs are health goals for drinking water sources. These unenforceable health goals are available for a number of organic and inorganic compounds.	Groundwater monitoring using these standards will ensure that contamination present in the non-potable aquifer does not migrate into the downgradient drinking water aquifer within the BRWRPD. Groundwater within the BRWRPD will be monitored to determine when natural processes or bedrock groundwater pump and treat, if the contingency component is needed, have achieved these standards.
Clean Air Act (CAA), Hazardous Air Pollutants; National Emission Standards for Hazardous Air Pollutants (NESHAPS)	42 USC §112(b)(1); 40 CFR Part 61	Applicable	The regulations establish emissions standards for 189 hazardous air pollutants. Standards set for dust and other release sources.	If the contingency component of this alternative is needed, remedial activities, including air discharges from the pump and treat system and excavation for installation of remedial infrastructure, will be implemented in accordance with these rules. No air emissions from remedial activities will cause air quality standards to be exceeded. Dust standards will be complied with during excavation and management of materials.
EPA Groundwater Protection Strategy	August 1984; NCP	To Be Considered	The Groundwater Protection Strategy provides a common reference for	Institutional controls will prohibit use of site bedrock groundwater for non-drinking water

TABLE E-11c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-4: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF PUMP AND TREAT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
	Preamble, Vol. 55, No. 46, March 8, 1990, 40 CFR 300, p. 8733); Guidelines for Ground-Water Classification (November 1986)		preserving clean groundwater and protecting the public health against the effects of past contamination. Guidelines for consistency in groundwater protection programs focus on the highest beneficial use of a groundwater aquifer.	(irrigation well) uses throughout the area where non-drinking water cleanup standards are exceeded in the underlying groundwater aquifer and natural processes will work to reduce COC concentrations over time. If drinking water cleanup standards are found to be exceeded within the area of Bungay River Resource Protection District (BRWRPD), the contingency portion of this alternative will implemented, including 1) ICs to prohibit use of bedrock groundwater as drinking water within that BRWRPD area; 2) expansion of the monitoring area to include impacted groundwater within the BRWRPD; and 3) bedrock groundwater pump and treat to further work to reduce COC concentrations over time. This alternative will attain groundwater cleanup standards within the BRWRPD within a reasonable time period.
Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites	OSWER Directive 9200.4-17P (April 21, 1999)	To Be Considered	EPA guidance regarding the use of monitored natural attenuation for the cleanup of contaminated soil and groundwater. In particular, a reasonable timeframe to achieve cleanup standards through monitored attenuation would be comparable to that achieved by active restoration.	The effectiveness of this alternative will be assessed under a monitoring plan that meets these guidance standards during each five-year review to ensure groundwater cleanup within the BRWRPD occurs within a reasonable time period.
Generation of investigation derived waste.	USEPA OSWER Publication 9345.3-03 FS (January 1992)	To Be Considered	Guidance on the management of Investigation Derived Waste (IDW) in a manner that ensures protection of human health and the environment.	IDW generated as part of this remedial alternative will be managed based on guidance standards.
State Standards				
Certification of Operators of Wastewater Treatment Facilities	257 CMR 2.00	Applicable	These regulations set forth contain requirements for evaluation and certification of operators of wastewater treatment facilities.	If the contingency component of this alternative is needed, the groundwater treatment facility will be operated by a licensed operator with a grade level consistent with the requirements of this regulation.
Massachusetts Drinking Water Regulations	310 CMR 22.00	Relevant and	These standards establish Massachusetts Maximum Contaminant	Groundwater monitoring using these standards will ensure that contamination present in the non-

TABLE E-11c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-4: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF PUMP AND TREAT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
		Appropriate	Levels (MA MCLs) for organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water supply systems.	potable aquifer does not migrate into the downgradient drinking water aquifer within the BRWRPD. Groundwater within the BRWRPD will be monitored to determine when natural processes or bedrock groundwater pump and treat, if the contingency component is needed, have achieved these standards.
Massachusetts Hazardous Waste Rules for Identification and Listing of Hazardous Wastes	310 CMR 30.100	Applicable	Massachusetts is delegated to administer RCRA through its State regulations. These regulations establish requirements for determining whether wastes are characteristic hazardous waste.	Any wastes generated by remedial activities including drilling for well installation and groundwater monitoring or operation of the groundwater pump and treat system, if the contingency component is needed, will be analyzed under these standards to determine whether they are characteristic hazardous waste. Non-hazardous materials will be disposed appropriately. Contaminated soil from well drilling, as well as any groundwater removed, meeting characteristic hazardous waste standards will be disposed of off-site at a licensed facility.
Massachusetts Hazardous Waste Management Rules – Requirements for Generators	310 CMR 30.300	Applicable	These regulations contain requirements for generators of hazardous waste. The regulations apply to generators of sampling waste and also apply to the accumulation of waste prior to off-site disposal.	Wastes generated during remedial actions that are determined to be hazardous would be managed in accordance with these requirements.
Massachusetts Hazardous Waste Management Rules – General standards for hazardous waste facilities	310 CMR 30.500	Applicable	General facility requirements for waste analysis, security measures, inspections, and training requirements. Section 30.580 addresses closure and Section 30.590 post-closure of hazardous waste facilities.	If any remedial activity generates hazardous wastes, on-site facilities used to handle the waste will be managed in accordance with the substantive requirements of these regulations.
Massachusetts Hazardous Waste Rules – Groundwater Protection	310 CMR 30.660	Relevant and Appropriate	Hazardous waste facility standards for the protection of groundwater.	Any hazardous waste generated by the remedial alternative will be managed to prevent contaminant migration to groundwater.
Massachusetts Hazardous Waste Rules - Containers	310 CMR 30.680	Applicable	Establishes requirements for the management of containers, such as drums, that would hold field-generated	If any remedial activity generates hazardous wastes that will be stored in containers, the containers will be managed in accordance with

TABLE E-11c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-4: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF PUMP AND TREAT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
			hazardous wastes.	the substantive requirements of these regulations.
Massachusetts Hazardous Waste Rules - Management, Storage, and Treatment in Tanks	310 CMR 30.690	Applicable	These standards specify requirements for tank systems used to store or treat hazardous waste. Provides specifications for design and installation of tank systems. Requires secondary containment, leak detection systems, and inspections. Identifies general operating requirements, and closure and post-closure care.	If any remedial activity generates hazardous wastes that will be stored in tanks, the tanks will be managed in accordance with the substantive requirements of these regulations.
Massachusetts Supplemental Requirements for Hazardous Waste Management Facilities	314 CMR 8.03	Relevant and Appropriate	This regulation outlines the additional requirements that must be satisfied in order for a RCRA facility to comply with the NPDES regulation.	Any water generated during drilling for well installation and groundwater monitoring or operation and maintenance of the pump and treat system, if the contingency component is needed, will be treated to meet NPDES standards, if the water is to be discharged to surface waters.
Massachusetts Clean Water Act; Surface Water Discharge Permit Regulations	314 CMR 3.00	Applicable	These regulations provide that discharges to waters of the Commonwealth shall not result in exceedances of MA Surface Water Quality Standards (MSWQS).	Any water generated during drilling for well installation and groundwater monitoring or operation and maintenance of the pump and treat system, if the contingency component is needed, will be treated to meet discharge standards if the water is to be discharged to surface waters.
Massachusetts Clean Water Act; MA Surface Water Quality Standards (MSWQS)	314 CMR 4.00	Relevant and Appropriate	These standards designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained, or protected. Minimum water quality criteria required to sustain the designated uses are established.	Will be used as performance standards to monitor surface water and sediments, if required, during the remedial action.
Massachusetts Ambient Air Quality Standards	310 CMR 6.00	Applicable	Sets primary and secondary standards for emissions of certain contaminants including particulate matter.	If the contingency component of this alternative is needed, remedial activities, including air discharges from the pump and treat system and excavation for installation of remedy infrastructure, will be implemented in accordance with these rules. No air emissions from remedial activities will cause air quality standards to be exceeded. Dust standards will be complied with during excavation and management of materials.

TABLE E-11c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-4: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF PUMP AND TREAT
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Massachusetts Air Pollution Control Regulations	310 CMR 7.00	Applicable	These regulations set emission limits necessary to attain ambient air quality standards.	If the contingency component of this alternative is needed, remedial activities, including air discharges from the pump and treat system and excavation for installation of remedy infrastructure, will be implemented in accordance with these rules. No air emissions from remedial activities will cause air quality standards to be exceeded.

Key:
ARAR = Applicable or Relevant and Appropriate Requirement
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
TBC = To Be Considered
USC = United States Code

TABLE E-12a
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-5: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF ENHANCED (DEEPER) PERMEABLE REACTIVE BARRIER
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Human Health Assessment Cancer Slope Factors (CSFs)	None	To Be Considered	CSFs are estimates of the upper-bound probability of an individual developing cancer as a result of a lifetime exposure to a particular concentration of a potential carcinogen.	Alternative BR-5 (including the contingency for enhanced [deeper] permeable reactive barrier if needed) will achieve carcinogenic risk-based standards calculated using this guidance.
EPA Risk Reference Doses (RfDs)	None	To Be Considered	Guidance used to compute human health hazard resulting from exposure to non-carcinogens in site media. RfDs are considered to be the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime.	Alternative BR-5 (including the contingency for enhanced [deeper] permeable reactive barrier if needed) will achieve non-carcinogenic risk-based standards calculated using this guidance.
Guidelines for Carcinogenic Risk Assessment	EPA/630/P-03/001F (March 2005)	To Be Considered	These guidelines provide guidance on conducting risk assessments involving carcinogens.	Alternative BR-5 (including the contingency for enhanced [deeper] permeable reactive barrier if needed) will achieve carcinogenic risk-based standards calculated using this guidance.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F(March 2005)	To Be Considered	This provides guidance on assessing risk to children from carcinogens.	Alternative BR-5 (including the contingency for enhanced [deeper] permeable reactive barrier if needed) will achieve carcinogenic risk-based standards for children calculated using this guidance.
Safe Drinking Water Act, National Primary Drinking Water Regulations - Maximum Contaminant Levels (MCLs)	40 Code of Federal Regulations (CFR) 141 Subpart G	Relevant and Appropriate	Establishes maximum contaminant levels (MCLs) for common organic and inorganic contaminants applicable to public drinking water supplies. Used as relevant and appropriate cleanup standards for aquifers and surface water bodies that are potential drinking water sources.	These drinking water standards will be achieved within the Bungay River Resource Protection District (BRWRPD) through natural processes (with a contingency for an enhanced [deeper] permeable reactive barrier).

TABLE E-12a
CHEMICAL-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-5: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF ENHANCED (DEEPER) PERMEABLE REACTIVE BARRIER
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Safe Drinking Water Act, National Primary Drinking Water Regulations – Maximum Contaminant Level Goals (MCLGs)	40 CFR 141 Subpart F	Relevant and Appropriate (non-zero MCLGs only)	Establishes maximum contaminant level goals (MCLGs) for public water supplies. MCLGs are health goals for drinking water sources. These unenforceable health goals are available for a number of organic and inorganic compounds.	These drinking water standards will be achieved within the BRWRPD through natural processes (with a contingency for an enhanced [deeper] permeable reactive barrier).
Drinking Water Health Advisory for Manganese (EPA Office of Drinking Water), 2004	None	To Be Considered	Health advisories are estimates of risk from consumption of contaminated drinking water. They consider non-carcinogenic effects only. To be considered for contaminants in groundwater that may be used for drinking water purposes, where the standard is more conservative than either federal or state statutory or regulatory standards. The Advisory standard for manganese is 0.3 mg/L.	Alternative BR-5 (including the contingency for enhanced [deeper] permeable reactive barrier if needed) will achieve risk-based standards calculated using this guidance.
State				
Massachusetts Drinking Water Regulations	310 CMR 22.00	Relevant and Appropriate	These standards establish Massachusetts Maximum Contaminant Levels (MA MCLs) for organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water supply systems.	These drinking water standards will be achieved within the BRWRPD through natural processes (with a contingency for an enhanced [deeper] permeable reactive barrier).

TABLE E-12b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-5: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF ENHANCED (DEEPER) PERMEABLE REACTIVE BARRIER
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Protection of Wetlands (Executive Order 11990)	44 CFR Part 9	Relevant and Appropriate	Per the FEMA regulations (44 CFR Part 9; incorporating requirements under Executive Order 11990), federal agencies are required to avoid adversely impacting federal jurisdictional wetlands unless there is no practicable alternative with lesser effects and the proposed action includes all practicable measures to minimize harm to federal jurisdictional wetlands that may result from such use.	To the extent federal jurisdictional wetlands exist within areas to be altered by monitoring well installation, maintenance or sampling, or by the enhanced (deeper) permeable reactive barrier contingency, if needed, action to be taken will minimize alterations to protected resource areas. Mitigation measures, as required, will be taken to compensate for resource areas impacted by remedial actions.
Floodplain Management (Executive Order 11988)	44 CFR Part 9	Relevant and Appropriate	Per the FEMA regulations (44 CFR Part 9; incorporating requirements under Executive Order 11988), federal agencies are required to avoid long-and short-term adverse impacts associated with the occupancy and modification of federally-designated 100-year and 500-year floodplain wherever there is a practicable alternative.	Remedial activities associated with monitoring well installation, maintenance or sampling or with the enhanced (deeper) permeable reactive barrier contingency, if needed, may be conducted within the 100-year or 500-year floodplain under this alternative. Available practicable means will be used to reduce the risk of flood loss during the remedial action. Because the original grade will be restored at the completion of the remedial action, there will be no occupancy or modification of the floodplain.
Clean Water Act, Guidelines for Specification of Disposal Sites for Dredged or Fill Material	33 U.S.C. § 1344; § 404(b)(1); 40 CFR Part 230, 231, and 33 CFR Parts 320-323	Applicable	Controls discharges of dredged or fill material to protect aquatic ecosystem. This alternative includes work to be performed in a wetland. Under this requirement no activity that adversely affects a wetland shall be permitted if a practicable alternative with lesser effects is available. If activity takes place, impacts must be minimized to the maximum extent. Sets standards for restoration and mitigation required as a result of unavoidable impacts to wetland and aquatic resources. EPA must determine which alternative is the “Least	This alternative may include monitoring well installation, maintenance or sampling or work associated with implementation of the enhanced (deeper) permeable reactive barrier contingency, if needed, within federal jurisdictional wetlands. Work will be done to minimize and mitigate for any impacts to wetland resources. EPA will solicit public comment as to whether this alternative is the Least Environmentally Damaging Practicable Alternative.

TABLE E-12b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-5: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF ENHANCED (DEEPER) PERMEABLE REACTIVE BARRIER
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
			Environmentally Damaging Practicable Alternative" (LEDPA) to protect wetland and aquatic resources.	
Management of Undesirable Plants	7 U.S.C. § 2814	Relevant and Appropriate	Regulations calling for federal actions to contain or control undesirable plant species or group of species using all available methods, including: (A) preventive measures; (B) physical or mechanical methods; (C) biological agents; (D) herbicide methods; and (E) general land management practices.	Measures will be taken to prevent the establishment of undesirable plant species (i.e., non-native and invasive species) as part of any wetlands/habitat restoration conducted as part of this alterative.
Historic Sites Act of 1935; National Historic Landmarks	16 USC 469 *et seq.*; 36 CFR Part 65	Applicable	The purpose of the National Historic Landmarks program is to identify and designate National Historic Landmarks and encourage the long-range preservation of nationally significant properties that illustrate or commemorate the history and prehistory of the United States.	Features with potential historical/cultural significance will be evaluated during the remedial design phase. Should this alternative impact historical properties/structures determined to be protected by these standards activities will be coordinated with the Department of the Interior.
National Historical Preservation Act	16 USC 470 *et seq.*; 36 CFR, Part 800	Applicable	When a federal agency finds, or is notified, that its activities may cause irreparable loss or destruction of significant scientific, pre-historical, historical, archeological data, such agency shall consult with relevant federal and State officials to address the preservation of such data or other forms of mitigation, as necessary.	If it is determined that this alternative may cause irreparable loss or destruction of significant scientific, pre-historical, historical, or archaeological data, EPA will consult with federal and State officials and implement preservation and/or mitigation measures, as necessary.
Endangered Species Act	16 USC 1531 *et seq.*; 50 CFR Part 402	Applicable	If a location contains a federal endangered or threatened species or its critical habitat, and an action may impact the species or its habitat, the U.S. Fish & Wildlife Service or the National Marine Fisheries Service must be consulted.	Southeastern Massachusetts is located within the range of the federally endangered Northern Long-Eared Bat. This requirement may be applicable if tree removal is needed during remedial activities. Consultation with the U.S. Fish & Wildlife Service will occur during the planning process to determine if the project is near known hibernacula or known maternity roost trees so that activities do not

TABLE E-12b
LOCATION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-5: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF ENHANCED (DEEPER) PERMEABLE REACTIVE BARRIER
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
				adversely impact bat populations or habitat. Tree cutting may need to be restricted to timeframes outside of the summer season.
State				
Wetlands Protection Act	Mass. Gen. Laws ch. 131, §40; Wetlands Protection Regulations (310 CMR §10.00)	Applicable	Sets performance standards for dredging, filling, altering of inland wetland resource areas and sets buffer zones within 100 feet of a vegetated wetland and 200 feet from a perennial stream. The standards include mitigation requirements for alteration of regulated wetland resource areas. Resource areas at the site covered by the regulations include banks, bordering vegetated wetlands, land under bodies of water, land subject to flooding, and riverfront.	Monitoring well installation, maintenance or sampling or work associated with implementation of the enhanced (deeper) permeable reactive barrier contingency, if needed, including access ways, may possibly impact wetland resource areas and buffer zones. Alternatives requiring that work be completed within 100 feet of a state regulated wetland or 200 feet of a perennial waterway, will comply with these regulations. Mitigation of impacts on wetlands will be addressed.
Antiquities Act and Regulation; Protection of Properties included in the State Register of Historic Places	Mass. Gen. Laws ch. 9 §§ 26-27; 950 CMR § 71.00	Relevant and Appropriate	Projects which are state-funded or state-licensed or which are on state property must eliminate, minimize or mitigate for adverse effects to properties that are listed in the register of historic places.	Features with potential historical/cultural significance on the state register will be evaluated during the remedial design phase. Should this alternative impact historical properties/structures determined to be protected by these standards, activities will be coordinated with the Massachusetts Historical Commission.

Key:
ARAR = Applicable or Relevant and Appropriate Requirement
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
TBC = To Be Considered
USC = United States Code

TABLE E-12c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-5: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF ENHANCED (DEEPER) PERMEABLE REACTIVE BARRIER
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal Standards				
Resource Conservation and Recovery Act (RCRA) Subtitle C; Hazardous Waste Identification and Listing Regulations; Generator and Handler Requirements	42 USC §6904 *et seq.*; 40 CFR Parts 260-262	Applicable to any action that generates a hazardous waste	Federal standards used to identify, manage, and dispose of hazardous waste. Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State.	Any wastes generated by remedial activities including drilling for well installation and groundwater monitoring or drilling for *in-situ* bedrock injections, if the contingency component is needed, will be analyzed under these standards to determine whether they are characteristic hazardous waste. Non-hazardous materials will be disposed appropriately. Contaminated soil from well drilling, as well as any groundwater removed, meeting characteristic hazardous waste standards will be disposed of off-site at a licensed facility.
Clean Water Act; National Pollutant Discharge Elimination System (NPDES)	40 CFR Parts 122 and 125	Applicable	Establishes the specifications for discharging pollutants from any point source into the waters of the U.S. Also, includes stormwater standards for activities disturbing more than one acre.	Any water generated during drilling for monitoring well installation, maintenance or sampling or during *in-situ* bedrock injection, if the contingency component is needed, will be treated to meet these standards before discharge to surface waters.
Safe Drinking Water Act, National Primary Drinking Water Regulations – Maximum Contaminant Levels (MCLs)	40 CFR 141 Subpart G	Applicable	Establishes maximum contaminant levels (MCLs) for common organic and inorganic contaminants applicable to public drinking water supplies. Used as relevant and appropriate cleanup standards for aquifers and surface water bodies that are potential drinking water sources.	Groundwater monitoring using these standards will ensure that contamination present in the non-potable aquifer does not migrate into the downgradient drinking water aquifer within the Bungay River Resource Protection District (BRWRPD). Groundwater within the BRWRPD will be monitored to determine when natural processes and the *in-situ* chemical reduction treatment contingency, if needed, have achieved these standards.
Safe Drinking Water Act, National Primary Drinking Water Regulations – Maximum Contaminant Level Goals (MCLGs)	40 CFR 141 Subpart F	Applicable (non-zero MCLGs only)	Establishes maximum contaminant level goals (MCLGs) for public water supplies. MCLGs are health goals for drinking water sources. These unenforceable health goals are available for a number of organic and inorganic compounds.	Groundwater monitoring using these standards will ensure that contamination present in the non-potable aquifer does not migrate into the downgradient drinking water aquifer within the BRWRPD. Groundwater within the BRWRPD will be monitored to determine when natural processes or in-situ chemical reduction treatment, if the contingency component is needed, have achieved these standards.

TABLE E-12c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-5: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF ENHANCED (DEEPER) PERMEABLE REACTIVE BARRIER
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Underground Injection Control Program	40 CFR 144, 146, 147 (Subpart EE)	Applicable	Regulations established to assure that underground injection will not endanger drinking water sources.	If the contingency component of this alternative is needed, in-situ treatment will be implemented in compliance with these standards.
RCRA, Interim Status Treatment, Storage, and Disposal Facility Standards, Chemical, Physical and Biological Treatment: 40 C.F.R. Part 265 Subpart Q	40 CFR, Part 265 Subpart Q	Relevant and Appropriate	Standards for operating chemical, physical and biological treatment systems, including the proper handling of reagents, system maintenance, and closure procedures.	If the contingency component of this alternative is needed, in-situ treatment will be implemented in compliance with these standards.
EPA Groundwater Protection Strategy	August 1984; NCP Preamble, Vol. 55, No. 46, March 8, 1990, 40 CFR 300, p. 8733); Guidelines for Ground-Water Classification (November 1986)	To Be Considered	The Groundwater Protection Strategy provides a common reference for preserving clean groundwater and protecting the public health against the effects of past contamination. Guidelines for consistency in groundwater protection programs focus on the highest beneficial use of a groundwater aquifer.	Institutional controls will prohibit use of site bedrock groundwater for non-drinking water (irrigation well) uses throughout the area where non-drinking water cleanup standards are exceeded in the underlying groundwater aquifer and natural processes will work to reduce COC concentrations over time. If drinking water cleanup standards are found to be exceeded within the area of Bungay River Resource Protection District (BRWRPD), the contingency portion of this alternative will implemented, including 1) ICs to prohibit use of bedrock groundwater as drinking water within that BRWRPD area; 2) expansion of the monitoring area to include impacted groundwater within the BRWRPD; and 3) *in-situ* bedrock injections to further work to reduce COC concentrations over time. This alternative will attain groundwater cleanup standards within the BRWRPD within a reasonable time period.
Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites	OSWER Directive 9200.4-17P (April 21, 1999)	To Be Considered	EPA guidance regarding the use of monitored natural attenuation for the cleanup of contaminated soil and groundwater. In particular, a reasonable timeframe to achieve cleanup standards through monitored attenuation would be comparable to that achieved by active	The effectiveness of this alternative will be assessed under a monitoring plan that meets these guidance standards during each five-year review to ensure groundwater cleanup within the BRWRPD occurs within a reasonable time period.

TABLE E-12c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-5: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF ENHANCED (DEEPER) PERMEABLE REACTIVE BARRIER
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
			restoration.	
Generation of investigation derived waste.	USEPA OSWER Publication 9345.3-03 FS (January 1992)	To Be Considered	Guidance on the management of Investigation Derived Waste (IDW) in a manner that ensures protection of human health and the environment.	IDW generated as part of this remedial alternative will be managed based on guidance standards.
State Standards				
Solid Waste Management Facility Regulations	310 CMR 19.00	Applicable	The regulations contain requirements for disposal of solid wastes.	Any wastes generated by remedial activity that are determined to not be hazardous wastes will be managed in accordance with this regulation.
Massachusetts Drinking Water Regulations	310 CMR 22.00	Relevant and Appropriate	These standards establish Massachusetts Maximum Contaminant Levels (MA MCLs) for organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water supply systems.	Groundwater monitoring using these standards will ensure that contamination present in the non-potable aquifer does not migrate into the downgradient drinking water aquifer within the BRWRPD. Groundwater within the BRWRPD will be monitored to determine when natural processes or in-situ chemical reduction treatment, if the contingency component is needed, have achieved these standards.
Massachusetts Hazardous Waste Rules for Identification and Listing of Hazardous Wastes	310 CMR 30.100	Applicable	Massachusetts is delegated to administer RCRA through its State regulations. These regulations establish requirements for determining whether wastes are characteristic hazardous waste.	Any wastes generated by remedial activities including drilling for well installation and groundwater monitoring or drilling for bedrock injections, if the contingency component is needed, will be analyzed under these standards to determine whether they are characteristic hazardous waste. Non-hazardous materials will be disposed appropriately. Contaminated soil from well drilling, as well as any groundwater removed, meeting characteristic hazardous waste standards will be disposed of off-site at a licensed facility.
Massachusetts Hazardous Waste Management Rules – Requirements for Generators	310 CMR 30.300	Applicable	These regulations contain requirements for generators of hazardous waste. The regulations apply to generators of sampling waste and also apply to the accumulation of waste prior to off-site	Wastes generated during remedial actions that are determined to be hazardous would be managed in accordance with these requirements.

TABLE E-12c
ACTION-SPECIFIC ARARs AND TBCs
ALTERNATIVE BR-5: INSTITUTIONAL CONTROLS AND CONTINGENCY REMEDY OF ENHANCED (DEEPER) PERMEABLE REACTIVE BARRIER
WALTON & LONSBURY SUPERFUND SITE
ATTLEBORO, MASSACHUSETTS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
			disposal.	
Massachusetts Hazardous Waste Rules - Containers	310 CMR 30.680	Applicable	Establishes requirements for the management of containers, such as drums, that would hold field-generated hazardous wastes.	If any remedial activity generates hazardous wastes that will be stored in containers, the containers will be managed in accordance with the substantive requirements of these regulations.
Massachusetts Hazardous Waste Rules - Management, Storage, and Treatment in Tanks	310 CMR 30.690	Applicable	These standards specify requirements for tank systems used to store or treat hazardous waste. Provides specifications for design and installation of tank systems. Requires secondary containment, leak detection systems, and inspections. Identifies general operating requirements, and closure and post-closure care.	If any remedial activity generates hazardous wastes that will be stored in tanks, the tanks will be managed in accordance with the substantive requirements of these regulations.
Massachusetts Clean Water Act; Surface Water Discharge Permit Regulations	314 CMR 3.00	Applicable	These regulations provide that discharges to waters of the Commonwealth shall not result in exceedances of MA Surface Water Quality Standards (MSWQS).	Any water generated during drilling for well installation and groundwater monitoring or during *in-situ* bedrock injection, if the contingency component is needed, will be treated to meet discharge standards if the water is to be discharged to surface waters.
Massachusetts Clean Water Act; MA Surface Water Quality Standards (MSWQS)	314 CMR 4.00	Relevant and Appropriate	These standards designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained, or protected. Minimum water quality criteria required to sustain the designated uses are established.	Will be used as performance standards to monitor surface water and sediments, if required, during the remedial action.

Key:
ARAR = Applicable or Relevant and Appropriate Requirement
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
TBC = To Be Considered
USC = United States Code

APPENDIX F - MODELING SUPPORT

APPENDIX F

MODELING SUPPORT

EVALUATION OF VERTICAL GRADIENTS BENEATH BLISS BROOK

- AECOM reviewed the vertical groundwater hydraulic gradients determined from water levels collected on April 5, 2018 beneath Bliss Brook.
- The groundwater contours for the cross-sectional transect along Bliss Brook are shown in Figure 1.
- The results indicate a predominant upward gradient in overburden groundwater from the base of the overburden aquifer. This indicates that overburden groundwater is discharging predominantly to the brook and not passing under the surface water body.
- The review of the hydraulic cross-section also shows little, if any, vertical gradient between the fractured bedrock aquifer and overburden. This indicates essentially no upward discharge of bedrock groundwater to the overburden aquifer under Bliss Brook. It also indicates that bedrock groundwater is passing beneath the brook and moving to areas further downgradient.

GROUNDWATER FLOW MODELING

- Evaluated number, spacing, and pumping rates of extraction wells to capture the Cr+6 plume in both overburden and bedrock using a groundwater flow model.
- The analytical element model (AEM) GFLOW was used for the hydraulic flow modeling.
- GFLOW uses particle tracking to simulate movement of groundwater particles.
- Two models were created, one for overburden and one for bedrock.
- Each model was calibrated to the April 5, 2018 water levels. In each case, the root mean square error (RMS) of observed versus simulated heads was less than 10 percent (%) of the head change across the model domain. Therefore, each model was adequately robust to simulate groundwater capture with extraction wells.
- In the calibrated model under non-pumping conditions groundwater particles were seeded in the known/suspected source areas within and to the south of the former building footprint to simulate the plume trajectory. The simulated overburden plume is shown in Figure 2. The bedrock plume is provided in Figure 3.
- The models included the surrounding surface water bodies, including Bliss Brook, Bungay River, and the Ten Mile River.
- For the overburden calibrated model, the input parameters included:
  - Areal recharge rate = 0.002 ft/d (started with one-third of the annual rainfall rate of 49 inches per year for Attleboro; was able to calibrate the model using 0.002 ft/d = 8.76 inches per year and is the final calibrated rate);
  - Hydraulic conductivity (K) = 200 ft/d (started with K = 140 ft/d derived from Weston 2013; was able to calibrate the model using K = 200 ft/d and is the final calibrated value);
  - Bliss Brook streambed resistance = 1 day (low resistance value mimics good communication between surface water and underlying overburden aquifer);
  - Aquifer thickness = 40 feet (average thickness as shown in geologic cross-sections found in AECOM 2016 Remedial Investigation Report)
- For the bedrock calibrated model, the input parameters included:

- Areal recharge rate = 0.00001 ft/d (started with 0.002 ft/d = 8.76 inches per year; was able to calibrate the model using 0.00001 ft/d = 0.04 inches per year and is the final calibrated rate);
- Hydraulic conductivity (K) = 3.3 ft/d (started with value of 2.7 ft/d based on bedrock aquifer test results at an AECOM site located 1.5 miles from the Walton & Lonsbury site in Attleboro; was able to calibrate the model using K = 3.3 ft/d and is the final calibrated value);
- Bliss Brook streambed resistance = 10,000 days (was able to calibrate the model using this streambed resistance value);
- Aquifer thickness = 100 feet (assumed 100 feet of bedrock is fractured and relevant to bedrock groundwater flow)

- The optimal overburden hydraulic simulation indicated that three extraction wells spaced approximately 50 feet apart and pumping at 18 gpm each would capture the particles released from the known/suspected source areas (see Figure 4).
- The optimal bedrock hydraulic simulation indicated that two extraction wells spaced approximately 100 feet apart and pumping at 3 gpm each would capture the particles released from the known/suspected source areas (see Figure 5).

OVERBURDEN SOLUTE TRANSPORT MODEL

- A solute transport model (HYDROSCAPE) was used to simulate the generation and movement of the overburden Cr+6 plume.
- The HYDROSCAPE model is an Excel-based MatLab program that uses analytical solutions to simulate solute transport. The model allows for simulation of advection, dispersion, sorption and first order decay.
- HYDROSCAPE uses mathematical techniques to modify the solution to make it more versatile. These modifications allow the user to: (1) build a custom source region (arbitrary source function/geometry and spatial variations in source concentration); and (2) implement horizontal geological units within the domain.
- Solute Transport Model Limitations include the following:
    - Representative source concentration of Cr+6 in groundwater at the Walton & Lonsbury site is not well established. For example, the highest Cr+6 concentration (83 mg/L) ever observed at the site was at well AE-04D, which is located approximately 400 feet downgradient of the former manufacturing building suspected to be the primary source area. In August of 2014, Cr+6 concentration at AE-04D = 83 mg/L, whereas, the Cr+6 concentration in the upgradient "source area" well (AE-01S) was 23 mg/L. In December 2014, a similar pattern was observed where Cr+6 concentration in the source area well AE-01S was 36.8 mg/L, whereas, Cr+6 concentration was 64.5 mg/L in the downgradient well AE-04D.
    - Long-term trend data is lacking (only 3 comprehensive rounds have been collected – August 2014, December 2014, and September 2015); therefore, estimates of the rate of attenuation of Cr+6 in groundwater, if any, has not been established. Therefore, the model assumed that the transport of Cr+6 was conservative and did not undergo any attenuation other than sorption (retardation) and dispersion.
    - Soil treatability tests were conducted by AECOM that determined that the overburden aquifer soils do have a reductive capacity to naturally convert mobile Cr+6 to immobile forms of Cr+3 (AECOM 2017 Treatability Test Report). Soil samples collected within the existing plume area appear to have exhausted their reductive capacity relative to soils not impacted by the plume. The soils near the perimeter of the plume likely retain some reductive capacity and will help to attenuate the plume along the edges.
    - The model does not account for the reductive capacity of the aquifer soils and is not robust enough to simulate this complex process.

- The transport model was used to predict:
  - overburden groundwater concentration immediately adjacent to Bliss Brook at a distance of 320 meters (1,050 feet) from the source; and
  - time for the plume to achieve equilibrium conditions following 90 percent (%) source removal via remediation.
- The following input parameters were used for the overburden Cr+6 transport model:
  - Hydraulic conductivity (K) = 140 ft/d (derived from Weston 2013);
  - Effective porosity (n_e) = 0.3 (sand and gravel from Fetter 1980);
  - Hydraulic gradient = 0.003 ft/ft (derived from Weston 2013);
  - Linear seepage velocity = 1.4 ft/d (511 ft/year) (derived from Weston 2013);
  - Initial Distribution coefficient (Kd) = 18 L/Kg (USEPA Soil Screening Guidance document, attachment C);
  - Distribution coefficient (Kd) = 12.35 L/Kg (calibrated value);
  - Decay constant = 0/year (assumed no biodegradation);
  - Soil bulk density (b_d) = 1.7 g/cm^3 (Fetter 1980);
  - Retardation factor = 71 (calculated from Kd, n_e, b_d and retardation equation);
  - Dispersion (x) = 68 m (Xu and Eckstein 1995 equation and assumed plume length of 2000 feet);
  - Dispersion (Y) = 6.8 m (Xu and Eckstein 1995 equation);
  - Dispersion (Z) = 0.68 m (Xu and Eckstein 1995 equation);
  - Tortuosity Factor = 0.5 (assumed value for sand and gravel soils);
  - Free solution diffusion coefficient for chromium = 5.94E-10 m^2/s (Shackelford and Daniel, 1991);
  - Effective diffusion coefficient = 1.7E-10 m^2/s (calculated using Tortuosity factor and free solution diffusion coefficient).

- The HYDROSCAPE transport model was calibrated to two observed Cr+6 concentrations in the overburden plume based on the December 2014 sampling round results.
  - At calibration point X1 = 110 m, Cr+6 concentration = 64.5 mg/L at AE-04D
  - At calibration point X2 = 320 m, Cr+6 concentration = 3.12 mg/L at AE-07D
  - Cr+6 concentration in source area = 200 mg/L (this value was back-calculated by adjusting source concentration until a good match was obtained at both calibration points X1 and X2 after a period of 70 years).
  - Assumed that release occurred 70 years ago (i.e., 2018 – 70 = 1948). This is consistent with site history that indicates that from 1940 until 1970, wastewater and waste streams generated at the facility were directly discharged without treatment via an underground pipe from the plating room into the wetlands located on the southern portion of the property. From 1940 until 2007, electroplating was performed on the property.
  - Therefore, calibrated to current observed concentrations at points X1 and X2 along the plume by running the model 70 years.
  - The breakthrough curve generated for the 70-year scenario indicates that the plume has not yet reached equilibrium conditions (see Figure 6).
  - The calibrated model was then re-run for a period of 570 years, where a constant source concentration (200 mg/L) was used for the first 70 years and then the constant source concentration was reduced 90% for years 71 through 570 to simulate source remediation.
  - At point X2 (AE-07D) located 320 m from the source, the resulting breakthrough curve (Figure 7) for this simulation shows that it will take approximately 530 years (600-70 yr) for the predicted groundwater concentration of 2.2 mg/L at AE-07D to achieve approximate equilibrium conditions.

- Per the request of EPA, the source concentration was set to the highest Cr+6 concentration ever observed at the site. In August 2014, the Cr^{+6} concentration of 83 mg/L was observed at AE-04D. This well is located approximately 225 feet downgradient of the source area. The resulting breakthrough curve (Figure 8) shows that equilibrium conditions were not achieved until approximately 330 years (400-70 yr) after 90% source reduction.
- An additional model run was simulated to evaluate treatment applied at the mid-plume location (near AE04D). It was assumed that the starting Cr^{+6} concentration at the mid-plume location was 83 mg/L. The model was run for 570 years, where a constant source concentration at the mid-plume location of 83 mg/L was used for the first 70 years and then a 90% source reduction was applied at year 71. The distance from the mid-plume area to point X2 (AE-07D) is approximately 195 m (640 feet). The resulting breakthrough curve (Figure 9) shows that equilibrium conditions were not achieved until approximately 280 years (350-70 yr) after 90% source reduction at the mid-plume location.
- The mid-plume source reduction alternative reduces the estimated time to achieve approximate equilibrium conditions at AE-07D by 250 years (530 years – 280 years), a reduction of approximately 45%.

FATE OF CR+6 IN BEDROCK

- The modeling effort does not account for the possible natural reduction and precipitation of Cr+6 in contact with reduced iron in naturally-occurring bedrock minerals.
- The bedrock at the site is part of the Wamsutta Formation. This rock type is described as a conglomerate whose matrix is primarily a sandstone. Being a sedimentary rock, it has both primary (rock matrix) and secondary (fracture) porosity. Recent studies (Zhao et al., 2017) in similar sedimentary rock types with significant matrix porosity have shown that Cr+6 can diffuse into the primary porosity of porous sedimentary rocks and act as strong attenuation mechanism of Cr+6 transport. In addition, the study has shown that Cr+6 can be reduced to the more immobile form of Cr+3 due to the presence of reduced iron minerals in the rock matrix.
- Based on this paper it appears that Cr+6 can be naturally attenuated via diffusion and reduction to the more immobile form of Cr+3 in the rock matrix.
- Natural reduction of Cr+6 to Cr+3 in the rock matrix would be dependent on site specific conditions (iron content and valence in the rock, pH, and presence of other minerals). The rate of natural reduction cannot be estimated at this time. To date, the bedrock plume of Cr+6 has expanded approximately 300 meters from the source area. This indicates that Cr+6 is not fully reduced in proximity to the source.

BEDROCK SOLUTE TRANSPORT MODEL

- A one-dimensional (1D) solute transport model (MPNE1D) was used to simulate the generation and movement of Cr^{+6} in the fractured rock.
- The MPNE1D model is a FORTRAN90 code that implements the general analytical solution for one-dimensional solute transport derived by Neville et al., 2000.
- The MPNE1D model and code is available at the S.S. Papadopulos & Associates, Inc. web-site: www.sspa.com.
- The MPNE1D solution is capable of representing any combination of the following transport processes:
    - One-dimensional advection and dispersion (including purely diffusive transport);
    - Dual porosity mobile-immobile mass transfer;
    - Combined equilibrium and kinetic sorption; and

- First-order transformation reactions.

- The MPNE1D solution is capable of simulating general initial and boundary conditions, including:
  - Specified concentration or flux-type inflow boundary conditions, with a general time-varying reservoir concentration;
  - A semi-infinite domain;
  - A finite domain with specified concentration at the outflow boundary;
  - A finite domain with specified zero concentration gradient at the outflow boundary; and
  - An initial uniform concentration.

- MPNE1D Solute Transport Model Limitations include the following:
  - Representative source concentration of Cr^{+6} in bedrock groundwater at the Walton & Lonsbury site is not well established. For example, the highest Cr^{+6} concentration (72 mg/L) ever observed in bedrock at the site was at well AE-04B, which is located approximately 400 feet downgradient of the former manufacturing building suspected to be the primary source area. In August of 2014, Cr^{+6} concentration at AE-04B = 72,000 ug/L, whereas, the Cr^{+6} concentration in the upgradient bedrock "source area" well (AE-01B) was 10.3 ug/L.
  - Long-term trend data is lacking (only 3 comprehensive rounds have been collected – August 2014, December 2014, and September 2015); therefore, estimates of the rate of attenuation of Cr^{+6} in bedrock groundwater, if any, has not been established. Therefore, the model assumed that the transport of Cr^{+6} was conservative and did not undergo any attenuation (e.g., geochemical conversion to Cr^{+3}) other than sorption, diffusion and dispersion.
  - No aquifer testing or slug tests results were measured at the Walton & Lonsbury site. Transmissivity from another site located 1.3 miles southeast of the Walton & Lonsbury site was used and may not be representative. Although the rock types are similar, that is, sedimentary sandstone and greywacke, the bedrock at the other site is classified as a different rock unit (Rhode Island Formation) than that present at Walton & Lonsbury site (Wamsutta Formation).
  - The model is very sensitive to longitudinal dispersion which cannot be reliably measured in the field. An estimate based on the scientific literature was used.
  - The model does not account for the potential reductive capacity of the bedrock and is not robust enough to simulate this complex process.

- The transport model was used to predict:
  - The straight line distance travelled by the bedrock groundwater Cr^{+6} plume at concentration intervals of 100 ug/L, 10 ug/L and 1 ug/L over a period of 70 years.

- The following input parameters were used for the bedrock Cr^{+6} transport model (see the input parameters calculations sheet for more detail):
  - Average aperature of the open fractures = 4.37E-04 cm (14.32 micron) (from borehole geophysics);
  - Average fracture spacing = 1 foot (from borehole geophysics);
  - Number of hydraulically active fractures = 100 (from borehole geophysics);
  - Bulk transmissivity of the rock mass = 158.7 ft2/d (derived from aquifer pumping tests conducted at the nearby TI Attleboro site);
  - Fracture porosity = 1.43E-05 (see calculations sheet);
  - Hydraulic gradient = 0.0042 ft/ft (from Phase 3 investigation);

- Darcy Flux = 0.203 cm/d (see calculations sheet);
- Linear seepage velocity = 465 ft/d (1.42E+04 cm/d) (see calculations sheet);
- Fracture porosity (n_e) = 1.43E-05 (from borehole geophysics data – see calculations sheet);
- Hydraulic gradient = 0.0042 ft/ft (from site water levels);
- Linear seepage velocity = 1.42E+04 cm/d (465 ft/d) (see calculations sheet);
- Fraction of total porosity that is immobile (porous rock matrix) = 0.1 (assumed 10%);
- Fraction of total porosity that is mobile (open fractures) = 4.37E-05 (see calculations sheet);
- Free solution diffusion coefficient for Cr^{+6} = 5.94E-10 m^2/s (Shackelford and Daniel, 1991);
- Tortuosity factor = 5.02E-03 (see calculations sheet);
- Effective diffusion coefficient for Cr^{+6} in porous rock matrix = 2.58E-07 m^2/d (see calculations sheet);
- Longitudinal dispersivity = 12 m (one-tenth of the length of the plume – Gelhar, 1987);
- Hydrodynamic dispersion coefficient = 1.70E+07 cm^2/d (see calculations sheet);
- First order mass transfer (FOMT) coefficient for parallel slabs = 1.25E-09/day;
- Rock bulk density (b_d) = 2.60 g/cm^3;
- Fraction of sorbent accessible to dissolved phase in mobile region = 1;
- Fraction of sorbent (instantaneous) in the mobile region = 1;
- Fraction of sorbent (instantaneous) in the immobile region = 1;
- Distribution (sorption) coefficient (K_d) for Cr^{+6} in soil = 18 L/Kg (EPA Soil Screening Guidance document, attachment C);
- Sorption partitioning coefficient (K_d) for mobile (open fractures) = 0.18 cm^3/g (assumed 100X lower than soil K_d);
- Sorption partitioning coefficient (K_d) for immobile (porous rock matrix) = 1.8 cm^3/g (assumed 10X lower than soil K_d);
- Decay constants = 0 (assumes no biodegradation of Cr+6);
- Constant source (inflow boundary condition =1);
- Number of points describing inflow (source) concentration = 1;
- Location of constant source = well AE-01B;
- Start time for constant source concentration = 0 days;
- Constant source concentration = 60 mg/L (6.0E-05 g/mL) (back-calculated to calibrate model);
- Outflow boundary condition = 1 (semi-infinite domain);
- Length of model domain = 2.0E+05 cm (6,562 ft);
- Concentration at outflow boundary = 0 (use 0 for Outflow BC = 1);
- Initial concentrations in mobile and immobile regions = 0 (assume instantaneous spill occurred 70 years ago);
- Number of concentration profiles = 1;
- Time since release occurred = 2.56E+04 days (70 years = 2018-1948);

- The MPNE1D transport model was calibrated to three observed Cr^{+6} concentrations in the bedrock plume based on the December 2014 and September 2015 sampling round results.
    - At calibration point X1 = 585 ft (1.78E+04 cm), Cr^{+6} concentration = 17,700 ug/L (1.7E-05 g/mL) at AE-ML04A;
    - At calibration point X2 = 820 ft (2.50E+04 cm), Cr^{+6} concentration = 3,170 ug/L (3.17E-06 g/mL) at AE-12B;
    - At calibration point X3 = 974 ft (2.97E+04 cm), Cr^{+6} concentration = 1,270 ug/L (1.27E-06 g/mL) at AE-20B.

- Cr+6 concentration in source area = 60,000 ug/L (this value was back-calculated by adjusting source concentration until a good match was obtained at calibration points X1, X2 and X3 after a period of 70 years).
- Assumed that release occurred 70 years ago (i.e., 2018 – 70 = 1948). This is consistent with site history that indicates that from 1940 until 1970, wastewater and waste streams generated at the facility were directly discharged without treatment via an underground pipe from the plating room into the wetlands located on the southern portion of the property. From 1940 until 2007, electroplating was performed on the property.
- Therefore, calibrated to current observed concentrations at points X1, X2 and X3 along the plume by running the model 70 years.
- A plot of the predicted concentration profile curve along with the calibration targets is presented in Figure 10. A good match was observed.
- The calibrated concentration profile curve generated for the 70-year scenario indicates that the leading edge of the plume at 1 ug/L of Cr+6 has travelled 1,670 feet and is within the groundwater Protection District (see Figure 11).

REFERENCES

AECOM, 2016. Draft Remedial Investigation Report, Walton & Lonsbury Superfund Site, Attleboro, Massachusetts. Prepared for USEPA Region 1, Boston, MA. Contract Number EP-S1-06-01, Task Order 0065.

AECOM, March 2017. Treatability Test Report: Bench Testing for Hexavalent Chromium Treatment. Remedial Investigation / Feasibility Study, Walton & Lonsbury Superfund Site, Attleboro, Massachusetts. Prepared for USEPA Region 1, Boston, MA. Contract Number EP-S1-06-01, Task Order 0065.

Fetter, C.W., 1980. Applied Hydrogeology, Second Edition. Prentice Hall.

Gelhar, L., 1992. A critical review of data on field-scale dispersion in aquifers. Lynn Gelhar. Water Resources Research, Vol. 28, No.7, pp. 1955-1974, July 1992.

Neville, C.J., 2004. MPNE1D Analytical Solution for One-Dimensional Solute Transport with Multiprocess Nonequilibrium, User's Guide, Version 4.1, August 2004.

Neville, C.J., M. Ibaraki, and E.A. Sudicky, 2000. Solute transport with multiprocess nonequilibrium: A semi-analytical approach, Journal of Contaminant Hydrology, vol. 44, pp. 141-159.

Shackelford, C.D, Daniel, D.E., 1991. Diffusion in Saturated Soil. I: Background. Journal of Geotechnical Engineering, Vol. 117, Issue 3, pp. 467-484.

Weston Solutions, Inc. (Weston), November 2013. Hydrogeologic Investigation Summary Report for the Walton and Lonsbury Site, Attleboro, Bristol County, Massachusetts. Prepared for the U.S. Environmental Protection Agency, Region 1, Emergency Planning and Response Branch, Contract No. EP-W-05-042, Task Order No. 0003, DCN NO. R-7549.

Xu and Eckstein, D., 1995, Use of weighted least-squares method in evaluation of the relationship between dispersivity and field scale, Ground Water, Vol. 33, No. 6, 905-908.

USEPA, 1996. Soil Screening Guidance: Technical Background Document. Office of Emergency and Remedial Response, Washington, DC. EPA/540/R-96/128. NTIS PB96-963502.

Zhao, J. et al., 2017. Determination of Cr(III) solids formed by reduction of Cr(VI) in a contaminated fractured bedrock aquifer: Evidence for natural attenuation of Cr(VI). Chemical Geology 474, pp. 1-8.

Figures for Appendix F – Modeling Support

Figure 1: Vertical Gradients Beneath Bliss Brook

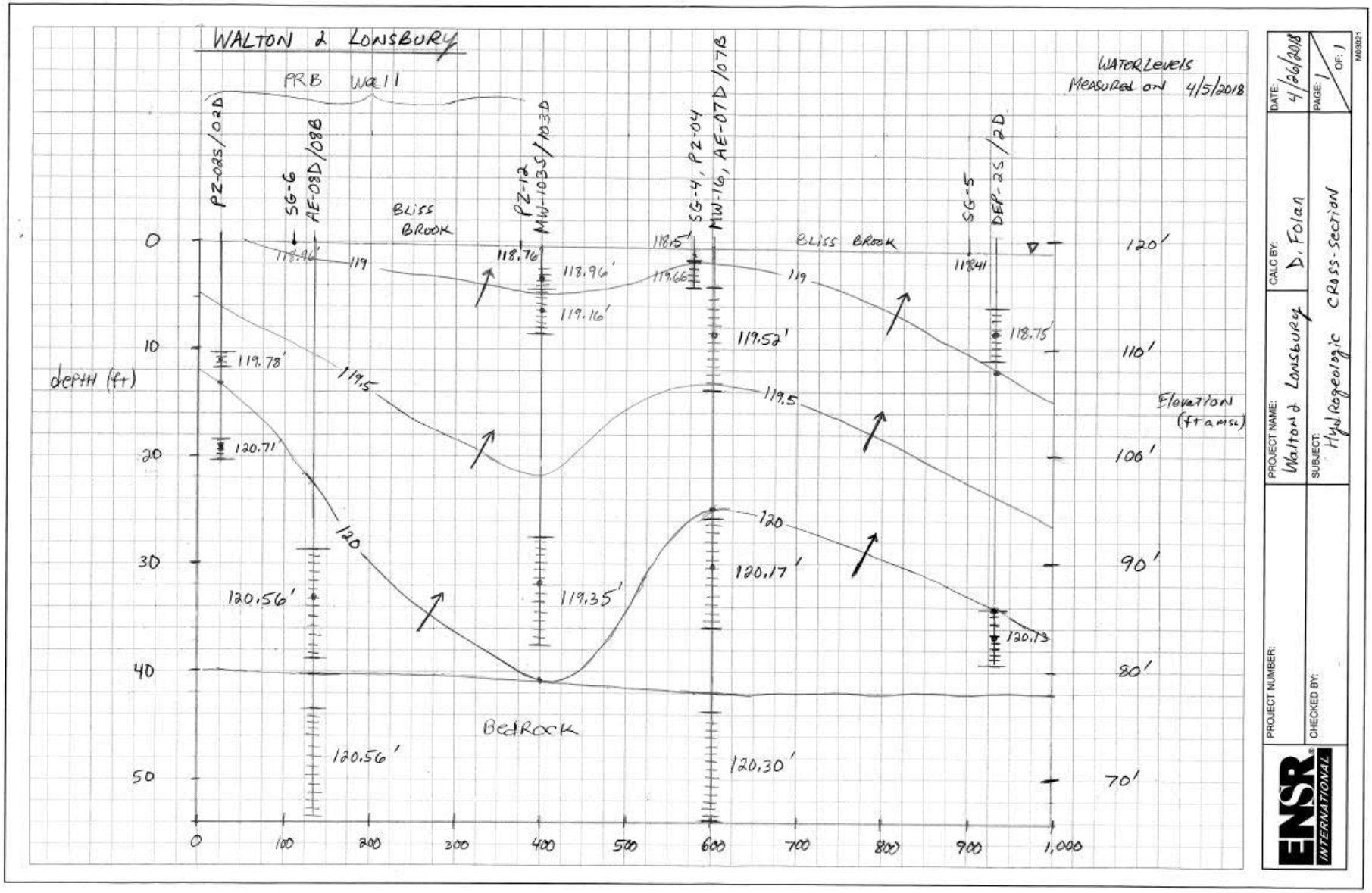


Figure 2: Simulated Ambient Overburden Flow – Forward Particle Tracking

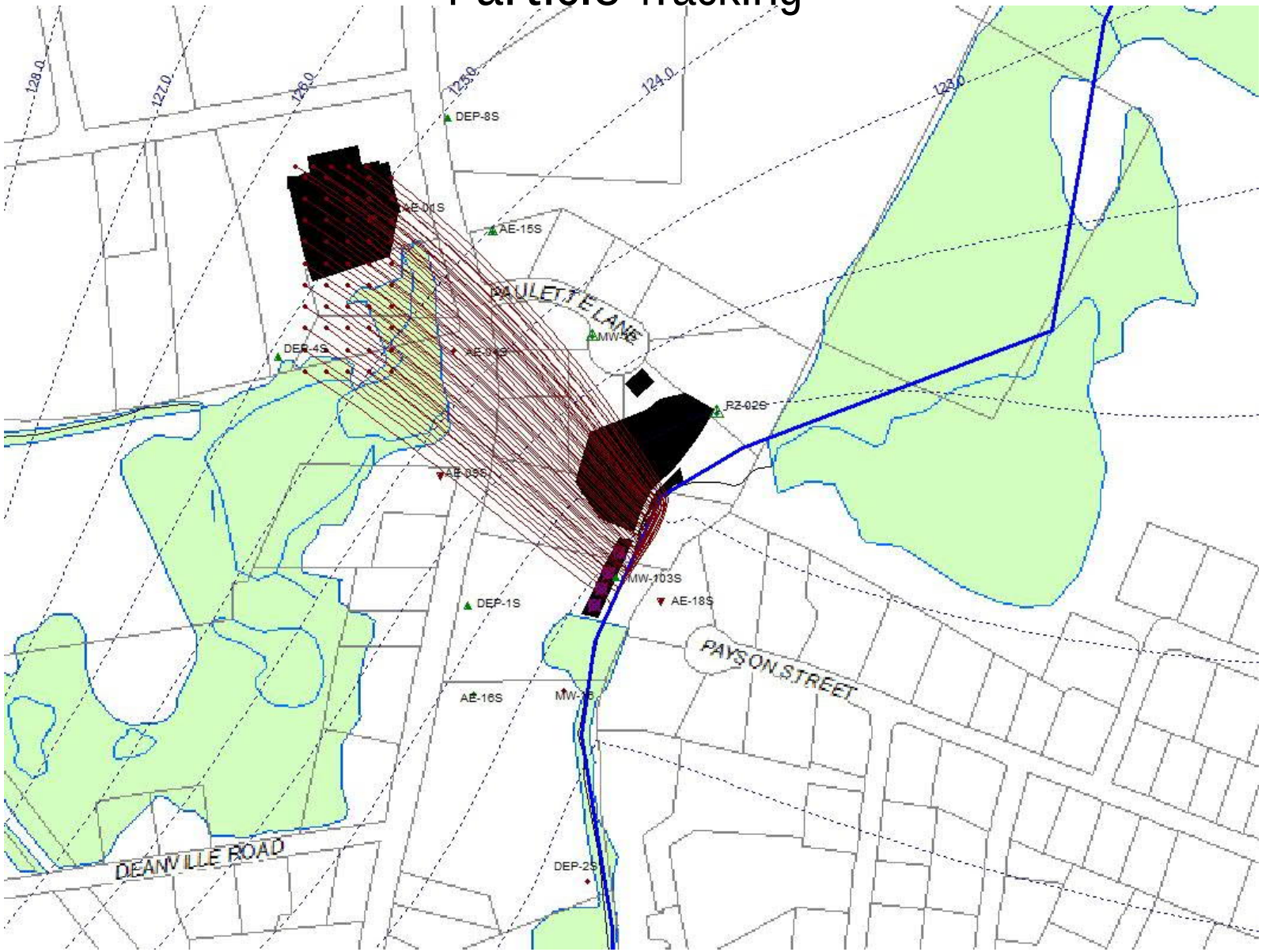


Figure 3: Simulated Ambient Bedrock Flow – Forward Particle Tracking



Figure 4: Simulated Overburden Pumping – Forward Particle Tracking

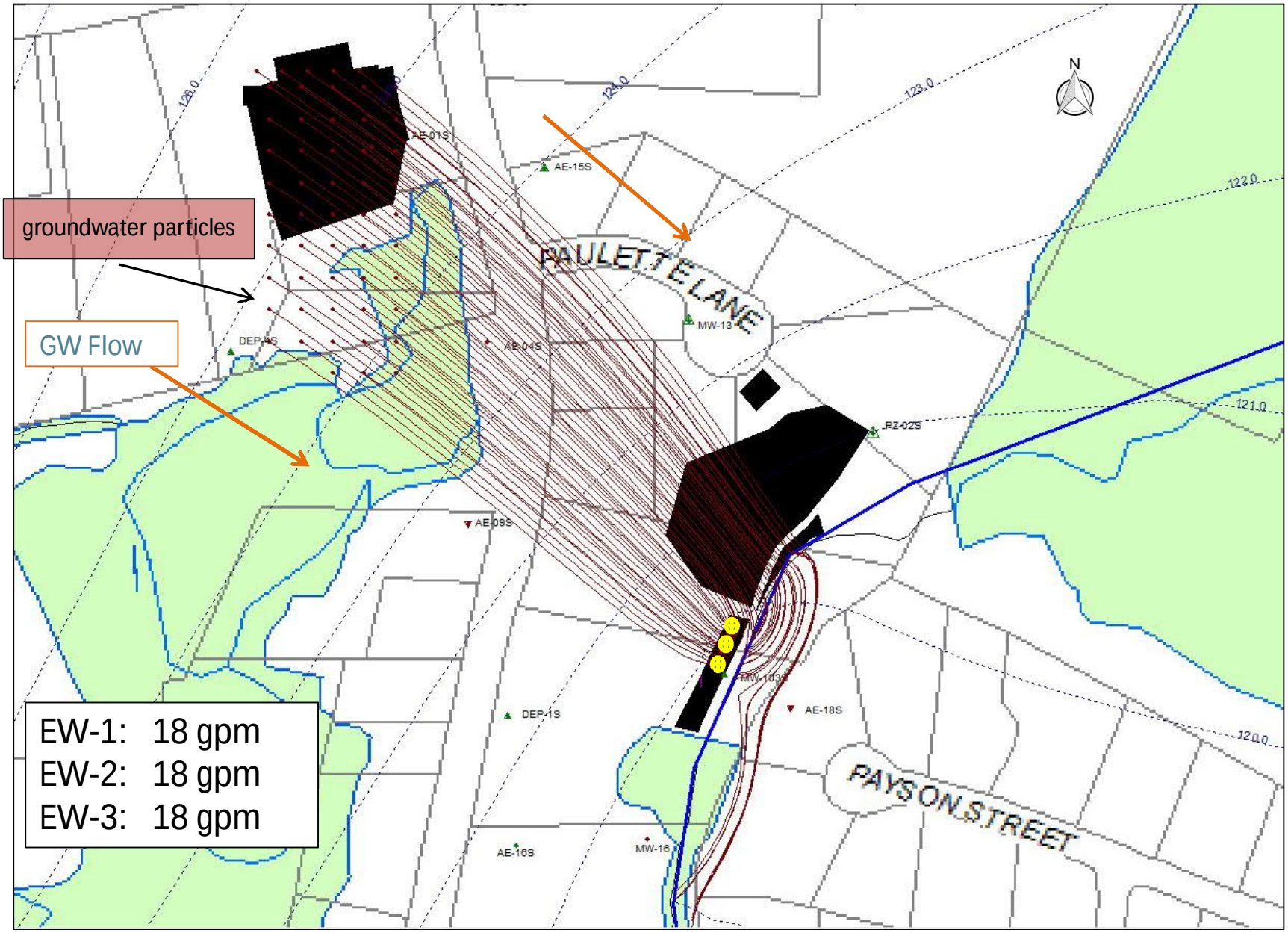


Figure 5: Simulated Bedrock Pumping – Forward Particle Tracking



Figure 6: Calibrated Transport Model Breakthrough Curve

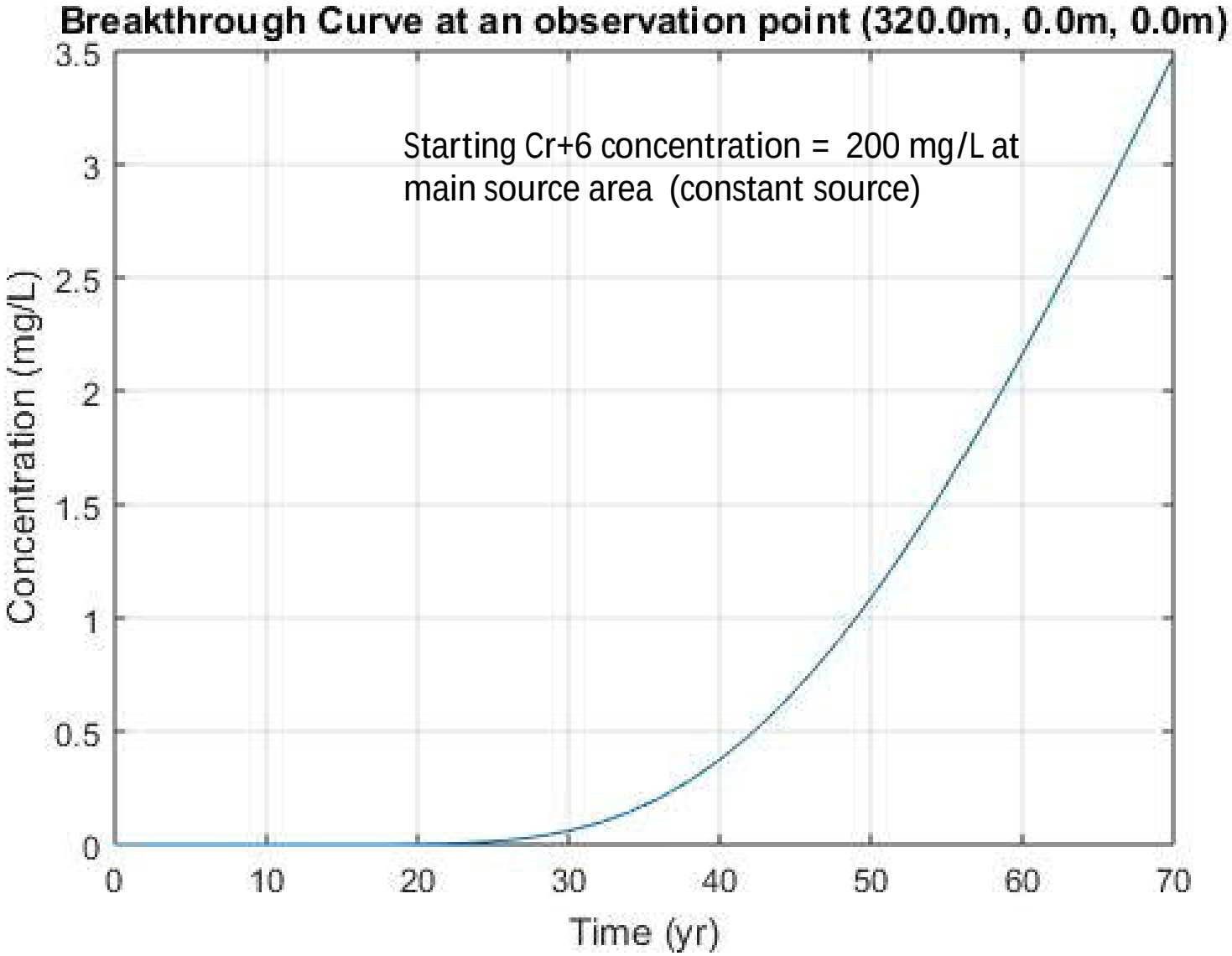


Figure 7: Breakthrough Curve: 90% Source Reduction

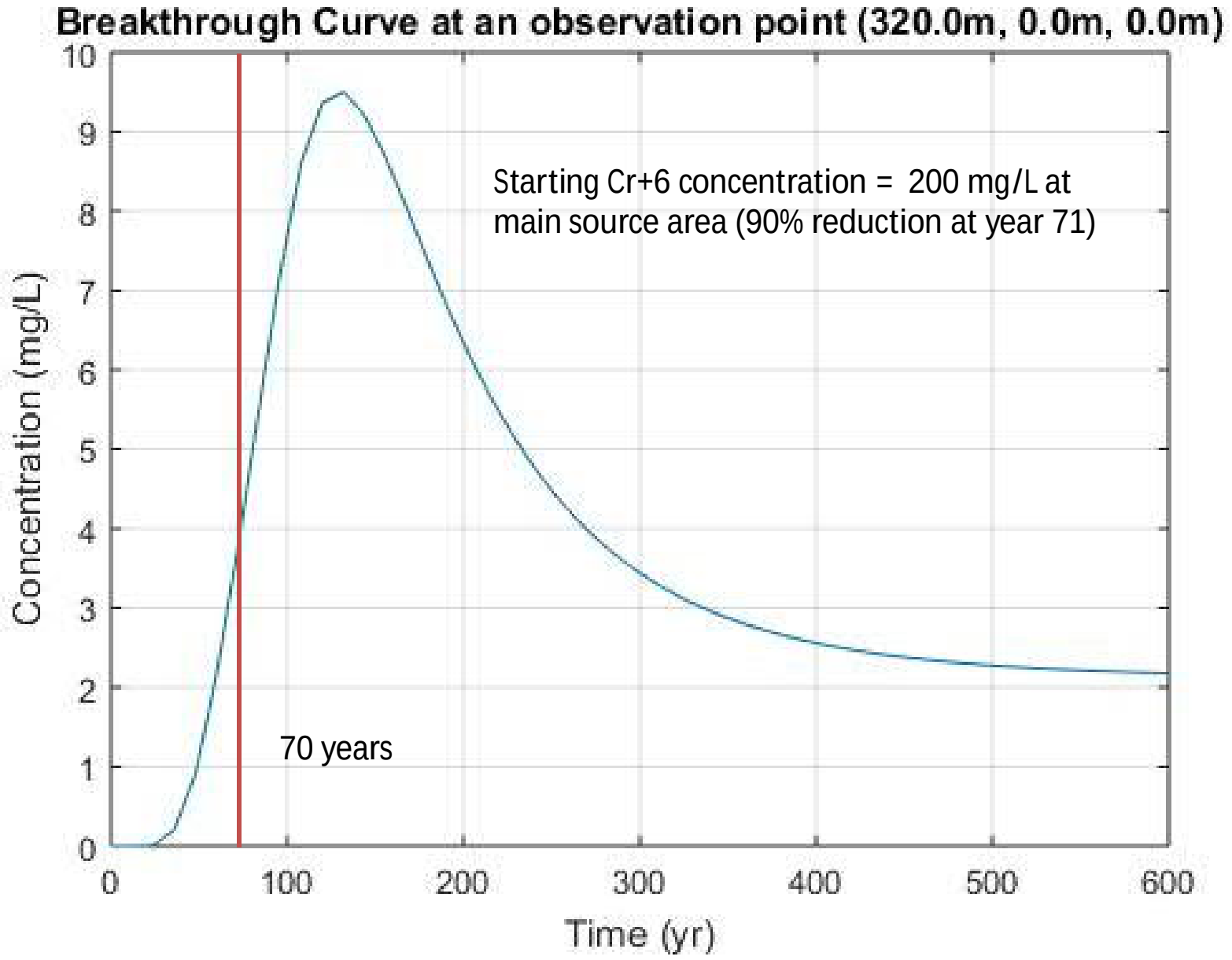


Figure 8: Breakthrough Curve: 90% Source Reduction with 83 mg/L Cr+6 Source Concentration

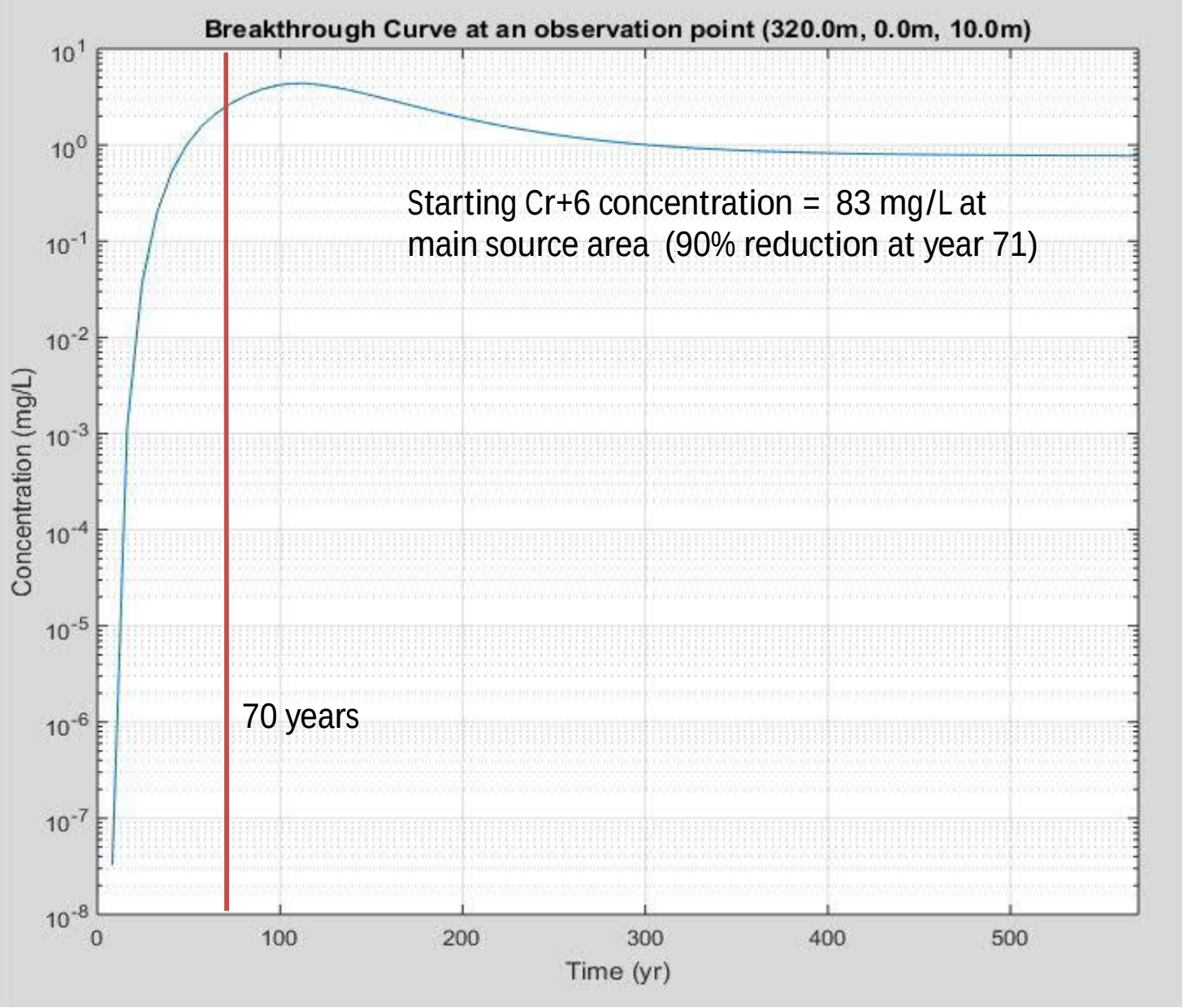


Figure 9: Breakthrough Curve: 90% Reduction at Mid-Plume Location

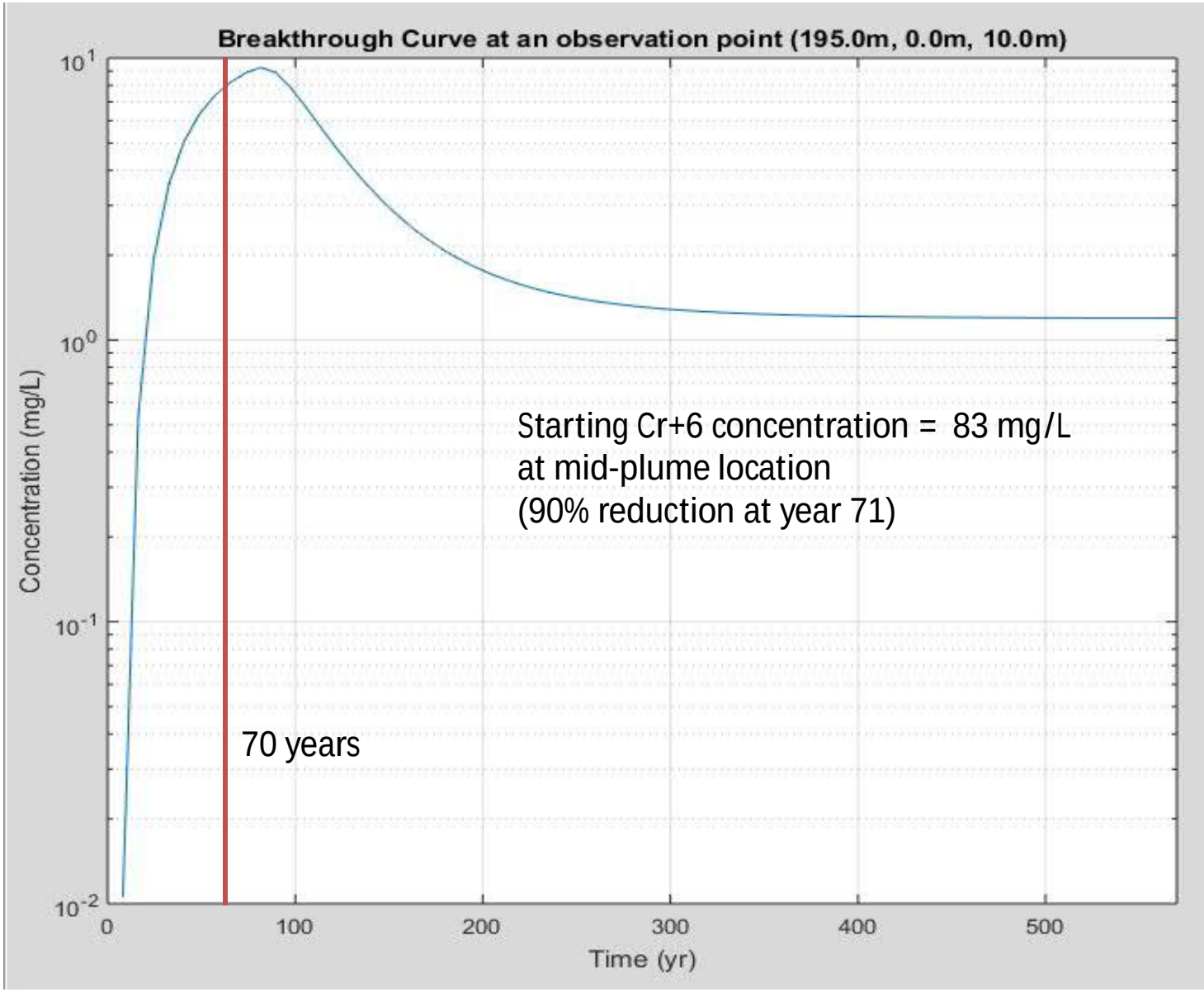


Figure 10: Simulated Cr+6 concentration in bedrock vs. distance
Walton & Lonsbury

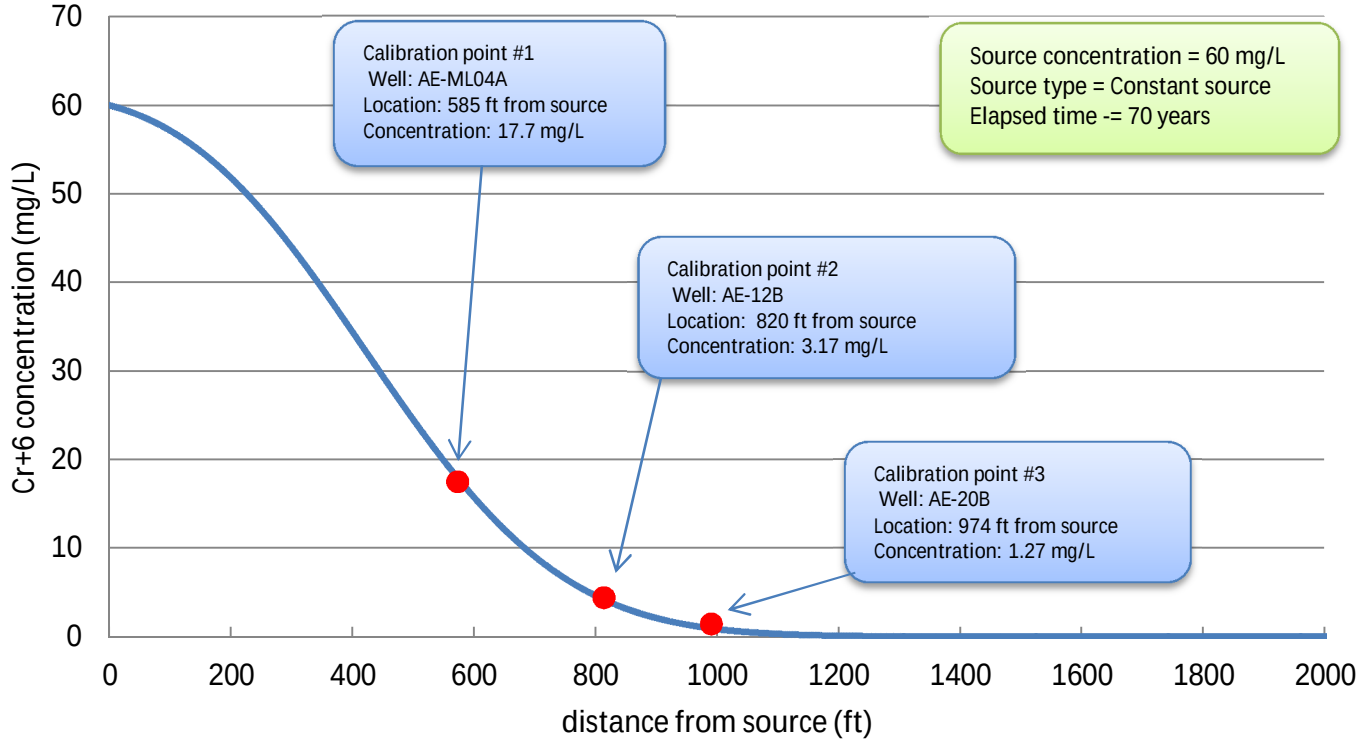


FIGURE 11

SIMULATED BEDROCK Cr+6 PLUME EXTENT

Legend

- Bedrock Monitoring Well
- Bedrock Solute Transport Model Simulated Results
- Existing PRB Trench
- Fence Installed by Removal Program
- Hexavalent Chromium Concentration Contour (from Figure 1-9: Phase 3 Groundwater Results for Hexavalent Chromium in Bedrock)
- (Dashed Where Inferred)
- Former Building Footprint

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water
- Stream Channel
- Bungay River Water Resource Protection District

Stereoplots showing bedrock fracture orientations from borehole geophysics

1 inch equals 150 feet

AECOM 0 75 150 300 Feet

G:\Projects\HAZWASTE\60308115\WAL\Maps\BedrockSolute.mxd

AE-01B
AE-ML-01
AE-02B
AE-15B
AE-11B
AE-03B
AE-ML-02
AE-04B
AE-05B
AE-ML-04
AE-06B
AE-08B
AE-12B
AE-ML-03
AE-20B
AE-14B
AE-07B
AE-13B
PAULETTE LANE
PAYSON STREET
NORTH AVENUE
WEST STREET
BLISS BROOK
100 µg/L
10,000 µg/L
1,000 µg/L
100 µg/L
10 µg/L
1 µg/L

APPENDIX G – TECHNICAL MEMO - LEAD EVALUATION

TO 65 WALTON & LONSBURY

REMEDIAL INVESTIGATION/FEASIBILITY STUDY

EVALUATION SUMMARY MEMORANDUM: FINE FRACTION LEAD IN SURFACE SOIL

April 30, 2019

This memorandum describes the methodologies and results from investigations performed in 2017 and 2018 to evaluate lead concentrations in the fine fraction (less than 150 microns) of surface soil (fine fraction lead) at the Walton and Lonsbury (W&L) Superfund Site. It serves as a supplement to the draft final remedial investigation report (planned for May 2019) and final human health risk assessment (April 2019), and describes the basis for the evaluation of remedial alternatives for lead in surface soil that is included in the revised draft feasibility study report (April 2019).

Background

The draft remedial investigation (RI) and associated baseline human health risk assessment (HHRA) for the Site were submitted to EPA in June 2016. Consistent with the guidance in effect at that time, the RI sampling efforts included bulk soil sampling only (no samples were sieved), and the HHRA evaluated the bulk (un-sieved) soil sample results for lead and other contaminants of potential concern. Lead was concluded to be a contaminant of potential concern in soil and sediment that is most likely Site-related, based on the known former use of lead at the W&L facility and the patterns of lead (and other metal) concentrations on the W&L Property itself and in the Southern Wetland, which suggested that releases had occurred on the property and to the wetland.

Figures 4-7 and 4-17 of the Revised Draft RI report (appended to this memo) show the pattern of total lead concentrations in bulk surface soil (Figure 4-7) and sediment (Figure 4-17) based on RI samples and on historic samples from 2016 and earlier that were determined to be useable for the RI and risk assessments. Lead concentrations in surface soil samples from west of North Avenue (i.e., the W&L property building footprint and upland soil bordering the Southern Wetland), and in Southern Wetland soil and sediment samples, were generally higher than those found in reference soil and sediment samples. Note that the area enclosed by a black line (denoted as “excavation extent” on Figure 4-7) was remediated by the removal program for chromium contamination, and co-located lead contamination was also removed from this area. Samples collected from the excavated area prior to excavation taking place are not shown on Figure 4-7 since the soil that the samples represented is no longer present, but the co-location of chromium and lead is apparent from the pre-excavation sample results. Therefore, it is considered likely that the lead is at least partially related to releases from the W&L facility, although other sources of lead cannot be ruled out.

Since June 2016, EPA has issued new guidance regarding evaluation of lead at Superfund sites. The current guidance recommends collection of fine-fraction (less than 150 µm) surface soil samples with analysis for total lead, followed by In-Vitro Bioaccessibility (IVBA) lead testing if the total fine-fraction soil lead concentration (based on an average of results within an exposure point) is above 200 mg/kg. (The 200 mg/kg value is a screening level developed using default blood lead level modeling parameters for children at a target blood lead level of 5 µg/dL for a residential exposure scenario[1]). Because RI and historic soil sampling from 2016 and earlier did not include separation (sieving of soil samples) and analysis of the fine fraction, it was determined that additional samples needed to be collected for sieving and analysis of the fine fraction.

Fine Fraction Lead Sample Collection – December 2017

In December 2017, additional sample collection was done for the four exposure points where the June 2016 HHRA indicated that there was no actionable risk from soil exposure, but that lead could be present at levels above 200 mg/kg in fine fraction soil, based on un-sieved soil lead results that occasionally exceeded this value. These exposure points are:

- yards in the residential area west of North Avenue
- yards in the residential area east of North Avenue
- Southern Wetland
- Bliss Brook

A fifth exposure point (the W&L property and immediate area to the south, as far as the southern end of the fence installed by EPA along North Avenue) was determined to have actionable risk due to soil constituents other than lead that are co-located with lead. Therefore, soil remedial alternatives were already planned to be included in the FS for this exposure point, and additional data collection for fine-fraction soil lead from this exposure point was deemed unnecessary.

This first phase of fine-fraction lead sampling was performed in accordance with the Sampling and Analysis Plan (SAP) for Soil Fine Fraction Lead Testing and Micro-Well Installation and Sampling (AECOM, November 2017). Sampling locations (identified as SO-601, SO-602, etc.) are shown on Figure 2-15 (Southern Wetland and Residential Area West of North Avenue) and Figure 2-16 (Bliss Brook and Residential Area East of North Avenue) from the Revised Draft RI report. The rationale for the selection of these locations was presented in the November 2017 SAP, Worksheet 17. The sampling depth for each location was 0 to 6 inches. A total of 51 samples were collected at 48 locations (12 locations per exposure point plus 3 field duplicates).

[1] Concentrations higher than 200 mg/kg are acceptable for recreational areas where less soil exposure occurs than in a residential yard, or for residential soils with lower absolute bioavailability for lead than the default assumption of 30-percent.

December 2017 Results - Total Lead, Extractable Lead, and IVBA Lead in Fine Fraction (< 150 µm) Soil Samples

Both total lead and IVBA lead analyses were performed on the less than 150 µm fraction (fine fraction) for all of the December 2017 surface soil samples.

Figure 4-8 from the Revised Draft RI Report presents the fine fraction total lead results. Concentrations of fine fraction total lead are generally greater than bulk soil lead concentrations from the same locations, and are also generally greater in wetland soil samples (indicated by red symbols on Figure 4-8) than in upland soil samples (indicated by green symbols). In upland soil samples representing the residential area west of North Avenue, fine fraction total lead concentrations were high enough to result in actionable human health risk.

Table 4-15 from the Revised Draft RI Report presents the fine fraction total lead and extractable lead results and IVBA lead results from December 2017, along with bulk (not sieved) results for total lead and total chromium for the same sample locations. The purpose of showing lead and total chromium results in this table is to help evaluate whether there is a correlation between elevated lead and elevated chromium, which would be an indication that the lead is associated with known releases of chromium from the site. Results for total lead and total chromium in unsieved samples are also compared to their respective reasonable maximum exposure (RME) exposure point concentrations as calculated in the Baseline Ecological Risk Assessment (BERA) for soil samples collected from reference areas, where "reference" areas are locations that were selected for the purpose of evaluating contaminant concentrations present in areas near the site but not likely to have been impacted by the site. The RME exposure point concentrations are 95% upper confidence limits on the arithmetic mean calculated using EPA's ProUCL software.

There appears to be a weak correlation between elevated total lead and elevated total chromium concentrations. Nearly all samples with elevated total lead also have elevated total chromium. However, there are a significant number of samples where the total chromium concentration is elevated but the total lead concentration is consistent with background. Therefore, an elevated total chromium concentration is not necessarily indicative of a higher total lead concentration.

November 2018 Effort – Residential Soil West of North Avenue

After evaluation of the December 2017 data, EPA determined that additional sampling for fine fraction lead should be performed for residential (floodplain) soil west of North Avenue to refine the understanding of extent and to provide a sufficient number of samples on each individual property so that risk could be evaluated on a property-by-property basis. The conceptual site model is that lead may have been transported to these properties due to flooding from the Southern Wetland that borders this residential area to the west, although the possibility of other sources of lead also exists.

EPA discussed the existing results with the affected property owners and obtained permission for additional fine fraction lead sampling. Samples were located within the FEMA AE flood zone (1% annual chance of flooding) but outside the Southern Wetland to characterize upland soil subject to flooding, as this is the mechanism by which is it believed that site-related contamination would have been deposited. The number of samples needed was determined in consideration of the existing samples already collected, and attempting to have a ratio of at least 2 samples per 1000 square feet of "flood plain" area on each property, where "flood plain" is defined by the FEMA flood zone designation AE (1% annual chance of flooding, with Base Flood Elevation). Further details explaining the rationale for sample location selections and the procedures used to collect and analyze the samples are presented in the Sampling and Analysis Plan for Soil Fine Fraction Lead Testing: Residential Yards West of North Avenue (AECOM, October 2018) and the companion SAP prepared by the New England Regional Laboratory (NERL) entitled Collection of Soil Samples for Analyses of Fine Fraction Lead, and Metals: Sampling and Analysis Plan (NERL, October 2018).

The sampling was performed in November 2018 by EPA NERL staff with assistance from AECOM. The results are presented on Figure 1-13 of the Revised Draft FS Report. This figure also includes the previous (December 2017) results from west of North Avenue. Table 1 presents the fine fraction lead and bulk (unsieved sample) total lead and total chromium results for the November 2018 sampling event, along with earlier (December 2017) results for the same properties, for any soil sample classified as residential (either within the floodplain or at a higher elevation outside the floodplain). As with the December 2017 data, there appears to be only a weak correlation between elevated levels of lead (bulk and fine fraction) and elevated levels of total chromium.

Two soil samples within the flood plain (10-DE-10 and 28-NO-01) appear to be outliers (inconsistent with other nearby results), and the soil in these locations may be impacted by other sources. Sample 28-NO-01 is close to the road and where the property owner currently parks recreational vehicles. Sample 10-DE-10 is in the rear of the lot in an area that appears to have been a disturbed area, based on examination of historic aerial photos from before the home was built. Unlike the other properties north of Deanville Road, it appears that the lead on these two properties is localized to two areas (one on each lot) rather than being present throughout the flood plain.

Risk Evaluation for Fine Fraction Lead in Residential Soil West of North Avenue

Samples used for the lead risk evaluation are those of residential soil within the flood plain, as these samples represent the part of each property likely to have been impacted by flooding from the wetland and also represent residential exposure. Samples collected from a higher elevation outside the floodplain are not included in the evaluation since any lead in these samples is not related to releases from the site due to the chosen flooding scenario.

Floodplain fine fraction lead soil data collected in December 2017 and November 2018 from seven residential properties along the western side of North Avenue were combined to evaluate the need for

remedial action at the properties. Decisions concerning the need for remedial action are based on a comparison of arithmetic average lead concentrations to the 200 mg/kg residential screening value. This 200 mg/kg residential screening value is based on the default lead absolute bioavailability of 30-percent. Because site-specific IVBA testing revealed that the average absolute bioavailability of lead in soil samples from the west of North Avenue exposure point (28.3-percent) is consistent with the default assumption, the 200 mg/kg residential screening value has been used. The following describes the results of the comparison by property. Soil data used in this evaluation are presented in Table 2.

- 60 North Avenue – One floodplain soil sample has been collected from this parcel (SO-606). The other two soil samples from this property are close to the edge of the flood zone but not within it. The rear of this property extends to the south behind (west) of the 50 North Avenue property. Additional samples were not collected from the 60 North Avenue property in 2018 because it was not suspected that this property would be impacted based on the available results from 2017. Because the lead result for this one sample is less than 200 mg/kg, no action is indicated for this property; however, because this conclusion is based on only one sample, and because 48 North Avenue to the immediate south has confirmed impacts, additional sampling of residential soil within the floodplain is recommended for this property.

- 48 North Avenue – Five floodplain soil samples have been collected from this parcel. The average lead concentration exceeds the screening value; therefore, remedial action is required for this property. However, one of the samples collected from this property has a concentration that is less than the lead residential screening value indicating that there may be a portion of the floodplain that does not require action.

- Mass Electric Parcel – Two floodplain soil samples have been collected from this parcel. The average lead concentration exceeds the screening value; therefore, remedial action is required for this property.

- 42 North Avenue - Six floodplain soil samples have been collected from this parcel. The average lead concentration exceeds the screening value; therefore, remedial action is required for this property.

- 34 North Avenue – Five floodplain soil samples have been collected from this parcel. The average lead concentration exceeds the screening value; therefore, remedial action is required for this property. However, one of the samples collected from this property has a concentration that is less than the lead residential screening value indicating that there may be a portion of the floodplain that does not require action.

- 10 Deanville Road – Fourteen floodplain soil samples have been collected from this parcel. One of the samples (10DE-10), as previously described, is considered an outlier and requires removal as a lead “hot spot”. The average lead concentration of the remaining 13 samples collected from this property is less than 200 mg/kg; therefore, no action other than the removal of the 10DE-10 lead hot spot is required.

- 28 North Avenue – Ten floodplain soil samples have been collected from this parcel. One of the samples (28NO-01), as previously described, is considered an outlier and requires removal as a lead "hot spot". The average lead concentration of the remaining nine samples collected from this property is less than 200 mg/kg; therefore, no action other than the removal of the 28NO-01 lead hot spot is required.

Feasibility Study Remedial Alternative for Residential Soil West of North Avenue

The revised draft feasibility study (April 2019) considered three alternatives for addressing lead in the residential soil west of North Avenue:

- SL-1 No Action
- SL-2 Capping and Institutional Controls on Residential Properties
- SL-3 Soil Excavation on Residential Properties with Off-Site Disposal

Alternative SL-2 (capping) was eliminated during alternatives screening because contaminants would remain on the properties above PRGs. Although SL-2 would be effective in reducing exposure, providing the ICs are adhered to, it would restrict a homeowner's use of the property. Capping would also result in net filling within the flood plain and decrease flood storage and likely would not be acceptable to the owners. Based on these considerations, capping is not likely to provide a benefit over a remedial alternative that would remove soil contaminants.

Alternative SL-3 (excavation and off-site disposal) is therefore the only feasible alternative, since No Action does not address the actionable risk on these properties. Under this alternative, remedial action objectives would be achieved by soil excavation and off-site disposal to remove all soil in excess of the soil PRG for lead from the residential properties north of Deanville Road between the wetland and Flood Zone AE (48, 42, and 34 North Avenue) and the Mass Electric parcel. The alternative also includes removal of two isolated areas of soil contamination on two properties south of Deanville Road (10 Deanville Road and 28 North Avenue). The entire Flood Zone AE is not proposed for excavation on these two lots because the remaining samples (once the two "hot spots" are removed) have an average concentration below the PRG of 200 mg/kg fine fraction lead.

Pre-design sampling would be conducted to further refine the extent of soil to be excavated. Figure 3-3 of the Revised Draft FS shows the current estimated extent of surface soil impacts above PRGs, which covers a total area of approximately 8,310 square feet (approximately 7,790 square feet west of North Ave and approximately 520 square feet south of Deanville Road). The focus of the pre-design sampling would be to better define the overall horizontal and vertical extent of impacts above the Residential PRG for lead.

A primary objective of the additional sampling is to establish whether a 1 foot excavation depth is suitable. One foot is considered the smallest realistically achievable depth with excavation equipment

and is also likely to be sufficiently deep. Current samples are from 0 to 6 inches only; no deeper samples have been collected and analyzed for fine fraction lead. Based on the conceptual site model that the lead contamination was deposited to these areas due to flooding from the Southern Wetland, it is expected that the contamination would be limited to the immediate surface and that soil deeper than one foot bgs would not be impacted by the Site. Additional samples from 1 to 1.5 feet bgs would be collected to confirm that soil deeper than 1 foot bgs is not impacted, and also to obtain more data on the lateral extent of the contamination. This pre-design sampling would also eliminate the need for post-excavation confirmation samples, because the excavation area would have been clearly defined before any excavation takes place. In the unlikely event that fine-fraction lead contamination above the PRG is found in the 1-1.5 foot interval samples, the conceptual site model would need to be re-evaluated and more investigation done to try to establish whether the Site is in fact the source of the lead and how the lead came to be located at depth in these areas, or if there are unidentified sources that need to be investigated and understood before a new remediation plan could be developed.

Prior to the excavation, erosion control measures (i.e., hay bales and silt fences) would be installed around the excavation area. During the excavation, dust control and air monitoring would be performed, as necessary.

All excavated soil would be stockpiled at an approved location. Details regarding stockpile management (e.g., storm water controls and temporary covers) would be developed during the design phase.

Prior to disposal, waste characterization samples would be collected from the stockpiled soil. The excavated soil would be transported and disposed of at an off-site, licensed landfill. Soils are not anticipated to be classified as a hazardous waste. The actual disposal classification for excavated soils would be determined through waste characterization sampling. Once the contaminated soil has been removed, the excavation would be backfilled with clean soil, compacted, and graded to achieve existing elevations and grades. Topsoil would be placed, and each of the residential properties would be re-vegetated to conform to pre-remedial conditions as best as practicable. Erosion control measures would be required during placement of backfill and until the site is stabilized.

Tables

Table 1

December 2017 and November 2018 Surface Soil Sampling for Lead Risk Evaluation

Residential Area West of North Avenue:

Results for Total Lead, Total Chromium, and Total Fine Fraction Lead for Residential Soil Samples

Location/ID	Soil Sample Type	Total Lead, Whole Sample (Not Sieved), dry weight (mg/Kg)		Results for Fine Fraction (< 150 µm) Samples		Total Chromium, Whole Sample (Not Sieved), dry weight (mg/Kg)	
				Total Lead, dry weight (mg/Kg)			
		Result	Qualifier	Result	Qualifier	Result	Qualifier
60 North Avenue							
SO-605	residential above flood plain	57		109		16.9	J
SO-606	residential flood plain	163		163		72.7	J
48 North Avenue							
48NO-01	residential flood plain	383		372		26.7	J
48NO-02	residential flood plain	153		280		16.8	J
48NO-03	residential flood plain	663		781		30	J
48NO-04	residential flood plain	191		163		47.7	J
48NO-05	residential flood plain	214	J	241		22.5	
Mass Electric Parcel							
ME-01	residential flood plain	345	J	490		21	
ME-02	residential flood plain	520	J	790		57.3	
42 North Avenue							
42NO-01	residential flood plain	192		369		33.1	J
42NO-02 (FD)	residential flood plain	228		397		23.5	J
42NO-02 (FD)	residential flood plain	178		411		17.5	J
42NO-03	residential flood plain	202		409		16.1	J
42NO-04	residential flood plain	194		511		18.8	J
SO-611	residential flood plain	549	J	474		70.1	J
SO-612	residential flood plain	225	J	478		42.1	J
34 North Avenue							
34NO-01	residential flood plain	318	J	471		40.1	
34NO-02 (FD)	residential flood plain	50.0		109		14.1	J
34NO-02 (FD)	residential flood plain	49.3		90.8		15	J
34NO-03	residential flood plain	200		472		104	J
34NO-04	residential flood plain	145		303		12.5	J
SO-617	residential flood plain	554	J	705		882	J
SO-618	residential above flood plain	74.9	J	118		207	J
SO-619	residential above flood plain	59.4	J	111		15.0	J
SO-621	residential above flood plain	160	J	428		57.0	J
10 Deanville Road							
10DE-01	residential flood plain	46.2	J	89.1		14.5	
10DE-02	residential flood plain	81.5	J	172		18.2	
10DE-03	residential flood plain	141	J	272		54.9	
10DE-04	residential flood plain	169	J	308		39.3	
10DE-05	residential flood plain	63.5	J	142		42	
10DE-06	residential flood plain	62.9	J	136		27.4	

Table 1

December 2017 and November 2018 Surface Soil Sampling for Lead Risk Evaluation

Residential Area West of North Avenue:

Results for Total Lead, Total Chromium, and Total Fine Fraction Lead for Residential Soil Samples

Location/ID	Soil Sample Type	Total Lead, Whole Sample (Not Sieved), dry weight (mg/Kg)		Results for Fine Fraction (< 150 µm) Samples		Total Chromium, Whole Sample (Not Sieved), dry weight (mg/Kg)	
				Total Lead, dry weight (mg/Kg)			
		Result	Qualifier	Result	Qualifier	Result	Qualifier
10DE-07	residential flood plain	59.7	J	89.8		20.9	
10DE-08	residential flood plain	101	J	172		18.9	
10DE-09	residential flood plain	98.1	J	220		17.7	
10DE-10	residential flood plain	568	J	1240		42.8	
10DE-11	residential flood plain	84.2	J	198		34.6	
10DE-12	residential flood plain	73.3	J	131		15.9	
SO-622 (FD)	residential flood plain	86.6	J	199		39.7	
SO-622 (FD)	residential flood plain	75.8		203		35.3	J
SO-623	residential flood plain	141		263		37.8	J
28 North Avenue							
28NO-01	residential flood plain	682	J	1170		35	
28NO-02	residential flood plain	90.2	J	127		22.1	
28NO-03	residential flood plain	68.3		162		11.5	J
28NO-04	residential flood plain	40.6		68.5		14.7	J
28NO-05	residential flood plain	79.9		124		40.1	J
28NO-06	residential flood plain	192		360		24.9	J
28NO-07	residential flood plain	68.9		126		23.7	J
28NO-08	residential flood plain	100		228		27.9	J
28NO-09	residential flood plain	170		358		145	J
SO-624	residential flood plain	73.5		149		182	J

mg/Kg = milligram per kilogram

FD = Field duplicate collected at this location.

Qualifier = qualifier applied by AECOM during data validation:

J = result is estimated due to limitations identified in the data validation memorandum

U = not detected; reported value is the reporting limit

Total lead (fine fraction) concentration exceeds the screening value for residential soil (200 mg/kg). Not flagged if sample is not residential soil (that is, if sample is wetland soil), as the screening value does not apply to wetland soil.

Total chromium (unsieved sample) concentration exceeds the RME exposure point concentration for soil samples from reference areas (16 mg/kg) as calculated in the BERA.

Table 2
Lead Risk Evaluation
Residential Area West of North Avenue

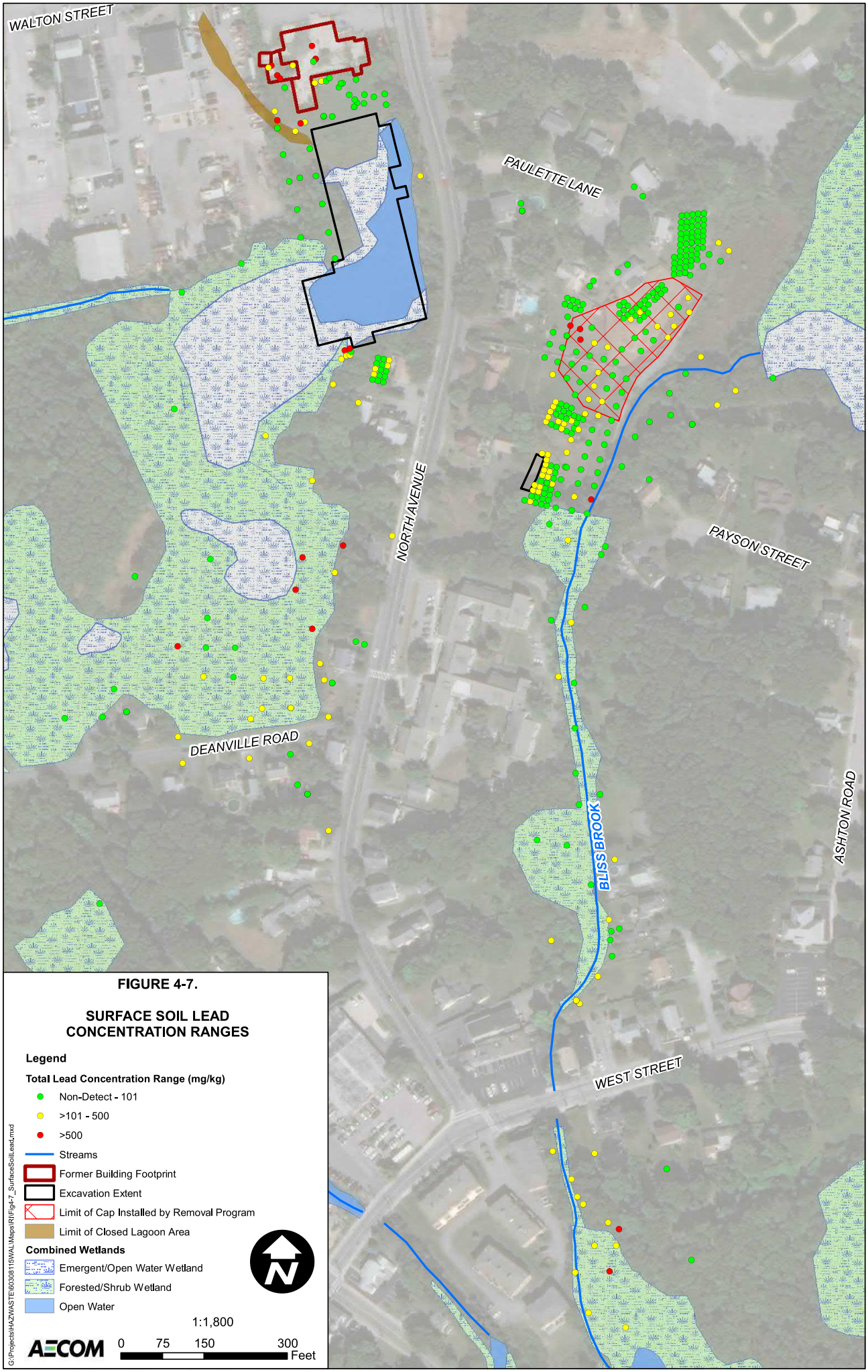
Location/ID	Soil Sample Type	Results for Fine Fraction (< 150 µm) Samples Total Lead, dry weight (mg/Kg) Result
60 North Avenue		
SO-606	residential flood plain	163
48 North Avenue		
48NO-01	residential flood plain	372
48NO-02	residential flood plain	280
48NO-03	residential flood plain	781
48NO-04	residential flood plain	163
48NO-05	residential flood plain	241
	average	**367.4**
Mass Electric Parcel		
ME-01	residential flood plain	490
ME-02	residential flood plain	790
	average	**640**
42 North Avenue		
42NO-01	residential flood plain	369
42NO-02 (combo)	residential flood plain	404
42NO-03	residential flood plain	409
42NO-04	residential flood plain	511
SO-611	residential flood plain	474
SO-612	residential flood plain	478
	average	**440.8**
34 North Avenue		
34NO-01	residential flood plain	471
34NO-02 (combo)	residential flood plain	99.9
34NO-03	residential flood plain	472
34NO-04	residential flood plain	303
SO-617	residential flood plain	705
	average	**410.2**
10 Deanville Road (outlier 10DE-10)		
10DE-10	residential flood plain	1240
10 Deanville Road		
10DE-01	residential flood plain	89.1
10DE-02	residential flood plain	172
10DE-03	residential flood plain	272
10DE-04	residential flood plain	308
10DE-05	residential flood plain	142

Table 2
Lead Risk Evaluation
Residential Area West of North Avenue

Location/ID	Soil Sample Type	Results for Fine Fraction (< 150 µm) Samples Total Lead, dry weight (mg/Kg) Result
10DE-06	residential flood plain	136
10DE-07	residential flood plain	89.8
10DE-08	residential flood plain	172
10DE-09	residential flood plain	220
10DE-11	residential flood plain	198
10DE-12	residential flood plain	131
SO-622 (combo)	residential flood plain	201
SO-623	residential flood plain	263
	average	**184.1**
28 North Avenue (outlier 28NO-01)		
28NO-01	residential flood plain	1170
28 North Avenue		
28NO-02	residential flood plain	127
28NO-03	residential flood plain	162
28NO-04	residential flood plain	68.5
28NO-05	residential flood plain	124
28NO-06	residential flood plain	360
28NO-07	residential flood plain	126
28NO-08	residential flood plain	228
28NO-09	residential flood plain	358
SO-624	residential flood plain	149
	average	**189.2**

mg/Kg = milligram per kilogram
combo = average of parent sample and field duplicate collected at this location.

Figures and Tables from Revised Draft RI Report (AECOM, September 2018)


WALTON STREET
PAULETTE LANE
NORTH AVENUE
PAYSON STREET
DEANVILLE ROAD
BLISS BROOK
ASHTON ROAD
WEST STREET
FIGURE 4-7.
SURFACE SOIL LEAD CONCENTRATION RANGES
Legend
Total Lead Concentration Range (mg/kg)
Non-Detect - 101
>101 - 500
>500
Streams
Former Building Footprint
Excavation Extent
Limit of Cap Installed by Removal Program
Limit of Closed Lagoon Area
Combined Wetlands
Emergent/Open Water Wetland
Forested/Shrub Wetland
Open Water
N
1:1,800
AECOM
0 75 150 300
Feet
G:\Projects\HAZWASTE\60308115\WAL\Maps\R\[Fig4-7_SurfaceSoilLead.mxd

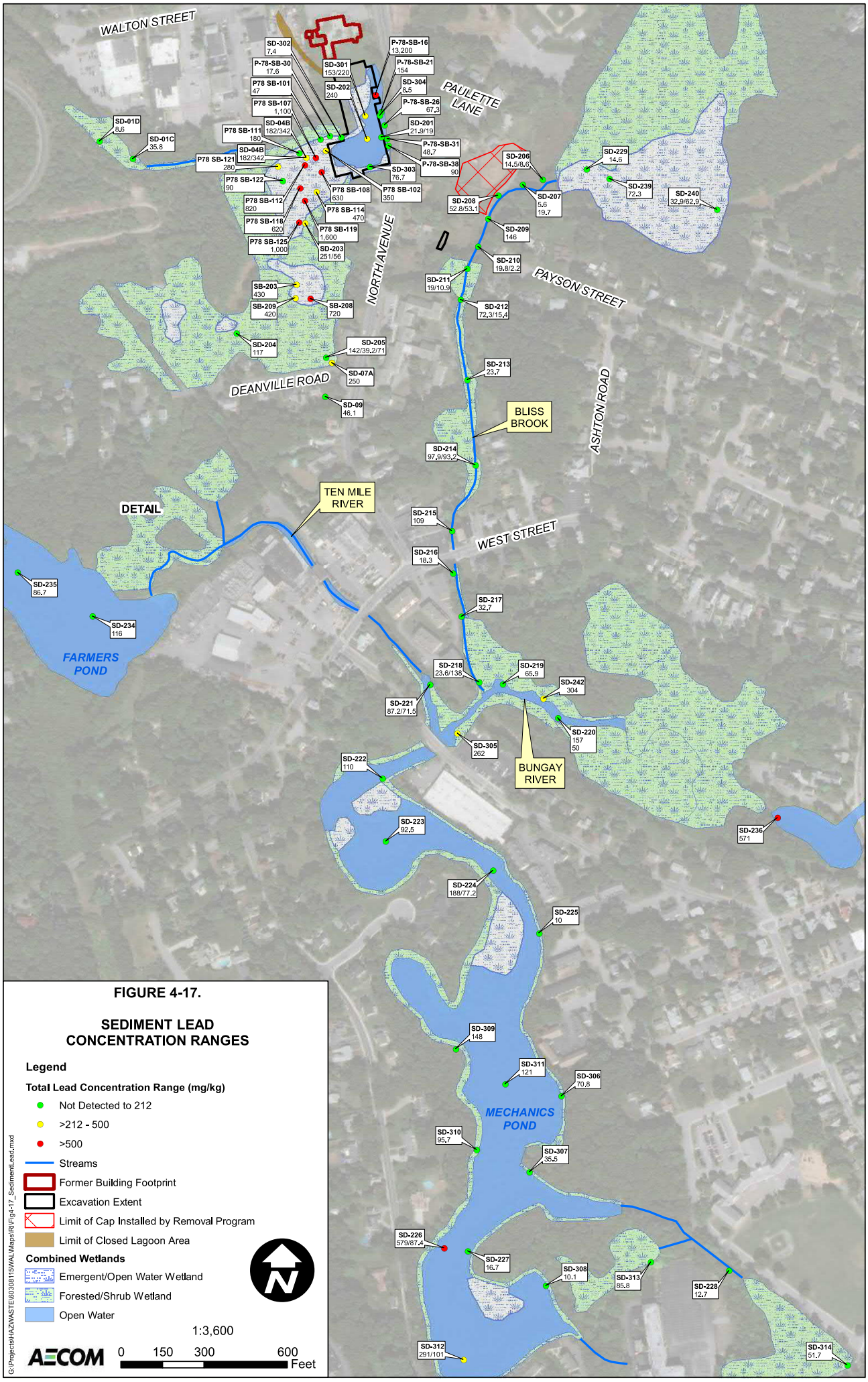


FIGURE 4-17.

SEDIMENT LEAD CONCENTRATION RANGES

Legend

Total Lead Concentration Range (mg/kg)

- Not Detected to 212
- >212 - 500
- >500
- Streams
- Former Building Footprint
- Excavation Extent
- Limit of Cap Installed by Removal Program
- Limit of Closed Lagoon Area

Combined Wetlands

- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water

1:3,600

AECOM 0 150 300 600 Feet

G:\Projects\HAZWASTE\60308115\WAL\Maps\RI\Fig4-17_SedimentLead.mxd

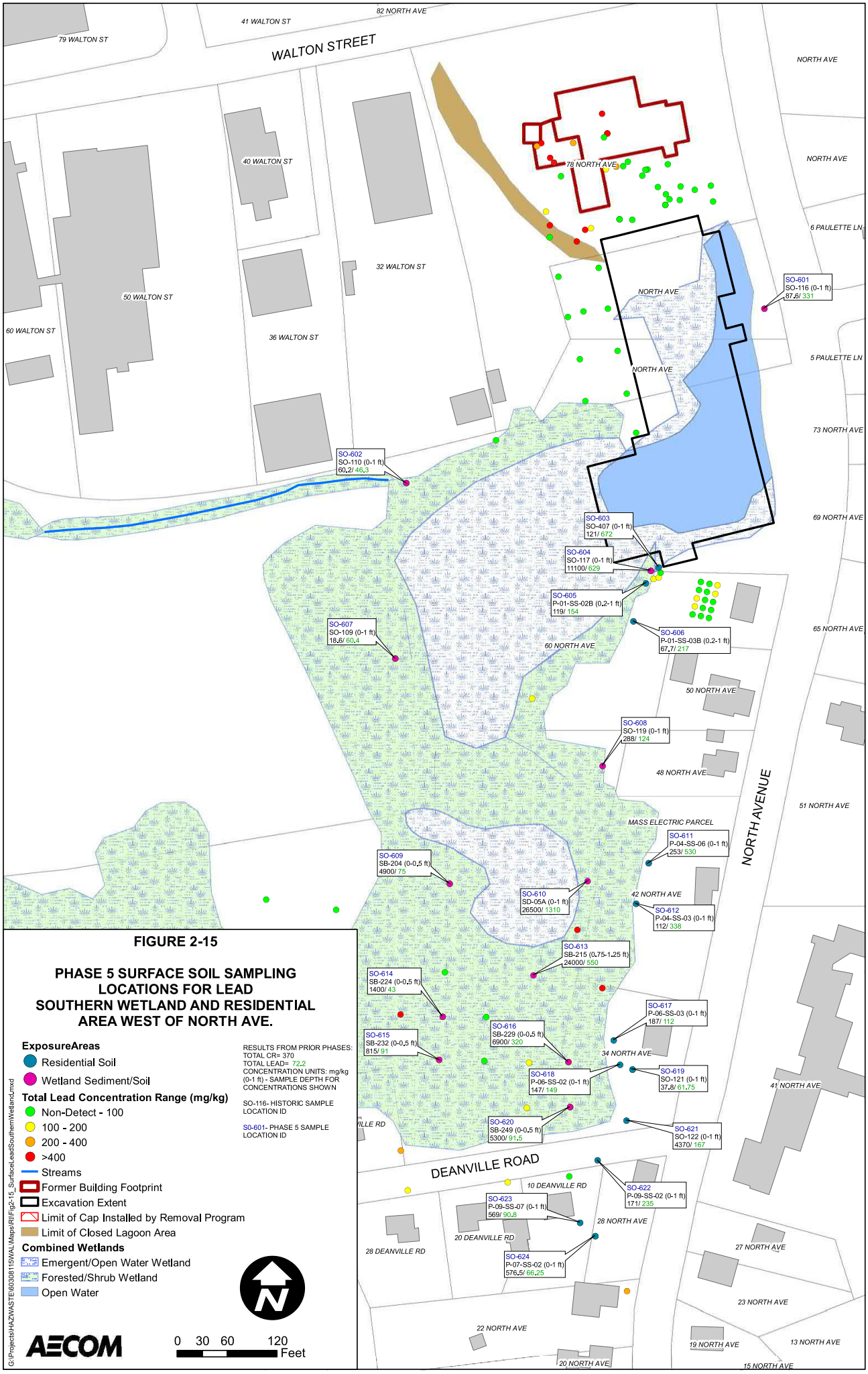


FIGURE 2-15

PHASE 5 SURFACE SOIL SAMPLING LOCATIONS FOR LEAD SOUTHERN WETLAND AND RESIDENTIAL AREA WEST OF NORTH AVE.

ExposureAreas
- Residential Soil
- Wetland Sediment/Soil

Total Lead Concentration Range (mg/kg)
- Non-Detect - 100
- 100 - 200
- 200 - 400
- >400
- Streams
- Former Building Footprint
- Excavation Extent
- Limit of Cap Installed by Removal Program
- Limit of Closed Lagoon Area

Combined Wetlands
- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water

RESULTS FROM PRIOR PHASES:
TOTAL CR= 370
TOTAL LEAD= 72.2
CONCENTRATION UNITS: mg/kg
(0-1 ft) - SAMPLE DEPTH FOR CONCENTRATIONS SHOWN

SO-116- HISTORIC SAMPLE LOCATION ID

S0-601- PHASE 5 SAMPLE LOCATION ID

AECOM

0 30 60 120 Feet

G:\Projects\HAZWASTE\60308115\WAL\Maps\R\Fig2-15_SurfaceLeadSouthernWetland.mxd

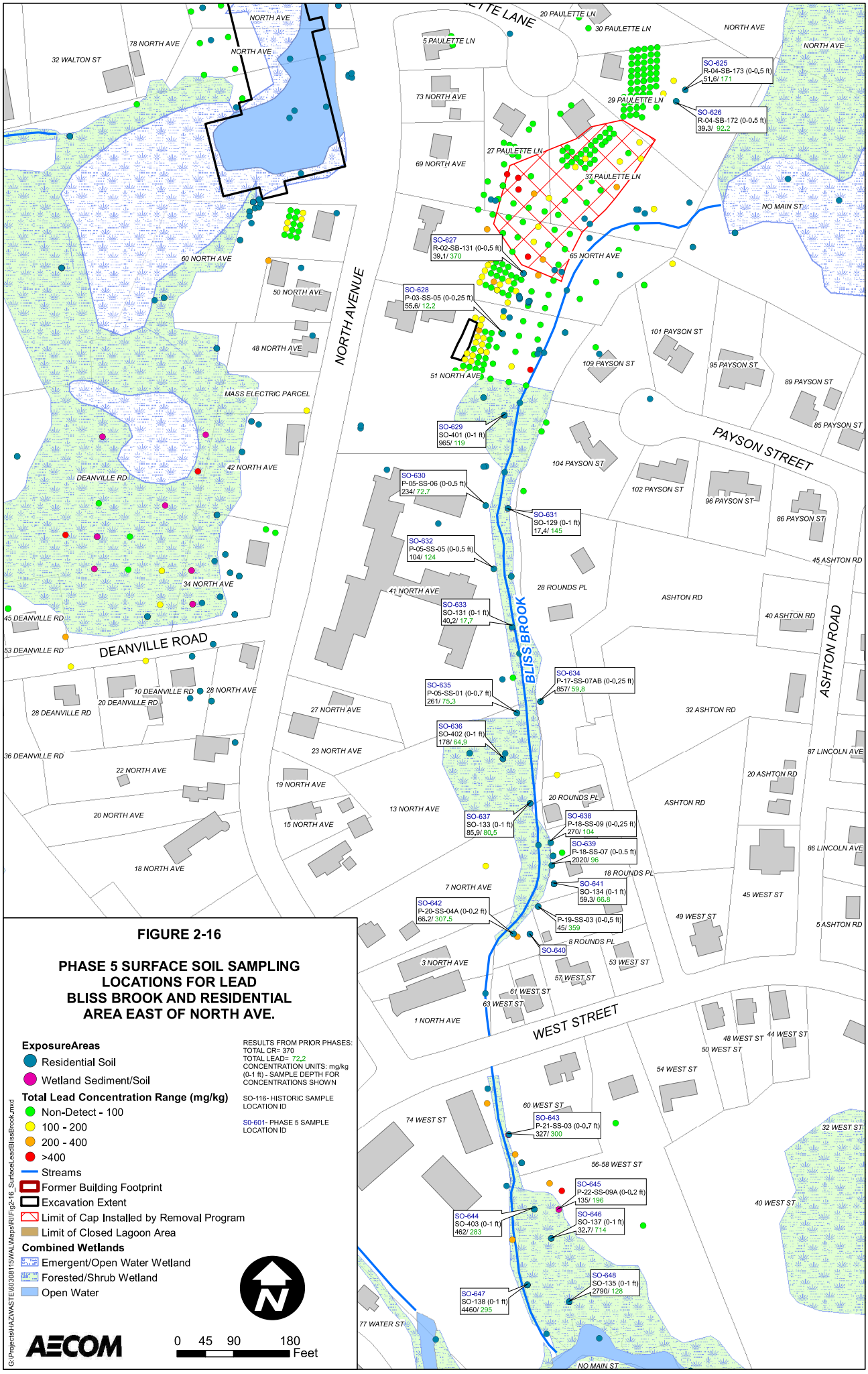


FIGURE 2-16

PHASE 5 SURFACE SOIL SAMPLING LOCATIONS FOR LEAD BLISS BROOK AND RESIDENTIAL AREA EAST OF NORTH AVE.

ExposureAreas
- Residential Soil
- Wetland Sediment/Soil

Total Lead Concentration Range (mg/kg)
- Non-Detect - 100
- 100 - 200
- 200 - 400
- >400
- Streams
- Former Building Footprint
- Excavation Extent
- Limit of Cap Installed by Removal Program
- Limit of Closed Lagoon Area

Combined Wetlands
- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water

RESULTS FROM PRIOR PHASES:
TOTAL CR= 370
TOTAL LEAD= 72.2
CONCENTRATION UNITS: mg/kg (0-1 ft) - SAMPLE DEPTH FOR CONCENTRATIONS SHOWN

SO-116- HISTORIC SAMPLE LOCATION ID

S0-601- PHASE 5 SAMPLE LOCATION ID

AECOM

0 45 90 180 Feet

G:\Projects\HAZWASTE\60308115\WAL\Maps\R\Fig2-16_SurfaceLeadBlissBrook.mxd

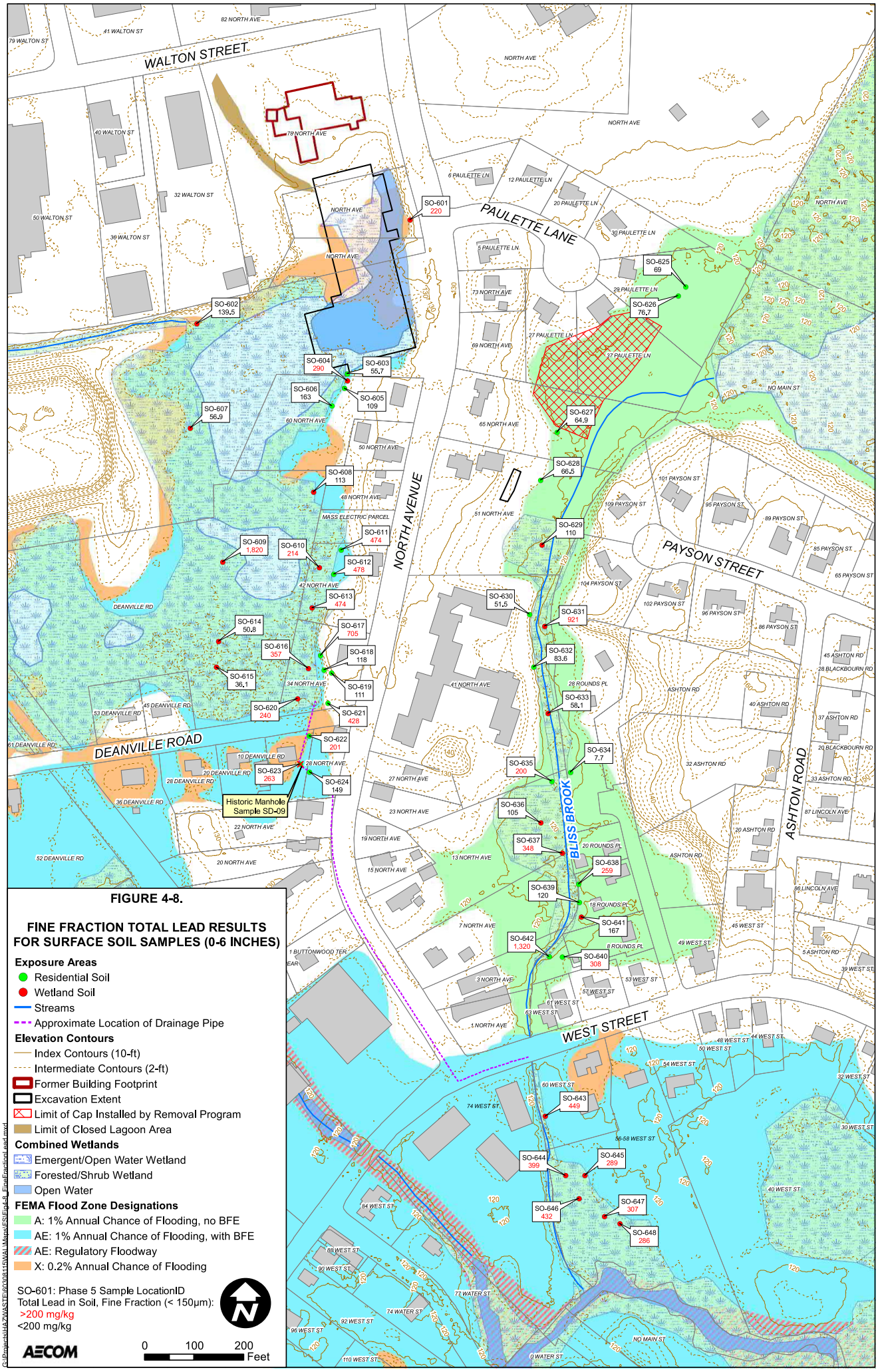


FIGURE 4-8.

FINE FRACTION TOTAL LEAD RESULTS FOR SURFACE SOIL SAMPLES (0-6 INCHES)

Exposure Areas
- Residential Soil
- Wetland Soil
- Streams
- Approximate Location of Drainage Pipe

Elevation Contours
- Index Contours (10-ft)
- Intermediate Contours (2-ft)
- Former Building Footprint
- Excavation Extent
- Limit of Cap Installed by Removal Program
- Limit of Closed Lagoon Area

Combined Wetlands
- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water

FEMA Flood Zone Designations
- A: 1% Annual Chance of Flooding, no BFE
- AE: 1% Annual Chance of Flooding, with BFE
- AE: Regulatory Floodway
- X: 0.2% Annual Chance of Flooding

SO-601: Phase 5 Sample LocationID
Total Lead in Soil, Fine Fraction (< 150µm):
>200 mg/kg
<200 mg/kg

AECOM

0 100 200 Feet

G:\Projects\HAZWASTE\60308145\GIS\Maps\ES\Fig4-8_FineFractionLead.mxd

Table 4-15

December 2017 Surface Soil Sampling for Lead Risk Evaluation:

Results for Total Lead, IVBA Lead, and Total Chromium

Location\AECOM ID	Total Lead, Whole Sample (Not Sieved), dry weight (mg/Kg)		Results for Fine Fraction (< 150 µm) Samples					Total Chromium, Whole Sample (Not Sieved), dry weight (mg/Kg)	
			Total Lead, dry weight (mg/Kg)		Extractable Lead, dry weight (mg/Kg)		IVBA Lead, %		
	Result	Qualifier	Result	Qualifier	Result	Qualifier		Result	Qualifier
Exposure Point: Residential Area West of North Avenue									
SO-605	57		109		73.2	J	67.2	16.9	J
SO-606	163		163		107	J	65.6	72.7	J
SO-612	225	J	478		364	J	76.2	42.1	J
SO-611	549	J	474		384	J	81	70.1	J
SO-618	74.9	J	118		84.9	J	71.9	207	J
SO-617	554	J	705		432	J	61.3	882	J
SO-624	73.5		149		103	J	69.1	182	J
SO-622 (FD)	86.6	J	199		135	J	67.8	39.7	
SO-622 (FD)	75.8		203		131	J	64.5	35.3	J
SO-623	141		263		156	J	59.3	37.8	J
SO-619	59.4	J	111		67	J	60.4	15.0	J
SO-621	160	J	428		286	J	66.8	57.0	J
SO-603	76.1		55.7		36.7	J	65.9	22.2	J
Average	185		271						
Exposure Point: Southern Wetland									
SO-609	23.8	J	1820		75.3	J	4.1	96.0	J
SO-613	323	J	474		277	J	58.4	10300	J
SO-614	51.8	J	50.8		71.6	J	NC	99.0	J
SO-616	369	J	357		220	J	61.6	14400	J
SO-615	43.3	J	36.1		26.2	J	72.6	98.8	J
SO-620	110	J	240		157	J	65.4	1150	J
SO-610	301	J	214		163	J	76.2	3790	J
SO-607	59.1	J	56.9		39.3	J	69.1	18.9	J
SO-602 (FD)	207		135		85.5	J	63.3	16000	J
SO-602 (FD)	138	J	144		93.4	J	64.9	35.0	J
SO-601	184		220		142	J	64.5	14400	J
SO-604	157		290		226	J	77.9	15.9	J
SO-608	142		113		81.5	J	72.1	329	J
Average*	174		199						
Exposure Point: Residential Area East of North Avenue									
SO-628	41.2		66.5		41.6		62.6	14.2	J
SO-635	127	J	200		147	J	73.5	531	J
SO-632	33.2		83.6		53.4	J	63.9	8.7	J
SO-630	16.9		51.5		29.4	J	57.1	8.9	J
SO-634	9.3	J	7.7		3.7	U	--	70.4	J
SO-639	115	J	120		51.6	J	43	87.8	
SO-638	133	J	259		167	J	64.5	150	
SO-640	243	J	308		211		68.5	142	
SO-642 (FD)	836	J	1330		1010		75.9	25.8	
SO-642 (FD)	700	J	1310		1000		76.3	29.2	
SO-627	40.5		64.9		38.8	J	59.8	16.5	J
SO-626	51.6		76.7		55.1	J	71.8	14.9	J
SO-625	54.5		69		46.8	J	67.8	16.5	J
Average	136		219						
Exposure Point: Bliss Brook									
SO-643	429	J	449		276		61.5	813	J
SO-645	226	J	289		203		70.2	83.7	
SO-631	389		921		548	J	59.5	19.6	J
SO-633	28.9		58.1		33.8	J	58.2	11.2	J
SO-637	177	J	348		229		65.8	27.6	J
SO-641	128	J	167		117		70.1	27.0	

Table 4-15

December 2017 Surface Soil Sampling for Lead Risk Evaluation:

Results for Total Lead, IVBA Lead, and Total Chromium

Location\AECOM ID	Total Lead, Whole Sample (Not Sieved), dry weight (mg/Kg)		Results for Fine Fraction (< 150 µm) Samples					Total Chromium, Whole Sample (Not Sieved), dry weight (mg/Kg)	
			Total Lead, dry weight (mg/Kg)		Extractable Lead, dry weight (mg/Kg)		IVBA Lead, %		
	Result	Qualifier	Result	Qualifier	Result	Qualifier		Result	Qualifier
SO-648	181	J	286		262		91.6	323	J
SO-646	694	J	432		356		82.4	1380	J
SO-647	485	J	307		277		90.2	601	J
SO-629	96.1		110		77.9		70.8	71.9	J
SO-636	119	J	105		73.2		69.7	1150	J
SO-644	389	J	399		303		75.9	738	
Average	279		323						

NC = Lab notation, assumed to mean that the extractable lead result > lead in soil result, therefore Not Calculated.

-- = Not determinable because extractable lead was not detected.

IVBA = In Vitro Bioaccessibility, calculated as Extractable Lead/Total Lead x 100 (expressed as a percentage)

mg/Kg = milligram per kilogram

FD = Field duplicate collected at this location.

Qualifier = qualifier applied by AECOM during data validation:

J = result is estimated due to limitations identified in the data validation memorandum

U = not detected; reported value is the reporting limit

*Average for Southern Wetland excludes SO-609. This location is evaluated separately in the HHRA.

Total lead (unsieved sample) concentration exceeds the RME concentration for soil samples from reference areas (101 mg/kg).

Total chromium (unsieved sample) concentration exceeds the RME concentration for soil samples from reference areas (16 mg/kg).

Figures from Revised Draft FS Report (AECOM, April 2019)

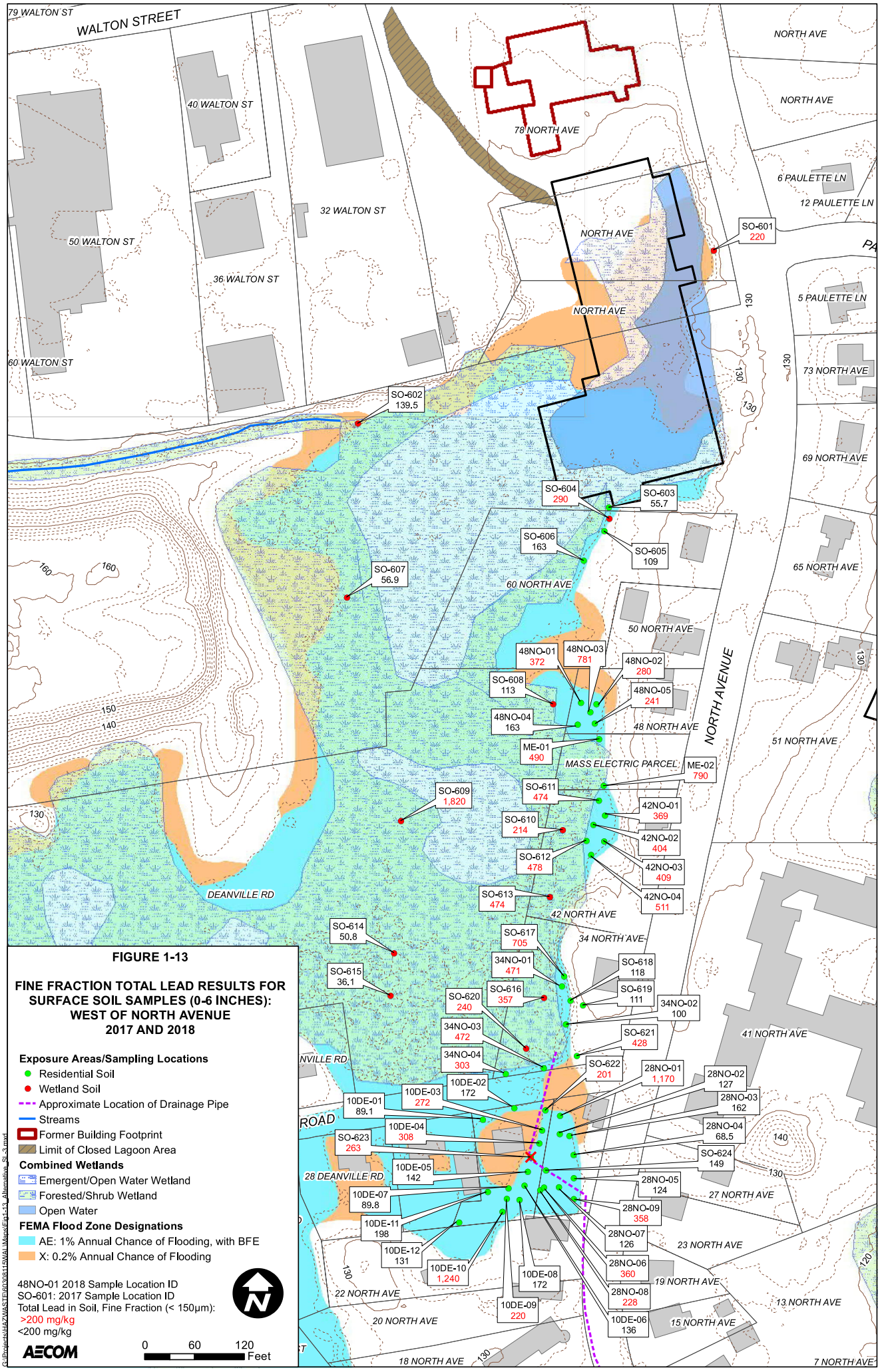


FIGURE 1-13

FINE FRACTION TOTAL LEAD RESULTS FOR SURFACE SOIL SAMPLES (0-6 INCHES): WEST OF NORTH AVENUE 2017 AND 2018

Exposure Areas/Sampling Locations
- Residential Soil
- Wetland Soil
- Approximate Location of Drainage Pipe
- Streams
- Former Building Footprint
- Limit of Closed Lagoon Area

Combined Wetlands
- Emergent/Open Water Wetland
- Forested/Shrub Wetland
- Open Water

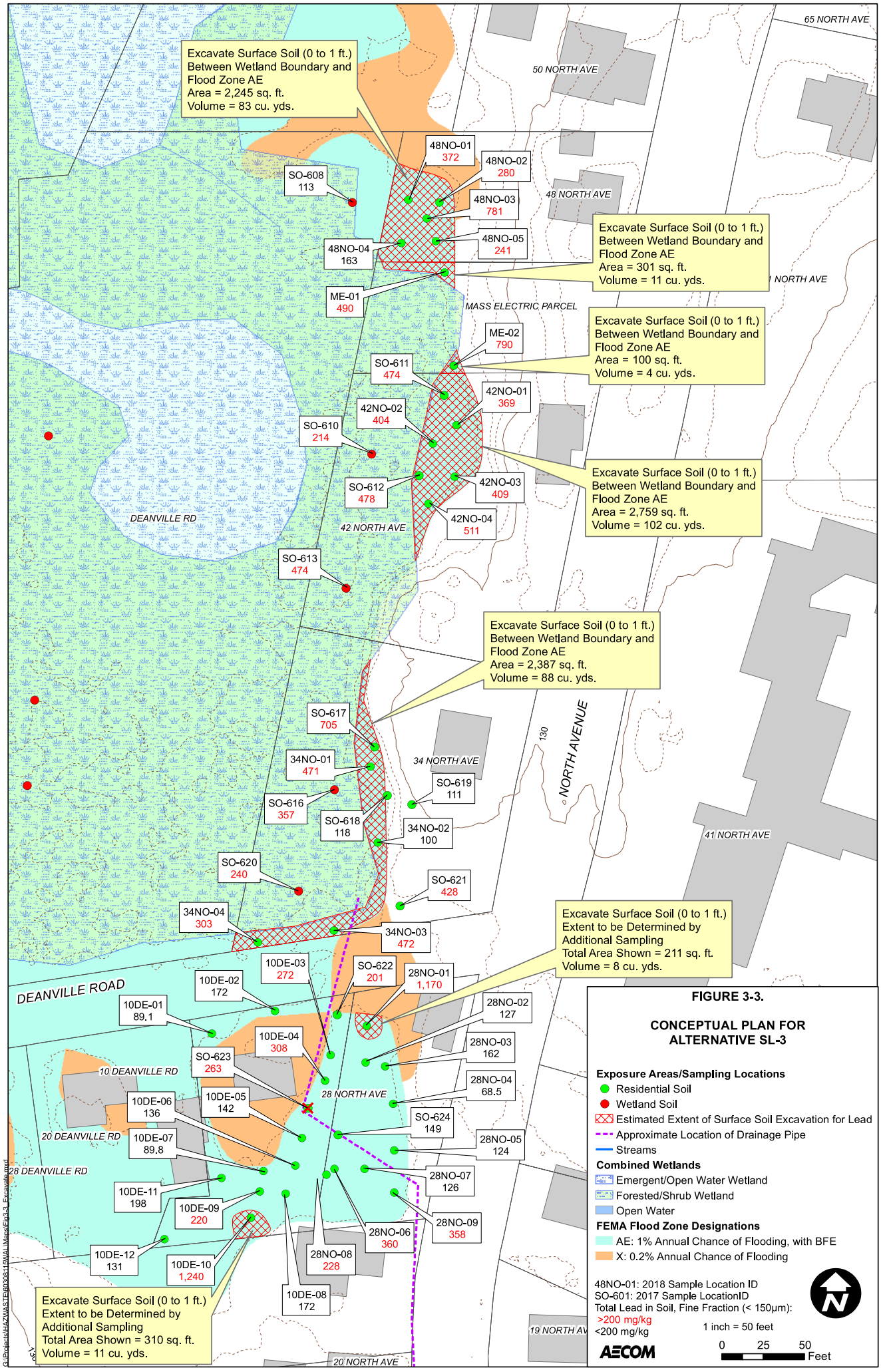
FEMA Flood Zone Designations
- AE: 1% Annual Chance of Flooding, with BFE
- X: 0.2% Annual Chance of Flooding

48NO-01 2018 Sample Location ID
SO-601: 2017 Sample Location ID
Total Lead in Soil, Fine Fraction (< 150µm):
>200 mg/kg
<200 mg/kg

AECOM

0 60 120 Feet

C:\Projects\HAZWASTE\60308145\WAI\Maps\Fig1-13_Alternative_SL_3.mxd


Excavate Surface Soil (0 to 1 ft.)
Between Wetland Boundary and
Flood Zone AE
Area = 2,245 sq. ft.
Volume = 83 cu. yds.
Excavate Surface Soil (0 to 1 ft.)
Between Wetland Boundary and
Flood Zone AE
Area = 301 sq. ft.
Volume = 11 cu. yds.
Excavate Surface Soil (0 to 1 ft.)
Between Wetland Boundary and
Flood Zone AE
Area = 100 sq. ft.
Volume = 4 cu. yds.
Excavate Surface Soil (0 to 1 ft.)
Between Wetland Boundary and
Flood Zone AE
Area = 2,759 sq. ft.
Volume = 102 cu. yds.
Excavate Surface Soil (0 to 1 ft.)
Between Wetland Boundary and
Flood Zone AE
Area = 2,387 sq. ft.
Volume = 88 cu. yds.
Excavate Surface Soil (0 to 1 ft.)
Extent to be Determined by
Additional Sampling
Total Area Shown = 211 sq. ft.
Volume = 8 cu. yds.
Excavate Surface Soil (0 to 1 ft.)
Extent to be Determined by
Additional Sampling
Total Area Shown = 310 sq. ft.
Volume = 11 cu. yds.
65 NORTH AVE
50 NORTH AVE
48 NORTH AVE
NORTH AVE
MASS ELECTRIC PARCEL
DEANVILLE RD
42 NORTH AVE
34 NORTH AVE
NORTH AVENUE
41 NORTH AVE
DEANVILLE ROAD
10 DEANVILLE RD
20 DEANVILLE RD
28 DEANVILLE RD
28 NORTH AVE
19 NORTH AV
20 NORTH AVE
48NO-01 372
48NO-02 280
48NO-03 781
48NO-04 163
48NO-05 241
SO-608 113
ME-01 490
ME-02 790
SO-611 474
42NO-01 369
42NO-02 404
SO-610 214
42NO-03 409
SO-612 478
42NO-04 511
SO-613 474
SO-617 705
34NO-01 471
SO-616 357
SO-618 118
SO-619 111
34NO-02 100
SO-620 240
SO-621 428
34NO-04 303
34NO-03 472
10DE-03 272
SO-622 201
28NO-01 1,170
10DE-02 172
10DE-01 89.1
28NO-02 127
10DE-04 308
28NO-03 162
SO-623 263
10DE-06 136
10DE-05 142
28NO-04 68.5
SO-624 149
10DE-07 89.8
28NO-05 124
28NO-07 126
10DE-11 198
10DE-09 220
28NO-09 358
28NO-06 360
10DE-12 131
28NO-08 228
10DE-10 1,240
10DE-08 172
FIGURE 3-3.
CONCEPTUAL PLAN FOR
ALTERNATIVE SL-3
Exposure Areas/Sampling Locations
Residential Soil
Wetland Soil
Estimated Extent of Surface Soil Excavation for Lead
Approximate Location of Drainage Pipe
Streams
Combined Wetlands
Emergent/Open Water Wetland
Forested/Shrub Wetland
Open Water
FEMA Flood Zone Designations
AE: 1% Annual Chance of Flooding, with BFE
X: 0.2% Annual Chance of Flooding
48NO-01: 2018 Sample Location ID
SO-601: 2017 Sample LocationID
Total Lead in Soil, Fine Fraction (< 150µm):
>200 mg/kg
<200 mg/kg
1 inch = 50 feet
0 25 50
Feet
AECOM
G:\Projects\HAZWASTE\60308145\GIS\MapFile\Fig3-3_Excavate.mxd

APPENDIX H – INSTITUTIONAL CONTROLS FOR INDIVIDUAL PROPERTIES: SUMMARY BY ALTERNATIVE

Appendix H Institutional Controls for Individual Properties: Summary by Alternative

Property ID (Map-Lot)	Street Address	Current Land Use	Soil Alternatives	GW/SW Alternatives				BR Alternatives		
			S-2	GW/SW-2A	GW/SW-2B	GW/SW-3A	GW/SW-3B	BR-3	BR-4	BR-5
89-2D	78 North Ave. (Walton & Lonsbury Property)	commercial; vacant	prevent residential use	ZVI Barrier Wall; VI assessment needed prior to future building construction; prevent construction worker exposure to shallow groundwater	ZVI Barrier Wall; VI assessment needed prior to future building construction; prevent construction worker exposure to shallow groundwater	ZVI Barrier Wall; VI assessment needed prior to future building construction; prevent construction worker exposure to shallow groundwater	ZVI Barrier Wall; VI assessment needed prior to future building construction; prevent construction worker exposure to shallow groundwater			
89-3	North Ave.	commercial; vacant	prevent residential use	VI evaluation needed prior to future building construction; prevent construction worker exposure to shallow groundwater	Mid-plume in-situ treatment; VI evaluation needed prior to future building construction; prevent construction worker exposure to shallow groundwater	VI evaluation needed prior to future building construction; prevent construction worker exposure to shallow groundwater	Mid-plume in-situ treatment; VI evaluation needed prior to future building construction; prevent construction worker exposure to shallow groundwater	Mid-plume in-situ treatment		
89-1	North Ave.	commercial: vacant	prevent residential use	VI evaluation needed prior to future building construction; prevent construction worker exposure to shallow groundwater	Mid-plume in-situ treatment; VI evaluation needed prior to future building construction; prevent construction worker exposure to shallow groundwater	VI evaluation needed prior to future building construction; prevent construction worker exposure to shallow groundwater	Mid-plume in-situ treatment; VI evaluation needed prior to future building construction; prevent construction worker exposure to shallow groundwater	Mid-plume in-situ treatment		
59-244	65 North Ave. (House K)	residential		Existing PRB Trench, GW collection pipe, and soil cover; new treatment system infrastructure	Existing PRB Trench, GW collection pipe, and soil cover; new treatment system infrastructure	Existing PRB Trench, GW collection pipe, and soil cover; new treatment system infrastructure	Existing PRB Trench, GW collection pipe, and soil cover; new treatment system infrastructure		New treatment system infrastructure	New treatment system infrastructure
49-111	51 North Ave. (House N)	residential		Existing PRB Trench, new treatment system infrastructure.	Existing PRB Trench, new treatment system infrastructure.	Existing PRB Trench, new treatment system infrastructure.	Existing PRB Trench, new treatment system infrastructure.		New treatment system infrastructure	New treatment system infrastructure
49-109	41 North Ave. (House P)	residential		New treatment system infrastructure	New treatment system infrastructure	New treatment system infrastructure	New treatment system infrastructure			
59-242	27 Paulette Ln. (House G)	residential		Existing soil cover	Existing soil cover	Existing soil cover	Existing soil cover			
59-241	37 Paulette Ln. (House F)	residential		Existing PRB Trench, GW collection pipe, and soil cover; new treatment system infrastructure	Existing PRB Trench, GW collection pipe, and soil cover; new treatment system infrastructure	Existing PRB Trench, GW collection pipe, soil cover	Existing PRB Trench, GW collection pipe, soil cover		New treatment system infrastructure	New treatment system infrastructure
59-240	29 Paulette Ln. (House E)	residential		Existing GW collection pipe	Existing GW collection pipe	Existing GW collection pipe	Existing GW collection pipe			
No Lot #	North Ave (land taken for I-295)	State-owned; vacant			Mid-plume in-situ treatment		Mid-plume in-situ treatment	Mid-plume in-situ treatment		
Total # Properties			3	9	10	9	10	3	3	3

Notes:

1. It is assumed that restrictions on groundwater use will be implemented by a local ordinance rather than a property-by-property institutional control, and therefore IC for this purpose are not included on this table.

This list is limited to restrictions to protect remedy infrastructure (existing or new), require VI evaluations for new buildings, and limit land uses to industrial/commercial where applicable (Alternative S-2).