From: Shephard, Eugene S. <eugene.shephard@woodplc.com>
Sent: Thursday, June 9, 2022 12:24 PM
To: Devlin, Cynde <devlincl@dhec.sc.gov>
Cc: John.Young (Robert Bosch LLC) <John.Young@us.bosch.com>; Wojdyla Steve (PT/FCM1-NA PT/PRS-Mtp) <Steve.Wojdyla@us.bosch.com>; Knox, Sheri <sheri.knox@woodplc.com>
Subject: RE: RBTC Fountain Inn - Proposed Plan Comparison Table

Cynde –

The table has been revised to reflect the SCDHEC comments below (some wording tweaked to be consistent with the changes) and is attached (revision date of 06/09/2022 added to the table header). The table was inserted into the FS and the revised FS is attached as requested.

Please let us know if you need any additional information/support.

Thanks!
Shep

Eugene Shephard, PE, LEP
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wood.

wood.

June 26, 2020

Ms. Cynde Devlin
Project Manager
State Voluntary Cleanup Section
Bureau of Land and Waste Management
S.C. Dept of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201

Subject: **Revised Feasibility Study**
Former Vermont Bosch Site
Fountain Inn, SC
SCDHEC Site ID #52309
Wood Project 6251-16-1022.04.02

Dear Ms. Devlin:

Wood Environment and Infrastructure Solutions, Inc. (Wood), on behalf of Robert Bosch Tool Corporation (RBTC), is submitting the attached revised Feasibility Study (FS) for the Former Vermont Bosch Site located in Fountain Inn, SC, SCDHEC Site ID # 52309. The FS was revised to address comments from SCDHEC dated May 8, 2020.

The FS revision, at the request of SCDHEC, included removal of the discussion of RBTC's preferred alternative. RBTC would like to note in this cover letter that based on the evaluation of remedial alternatives in the FS, RBTC preferred alternative is: Alternative 3 in-situ chemical oxidation (ISCO) treatment of source area soil and the groundwater interface, in-situ chemical reduction (ISCR) for source area groundwater, and ISCR for downgradient groundwater.

Should you have any questions, please contact Eugene Shephard at (207) 272-8055.

Sincerely,

Wood Environment & Infrastructure Solutions, Inc.

Eugene S. Shephard
Associate Project Manager

Sheri L. Knox, P.E.
Associate Environmental Engineer
Registered, PE License #29633

Attachment (Revised FS)

cc: Mr. John Young – Robert Bosch LLC (via email)
Mr. Steve Wojdyla – RBTC (via email)

52309
Email Scanned

FEASIBILITY STUDY

FORMER VERMONT BOSCH SITE
FOUNTAIN INN, SOUTH CAROLINA
SCDHEC SITE ID #52309

Prepared For:

Robert Bosch Tool Corporation
1800 West Central Road
Mount Prospect, Illinois 60059

Prepared By:

Wood
Environment & Infrastructure Solutions, Inc.
30 Patewood Drive, Suite 200
Greenville, South Carolina 29615

Wood Project 6251161022.02.04

June 26, 2020

FEASIBILITY STUDY

FORMER VERMONT BOSCH SITE
FOUNTAIN INN, SOUTH CAROLINA
SCDHEC SITE ID #52309

Prepared For:

ROBERT BOSCH TOOL CORPORATION
1800 West Central Road
Mount Prospect, Illinois 60056

Prepared by:

Wood Environment & Infrastructure, Inc.
30 Patewood Drive, Suite 200
Greenville, South Carolina 29615

Wood Project 6251161022.04.02

June 26, 2020

SOUTH CAROLINA
LICENSED PROFESSIONAL ENGINEER
6/24/2020
No. 29633
SHERI LANE KNOX

Eugene Shephard, P.E., LEP
Associate Project Manager

Sheri Knox, P.E.
Associate Environmental Engineer
Registered, SC #29633

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LIST OF ACRONYMS AND ABBREVIATIONS

Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, Inc.
AMEC	AMEC Environment & Infrastructure, Inc.
AOC	Area of Concern
ARAR(s)	Applicable or Relevant and Appropriate Requirements
AS	air sparging
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cis-1,2-DCE	cis-1,2-dichloroethene
COC	chemical of concern
COPC	chemical of potential concern
DO	dissolved oxygen
DPT	direct-push technology
FS	Feasibility Study
ft^2	square feet
HAZWOPER	Hazard Waste Operations and Emergency Response
HHRA	human health risk assessment
HI	hazard index
ISCO	in-Situ chemical oxidation
ISCR	in-situ chemical reduction
MACTEC	MACTEC Engineering and Consulting, Inc.
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
NCP	National Contingency Plan
ND	non-detect
O&M	operation and maintenance
OSWER	Office of Solid Waste and Emergency Response
PAH	polynuclear aromatic hydrocarbon
PCE	tetrachloroethene (perchloroethylene)
PPE	personal protective equipment
RAOs	remedial action objectives
RBTC	Robert Bosch Tool Corporation
RCRA	Resource Conservation and Recovery Act

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

RI	Remedial Investigation
RI/FS WP	Remedial Investigation/Feasibility Study Work Plan
RL	reporting limit
RSL	Regional Screening Level
SCDHEC	South Carolina Department of Health and Environmental Control
SSL	Soil Screening Level
SVE	soil vapor extraction
SVOCs	semi-volatile organic compounds
TAL	Target Analyte List
TBC	To Be Considered
TCE	trichloroethene
TCL	Target Compound List
TPH DRO	total petroleum hydrocarbons, diesel range organics
UIC	Underground Injection Control
USEPA	United States Environmental Protection Agency
VAC	Vermont American Corporation
VCC	Voluntary Cleanup Contract
VISL	Vapor Intrusion Screening Level
VOCs	volatile organic compounds
Wirthwein	Wirthwein Real Estate, LLC
Wood	Wood Environment & Infrastructure Solutions, Inc.
WQC	Water Quality Criteria
ZOI	zone of influence
ZVI	zero valent iron

EXECUTIVE SUMMARY

This document presents the Feasibility Study (FS) for the Former Vermont Bosch Site (the "Site") located in Fountain Inn, Greenville County, South Carolina and describes the work conducted by Wood Environment & Infrastructure Solutions, Inc. (Wood), successor to Amec Foster Wheeler Environment & Infrastructure, Inc., AMEC Environment & Infrastructure, Inc. and MACTEC Engineering and Consulting, Inc., on behalf of Robert Bosch Tool Corporation (RTBC) under Voluntary Cleanup Contract #05-5613-RP. RBTC, a division of Robert Bosch, LLC, is the successor to Vermont American Corporation (VAC), who manufactured screwdrivers and spade bits at the Site. A Remedial Investigation (RI) Report including a Human Health Risk Assessment (HHRA) was submitted to the South Carolina Department of Health and Environmental Control (SCDHEC) on March 18, 2016. SCDHEC reviewed the RI report, and in a letter dated April 20, 2016, they requested additional characterization of the "intermediate groundwater zone", which is located between shallow groundwater and the top of bedrock.

A Report of Groundwater Field Screening was submitted to SCDHEC on November 11, 2016, and it provided the requested data. The Report of Groundwater Field Screening included a recommendation for the installation of seven monitoring wells to monitor the intermediate and deep portions of the aquifer downgradient from Area of Concern (AOC) #9. SCDHEC provided approval of the Report of Groundwater Field Screening including the recommendation to install the additional monitoring wells in a letter dated January 11, 2017. The additional monitoring wells were installed and sampled in February 2017. These activities and the associated results were presented in the RI Report Addendum that was submitted to SCDHEC on July 25, 2017. The RI Report Addendum recommended that SCDHEC provide final approval of the RI and request the preparation of an FS.

Due to a concern with elevated chloroform concentrations reported in two of the wells sampled in February 2017, SCDHEC requested in a letter dated September 21, 2017 that the two wells be evaluated to determine if representative groundwater samples could be collected from the wells. The two wells were resampled in November 2017 and the results were documented in a Groundwater Sampling Report dated December 8, 2017. SCDHEC approved the report in a letter dated June 11, 2018 and additionally approved the RI. However, prior to proceeding with the FS, SCDHEC requested that a Site-wide groundwater sampling event be conducted.

The Site-wide groundwater sampling event was conducted in October 2018 and the results were documented in a Report of Site-Wide Groundwater Sampling dated November 15, 2018. SCDHEC approved the report in a letter dated December 27, 2018 and agreed with the recommendation to move forward with the FS.

This FS has been developed in accordance with the approved Remedial Investigation/Feasibility Study Work Plan and the United States Environmental Protection Agency (USEPA) Guidance for Conducting Remedial Investigations and Feasibility Studies Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The FS develops and examines potential remedial alternatives to mitigate unacceptable risks identified by the RI.

Site Background and History

The Site is located at 800 Woodside Avenue in Fountain Inn, Greenville County, South Carolina. Access to the Site is from either South Carolina Highway 418 (McCarter Road) or Woodside Avenue. The Site is presently developed with an approximate 125,000-square foot manufacturing facility located in the approximate center of the property.

The Site was developed with the manufacturing plant in 1984 and operations commenced in 1985 as Rosco Tools, a division of VAC, which subsequently became RBTC. Three primary manufacturing processes were performed at the Site: manufacture of screwdriver handles and other specialty items; screwdriver head manufacturing; and spade bit manufacturing. The process areas were discussed at length previously in the RI/FS Work Plan. Manufacturing operations ceased in 2003 and the facility was vacant until it was sold in 2005. The Site is presently owned by Wirthwein Real Estate, LLC. South Carolina Plastics, LLC, a subsidiary of Wirthwein, currently manufactures parts for the automotive industry.

Areas of Concern

Nine AOCs have been identified at the Site: AOC #1 (Tank Containment and Underground Piping Area); AOC #2 (Heat Treat Water Cleaning Disposal Area); AOC #3 (Former Metals Baghouse); AOC #4 (Former Scrap Metal Rolloff); AOC #5 (Former Empty Drum Storage Pad); AOC #6 (Compounding Room Blower Exhaust); AOC #7 (Storm Water Outfalls); AOC #8 (Former Oil/Water Separator); and AOC #9 (Former Hazardous Waste Accumulation Building).

Nature and Extent of Site-Related Constituents

<u>Soil</u>: No chemicals of potential concern (COPCs) in surface or subsurface soil samples collected during the RI exceeded the USEPA Residential Regional Screening Levels. However, concentrations of tetrachloroethene (perchloroethylene, or PCE) in AOC #9 soil exceeded USEPA Soil Screening Levels for protection of groundwater, and PCE is the primary COPC in groundwater. Therefore, consideration is given to the remediation of source area soil to accelerate attainment of groundwater remediation goals. The HHRA identified unacceptable risk for human health based on exposure to arsenic, benzo(a)pyrene, and chromium in soil. Arsenic was not used in the historical industrial processes and concentrations are similar to background; therefore, arsenic is not considered to be Site related. Chromium risks were based on a conservative assumption that all non-speciated chromium detections were hexavalent; however, samples from AOC #3 that were tested for hexavalent chromium showed no detectable concentrations. Detections of

benzo(a)pyrene were in a drainage area adjacent to and receiving drainage from Woodside Avenue. This compound is a component of both asphalt and vehicle lubricants and is not considered related to Site activity. Therefore, remediation goals have not been identified for arsenic, chromium, or benzo(a)pyrene in soil.

Surface Water: Surface water samples collected from an unnamed tributary to Stoddard Creek indicate concentrations of PCE above the SCDHEC Ambient Water Quality Criteria (WQC); however, the HHRA did not identify an unacceptable risk for human health posed by exposure to surface water at the Site.

Sediment: The HHRA did not identify an unacceptable risk for human health posed by exposure to sediment at the Site.

Groundwater: Concentrations of PCE exceeded the SCDHEC Maximum Contaminant Level (MCL) in groundwater samples collected from AOC #9. No other AOCs had monitoring wells with constituents at or above SCDHEC MCLs. Additional groundwater field screening conducted in August 2016 and February 2017 provided additional data regarding the width and thickness of the AOC #9 groundwater PCE contamination, but it did not change the initial findings for AOC#9 groundwater. The results of the HHRA indicated that based on residential exposure, COPCs retained as chemicals of concern (COCs) include PCE in on- and off-Site groundwater.

Objectives of Remediation

Remedial action objectives (RAOs) for the FS were selected to comply with applicable regulations and to be protective of human health and the environment. The following are Site RAOs:

- Prevent the migration (i.e., leaching) of soil COCs from impacted soil to groundwater;
- Prevent exposure of human receptors to groundwater containing COCs at concentrations that exceed MCLs;
- Prevent exposure of human receptors to indoor air containing contaminants that exceed appropriate screening levels for indoor air;
- Restore groundwater to beneficial use within reasonable timeframe;
- Monitor soil and groundwater in a manner that will verify the effectiveness of the remedial actions; and
- Mitigate further migration of the contaminant plume and groundwater discharge to surface water above the Ambient WQC.

Screening of Remedial Technologies and Development of Alternatives

Potential technologies were initially screened for applicability, and then effectiveness, implementability, and cost. A total of 38 soil technologies and 37 groundwater technologies were initially evaluated. Based on the initial screening, 22 soil technologies 25 groundwater technologies underwent a secondary screening. Select soil and groundwater remediation technologies were subsequently assembled into four remedial alternatives:

- No Action;
- Soil vapor extraction of source area soil, air sparging of the groundwater interface, and in-situ chemical reduction (ISCR) for groundwater;
- In-situ chemical oxidation (ISCO) treatment of source area soil and the groundwater interface combined with ISCR for groundwater; and
- Excavation of source area soil, ISCO treatment of the groundwater interface, and ISCR for groundwater.

Analysis and Comparison of Alternatives

Each of the remedial alternatives was subjected to a detailed analysis relative to the nine criteria defined in the National Oil and Hazardous Substances Pollution Contingency Plan and the Guidance for Conducting RIs and FSs under CERCLA. These include overall protection of human health and environment, compliance with appropriate and applicable requirements; short-term effectiveness; long-term effectiveness and permanence; reduction of toxicity, mobility or volume; implementability, cost; state acceptance; and community acceptance. At the conclusion of the remedial alternatives evaluation, the four alternatives were compared with each other relative to the nine aforementioned criteria.

1.0 INTRODUCTION

This document presents the Feasibility Study (FS) for the Former Vermont Bosch Site (Site) located in Fountain Inn, Greenville County, South Carolina. This FS was prepared by Wood Environment and Infrastructure Solutions, Inc. (Wood), successor to Amec Foster Wheeler Environment and Infrastructure, Inc. (Amec Foster Wheeler), AMEC Environment & Infrastructure, Inc. (AMEC) and MACTEC Engineering and Consulting, Inc., on behalf of Robert Bosch Tool Corporation (RBTC) under Voluntary Cleanup Contract (VCC) #05-5613-RP. RBTC, a division of Robert Bosch, LLC, is the successor to Vermont American Corporation (VAC), who manufactured screwdrivers and spade bits at the Site.

1.1 PURPOSE OF REPORT

As described in the Remedial Investigation/Feasibility Study Work Plan (RI/FS WP; AMEC, 2012), this FS investigates a range of remedial options for materials posing unacceptable risks at the Site in a manner consistent with the VCC, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), and the United States Environmental Protection Agency (USEPA) "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (USEPA, 1988).

Remedial action alternatives were developed by assembling combinations of technologies and the media to which they are applied into overall alternatives that address contamination and exposure pathways identified by the Remedial Investigation (RI) as documented in the Remedial Investigation Report submitted to the South Carolina Department of Health and Environmental Control (SCDHEC) on March 18, 2016 (Amec Foster Wheeler, 2016). The RI Report included a Human Health Risk Assessment (HHRA) that evaluated the risks to receptors from chemicals of potential concern (COPCs) identified at the Site. Additional RI activities were conducted in 2016 and 2017 that led to the approval of the RI by SCDHEC in a letter dated June 11, 2018. Prior to proceeding with the FS, SCDHEC requested that a Site-wide groundwater sampling event be conducted. The Site-wide groundwater sampling event was conducted in October 2018 and the results were submitted to SCDHEC on November 15, 2018. In a letter dated December 17, 2018, the SCDHEC accepted the report of Site-wide groundwater sampling and concurred with Wood's recommendation to proceed with the FS.

1.2 REPORT ORGANIZATION

The FS contains the following sections:

Section 1	Introduction - Purpose and report organization.
Section 2	Background - Site description, Site history, results and conclusions of the RI, and summary of the HHRA.
Section 3	Objectives and Goals of Remedial Action - Examines applicable or relevant, and appropriate requirements (ARARs) and develops remedial action objectives (RAOs).
Section 4	Identification and Screening of Technologies - Includes general response actions and identification of potentially effective technologies for remediation of contaminants and impacted media. Potential technologies are screened with regard to effectiveness, implementability, and cost.
Section 5	Development and Screening of Alternatives - Combines surviving remedial action technologies into remedial alternatives and performs screening.
Section 6	Detailed Analysis of Alternatives - Provides an analysis of each option against a set of nine evaluation criteria.
Section 7	Summary of Alternatives – Provides a comparative review of all options using the same nine evaluation criteria as a basis for comparison.
Section 8	Qualifications of FS.
Section 9	References.

2.0 BACKGROUND

2.1 SITE DESCRIPTION AND AREAS OF CONCERN

The Site is located at 800 Woodside Avenue in Fountain Inn, Greenville County, South Carolina. A Site location map is included as **Figure 2.1**. The Site is located northwest of the intersection formed by South Carolina Highway 418 (McCarter Road) and Woodside Avenue. Access to the Site is from either McCarter Road or Woodside Avenue. The Site is currently developed with an approximate 125,000-square foot (ft^2) manufacturing facility where screwdrivers and spade bits were formerly manufactured.

The facility is in the approximate center of the property. Parking areas are located southeast of the facility with a grassy field between the parking area and McCarter Road. Northeast of the facility are landscaped areas, mowed grassy fields, and Woodside Avenue. Northwest of the facility are a mowed grassy field and woodlands. Southwest of the facility are the remnants of a former tank containment area, access road, and the former location of a hazardous waste accumulation building with mowed grassy areas in between.

The Site Areas of Concern (AOCs) are identified as follows, and are shown on **Figure 2.2**:

AOC #1	Tank Containment and Underground Piping Area
AOC #2	Heat Treat Water Cleaning Disposal Area
AOC #3	Former Metals Baghouse
AOC #4	Former Scrap Metal Rolloff
AOC #5	Former Empty Drum Storage Pad
AOC #6	Compounding Room Blower Exhaust
AOC #7	Storm Water Outfalls
AOC #8	Former Oil/Water Separator
AOC #9	Former Hazardous Waste Accumulation Building

Each of the AOCs are associated with manufacturing processes at the facility and were previously described in the RI/FS WP (AMEC, 2012). AOCs #2, #3, #4, #6, #7, #8 and #9 were found to have data gaps requiring further investigation to determine the potential risk associated with the specific AOC and human health and the environment. Those investigations and results are discussed in this report.

2.2 SITE HISTORY

The Site was developed with the manufacturing facility in 1984 and operations commenced in 1985 as Rosco Tools, a division of VAC, which subsequently became RBTC. Screwdrivers were manufactured initially, and spade bit manufacturing was added in 1992. Nickel plating and an associated wastewater pretreatment operation were present in the facility from 1985 to the early 1990s. A self-contained vapor degreaser was used at the facility from 1985 to the early 1990s. Manufacturing operations ceased in November 2003 and the facility was vacant until it was sold in September 2005 to Fountain Inn Investments, LLC (assignee of Liberty Property Development Corporation). Ownership of the property changed hands twice since 2005, and the Site is presently owned by Wirthwein Real Estate, LLC (Wirthwein). South Carolina Plastics, LLC, a subsidiary of Wirthwein, currently manufactures parts for the automotive industry at the Site.

Three primary manufacturing processes were performed at the Site during RBTC's ownership: manufacture of screwdriver handles and other specialty items; screwdriver head manufacturing; and spade bit manufacturing. These processes were previously described in detail in Section 1.2 of the RI/FS WP (AMEC, 2012).

2.3 NATURE AND EXTENT OF SITE-RELATED CONSTITUENTS

The RI identified five chemical constituents and four types of impacted environmental media after evaluation of sampling data and known Site activities.

2.3.1 Soil

Soil sampling has been conducted over multiple investigations dating back to 1996. The results of these previous investigations were presented in the RI/FS WP (AMEC, 2012). Soil sampling conducted during the RI included surface and subsurface sampling to fill data gaps identified from the previous investigations. **Figure 2.3** shows the locations of surface soil samples collected, and

Figure 2.4 shows the locations soil borings where subsurface soil samples were collected. **Table 2.1** presents the results of RI surface soil sampling, and **Table 2.2** presents the results of RI subsurface soil sampling.

2.3.1.1 AOC #1

AOC #1 includes tank containment areas on the east and southeast sides of the building. In 1996, an acetone release was reported, and soil samples were collected from what is now AOC #1. Acetone concentrations were below the November 2015 USEPA residential Regional Screening Levels (RSLs) in the USEPA *Regional Screening Levels for Chemical Contaminants at Superfund Sites* (USEPA, 2015); however, five of 12 samples collected exceeded the USEPA Protection of Groundwater Soil Screening Levels (SSLs). These results were reported in Section 3 of the RI/FS WP (AMEC, 2012). SCDHEC issued a no-further-action letter related to the acetone release on June 24, 1997. No further investigation is planned for this AOC.

2.3.1.2 AOC #2

AOC #2 is located west of the building where wash water from heat treating equipment was discharged onto the ground. Soil was determined to be contaminated with nitrates and nitrites. The affected soil was excavated during 2003 and disposed of off-Site. Nitrate concentrations from the grab soil samples collected from the bottom of the excavation ranged from non-detect (ND) to 280 milligrams per kilogram (mg/kg). Nitrite concentrations from the grab soil samples ranged from ND to 66 mg/kg. These results were reported in Section 3 of the RI/FS WP. SCDHEC issued a letter on March 22, 2002 stating that Site data indicate no violation of the Pollution Control Act and requiring no further investigation at that time. No further investigation is planned for this AOC.

2.3.1.3 AOC #3

AOC #3 is located west of the building beneath a metals treatment dust-collection baghouse. Three surface soil samples were collected and analyzed for the eight Resource Conservation and

Recovery Act (RCRA) metals. Only arsenic was detected at concentrations (2.1 mg/kg) above its USEPA residential RSL and SSL; however, this concentration was well below the upper end of the South Carolina background range of ND to 210 mg/kg (Canova, 1999). These results were reported in Section 3 of the RI/FS WP. No further investigation is planned for this AOC.

2.3.1.4 AOC #4

AOC #4 is the location of a former scrap metal rolloff located southwest of the building. At AOC #4, three shallow soil borings (SB-04-01, SB-04-02 and SB-04-03) were advanced, and a total of three subsurface soil samples were collected to evaluate the vertical extent of COPCs at the AOC. Subsurface sample soil boring locations are shown on **Figure 2.4**. Subsurface soil laboratory findings are summarized on **Table 2.2**. Only estimated concentrations of methylene chloride were reported in the soil samples, and the estimated concentrations did not exceed its USEPA residential RSL but did exceed its USEPA risk-based SSL for protection of groundwater. It should be noted that methylene chloride is a common laboratory contaminant. No further investigation is planned for this AOC.

2.3.1.5 AOC #5

AOC #5 is a former empty drum storage location at the southwest corner of the building. Surface samples collected from the area contained diethylphthalate at concentrations up to 530 mg/kg and total petroleum hydrocarbons, oil and grease at concentrations up to 5,800 mg/kg. The affected soil was excavated during 2002. Confirmatory samples were analyzed for total petroleum hydrocarbons and oil and grease. A maximum residual concentration of 160 mg/kg was detected. These results were reported in Section 3 of the RI/FS WP. No further investigation is planned for this AOC.

2.3.1.6 AOC #6

AOC #6 is an area along the southwest side of the building that received exhaust from compounding activities inside the building. At AOC #6, two shallow soil borings (SB-06-01 and

SB-06-02) were advanced, and a total of four subsurface soil samples were collected to evaluate the vertical extent of COPCs at the AOC. Subsurface sample soil boring locations are shown on **Figure 2.4**. Subsurface soil laboratory findings are summarized on **Table 2.2**. Only estimated concentrations of bis(2-ethylhexyl)phthalate, diethyl phthalate, and methylene chloride were reported in the soil samples. The estimated concentrations of bis(2-ethylhexyl)phthalate, diethyl phthalate, and methylene chloride did not exceed their respective USEPA residential RSLs. The estimated concentrations of methylene chloride exceeded its USEPA risk-based SSL for protection of groundwater. It should be noted that methylene chloride is a common laboratory contaminant. No further investigation is planned for this AOC.

2.3.1.7 AOC #7

AOC #7 includes the two stormwater outfalls at the Site. Outfall 001 is located in the southern portion of the Site and Outfall 002 is located in the northern portion of the Site. Three surface sampling locations at AOC #7 had estimated concentrations of polynuclear aromatic hydrocarbons (PAHs) that exceed the current USEPA risk-based SSLs for benzo(a)anthracene, benzo(b)fluoranthene, and benzo(a)pyrene (SS-07-04, SS-07-07, and SS-07-08). One surface sample, SS-07-07, contained benzo(a)pyrene at a concentration that exceeds current the USEPA residential RSL. Sample SS-07-04 was located upstream from Outfall 002 and samples SS-07-07 and SS-07-08 were located downstream from Outfall 002. Surface sample locations are shown on **Figure 2.3**. Surface soil laboratory findings are summarized in **Table 2.1**. Based on an evaluation of the location of the surface soil samples and the concentrations detected, it was concluded that the PAHs in the surface soil sample were related to an off-Site source (asphalt components and vehicle lubricants from street runoff) and not to a discharge from Outfall 002. No further investigation is planned for this AOC.

2.3.1.8 AOC #8

AOC #8 is the location of a former oil/water separator located near the southeast wall of the building. At AOC #8, eight soil borings (SB-08-01 through SB-08-08) were advanced and a total of sixteen subsurface soil samples were collected to evaluate the horizontal and vertical extent of COPCs at the AOC. Subsurface sample soil boring locations are shown on **Figure 2.4**. Subsurface soil laboratory findings are summarized on **Table 2.2**. Estimated concentrations of acetone, diethyl phthalate, and methylene chloride were reported in the soil samples. The estimated concentrations of acetone, diethyl phthalate, and methylene chloride did not exceed their respective USEPA residential RSLs. The estimated concentrations of methylene chloride exceeded its USEPA risk-based SSL. It should be noted that methylene chloride is a common laboratory contaminant. No further investigation is planned for this AOC.

2.3.1.9 AOC #9

AOC #9 is the location of the former hazardous waste accumulation building located southwest of the main facility. After demolition of the former hazardous waste accumulation building, six soil borings (SB-09-01 through SB-09-06) were advanced and a total of twenty-seven subsurface soil samples were collected in the area to evaluate the vertical and horizontal extent of COPCs beneath the former building. Subsurface sample soil boring locations are shown on **Figure 2.4**. Subsurface soil laboratory findings are summarized on **Table 2.2**. Concentrations of methylene chloride and tetrachloroethene (perchloroethylene, or PCE) were detected above the laboratory's Reporting Limit (RL). Estimated concentrations of PCE and methylene chloride were also reported in the soil samples. The concentrations of PCE and methylene chloride did not exceed their respective USEPA residential RSLs. The concentrations of PCE and methylene chloride exceeded their respective USEPA risk-based SSLs, indicating a potential to contribute to groundwater contamination. It should be noted that methylene chloride is a common laboratory contaminant. No further investigation is planned for this AOC.

2.3.1.10 Soil Summary

The nature and extent of potential Site impacts to surface and subsurface soil were delineated during performance of the RI. No COPCs were found to be present above the USEPA residential RSLs in the surface or subsurface soil samples collected during the RI with the exception of one surface soil sample collected at AOC #7. AOC #9 soil has PCE concentrations exceeding SSLs, and PCE is present in groundwater above its SCDHEC Maximum Contaminant Level (MCL) in the same area (SCDHEC, 2014). The HHRA concluded that on-Site soil risks appear to be related to background levels of arsenic and chromium; therefore, the RI did not identify remediation goals for these on-Site soil COPCs.

2.3.2 Surface Water

Analytical results from surface water samples collected from the unnamed tributary to Stoddard Creek downgradient from AOC #9 were compared to SCDHEC Water Quality Criteria (WQC) and USEPA National Primary Drinking Water Regulations MCLs to evaluate the level and potential extent of impact to the unnamed tributary downgradient of the Site due to former waste handling activities. Surface water samples were collected from eleven locations along the unnamed tributary to Stoddard Creek, and nine of these samples were sent to the laboratory for analysis. The surface water sampling locations are shown on **Figure 2.5**. Other than PCE, no other volatile organic compounds (VOCs) were detected in the surface water samples. PCE exceeded the WQC at six of the surface water locations (SW-09-04, SW-09-05, SW-09-06, SW-09-07, SW-09-08, SW-09-12) and exceeded the USEPA MCL at four of the surface water locations (SW-09-04, SW-09-05, SW-09-06, SW-09-07). The results of the surface water sampling are provided in **Table 2.3**, and **Figure 2.6** shows the extent of surface water PCE detections. The HHRA did not identify an unacceptable risk to human health posed by exposure to surface water at the Site.

2.3.3 Sediment

Analytical results from sediment samples collected from the unnamed tributary to Stoddard Creek located downgradient from AOC #9 were compared to USEPA residential RSLs and risk-based SSLs to evaluate the level and potential extent of impact to the unnamed tributary to Stoddard Creek downgradient of the Site. Sediment samples were collected from nine locations along the unnamed tributary to Stoddard Creek. The sediment sampling locations are shown on **Figure 2.5** (along with the surface water locations). Only PCE was detected at concentrations above the laboratory's RL. Methylene chloride was reported at estimated concentrations. The concentrations of PCE or estimated concentrations of methylene chloride did not exceed their respective USEPA residential RSLs. Three of the detected concentrations of PCE exceeded its risk-based SSL. Five of the seven estimated concentrations of methylene chloride exceed its risk-based SSL. It should be noted that methylene chloride is a common laboratory contaminant. The results of the sediment sampling are provided in **Table 2.4**.

2.3.4 Groundwater

Groundwater sampling was conducted over multiple investigations conducted between January 2015 and October 2018. The results of these previous investigations were presented in the RI Report (Amec Foster Wheeler, 2016), the RI Report Addendum (Amec Foster Wheeler, 2017a), the Groundwater Sampling Report (Amec Foster Wheeler, 2017b), and the Report of Site-Wide Groundwater Sampling (Wood, 2018). Sampling was conducted to delineate the horizontal and vertical extent of PCE in groundwater. **Figure 2.7** shows the locations of groundwater monitoring well locations. **Table 2.5** through **Table 2.8** present the analytical results for groundwater samples collected during the various investigations.

2.3.4.1 AOC #2

One shallow monitoring well (MW-02-24) was installed downgradient from previous soil sample location SS-6 and a groundwater sample was collected to confirm that, other than nitrates and nitrites, no other COPCs were discharged with the Heat Treat cleaning water in this AOC. The groundwater sample was analyzed for Target Compound List (TCL) VOCs and Target Analyte List (TAL) metals. No VOCs were detected above the laboratory's RL in January 2015 or October 2018. Barium was detected above the laboratory's RL at a concentration below its SCDHEC MCL in January 2015.

2.3.4.2 AOC #3

Two shallow monitoring wells (MW-03-20 and MW-03-21) were installed at AOC #3, and groundwater samples were collected to evaluate the vertical extent of COPCs at the AOC. The groundwater sample from MW-03-20 was analyzed for TCL VOCs, TCL semi-volatile organic compounds (SVOCs), and TAL metals; the sample from MW-03-21 was analyzed for TAL metals only. No VOCs were detected above the laboratory's RL in MW-03-20 in January 2015 or October 2018. Estimated concentrations of barium and chromium were reported in MW-03-20 in January 2015. The estimated concentrations of barium and chromium in MW-03-20 did not exceed their respective SCDHEC MCLs. A concentration of barium was detected above the laboratory RL in MW-03-21 in January 2015. The concentration of barium did not exceed its SCDHEC MCL.

2.3.4.3 AOC #4

Two shallow monitoring wells (MW-04-22 and MW-04-23) were installed and groundwater samples were collected to evaluate the vertical extent of COPCs at AOC #4. The groundwater samples from MW-04-22 and MW-04-23 were analyzed for TAL metals in January 2015. A concentration of barium above the laboratory's RL was detected in MW-04-22 and MW-04-23. Estimated concentrations of arsenic, chromium, and mercury were reported in MW-04-23. The concentrations of barium, arsenic, chromium, and mercury did not exceed their respective SCDHEC MCLs.

Monitoring wells MW-04-22 and MW-04-23 were sampled in October 2018 and analyzed for VOCs. A concentration of PCE below the SCDHEC MCL was reported in MW-04-22. No VOCs were reported in MW-04-23.

2.3.4.4 AOC #8

One monitoring well (MW-08-01) existed prior to conducting the RI activities. Four additional monitoring wells were installed in November 2014. MW-08-2D was installed to the top of the bedrock surface at the source area. Three shallow wells (MW-08-03, MW-08-04 and MW-08-05) were installed downgradient of the source area to further define the vertical and horizontal extent of COPCs at AOC #8. The groundwater samples from MW-08-01 through MW-08-05 were analyzed for TCL VOCs, TCL SVOCs and total petroleum hydrocarbons, diesel-range organics (TPH-DRO) in January 2015. A concentration of isopropylbenzene in one well and TPH-DRO in two wells were detected above the laboratory's RL. Estimated concentrations of chlorobenzene (one sample), diethyl phthalate (one sample), isopropylbenzene (one sample), and TPH-DRO (one sample) were reported. The concentration of chlorobenzene was below its SCDHEC MCL. The concentrations of diethyl phthalate and isopropylbenzene were below their USEPA Tap Water RSLs. TPH-DRO does not have an SCDHEC MCL or USEPA Tap Water RSL.

Groundwater samples were collected from MW-08-01 through MW-08-05 in October 2018 and analyzed for VOCs. A concentration of isopropylbenzene was reported above the laboratory RL but below the USEPA Tap Water RSL in the sample from MW-08-01. Isopropylbenzene does not have a SCDHEC MCL.

2.3.4.5 AOC #9

2015 RI

Fifteen monitoring wells, including ten shallow and five bedrock, were installed to allow for groundwater monitoring at the AOC #9 source area and downgradient of the source area. Shallow wells MW-09-06, MW-09-07, MW-09-09, MW-09-10, MW-09-11, MW-09-13, MW-09-14, MW-09-15, MW-09-17 and MW-09-25 were installed in the overburden below the water table surface. MW-09-8D, MW-09-12D, MW-09-16D, MW-09-18D and MW-09-19D were installed in the bedrock. The monitoring wells were installed to define the vertical and horizontal extent of COPCs at AOC #9.

Select monitoring wells associated with AOC #9 were sampled in January 2015 and July 2015. The groundwater samples collected from MW-09-06 through MW-09-19D and MW-09-25 were analyzed for TCL VOCs. Four of the shallow monitoring wells had PCE concentrations that exceeded its SCDHEC MCL of 5 micrograms per liter (µg/L) established in South Carolina Primary Drinking Water Regulation R.61-58 (October 2014) including: MW-09-07 (1,100 µg/L), MW-09-09 (7.4 µg/L), MW-09-11 (54 µg/L), and MW-09-15 (67 µg/L). Estimated concentrations of carbon disulfide (one sample) and chloroform (one sample) were also detected. The estimated concentration of carbon disulfide was below its USEPA Tap Water RSL, and the estimated concentration of chloroform was below its SCDHEC MCL. The locations of the monitoring wells are shown on **Figure 2.7**, and the analytical laboratory results from the 2015 investigation are summarized in **Table 2.5**.

<u>2016 Field Screening</u>

Groundwater field screening activities were conducted in August 2016 in response to comments on the RI Report that were received from SCDHEC on April 20, 2016. Ten multi-level groundwater field-screening borings identified as GW-09-01 through GW-09-05, GW-09-05A, and GW-09-06 through GW-09-09 were completed using a direct-push technology (DPT) drill rig to further delineate the horizontal and vertical extent of the PCE plume. Specifically, the intermediate (mid-level) water table aquifer downgradient of the suspected AOC #9 source area was targeted for further investigation.

A total of 28 groundwater field-screening samples were collected at ten-foot vertical intervals starting approximately five feet below the bottom of existing shallow groundwater monitoring wells (approximately 25 feet below ground surface [bgs]) down to DPT refusal. The 28 samples were field screened using the Color-Tec method, and positive Color-Tec results were observed in 6 of the 28 groundwater samples. Split samples were selected from 17 of the samples and submitted for laboratory analysis for VOCs by USEPA Method 8260B. Concentrations of 2-butanone (methyl ethyl ketone), acetone, and PCE were detected above the laboratory RL in nine of the field-screening groundwater samples submitted to the laboratory. Estimated concentrations (J-flagged) of acetone, methylene chloride, and PCE between the laboratory method detection limit (MDL) and the RL were reported in 13 of the field-screening groundwater samples. It should be noted that acetone and methylene chloride are common laboratory contaminants.

PCE concentrations ranged from an estimated concentration of 0.99J µg/L at GW-09-06 (46 to 50 feet bgs) to 130 µg/L at GW-09-04 (26 to 30 feet bgs). Concentrations of PCE above its MCL of 5 µg/L were detected in three borings: GW-09-04 (26 to 30 feet bgs; 130 µg/L), GW-09-05A (46 to 50 feet bgs; 6.9 µg/L), and GW-09-07 (26 to 30 feet bgs; 27 µg/L). The locations of the groundwater field-screening borings are shown on **Figure 2.7**; and the laboratory analytical results for the screening samples are summarized on **Table 2.6**.

<u>2017 Additional Monitoring Well Installation</u>

As a result of the groundwater field screening activities, seven additional monitoring wells were installed to supplement the permanent groundwater monitoring system developed during the RI for the Site. The monitoring wells were installed over the period from February 6, 2017 through February 10, 2017. Four of the monitoring wells were installed in the intermediate portion of the aquifer (MW-09-28, MW-09-29, MW-09-30, and MW-09-32). Three of the monitoring wells were installed in the deep portion of the aquifer (MW-09-26, MW-09-27, and MW-09-31).

Results from the February 2017 sampling event indicated concentrations of PCE above the laboratory's RL in two intermediate monitoring well samples (MW-09-28 and MW-09-32). Chloroform was detected above the laboratory's RL in four samples (one intermediate well and three deep wells). A concentration of toluene was reported above the laboratory's RL in one intermediate well sample. Estimated concentrations of benzene (one sample) and methylene chloride (four samples) were also detected.

Only one of the intermediate monitoring wells (MW-09-32) had a PCE result (30 µg/L) that exceeded its SCDHEC MCL of 5 µg/L. The estimated concentrations of benzene and methylene chloride and the concentration of toluene were below their respective SCDHEC MCLs. It should be noted that methylene chloride and toluene are common laboratory contaminants.

Although chloroform does not have a specific SCDHEC MCL, it is a trihalomethane and total trihalomethanes have an MCL of 80 µg/L. In 2017, two of the concentrations of chloroform (MW-09-26 and MW-09-27), both deep monitoring wells, had concentrations of chloroform that exceed the total trihalomethanes MCL at 730 µg/L and 1,100 µg/L, respectively. The chloroform that was detected in groundwater samples was likely the artifact of drilling mud used during the installation of the deep monitoring wells. In a letter dated September 21, 2017, SCDHEC requested that monitoring wells MW-09-26 and MW-09-27 be evaluated and assessed for their ability to yield representative groundwater samples. In November 2017, the two wells were resampled and during purging, total residual chlorine was measured to evaluate the previous elevated chloroform concentrations. Laboratory analytical results reported that chloroform was not detected above the RL in the groundwater sample from MW-09-26 and a low concentration of chloroform was reported significantly below the MCL in the groundwater sample from MW-09-27. A letter report of groundwater sampling was submitted to SCDHEC on December 8, 2017 that concluded that MW-09-26 and MW-09-27 were capable of providing representative groundwater samples. Additionally, chloroform was not detected in groundwater samples collected above the laboratory RL in these wells in October 2018.

In a letter dated June 11, 2018, the SCDHEC approved the groundwater sampling report and additionally, provided approval of the RI. However, prior to proceeding with the FS, SCDHEC requested that a Site-wide groundwater sampling event be conducted.

The locations of the additional monitoring wells installed in February 2017 are shown on **Figure 2.7**. The associated groundwater analytical laboratory results for the additional monitoring well installation details are summarized in **Table 2.7**.

2018 Site-Wide Groundwater Monitoring

A Site-wide groundwater monitoring event was conducted prior to proceeding with the FS at the request of SCDHEC in a letter dated June 11, 2018. Groundwater samples were collected from the Site monitoring wells over the period from October 2 to October 3, 2018. PCE was detected in five shallow monitoring wells (MW-09-07, MW-09-09, MW-09-11, MW-09-15, and MW-04-22) at concentrations ranging from 3.3 µg/L to 1,900 µg/L; two intermediate monitoring wells (MW-09-28 and MW-09-29) at concentrations of 28 µg/L and 1.2 µg/L, respectively; and one deep monitoring well (MW-09-27) at a concentration of 1.2 µg/L.

Three shallow monitoring wells (MW-09-07, MW-09-11, and MW-09-15) and one intermediate monitoring well (MW-09-28) had concentrations of PCE that exceeded its MCL at 1,900 µg/L, 36 µg/L, 43 µg/L, and 28 µg/L, respectively. The results of the sampling event were submitted to

SCDHEC in a Report of Site-Wide Groundwater Sampling (Wood, 2018). The SCDHEC approved the report in a letter dated December 27, 2018 and agreed with the recommendation to proceed with the FS. The locations of the monitoring wells are shown on **Figure 2.7**. The associated groundwater analytical laboratory results for the site-wide groundwater sampling are summarized in **Table 2.8**.

2.3.4.6 Groundwater Summary

During the initial RI in 2015, PCE was detected above its SCDHEC MCL in 4 of the 16 shallow groundwater monitoring wells sampled for VOCs (MW-09-07, MW-09-09, MW-09-11, and MW-09-15). PCE was not detected in the six bedrock monitoring well samples. In 2016, PCE was detected above its MCL in 3 of the 17 groundwater screening samples from AOC #9 (GW-09-04 [26-30 feet bgs], GW-09-05A [46-50 feet bgs], and GW-09-07 [26-30 feet bgs]). Two of the detections were observed in Intermediate Zone A (26 to 30 feet bgs), and one detection was observed in the Deep Zone (46 to 50 feet bgs). Based on the 2016 groundwater field screening results, seven additional monitoring wells (four intermediate zone wells and three deep wells) were installed and sampled at the Site in February 2017. One intermediate zone monitoring well (MW-09-32) had a detection of PCE above its MCL.

During the Site-wide groundwater sampling event conducted in October 2018, PCE was detected above its MCL in three of the 20 shallow monitoring wells (MW-09-07, MW-09-11, and MW-09-15) and one Intermediate Zone A monitoring well (MW-09-28) sampled for VOCs.

Based on the RI, groundwater field screening, and additional monitoring well installation for the intermediate and deep portions of the aquifer, the PCE-impacted groundwater has been defined both horizontally and vertically. The zone of maximum contamination primarily occurs in the Shallow Zone (10 to 25 feet bgs) and Intermediate Zone A (26 feet to 30 feet bgs). Intermediate Zone B (36 to 40 feet bgs) and the Deep Zone of the saprolite aquifer (46 to 50 feet bgs) appear to be minimally impacted (i.e., minimum detections of PCE above the MCL) by PCE. The bedrock portion of the aquifer is not impacted by PCE.

A Shallow Zone isoconcentration contour map for the October 2018 site-wide sampling showing the extent of PCE is shown on **Figure 2.8**. An Intermediate Zone isoconcentration contour map for the October 2018 sampling event showing the extent of PCE is shown on **Figure 2.9**. The configuration of the PCE plume is similar to the PCE plume detected in the RI report. The axis of the plume has shifted slightly to the west based on the most recent groundwater sampling results. The configuration of the saprolite thickness appears to greatly influence the direction of PCE transport at the Site.

2.4 CONSTITUENT FATE AND TRANSPORT

The fate and transport of the Site-related constituents considers in general terms, the chemical and physical properties of the constituents, how those properties affect the ability of the constituents to interact with the environment, and how those interactions influence the ability of the constituents to migrate or be retained in the media. The degree of interaction of the constituents with the environment determines its fate in the environment and to what extent it is transformed through chemical reactions, biological or abiotic degradation, retained by sorption and other attenuative mechanisms. The nature of these interactions also influences constituent transport which considers migration within a specific medium (e.g., surface water or groundwater) or migration across media boundaries (e.g., from soil to groundwater, surface water, or air).

The Site Conceptual Model (**Figure 2.10**) as presented in the RI Report (Amec Foster Wheeler, 2016) relates the fate and transport, migration pathways to the environmental setting, and exposure points to provide an understanding of the current distribution of COPCs in the environment. Because PCE is the only COPC that exceeds regulatory action levels (i.e., SCDHEC MCLs), this section describes the environmental fate and transport of PCE and potential routes of migration within Site media, including soil, groundwater, and surface water.

2.4.1 Potential Routes of Migration

Metal degreasing solvents, such as PCE, were used at the Site and reportedly stored in the former hazardous waste accumulation building (AOC #9). The hazardous waste accumulation building had a bermed and sloped floor consisting of concrete that would have been sufficient to contain minor releases of solvents related to materials handling activities. No cracks or holes were observed in the concrete floor that could have provided a direct pathway for migration of solvents through the concrete floor to the underlying soil. However, chlorinated solvents such as PCE have the capacity to migrate through concrete and impact the soil beneath the concrete. Since the detected concentrations of PCE in the subsurface soil are not significantly elevated, it is probable that minor releases of PCE occurred during material handling activities and migrated through the concrete floor to the underlying soil.

2.4.2 Infiltration of Precipitation and Groundwater Discharge

Infiltration of precipitation through PCE-impacted soil in the vadose zone to the shallow aquifer system is a potential migration pathway at the Site. Only the shallow groundwater system is significantly impacted and the areal extent of PCE-impacted shallow groundwater is limited. The groundwater flow system at the Site is a local groundwater system wherein precipitation recharging the shallow groundwater ultimately discharges in part to the local surface water system. The area of PCE-impacted groundwater is depicted on **Figure 2.8** and **Figure 2.9**.

Cross-section locations for the PCE-impacted groundwater plume at AOC #9 are shown on **Figure 2.11**. **Figures 2.12** and **Figure 2.13** provide lithologic profiles beneath AOC #9 that present the estimated vertical extent of PCE-impacted groundwater. Cross-section A-A' in **Figure 2.12** runs northeast-southwest, down the axis approximately parallel to the plume centerline from north of the former hazardous waste accumulation building to the point of surface water discharge, and then continues farther south along the unnamed tributary to Stoddard Creek. Cross-section B-B' in **Figure 2.13** runs west-southwest-east-northeast, approximately perpendicular to the mid-downgradient portion of the PCE plume. The upward vertical gradients in well pairs within the plume (MW-09-07/MW-09-08D and MW-09-11/MW-09-12D) likely contributes to the limited vertical extent of impacted groundwater.

Groundwater flows laterally from AOC #9 to the southwest. A limited amount of flow from AOC #9 contributes to surface water within the unnamed tributary to Stoddard Creek. The PCE-affected surface water area is bounded upstream and downstream based on surface water samples that do not contain PCE above the laboratory RL. The area of PCE-impacted surface water is depicted on **Figure 2.6**.

2.4.3 Storm Water Runoff

Visual inspection of the Site does not indicate that overland migration of soil from the Site due to storm water runoff is an important migration pathway.

2.4.4 Constituent Persistence

PCE is likely to enter the environment from fugitive air emissions and by spills or accidental releases to air, soil, and water. If PCE is released to the atmosphere, it will exist mainly in the gas phase, and it will be subject to photooxidation. If PCE is released to soil, it will evaporate rapidly into the atmosphere due to its high vapor pressure and low absorption to soil. PCE is expected to exhibit low to medium mobility in soil and therefore may leach slowly to groundwater. If PCE is released to surface water, it will be subject to rapid volatilization. PCE is not expected to significantly biodegrade unless the appropriate geochemical conditions are present, bioconcentrate in aquatic organisms, or adsorb to sediment. PCE is not expected to hydrolyze in soil or water under normal environmental conditions.

2.4.5 Constituent Migration

PCE is a man-made solvent, commonly used as a degreaser in manufacturing applications. PCE is denser and heavier than water, highly mobile in groundwater, and toxic at low concentrations. Advection causes dissolved PCE to migrate with groundwater flow. In groundwater, PCE can undergo chemical and biological transformations to other organic compounds. PCE can undergo reductive dechlorination catalyzed by anaerobic bacteria. In microbially-mediated reductive dechlorination, chloride atoms in the PCE molecules are replaced with hydrogen atoms. Replacement of one chloride atom transforms PCE to trichloroethene (TCE). Replacement of a second chloride atom transforms TCE to cis-1,2-dichloroethene (cis-1,2-DCE). The replacement of a third chloride atom then transforms cis-1,2-DCE to vinyl chloride. Finally, vinyl chloride is converted to the harmless substances, ethylene and chloride. However, anaerobic degradation rarely proceeds to completion in groundwater unless the appropriate geochemical conditions are present, leading to accumulations of vinyl chloride. In aerobic groundwater environments, where dissolved oxygen (DO) is present at concentrations greater than 2 milligrams per liter, PCE is not subject to reductive dechlorination and is therefore relatively persistent.

2.4.6 Fate and Transport Summary

An evaluation of the fate and transport of constituents present in Site media indicate that PCE is the principal chemical of concern (COC) in AOC #9 groundwater and surface water. Due to the age of the Site, history of operations, and the likely release mechanisms, the magnitude and extent of impacts to groundwater and surface water are expected to be stable or to decrease in the future. The boundary of groundwater affected by the Site appears stable and should not expand but is expected to persist.

2.5 HUMAN HEALTH RISK ASSESSMENT

The HHRA conducted during the RI (Amec Foster Wheeler, 2016) identified a total of 30 COPCs in sampled media at the Site. Of these COPCs, nine were inorganic constituents (i.e., metals), eight were VOCs, and 13 were SVOCs. Twenty COPCs were only present in soil, five were only present in groundwater, three were only present in soil and groundwater, one was only present in soil and sediment, and one was present in soil, sediment, groundwater, and surface water. Soil and sediment COPCs were screened against the USEPA Residential RSLs, groundwater COPCs were screened against the USEPA Tap Water RSLs, and surface water results were screened against the USEPA Ambient Water Quality Criteria (AWQC). Additional screening against Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) items was conducted. A summary of the COPCs and screening results is presented in **Table 3.1**. Based on the results of the screening, five COPCs were retained for further evaluation of potential risks to affected populations, including carcinogenic and non-carcinogenic risks due to:

- ingestion, inhalation, and dermal contact with soil;

- ingestion, dermal contact, and inhalation of indoor air vapors with groundwater; and
- dermal contact with surface water

Affected populations considered included:

- On-Site Commercial/Industrial Worker (current and future)
- On-Site Construction Worker (future)
- On-Site Residential Adult (future)
- On-Site Residential Child (future)
- On-Site Residential Adult/Child (future)
- Youth Trespasser (current and future)
- Off-Site Commercial/Industrial Worker (current and future)
- Off-Site Construction Worker (future)
- Off-Site Residential Adult (future)
- Off-Site Residential Child (future)
- Off-Site Residential Adult/Child (future)

The COPCs retained for the Site are those that contribute to a Hazard Index (HI) greater than 1 or excess cancer risk greater than $1x10^{-6}$ and include arsenic, benzo(a)pyrene, chloroform, chromium, and PCE.

Of the five COPCs posing an unacceptable risk, arsenic and benzo(a)pyrene are not Site-related. Both compounds were not used in or generated by former plant operations. Arsenic concentrations are within the South Carolina background range (Canova, 1999) and are deemed to be naturally occurring. Benzo(a)pyrene was detected in ditch sediments downstream from Outfall 002 in AOC #7, located near Woodside Avenue. Similar or greater concentrations of benzo(a)pyrene were detected in an upstream sampling location. This chemical is commonly found in asphalt, wood smoke, and vehicle exhaust and is not deemed to be Site related.

Chromium concentrations in on-Site soil are on the same order of magnitude as South Carolina background levels (Canova, 1999), and chromium concentrations in on-Site groundwater are below MCLs. Risks calculated for chromium in the HHRA make the conservative assumption that total chromium detections could be hexavalent; however, for samples at AOC #3 where hexavalent chromium was analyzed, no detectable concentrations were reported. All other detections of total chromium in soil and groundwater are most likely trivalent also, in which case the calculated risks for chromium exposure are overestimated.

On-Site soil containing PCE does not pose an excessive direct risk to human health; however, at AOC #9, PCE concentrations in soil exceed its risk-based SSL for protection of groundwater, and groundwater PCE concentrations exceed its MCL in the same area. PCE is therefore be retained as an on-Site soil COC for consideration with groundwater remedies.

Based on residential exposure, the on-Site groundwater COPCs retained as COCs are chromium and PCE. The off-Site groundwater COPCs retained as COCs are chloroform and PCE. Although chromium and chloroform have been detected in groundwater, they have not been detected at concentrations greater than their respective SCDHEC MCLs. It should be noted that chloroform was not detected above the laboratory reporting limit in groundwater samples collected in October 2018 from the monitoring wells where chloroform was previously detected, and the risk assessment was based.

The HHRA did not identify unacceptable risk to human health posed by exposure to surface water or sediments.

3.0 REMEDIAL ACTION OBJECTIVES

Site-specific RAOs were developed based on the results of the HHRA that was completed for the Site RI Report (Amec Foster Wheeler, 2016) and also on the evaluation of ARARs and TBC information.

3.1 SITE COCS AND ALLOWABLE EXPOSURE BASED ON RISK AND ARARS

3.1.1 Contaminants of Concern

The RI and HHRA evaluated 30 chemicals detected in Site media that were evaluated as COPCs. Of these COPCs, five were retained as COPCs for the Site (arsenic, benzo(a)pyrene, chloroform, chromium, and PCE). The HHRA determined that, based on residential exposure, COPCs retained as COCs include chromium and PCE in on-Site groundwater and chloroform and PCE in off-Site groundwater. In addition, the HHRA identified PCE as a constituent detected in on-Site soil that could potentially further impact groundwater and pose risk to human health from drinking contaminated water. Based on the results of the November 2017 and October 2018 sampling events, chloroform in AOC #9 has decreased to below the SCDHEC MCL in all site monitoring wells and is no longer considered a COC. The chloroform that was initially detected in groundwater samples was likely the artifact of drilling mud used during the installation of the deep monitoring wells. Hexavalent chromium has not been detected at the Site, and chromium concentrations are within naturally-occurring chromium concentrations; therefore, chromium is not related to former Site operations. Also, benzo(a)pyrene was evaluated and considered not related to former Site operations.

3.1.2 Allowable Exposure Based on Risk Assessment

The HHRA identified unacceptable levels of risk to future residents and current and future Site workers that primarily resulted from exposure to PCE via groundwater used as a source of potable water and/or vapor intrusion of PCE in groundwater. Achieving the SCDHEC MCL for PCE will reduce human health risks to below goals (non-cancer HI <1 and cancer risk < 10^{-6}) for potential exposures.

3.1.3 Allowable Exposure Based on ARARs

Development of RAOs for the Site must include consideration of ARARs. Types of ARARs include chemical-specific, action-specific, and location-specific.

3.1.4 Chemical-Specific ARARs

Chemical-specific ARARs are concentration limits in the environment promulgated by government agencies. Chemical concentration standards include MCLs, RSLs, risk-based SSLs, ambient air concentrations, and WQC. **Table 3.2** provides a listing of all identified chemical-specific ARARs. The HHRA considered the following chemical-specific ARARs:

- USEPA RSLs for residential soil based on a cancer risk of 1E-06 and hazard quotient of 0.1.
- USEPA SSLs for residential soil based on risk-based exposure to groundwater
- USEPA SSLs for residential soil based on attainment of MCLs.
- USEPA Ambient WQC for human health (consumption of water and organisms).
- Vapor Intrusion Screening Level (VISL) Calculator Target Groundwater Concentration for residential exposure based on cancer risk of 1E-06, hazard quotient of 0.1 and default groundwater temperature of 25 degrees Celsius.

3.1.5 Action-Specific ARARs

Action-specific ARARs include regulations or requirements specific to activities or technologies. Examples include RCRA waste treatment regulations, Clean Air Act regulations for activities creating air emissions, and National Pollutant Discharge Elimination System regulations for discharges to surface water. **Table 3.3** presents a listing of potential action-specific ARARs.

3.1.6 Location-Specific ARARs

Location-specific ARARs include regulations and standards applicable to activities affecting areas such as wetlands, flood plains, coastal zones, or areas potentially having cultural artifacts. **Table 3.4** presents a listing of location-specific ARARs.

3.1.7 Waivers to ARARs

The NCP allows waivers of ARARs to be considered in six circumstances:

- The remedial action selected is only a part of a total remedial action where the final remedy will attain the ARAR upon completion. This is not applicable since no additional phases are contemplated in this FS.
- Compliance with the ARAR will result in a greater risk to human health and the environment than alternative options. This is possibly applicable where direct activity in surface water may result in erosion, damage to vegetation, and damage to wildlife habitat.
- Compliance with the ARAR is technically impracticable from an engineering perspective.
- An alternative remedial action will attain an equivalent standard of performance through the use of another method or approach.
- The ARAR is a State requirement that the State has not consistently applied (or demonstrated the intent to apply consistently) in similar circumstances.
- For Superfund-financed remedial actions, compliance with the ARAR will not provide a balance between protecting human health and the environment and the availability of Superfund money for response at other facilities. Not applicable to privately financed remediation.

A waiver of ARARs is not anticipated for the proposed remedial activities.

3.2 REMEDIAL ACTION OBJECTIVES

RAOs are selected to comply with applicable regulations and to be protective of human health and the environment. Based on the results of the HHRA and the ARARs, the following are Site RAOs:

- Prevent the migration (i.e., leaching) of soil COCs from impacted soil to groundwater.
- Prevent exposure of human receptors to groundwater containing COCs at concentrations that exceed MCLs.
- Prevent exposure of human receptors to indoor air containing contaminants that exceed appropriate screening levels for indoor air.
- Restore groundwater to beneficial use within a reasonable timeframe.

- Monitor soil and groundwater in a manner that will verify the effectiveness of the remedial actions.
- Mitigate further migration of the contaminant plume and groundwater discharge to surface water above the Ambient WQC.

Site-related soil COCs do not directly cause any unacceptable human health risks. However, AOC #9 soil PCE concentrations exceed the 0.0023 mg/kg MCL-based SSL, and there is a corresponding presence of PCE in the underlying AOC #9 groundwater that is above its MCL of 5 µg/L. The RAO for soil includes removal of PCE that exists above its SSL from soil to eliminate potential ongoing leaching to the underlying groundwater thereby accelerating attainment of groundwater RAOs.

The concentration-based remediation goals for Site groundwater are the South Carolina drinking water quality standards promulgated in the State Primary Drinking Water Regulations [R.61-58.5 D.(2)]. The groundwater COCs identified (chromium, chloroform, and PCE) have SCDHEC MCLs, and these were recommended as the remediation goals in the RI. The maximum detected concentrations of chromium and chloroform in groundwater are less than their respective MCLs. Therefore, only on-Site and off-Site concentrations of PCE exceed its MCL. The SCDHEC MCL for PCE (5 µg/L) is less than the USEPA Residential VISL for PCE (5.8 µg/L). Therefore, the PCE MCL is protective of potential inhalation exposures due to vapor intrusion of PCE from groundwater.

Detected surface water concentrations of PCE exceed its South Carolina WQC of 0.69 µg/L at multiple locations in the unnamed tributary to Stoddard Creek located southwest of the Site. Direct remediation of surface water will potentially do more environmental harm than good if it results in disturbance of the stream bed and/or surrounding ground vegetation. Since these impacts are a result of contaminated groundwater discharging to the surface, remediation of groundwater can achieve surface water compliance as well.

4.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

General response actions and preliminary screening of remedial technologies by affected medium are identified and described below.

4.1 GENERAL RESPONSE ACTIONS

General response action for Site soil, groundwater, and surface water are described in the following subsections.

4.1.1 Soil

Soil containing PCE at concentrations that may contribute to groundwater contamination are concentrated beneath the former hazardous waste accumulation building (AOC #9) concrete footprint. General response actions for soil potentially include:

- No Action;
- Containment;
- Ex-Situ Treatment/Removal/Disposal; and
- In-Situ Treatment.

4.1.2 Surface Water

Surface water impacted by PCE that is in excess of its South Carolina WQC (0.69 µg/L) has been identified over a distance of approximately 600 feet between surface water sampling locations SW-09-04 and SW-09-08 (**Figure 2.6**). Because surface water impacts are an extension of groundwater conditions, surface water and groundwater will be considered together for evaluation of technologies and alternatives.

4.1.3 Groundwater

Groundwater containing PCE above its MCL is present in AOC #9 and encompasses an area of approximately 62,560 ft^2 (**Figure 2.8** and **Figure 2.9**). The impacted groundwater flows southwest from the source at the former hazardous waste accumulation building to the unnamed tributary to Stoddard Creek. General response actions for groundwater potentially include:

- No Action;
- Institutional Controls;
- Containment;
- Ex-Situ Treatment/Removal/Disposal; and
- In-Situ Treatment.

4.2 IDENTIFICATION/SCREENING OF TECHNOLOGY TYPES/PROCESS OPTIONS

For each medium of interest, applicable technology types and the process options are identified and evaluated for potential applicability and effectiveness. Retained technologies are capable of being adapted to Site conditions and to achieving the RAOs for the media considered. A total of 38 soil technologies and 37 groundwater technologies were identified and initially screened. Technologies for remediation of soil are preliminarily screened in **Table 4.1**. Technologies for remediation of groundwater are preliminarily screened in **Table 4.2**.

5.0 SCREENING AND ALTERNATIVE DEVELOPMENT

Secondary screening of the technology types and process options retained after the preliminary screening conducted in Section 4.0 and the subsequent development of remedial alternatives for soil and groundwater are discussed in the following subsections.

5.1 SECONDARY SCREENING OF TECHNOLOGIES

A total of 22 soil technologies and 25 groundwater technologies were retained from the initial screening process. Retained technologies have undergone further screening for effectiveness, implementability, and relative cost. Secondary screening and selection of applicable technologies for soil are presented in **Table 5.1**. Groundwater technology screening and selection are presented in **Table 5.2**.

5.2 DEVELOPMENT OF ALTERNATIVES

Soil technologies selected for further evaluation include:

- Soil vapor extraction (SVE);
- In situ chemical oxidation (ISCO) soil blending; and
- Excavation, transportation, and off-Site disposal.

Groundwater technologies selected for further evaluation include:

- Source area air sparging (AS)
- Source area ISCO upper aquifer soil blending; and
- Source area and downgradient in situ chemical reduction (ISCR) using zero valent iron (ZVI).

The nature and extent of soil and groundwater contamination, subsurface lithology, ambient shallow groundwater aquifer geochemical conditions, existing on-Site and off-Site conditions, and access issues limited the practical remedial alternatives for soil and groundwater. For PCE-impacted groundwater, it is unlikely that any single technology can achieve its MCL in the immediate future. As such, the groundwater remedial alternatives considered, present the best potential for depleting source area mass, shrinking the overall size of the plume, and significantly reducing the overall life of remedial activities.

In-situ bioremediation is a popular option for the treatment of chlorinated solvent-impacted groundwater; however, this technology was eliminated from further consideration as a component of a remedial action alternative for groundwater for several reasons including:

- The lack of PCE degradation products in groundwater, which indicates that natural attenuation is not readily occurring;
- DO levels and oxidation-reduction potentials for on-Site and off-Site groundwater indicate the shallow groundwater system is generally aerobic, and PCE does not readily degrade under these ambient aquifer conditions;
- The impacted groundwater generally has a pH of less than 6, and biodegradation of PCE is severely limited or does not occur at a pH of less than 6; and
- It is better to enhance the ambient aquifer geochemistry rather than try to change it. The change of aquifer pH to a level more conductive to reductive dechlorination is not viable due to the natural buffering capacity of the impacted aquifer.

It is anticipated that passive remediation using monitored natural attenuation will be a component of the overall remedy once it has been demonstrated that the source has been removed, the plume is stable or shrinking, PCE concentrations are decreasing, and further active remedial actions would not provide significant reductions in contaminant mass.

Combined soil and groundwater remedial action alternatives were developed using combinations of the aforementioned soil and groundwater technologies. Because surface water impacts are an extension of groundwater conditions, surface water and groundwater are considered together during evaluation of the groundwater alternatives. The assembled remedial action alternatives are shown on **Table 5.3**.

5.3 REMEDIAL ACTION ALTERNATIVES

Remedial action alternatives to treat impacted soil and groundwater are presented in the following subsections.

5.3.1 Alternative 1: No Action

Alternative 1, the No-Action Alternative, is required to be evaluated to establish a baseline for comparison of the other remedial action alternatives. For this alternative, the concrete pad for the former hazardous waste accumulation building would remain in place, and there would be no active measures to prevent exposure to the soil contamination present or to prevent leaching to groundwater. Existing source area and downgradient groundwater contamination would not be addressed through any means other than naturally occurring attenuation processes, which are minimal. There would be no restrictions placed on groundwater use at the facility or off Site. Protections against further contaminant migration to off-Site properties would not be provided. Monitoring of any kind would not be implemented under Alternative 1. There would be no cost associated with this alternative.

5.3.2 Alternative 2: SVE/AS and ISCR

Alternative 2 uses five vertical SVE well pairs (ten total wells) and ten AS wells to treat source area soil and source area shallow groundwater. **Figure 5.1a** shows a plan and profile of the source area SVE/AS treatment system installation. Additional source area and downgradient treatment of the groundwater plume would be conducted by ISCR using ZVI. **Figure 5.1b** shows a plan view of the proposed groundwater remediation installation.

5.3.3 Alternative 3: ISCO Soil Blending and ISCR

Alternative 3 will treat source area vadose zone soil, shallow aquifer soil and groundwater via ISCO blending down to an approximate depth of 25 feet bgs. Treatment will require the removal and disposal of the concrete pad associated with the former hazardous waste accumulation building. Following ISCO soil blending, the structure of the treated soil is typically not competent enough to support aboveground structures if the treated area is not adequately stabilized. Therefore, stabilization of the soil using Portland cement will be conducted following ISCO soil blending to ensure the subsurface soil structure is suitable for future potential aboveground structures. **Figure 5.2a** shows a plan and profile of the source area soil remediation installation. Additional source area and downgradient treatment of the groundwater plume would be conducted by ISCR using ZVI. **Figure 5.2b** shows a plan view of the proposed groundwater remediation installation.

5.3.4 Alternative 4: Excavation and Off-Site Disposal/ISCO Blending and ISCR

Alternative 4 includes the excavation of source area vadose zone soil from the existing ground surface down to the capillary fringe with subsequent off-Site disposal. Saturated soil from approximately 18 feet to 25 feet bgs would be treated using ISCO blending. Alternative 4 will require the removal and disposal of the concrete pad associated with the former hazardous waste accumulation building. **Figure 5.3a** provides a plan and profile view of the planned source area soil remediation installation. Additional source area and downgradient treatment of the groundwater plume would be conducted by ISCR using ZVI. **Figure 5.3b** shows a plan view of the proposed groundwater remediation installation.

6.0 DETAILED ANALYSIS OF REMEDIAL ACTION ALTERNATIVES

A detailed analysis of the remedial action alternatives developed in Section 5.0 is conducted against the nine criteria required by Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and specified in Office of Solid Waste and Emergency Response (OSWER) Directive 9355.3-01. These include:

- Overall protection of human health and the environment;
- Compliance with ARARs;
- Short-term effectiveness;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume;
- Implementability;
- Cost;
- State acceptance; and
- Community acceptance.

The intent of the analysis is to present sufficient relevant information to allow decision-makers to select an appropriate remedy for the Site. The evaluation against the nine CERCLA criteria forms the basis for determining the ability of a remedial action alternative to satisfy CERCLA remedy selection requirements.

6.1 NO ACTION ALTERNATIVE

The No-Action Alternative includes no monitoring, institutional controls, or active remedial activities. This alternative has been retained for the purpose of a baseline comparison with other remedial action alternatives presented in this FS.

6.1.1 Overall Protection

Alternative 1 would result in a slow and minimal reduction in COC concentrations over time; however, no monitoring would be conducted to verify this reduction, if any. The No-Action Alternative does not increase or decrease risks to the community, workers, or the environment based on the detected concentrations. This alternative would not be protective of human health and the environment.

6.1.2 Compliance with ARARs

The No-Action Alternative would not comply with chemical-specific ARARs. Action-specific ARARs or location-specific ARARs are not applicable.

6.1.3 Short-Term Effectiveness

Alternative 1 does not include any actions which might create increased risks to the community, workers, or the environment; however, baseline risks determined by the HHRA are not changed from current levels.

6.1.4 Long-Term Effectiveness and Permanence

The No-Action Alternative would not provide long-term effectiveness and permanence. Only natural attenuation would affect COC concentrations, and these effects are expected to be minimal. Monitoring would not be conducted to determine if COC concentration trends are declining over time.

6.1.5 Reduction of Mobility, Toxicity, and Volume

Alternative 1 would not actively cause a reduction in mobility, toxicity, or volume. Only natural attenuation would affect COC concentrations, and no monitoring would be conducted to determine trends.

6.1.6 Implementability

There are no implementability concerns posed by Alternative 1 because no remedial activities or administrative actions are employed.

6.1.7 Cost

There are no capital costs or operation and maintenance (O&M) costs associated with this alternative.

6.1.8 State Acceptance

The No-Action Alternative is not expected to be acceptable to the state.

6.1.9 Community Acceptance

The No-Action Alternative is not expected to be acceptable to the community.

6.2 ALTERNATIVE 2: SVE/AS AND ISCR

Alternative 2 includes the use of SVE for source area soil combined with source area AS and ISCR for groundwater. Source area soil will be treated using SVE. The SVE treatment system would consist of ten extraction wells connected to a vacuum blower. During SVE operation, PCE vapors would be extracted from the soil via the ten SVE extraction wells and discharged to the surrounding air. The SVE wells would be screened at two elevations (5 to 10 feet bgs and 12 to 17 feet bgs) because historical soil sampling in the source area has indicated concentrations of PCE above its risk-based SSL from the ground surface down to the top of groundwater.

For Alternative 2, AS would be used in the source area in conjunction with the SVE treatment system. AS involves the injection of air into the targeted aquifer to strip PCE from the groundwater and saturated soil matrix. During this process, compressed air would be forced into the aquifer by means of ten injection wells installed in the concrete pad of the former hazardous waste accumulation building and screened from approximately 25 to 30 feet bgs. COCs dissolved in the groundwater and adsorbed onto soil particles would be volatilized into the vapor phase and transported from the saturated zone to the vadose zone within air channels. The SVE treatment system would capture the volatilized compounds in the vadose zone. A ten-foot zone of influence (ZOI) for each injection well was assumed; however, to better understand the Site-specific ZOI of an injection well and to gauge the effectiveness of treating PCE in Site groundwater using AS, a field-scale pilot test would need to be conducted. Costs for a pilot test were not included in the cost estimate for Alternative 2.

The SVE/AS treatment system would consist of a mobile, trailer-mounted system that is staged in a secured equipment compound. The SVE/AS equipment compound would be approximately 20 feet by 20 feet, enclosed by an eight-foot high fence with a locking gate. The underground conveyance piping from the ten SVE wells would be manifolded together in the compound and connected to a vacuum blower. The ten air sparging wells would be connected together via underground conveyance piping that would be manifolded together and connected to an air compressor. Electricity would be brought into the equipment compound via the nearest available electric service. To avoid extended down periods, a remote telemetry system would be used to indicate whether the SVE/AS treatment system was operational or not. **Figure 5.1a** shows a plan and profile of the source area soil remediation installation.

It is estimated that it will take one week to install the ten SVE wells and ten AS wells, one week to install the associated conveyance piping and to erect the SVE/AS equipment compound, and one week to install the combined SVE/AS equipment trailer, provide electric to the compound, and to start up the combined treatment system. Wood personnel would provide oversight primarily using a senior engineer.

Following start up, monthly (O&M would be performed for the SVE/AS system. O&M would consist of a field technician conducting a complete SVE/AS treatment system and SVE/AS equipment compound inspection, completing O&M forms for both systems, and conducting other support services as needed. Filters for the SVE blower and AS compressor would need to be changed on a quarterly basis, and the oil would need to be changed on a semi-annual basis.

Source area soil would be sampled after two years of SVE/AS treatment system operation unless quarterly vapor sampling for the SVE system exhaust does not detect the presence of VOCs, in which case confirmation sampling would be conducted in less than two years. Six confirmation soil boring locations would be sampled and analyzed for VOCs. At each soil boring location, four soil samples would be collected in five-foot intervals extending from the existing ground surface down to the capillary fringe (approximately 18 feet bgs). The collected soil samples would be submitted to a South Carolina-certified laboratory for VOC analysis via USEPA Method 8260B. Upon confirmation that soil cleanup criteria had been met in the source area, all SVE and AS wells would be abandoned in accordance with applicable rules and regulations.

Additional source area groundwater treatment and downgradient groundwater plume treatment would be achieved by using ISCR with ZVI. For this process, a DPT rig would be used to inject granular ZVI into borings. The ZVI borings would be placed approximately ten feet apart and completed in rows that are constructed perpendicular to the longitudinal axis of the plume. For the two most upgradient rows, the ZVI would be installed between 18 and 30 feet bgs. ZVI in the mid-plume area would be installed at approximately 10 to 25 feet bgs. Downgradient groundwater plume treatment would focus on the toe of the plume to eliminate the discharge of PCE the unnamed tributary to Stoddard Creek. Two rows of ZVI borings would be completed with the ZVI installed between approximately 12 to 25 feet bgs. **Figure 5.1b** shows a profile view of the groundwater remediation installation for Alternative 2.

A semi-annual groundwater sampling program would be implemented following installation of the ZVI barriers for the first three years followed by annual sampling for an additional two years. Samples would be collected from select monitoring wells and surface water locations and submitted to a South Carolina-certified laboratory for VOC analysis via USEPA Method 8260B and also for total and dissolved iron via USEPA Method 6010. A semi-annual monitoring report would be prepared following each semi-annual sampling event, and an annual monitoring report would be prepared following each annual sampling event. These reports would include a summary of SVE/AS activities, SVE treatment system vapor removal results, groundwater sampling results, and recommendations for the next reporting period.

Upon approval of Site closure by SCDHEC, Site SVE, AS, and monitoring wells would be abandoned in accordance with all applicable rules and regulations.

6.2.1 Overall Protection of Human Health and the Environment

Alternative 2 does not present any additional risks to the community other than potential emissions during SVE/AS treatment system operation, which will be controlled if necessary. Risks to remediation workers from contact with contaminated media is minimal and is addressed further in Section 6.2.3. This alternative would be protective of human health and the environment.

6.2.2 Compliance with ARARs

Alternative 2 would comply with chemical-specific and action-specific ARARs. No location-specific ARARs have been identified. ARAR compliance is expected to occur within five years.

6.2.3 Short-Term Effectiveness

Community Protection - Alternative 2 will reduce the likelihood of contact with PCE in soil and groundwater due to removal by SVE/AS and treatment by ISCR with ZVI. The alternative does not present any additional risks with the exception of air emissions during SVE/AS treatment system operation. SVE/AS treatment system vapor exhaust will be sampled during startup testing to allow for an accurate determination of actual emissions.

Worker Protection - Remediation workers may be exposed to COCs during drilling, SVE/AS treatment system installation, and SVE/AS treatment system startup. Workers may also be exposed to ZVI dust during injection activities. Workers and oversight personnel will all be Hazardous Waste Operations (HAZWOPER)-trained, and engineering controls and personal protective equipment (PPE) will be used to prevent excessive exposure. Construction and treatment activities are limited in duration and the overall exposure potential is low.

Environmental Impacts - The source area PCE mass is small, and the likelihood of air quality impacts are low. Monitoring before and during SVE/AS treatment system operation will ensure that exceedances of ambient air quality standards do not occur. Groundwater purged during sampling events will be securely stored and subsequently transported for off-Site treatment and disposal at a regulated facility. Due to potential negative impacts to surface water, DPT injection of ZVI will not be conducted immediately next to the unnamed tributary to Stoddard Creek. Response to the ZVI injections will be monitored to gauge the propagation distances for amendments, geochemical effects, and PCE breakdown products. Common concerns are expected to include monitoring and controls to prevent emergence (i.e., daylighting) of the injected ZVI at the ground surface and also in the surface water of the unnamed tributary to Stoddard Creek.

Time to Achieve RAOs - SVE treatment system operation is estimated to reduce PCE mass to its MCL-based SSL of 0.0023 mg/kg in the source area vadose zone soil within two years. Quarterly monitoring of the SVE/AS treatment system effluent will be used to determine when confirmation soil sampling should be conducted. Groundwater remediation using ISCR is estimated to achieve MCLs and surface water WQCs off-Site and at the Site boundary in two to four years. On-Site groundwater is estimated to achieve MCLs after three to five years.

6.2.4 Long-Term Effectiveness and Permanence

When complete, soil treatment will achieve compliance with the MCL-based SSL for PCE in source area soil. Completed groundwater treatment will also achieve compliance with the MCL for PCE (5 µg/L), removing risk to current and future residents from groundwater. Achieving groundwater MCLs also achieves vapor intrusion protection for possible future receptors as the MCL for PCE is lower that its Residential VISL (5.8 µg/L).

6.2.5 Reduction of Mobility, Toxicity, and Volume

Treatment of VOCs in soil and groundwater will be conducted by a combination of SVE, AS, and ISCR. VOC mobility, toxicity, and volume will be reduced in soil and groundwater. The physical stripping and chemical reduction of VOCs is permanent and irreversible.

6.2.6 Implementability

Alternative 2 implementation is technically feasible. Installation of AS wells and SVE wells uses standard drilling techniques and well construction methods. SVE/AS is an established remediation technique available through at least several vendors in the region. DPT injection of ZVI is also an established technique that is available through several vendors. Regarding administrative feasibility, well and borehole installation and ZVI injection will require access to both on-Site and off-Site properties, which should not be an issue. An air permit or exemption will be required for the SVE system. AS and ZVI injection require underground injection control (UIC) permits.

6.2.7 Cost

Table 6.1 provides a summary of estimated costs associated with Alternative 2, and **Appendix A** contains the itemized costs. The primary capital costs for soil remediation include utility locating, installation of SVE and AS wells, SVE/AS conveyance piping installation, fenced equipment compound installation, and mobile treatment system installation and startup. The primary O&M costs for soil remediation include SVE operation, monitoring, and reporting. A field-scale pilot test is recommended to more accurately determine full-scale SVE/AS treatment system design parameters and to better define a time frame to reach Site closure; however, the cost for a pilot test is not included as part of the Alternative 2 cost estimate. Alternative 2 capital and O&M costs for soil remediation are $251,500 and $14,000, respectively.

The primary capital groundwater remediation costs include utility locating, ZVI injection in the source area and the downgradient toe of the plume using DPT, and groundwater analytical reporting. O&M costs for groundwater remediation are associated with monitoring and reporting. Alternative 2 capital and O&M costs for groundwater remediation are $237,000 and $108,500, respectively. The total Alternative 2 cost for soil and groundwater remediation is an estimated $611,000.

6.2.8 State Acceptance

Alternative 2 is expected to be acceptable to the State. Potential concerns are expected to include monitoring and controls to prevent negative impacts to surface water by ZVI and an estimation of air emissions generated by the SVE/AS treatment system. Concerns can be addressed after receipt of SCDHEC FS review comments.

6.2.9 Community Acceptance

Alternative 2 is expected to be acceptable to the community. Potential concerns include noise and traffic as well as air emissions. Concerns can be addressed after receipt of SCDHEC FS review comments.

6.3 ALTERNATIVE 3: ISCO BLENDING WITH ISCR

Alternative 3 includes ISCO blending of impacted vadose zone soil and the underlying aquifer materials in the identified source area followed by stabilization of the treated soil using Portland cement. Stabilization is necessary to ensure that the soil treated by ISCO blending are competent enough to support any potential future aboveground structures. Experience with ISCO soil blending has determined that the treated soils are typically not competent enough to support aboveground structures if stabilization is not employed. The soil remedy would be combined with ISCR for the remaining source area and downgradient plume.

Source area soil and shallow aquifer soil and groundwater will be treated via ISCO blending using potassium permanganate which reacts quickly with the contaminants. This short duration will allow for rapid-turn confirmation soil sampling to determine the effectiveness of ISCO blending so that the overall time for treatment is minimized.

To complete Alternative 3, removal of the overlying former hazardous waste accumulation building concrete pad would first be conducted. Following its removal, a 640 ft^2 area would be targeted for ISCO blending from the ground surface down to an approximate depth of 25 feet bgs. Groundwater in this area of the Site is encountered at approximately 18 to 19 feet bgs. Field implementation of ISCO blending would involve excavation and temporary stockpiling of unsaturated soil. For this operation, ISCO blending is assumed to be conducted in two separate treatment intervals that cover the 0 to 25 feet bgs overall treatment interval. These two intervals would be from 0 to 10 feet bgs (shallow treatment zone) and from 10 to 25 feet bgs (deep treatment zone).

Initially, vadose zone soil in the shallow treatment zone would be excavated and temporarily stockpiled next to the excavation. ISCO blending would then be conducted using potassium permanganate within the deep treatment zone. Following completion of the ISCO reaction, confirmation soil samples would be collected from the deep treatment zone and analyzed for CoCs via rapid-turn analysis. Upon verification of successful treatment, stabilization of the deep treatment zone would be conducted using an approximate 5% by weight Portland cement, calculated as pounds of Portland cement per ton of treated soil. The stockpiled shallow treatment zone soil would subsequently be placed back into the excavation on top of the stabilized deep treatment zone soil, and the previously described ISCO blending, confirmation soil sampling, and stabilization activities would be repeated. Up to six days is anticipated to be necessary to complete this work. Due to the ISCO blending activities, monitoring wells MW-09-07 and MW-09-08D would be abandoned. Because the stabilized soil will essentially become a solid monolith following stabilization, the replacement monitoring well, or wells would need to be installed downgradient from the ISCO blending area. **Figure 5.2a** shows a plan and profile view of the source area soil remediation installation.

Similar to Alternative 2, additional source area groundwater treatment and downgradient groundwater plume treatment would be accomplished by using ISCR with ZVI. **Figure 5.2b** shows a profile view of the groundwater remediation installation for Alternative 3. Groundwater remediation monitoring and reporting will be the same as Alternative 2.

6.3.1 Overall Protection of Human Health and the Environment

Alternative 3 does not present any additional risks to the community. Risks to remediation workers from contact with contaminated media is minimal and of limited duration. Risks to remediation workers from contact with oxidants, Portland cement, and ZVI is somewhat greater and must be managed by engineering controls and PPE. Worker protection is addressed further in Section 6.3.3. This alternative would be protective of human health and the environment.

6.3.2 Compliance with ARARs

Alternative 3 would comply with chemical-specific and action-specific ARARs. No location-specific ARARs have been identified. ARAR compliance is expected to occur within five years.

6.3.3 Short-Term Effectiveness

<ins>Community Protection</ins> - Alternative 3 would reduce the likelihood of contact with PCE in soil and groundwater due to treatment by ISCO blending and ISCR in the source area and by treatment

using ISCR in the downgradient plume area. The alternative does not present any additional risks to the community.

Worker Protection - Remediation workers may be exposed to treatment chemicals and COCs during ISCO blending and also to ZVI dust during groundwater injection activities. Workers will be HAZWOPER trained, and engineering controls and PPE will be used to prevent excessive exposure. Construction and treatment activities are limited in duration and exposure potential is low.

Environmental Impacts – The source area PCE mass is small, and the likelihood of adverse impacts from ISCO blending activities is minimal. Groundwater purged during sampling events will be securely stored and subsequently transported for off-Site treatment and disposal at a regulated facility. Due to potential negative impacts to surface water, DPT injection of ZVI will not be conducted immediately next to the unnamed tributary to Stoddard Creek. Response to the ZVI injections will be monitored to gauge the propagation distances for amendments, geochemical effects, and PCE breakdown products. Common concerns are expected to include monitoring and controls to prevent emergence (i.e., daylighting) of the injected ZVI at the ground surface and also in the surface water of the unnamed tributary to Stoddard Creek.

Time to Achieve RAOs - ISCO blending is estimated to reduce the PCE mass in the source area to below its SSL of 0.0023 mg/kg within one week. The remaining source area and downgradient PCE mass can then be more readily treated using ISCR with ZVI. Groundwater remediation using ISCR is estimated to achieve MCLs and surface water WQCs off-Site and at the Site boundary within two to four years. On-Site groundwater is estimated to achieve MCLs within three to five years.

6.3.4 Long-Term Effectiveness and Permanence

When complete, soil treatment will achieve compliance with the MCL-based SSL for PCE in source area soil. Completed groundwater treatment will also achieve compliance with the MCL for PCE, removing risk to current and future residents from groundwater. Achieving groundwater MCLs also achieves vapor intrusion protection for possible future receptors as the MCL for PCE is lower that its Residential VISL.

6.3.5 Reduction of Mobility, Toxicity, and Volume

Treatment of VOCs in soil and groundwater will be conducted by a combination of ISCO blending and ISCR. VOC mobility, toxicity, and volume will be reduced in both soil and groundwater. Destruction of COCs by ISCO and ISCR is permanent and irreversible.

6.3.6 Implementability

Alternative 3 implementation is technically feasible. Demolition and disposal of the former hazardous waste accumulation concrete pad is required, and there are multiple local vendors that can conduct the work. ISCO treatment via blending is an established remediation technique but is somewhat specialized. It is available through at least several vendors in the region. DPT injection of ZVI is also an established technique that is available through multiple vendors. Regarding administrative feasibility, ISCO blending and ZVI injection activities will require access to both on-Site and off-Site properties, which should not be an issue. ISCO blending and ZVI injection will require a UIC permit.

6.3.7 Cost

Table 6.1 provides a summary of costs associated with Alternative 3, and **Appendix A** contains the itemized costs. Primary capital costs include slab demolition and disposal, ISCO blending of source area soil, rapid-turn confirmation soil sampling, and soil stabilization. There are no O&M costs associated with soil remediation. The Alternative 3 soil remediation cost is estimated to be $135,000.

The primary capital groundwater remediation costs include utility locating, ZVI injection in the source area and the downgradient toe of the plume using DPT, and groundwater analytical. O&M costs for groundwater remediation are associated with monitoring and reporting. Alternative 3 capital and O&M costs for groundwater remediation are $237,000 and $108,500, respectively. The total Alternative 3 cost for soil and groundwater remediation is an estimated $480,500.

6.3.8 State Acceptance

Alternative 3 is expected to be acceptable to the state. Concerns are expected to include monitoring and controls to prevent the emergence of ZVI in nearby surface water and prevention of mobilization of inorganics by oxidation. All concerns will be addressed after receipt of FS review comments.

6.3.9 Community Acceptance

Alternative 3 is expected to be acceptable to the community. Potential concerns include temporary noise and traffic, but this will only be for a short duration. All concerns will be addressed after receipt of FS review comments.

6.4 ALTERNATIVE 4: EXCAVATION AND OFFSITE DISPOSAL/ISCO BLENDING AND ISCR

Alternative 4 includes source area vadose zone soil and shallow aquifer soil that will be treated by a combination of excavation and ISCO blending. Mechanical excavation of soil involves the removal and off-Site disposal of the overlying concrete slab and subsequent excavation from the ground surface down to the capillary fringe (approximately 18 to 19 feet bgs). The excavated soil will be loaded into roll-off containers pending characterization with subsequent disposal at a permitted, off-Site facility.

Capillary fringe soil and five feet into the saturated zone will be treated by ISCO blending using potassium permanganate. Following the completion of blending activities, clean backfill will be brought in and compacted from the top of the ISCO blend area to the existing ground surface. **Figure 5.3a** shows a plan and profile view of the Alternative 4 source area and soil remediation installation. Due to the proposed excavation and blending activities, monitoring wells MW-09-07 and MW-09-08D will be abandoned and replaced after soil remedial activities are complete.

Similar to Alternatives 2 and 3, additional source area groundwater treatment and downgradient groundwater plume treatment will be accomplished by using ISCR with ZVI. **Figure 5.3b** shows a profile view of the groundwater remediation installation for Alternative 4. The associated groundwater remediation monitoring and reporting will be the same as previously described for Alternatives 2 and 3.

6.4.1 Overall Protection of Human Health and the Environment

Alternative 4 does not present any additional risks to the community. Risks to remediation workers from contact with contaminated media is minimal and of limited duration. Risks to remediation workers from contact with oxidants and ZVI is somewhat greater and must be managed by engineering controls and PPE. Worker protection is addressed further in Section 6.4.3. This alternative would be protective of human health and the environment.

6.4.2 Compliance with ARARs

Alternative 4 would comply with chemical-specific and action-specific ARARs. No location-specific ARARs have been identified. ARAR compliance is expected to occur within five years.

6.4.3 Short-Term Effectiveness

Community Protection - Alternative 4 will reduce the likelihood of contact with PCE in soil and groundwater due to removal by the excavation, treatment by ISCO soil blending, and reduction by ZVI. The alternative does not present any additional risks to the community.

Worker Protection - Remediation workers may be exposed to treatment chemicals and COCs during excavation, ISCO blending, and DPT injection of ZVI. Workers will be HAZWOPER trained, and engineering controls and PPE will prevent excessive exposure. Construction and treatment activities are limited in duration and exposure potential is low.

Environmental Impacts - The source area PCE mass is small, and the likelihood of adverse impacts from excavation and ISCO soil blending activities is minimal. Common concerns are expected to include monitoring and controls to prevent emergence of injectants at the ground surface and also in the surface water of the unnamed tributary to Stoddard Creek. Groundwater purged during sampling events will be securely stored and subsequently transported for off-Site treatment and disposal at a regulated facility. Due to potential negative impacts to surface water, DPT injection of ZVI will not be conducted immediately next to the unnamed tributary to Stoddard Creek. Response to the ZVI injections will be monitored to gauge the propagation distances for amendments, geochemical effects, and PCE breakdown products. Common concerns are expected to include monitoring and controls to prevent emergence (i.e., daylighting) of the injected ZVI at the ground surface and also in the surface water of the unnamed tributary to Stoddard Creek.

Time to Achieve RAOs - Excavation and ISCO blending are estimated to reduce PCE mass in the source area to below its SSL of 0.0023 mg/kg within two weeks. The remaining source area and downgradient PCE mass can then be more readily treated using ISCR with ZVI. Groundwater remediation using ISCR is estimated to achieve MCLs and surface water WQCs off-Site and at the Site boundary within two to four years. On-Site groundwater is estimated to achieve MCLs within three to five years.

6.4.4 Long-Term Effectiveness and Permanence

When complete, soil treatment will achieve compliance with the MCL-based SSL for PCE in source area soil. Completed groundwater treatment will also achieve compliance with the MCL for PCE, removing risk to current and future residents from groundwater. Achieving groundwater MCLs also achieves vapor intrusion protection for possible future receptors as the MCL for PCE is lower that its Residential VISL.

6.4.5 Reduction of Mobility, Toxicity, and Volume

Removal of VOCs in source area vadose zone soil will be conducted by excavation and off-Site disposal. Off-site disposal of soil does not reduce toxicity or volume, but it does reduce mobility. Excavation also does not satisfy the regulatory preference for treatment.

The treatment of VOCs in source area saturated soil will be performed by ISCO blending, and the treatment of VOCs in groundwater will be conducted by ISCR. VOC mobility, toxicity, and volume will be reduced in soil and groundwater. Destruction of COCs by ISCO and ISCR are permanent and irreversible.

6.4.6 Implementability

Alternative 4 implementation is technically feasible. Demolition and disposal of the former hazardous waste accumulation concrete pad is required, and there are multiple local vendors that can conduct the work. Excavation of source area vadose zone soil will require benching and shoring. Multiple local vendors could conduct this work. ISCO treatment via blending is an established remediation technique but is somewhat specialized. It is available through at least several vendors in the region. DPT injection of ZVI is also an established technique that is available through multiple vendors. Regarding administrative feasibility, mechanical excavation, ISCO blending, and ZVI injection activities will require access to both on-Site and off-Site properties, which should not be an issue. ISCO blending and ZVI injection will require a UIC permit.

6.4.7 Cost

Table 6.1 provides a summary of costs for Alternative 4, and **Appendix A** contains the itemized costs. Primary capital costs include concrete slab demolition and disposal, excavation and disposal of source area vadose zone soil, ISCO treatment of shallow source area aquifer soil, confirmation soil sampling, and backfilling. There are no O&M costs associated with soil remediation. Alternative 4 soil remediation cost is estimated to be $193,500. Note that this cost assumes that the excavated vadose zone soil can be disposed as nonhazardous.

The primary capital groundwater remediation costs include utility locating, ZVI injection in the source area and the downgradient toe of the plume using DPT, and groundwater analytical. O&M costs for groundwater remediation are associated with monitoring and reporting. Alternative 4 capital and O&M costs for groundwater remediation are $237,000 and $108,500, respectively. The total Alternative 4 cost for soil and groundwater remediation is an estimated $539,000.

6.4.8 State Acceptance

Alternative 4 is expected to be acceptable to the state. Concerns are expected to include monitoring and controls to prevent the emergence of ZVI in surface water and preventing the mobilization of inorganics by oxidation. All concerns will be addressed after receipt of FS review comments.

6.4.9 Community Acceptance

Alternative 4 is expected to be acceptable to the community. Potential concerns include temporary dust control, noise, and traffic for a short duration. Concerns can be addressed after receipt of FS review comments.

7.0 COMPARISON OF ALTERNATIVES ANALYSIS

Table 6.1 presents a summary and comparison of the baseline No-Action Alternative and the three active remedial alternatives considered in this FS. This section presents a comparative analysis of the results for the active remedial alternatives.

7.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative 1 (the No Action Alternative) is not protective of human health and the environment. Alternatives 2, 3 and 4 are all protective of human health and the environment.

7.2 COMPLIANCE WITH ARARS

Alternative 1 does not comply with any of the ARARs. All three active remedial alternatives would comply with chemical-specific and action-specific ARARs. No location-specific ARARs have been identified. Alternatives 3 and 4 would comply with soil risk-based SSLs the most quickly. Alternative 2 would reach risk-based SSL compliance in source area vadose zone soil more quickly than Alternative 1. Alternatives 2, 3, and 4 will all achieve groundwater MCL compliance in similar times, while Alternative 1 will not likely achieve groundwater MCL compliance within a reasonable time frame.

7.3 SHORT-TERM EFFECTIVENESS

Community Protection – There are no risks to the community presented by Alternative 1. Risks to the community presented by Alternatives 2, 3, and 4 are similar and are expected to be minimal.

Worker Protection – Alternative 1 presents no risk to workers. Alternatives 2 presents a slight degree of risk to remediation workers from contact with COCs during SVE and AS well installation, exposure to potential air emissions from the operation of the SVE/AS treatment system and contact with ZVI during injection. Alternative 3 presents a slightly higher degree of risk than Alternative 2 to remediation workers due to contact with COCs, chemical oxidants, and chemical reductants. Alternative 4 presents the most overall risk to remediation workers due to potential contact with COCs, exposure to chemical oxidants and chemical reductants, and work duties to be conducted around excavation equipment. These risks can be mitigated by a robust Site-specific health and safety plan, appropriate engineering controls, and PPE.

Environmental Impacts – No adverse environmental impacts are created by Alternative 1. The source area PCE mass is small, and the likelihood of adverse impacts from Alternatives 2, 3, and 4 is minimal. Common groundwater treatment concerns are expected to include monitoring and controls to prevent emergence of injectants at the ground surface and in the surface water of the unnamed tributary to Stoddard Creek.

Time to Achieve RAOs - Alternatives 3 and 4 provide the most rapid removal of VOC mass from source area vadose zone soil within one and two weeks of treatment, respectively. Alternative 2 is expected to take up to two years to remove source area vadose zone soil impact. Alternatives 2, 3, and 4 are expected to require three to five years to achieve groundwater RAOs. Alternative 1 is estimated to take at least 30 years to achieve Site RAOs.

7.4 LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 1 does not exhibit long-term effectiveness and permanence. Alternatives 2 through 4 are expected to provide similar degrees of long-term effectiveness and permanence.

7.5 REDUCTION OF MOBILITY, TOXICITY, AND VOLUME

Alternative 1 does nothing to reduce the mobility, toxicity, and volume of Site contamination. Alternatives 2 and 3 reduce volume, mobility, and toxicity of COCs at the Site as well as meet the statutory preference for treatment. Alternative 3 provides the greatest degree of reduction, since all treatment involves in-situ degradation without transfer to other media. Alternative 4 reduces the volume of COCs at the Site, but it does not reduce the toxicity and volume of the source area vadose zone soil targeted for excavation and off-Site disposal. Alternative 4 also does not meet the statutory preference for treatment.

7.6 IMPLEMENTABILITY

Alternative 1 requires no implementation. The three active remedial alternatives are technically feasible and readily implemented, with at least a moderate selection of qualified subcontractors. Alternative 2 requires the least remedial construction effort. Alternatives 3 and 4 both require demolition of the overlying concrete slab associated with the former hazardous waste accumulation building, and Alternative 4 requires transport of soil off-Site with backfilling using borrow soil. Alternatives 3 and 4 require abandonment and replacement of two monitoring wells (MW-09-07 and MW-09-08D).

7.7 COST

Table 6.1 provides a summary of costs for each of the alternatives. Alternative 1 costs nothing. Alternative 3 is the least costly active remedial alternative, and Alternative 2 is the most costly. The total costs for Alternatives 2, 3, and 4 are an estimated $611,000, $480,500, and $539,000, respectively.

7.8 STATE ACCEPTANCE

All of the alternatives except No Action are expected to be acceptable to the state. Common concerns are expected to include monitoring and controls to prevent emergence of injectants at the ground surface and also in the surface water of the unnamed tributary to Stoddard Creek. Concerns can be better evaluated after receipt of FS review comments from SCDHEC.

7.9 COMMUNITY ACCEPTANCE

All alternatives except No Action are expected to be acceptable to the community. Potential concerns will be addressed after receipt of FS review comments.

8.0 QUALIFICATIONS OF FEASIBILITY STUDY

The activities and evaluative approaches used in this FS are consistent with those normally employed in environmental waste-management projects of this type. Our evaluation of Site conditions has been based on our understanding of the Site and project information and the data obtained in our assessments. The general subsurface conditions utilized in our evaluation have been based on interpolation of subsurface data between the sampling locations. Regardless of the thoroughness of an environmental Site assessment, there is always the possibility that conditions between sampling locations will be different from that at specific locations due to the variability of subsurface conditions. Therefore, it was not possible to identify all conceivable forms of contamination.

This report has been prepared on behalf of and exclusively for the use of Robert Bosch Tool Corporation, Robert Bosch, LLC, and the SCDHEC. This report and the findings contained herein shall not, in whole or in part, be disseminated or conveyed to any other party or used or relied upon by any other party without Wood's prior written consent.

9.0 REFERENCES

AMEC Environment & Infrastructure, Inc., 2012. Remedial Investigation / Feasibility Study Work Plan, Revision 4.0, Former Vermont Bosch Site, Fountain Inn, South Carolina, AMEC Project 6251121007.01.01, Greenville, South Carolina.

Amec Foster Wheeler Environment & Infrastructure, Inc., 2016. Remedial Investigation Report, Former Vermont Bosch Site, Fountain Inn, South Carolina, Amec Foster Wheeler Project 6251121007.03.01, Greenville, South Carolina.

Amec Foster Wheeler Environment & Infrastructure, Inc., 2017a. Remedial Investigation Report Addendum, Former Vermont Bosch Site, Fountain Inn, South Carolina, Amec Foster Wheeler Project 6251121022.02.03, Greenville, South Carolina.

Amec Foster Wheeler Environment & Infrastructure, Inc., 2017b. Groundwater Sampling Report, Former Vermont Bosch Site, Fountain Inn, South Carolina, Amec Foster Wheeler Project 6251121022.02.03, Greenville, South Carolina.

Canova, Judy L., 1999. "Elements in South Carolina Inferred Background Soil and Stream Sediment Samples", South Carolina Geology, v. 41, pp. 11-25.

South Carolina Department of Health and Environmental Control, Office of Environmental Quality Control, 2014. "State Primary Drinking Water Regulations (R.61-58)," Columbia, South Carolina.

United States Environmental Protection Agency, 1988. "Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA, EPA/540/G-89/004, OSWER Directive 9355-3-01.

United States Environmental Protection Agency, 2015. Ambient Water Quality Criteria, United States Environmental Protection Agency, Office of Water.

United States Environmental Protection Agency, 2019a. Regional Screening Levels for Chemical Contaminants at Superfund Sites (April 2019).

United States Environmental Protection Agency, 2019b. Vapor Intrusion Screening Level (VISL) Calculator, May 2019 RSLs, United States United States Environmental Protection Agency, Office of Solid Waste and Emergency Response, May 2019.

Wood Environment & Infrastructure Solutions, Inc., 2018. Report of Site-Wide Groundwater Sampling, Former Vermont Bosch Site, Fountain Inn, South Carolina, Wood Project 6251161022.03.02, Greenville, South Carolina.

TABLES

TABLE 2.1

Summary of Surface Soil Laboratory Analytical Results
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Constituents	Units	USEPA RRSL	USEPA SSL	Sample Identification							
				SS-07-01X000XX	SS-07-02X000XX	SS-07-03X000XX	SS-07-04X000XX	SS-07-05X000XX	SS-07-06X000XX	SS-07-07X000XX	SS-07-08X000XX
Sample Date				11/4/2014	11/4/2014	11/4/2014	11/20/2015	11/20/2015	11/20/2015	11/20/2015	11/20/2015
Phenanthrene	µg/kg	NE	NE	<350	<410	<420	<390	<570	<400	*110J*	<400
Fluoranthene	µg/kg	2,400,000	89,000	*47J*	<410	<420	*110J*	*73J*	<400	*300J*	*96J*
Pyrene	µg/kg	1,800,000	13,000	<350	<410	<420	*86J*	*60J*	<400	*240J*	*75J*
Benz(a)anthracene	µg/kg	1,100	11	<350	<410	<420	*43J*	<570	<400	*170J*	*41J*
Chrysene	µg/kg	110,000	9,000	<350	<410	<420	*73J*	<570	<400	*220J*	*59J*
Benzo(b)fluoranthene	µg/kg	1,100	300	*40J*	<410	<420	*120J*	*91J*	<400	**440**	*100J*
Benzo(k)fluoranthene	µg/kg	11,000	2,900	<350	<410	<420	<390	<570	<400	*100J*	<400
Benzo(a)pyrene	µg/kg	110	29	<350	<410	<420	*48J*	<570	<400	*160J*	*53J*
Benzo(g,h,i)perylene	µg/kg	NE	NE	<350	<410	<420	*69J*	<570	<400	*130J*	*51J*
Indeno(1,2,3-cd)pyrene	µg/kg	1,100	980	<350	<410	<420	*52J*	<570	<400	*110J*	*41J*

Notes:
µg/kg = micrograms per kilogram
USEPA = United States Environmental Protection Agency
RRSL = Regional Screening Level for Residential Soil (April 2019) - Hazard Quotient of 1
SSL = Risk-Based Soil Screening Level (April 2019) - Hazard Quotient of 1
NE = not established
Bold values detected above the Reporting Limit
Italic values are estimated between the Minimum Detection Limit and Reporting Limit ("J" Flag)
Yellow shaded values indicate an exceedance of the USEPA RSL and SSL
Light green shaded values indicate an exceedance of the USEPA SSL
J = Value is estimated

Prepared By/Date: SEA 08/30/19
Checked By/Date: PSJ 08/30/19

TABLE 2.2

Summary of Soil Boring Laboratory Analytical Results
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Constituents	Units	USEPA RRSL	USEPA SSL	SB-04-01X002XX	SB-04-02X002XX	SB-04-03X002XX	SB-06-01X001XX	SB-06-01X002XX	SB-06-02X001XX	SB-06-02X002XX	SB-08-01X008XX	SB-08-01X010XX	SB-08-02X008XX	SB-08-02X010XX	SB-08-03X008XX
				11/3/14	11/3/14	11/3/14	11/3/14	11/3/14	11/3/14	11/3/14	11/3/14	11/3/14	11/3/14	11/3/14	11/3/14
Acetone	mg/kg	61,000	2.9	<0.0092	<0.010	<0.010	<0.016	<0.010	<0.017	<0.012	<0.010	<0.012	<0.0098	<0.013	<0.012
Bis (2-ethylhexyl)phthalate	mg/kg	39	1.3	<0.037	<0.037	<0.036	<0.046	<0.035	<0.031	*0.18J*	<0.038	<0.039	<0.0042	<0.041	<0.034
Di-n-butyl phthalate	mg/kg	6,300	2.3	<0.042	<0.042	<0.041	<0.051	<0.410U	<0.035	<0.400U	<0.043	<0.044	<0.047	<0.046	<0.390U
Diethyl phthalate	mg/kg	51,000	6.1	<0.044	<0.044	<0.043	<0.054	<0.041	<0.037	*0.33J*	<0.046	<0.046	<0.049	<0.048	<0.039
Methylene Chloride	mg/kg	57	0.0029	*0.0089J*	*0.0095J*	*0.011J*	*0.019J*	*0.0058J*	*0.022J*	*0.0080J*	*0.014J*	*0.014J*	*0.011J*	*0.017J*	*0.018J*
Tetrachloroethene	mg/kg	24	0.0051	<0.0003	<0.00033	<0.00033	<0.00053	<0.00034	<0.00054	<0.00038	<0.00033	<0.0004	<0.00032	<0.00042	<0.0004

Constituents	Units	USEPA RRSL	USEPA SSL	SB-08-03X010XX	SB-08-04X008XX	SB-08-04X010XX	SB-08-05X008XX*	SB-08-05X010XX	SB-08-06X008XX	SB-08-06X010XX	SB-08-07X008XX	SB-08-07X010XX	SB-08-08X008XX	SB-08-08X010XX
				11/3/14	11/3/14	11/3/14	11/3/14	11/3/14	11/3/14	11/3/14	11/3/14	11/3/14	11/3/14	11/3/14
Acetone	mg/kg	61,000	2.9	<0.0098	<0.017	<0.014	*0.024J*	<0.0091	<0.012	<0.012	<0.012	<0.014	<0.016	<0.012
Bis(2-ethylhexyl)phthalate	mg/kg	39	1.3	<0.036	<0.041	<0.045	<0.033	<0.036	<0.040	<0.040	<0.042	<0.045	<0.039	<0.036
Di-n-butyl phthalate	mg/kg	6,300	2.3	<0.040	<0.047	<0.050	<0.037	<0.041	<0.046	<0.045	<0.047	<0.051	<0.044	<0.040
Diethyl phthalate	mg/kg	51,000	6.1	<0.042	<0.049	<0.053	<0.039	*0.048J*	<0.048	<0.048	<0.050	<0.053	<0.046	*0.061J*
Methylene Chloride	mg/kg	57	0.0029	*0.0091J*	*0.020J*	*0.0084J*	*0.0066J*	*0.011J*	*0.011J*	*0.013J*	*0.016J*	*0.012J*	*0.019J*	*0.0094J*
Tetrachloroethene	mg/kg	24	0.0051	<0.00032	<0.00055	<0.00048	<0.00027	<0.0003	<0.0004	<0.00039	<0.0004	<0.00045	<0.00052	<0.00038

Notes:
mg/kg = milligrams per kilogram
USEPA = United States Environmental Protection Agency
RRSL = Residential Regional Screening Level (April 2019) - Hazard Quotient of 1
SSL = Risk-Based Soil Screening Level (April 2019) - Hazard Quotient of 1
Bold values indicate detections above the Reporting Limit
Italic values are estimated between the Minimum Detection Limit and Reporting Limit ("J" Flag)
Light green shaded values indicate exceedance of USEPA SSL
* = Sample was mislabeled as SB-08-03X008XX 1:30 PM on laboratory chain of custody
AOC = Area of concern
J = Value is estimated
U = not detected, value is the detection limit

TABLE 2.2

Summary of Soil Laboratory Analytical Results
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251121007.03.01

Constituents	**Units**	**USEPA RRSL**	**USEPA SSL**	SB-09-01X000XX 7/7/2015	SB-09-01X005XX 7/7/2015	SB-09-01X010XX 7/7/2015	SB-09-01X015XX 7/7/2015	SB-09-02X000XX 7/7/2015	SB-09-02X005XX 7/7/2015	SB-09-02X010XX 7/7/2015	SB-09-02X015XX 7/7/2015	SB-09-02X020XX 7/7/2015	SB-09-03X000XX 7/7/2015	SB-09-03X005XX 7/7/2015	SB-09-03X010XX 7/7/2015	SB-09-03X015XX 7/7/2015	SB-09-04X000XX 7/7/2015	SB-09-04X005XX 7/7/2015
Acetone	mg/kg	61,000	2.9	<0.0082	<0.073UJ	<0.0054	<0.006	<0.0051	< 0.007	<0.0063	<0.0069	<0.0052	<0.0062	<0.0064	<0.0062	<0.0049	<0.0048	<0.0053
Bis(2-ethylhexyl)phthalate	mg/kg	39	1.3	<0.097	<0.080	<0.093	<0.099	<0.083	<0.091	<0.088	<0.098	<0.086	<0.096	<0.080	<0.088	<0.085	<0.081	<0.082
Di-n-butyl phthalate	mg/kg	6,300	2.3	<0.110	<0.095	<0.110	<0.120	<0.098	<0.110	<0.100	<0.120	<0.100	<0.110	<0.095	<0.100	<0.100	<0.095	<0.097
Diethyl phthalate	mg/kg	51,000	6.1	<0.100	<0.084	<0.097	<0.100	<0.087	<0.095	<0.092	<0.100	<0.090	<0.100	<0.084	<0.092	<0.090	<0.084	<0.086
Methylene Chloride	mg/kg	57	0.0029	**0.029**	*0.016J*	**0.017**	**0.019**	**0.016**	**0.025**	**0.027**	<0.021	<0.023U	<0.017U	<0.04U	<0.022U	<0.015U	<0.017U	<0.016U
Tetrachloroethene	mg/kg	24	0.0051	**0.08**	**0.0051**	*0.0029J*	**0.11**	**0.017**	**0.011**	**0.11**	**0.091**	**0.230**	**0.070**	<0.0007	**0.021**	**0.210**	**0.014**	*0.0056J*

Constituents	**Units**	**USEPA RRSL**	**USEPA SSL**	SB-09-04X010XX 7/7/2015	SB-09-04X015XX 7/7/2015	SB-09-04X020XX 7/7/2015	SB-09-05X000XX 7/7/2015	SB-09-05X005XX 7/7/2015	SB-09-05X010XX 7/7/2015	SB-09-05X015XX 7/7/2015	SB-09-06X000XX 7/7/2015	SB-09-06X005XX 7/7/2015	SB-09-06X010XX 7/7/2015	SB-09-06X015XX 7/7/2015	SB-09-06X020XX 7/7/2015	AOC-09 Average Detection	AOC 09 Maximum Detection
Acetone	mg/kg	61,000	2.9	<0.0061	<0.0056	<0.0067	<0.0064	<0.0064	<0.0064	<0.0050	<0.0067	<0.088UJ	<0.0061	<0.0064	<0.0059	ND	ND
Bis(2-ethylhexyl)phthalate	mg/kg	39	1.3	<0.087	<0.086	<0.086	<0.095	<0.087	<0.086	<0.079	<0.091	<0.085	<0.085	<0.100	<0.082	ND	ND
Di-n-butyl phthalate	mg/kg	1.7	2.3	<0.100	<0.100	<0.100	<0.110	<0.100	<0.100	<0.094	<0.110	<0.100	<0.100	<0.120	<0.097	ND	ND
Diethyl phthalate	mg/kg	6,300	6.1	<0.091	<0.090	<0.090	<0.100	<0.091	<0.090	<0.083	<0.095	<0.089	<0.089	<0.110	<0.086	ND	ND
Methylene Chloride	mg/kg	57	0.0029	<0.017U	<0.016U	<0.018U	<0.02U	<0.029U	<0.028U	<0.020UJ	<0.018U	<0.019U	**0.0410**	**0.029**	**0.034**	**0.0253**	**0.0410**
Tetrachloroethene	mg/kg	24	0.0051	<0.00066	**0.130**	**0.120**	*0.21J*	**0.013**	**0.0078**	*0.014J*	**0.025**	**0.0063**	**0.0062**	**0.044**	**0.074**	**0.0651**	**0.230**

Notes:
mg/kg = milligrams per kilogram
USEPA = United States Environmental Protection Agency
RRSL = Residential Regional Screening Level (April 2019) - Hazard Quotient of 1
SSL = Risk-Based Soil Screening Level (April 2019) - Hazard Quotient of 1
Bold values indicate detections above the Reporting Limit
Italic values are estimated between the Minimum Detection Limit and Reporting Limit ("J" Flag)
Light green shaded values indicate exceedance of USEPA SSL
AOC = Area of concern
J = Value is estimated
U = not detected, value is the detection limit

Prepared By/Date: SEA 08/30/19
Checked By/Date: PSJ 08/30/19

TABLE 2.3

Summary of Surface Water Laboratory Analytical Results
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Constituents	**Laboratory Method**	**Units**	**SC WQC**	**USEPA MCL**	SW-09-03	SW-09-04	SW-09-05	SW-09-06	SW-09-07	SW-09-08	SW-09-10	SW-09-12	SW-09-13
					11/5/14	11/5/14	11/5/14	11/5/14	11/5/14	11/5/14	11/5/14	11/5/14	11/5/14
Tetrachloroethene	8260	µg/L	0.69	5.0	<0.39	**58**	**41**	**20**	**13**	**3.6**	<0.39	**4.4**	<0.39

Notes:
µg/L = micrograms per liter
SC WQC = Water Quality Criteria, South Carolina Regualtion 61-68, effective 6/27/2014
USEPA MCL = United States Environmental Protection Agency Maximum Contaminant Level; effective May 2009
Bold values indicate detections above the SC WQC Reporting Limit
Yellow shaded values exceed the USEPA MCL

Prepared By/Date: SEA 08/30/19
Checked By/Date: PSJ 08/30/19
Revised By/Date: SHM 06/18/20
Checked By/Date: SLK 06/18/20

TABLE 2.4

Summary of Stream Sediment Laboratory Analytical Results
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Constituents	**Units**	**USEPA RRSL**	**USEPA SSL**	SD-09-01 11/4/14	SD-09-02 11/4/14	SD-09-03 11/4/14	SD-09-04 11/4/14	SD-09-05 11/4/14	SD-09-06 11/4/14	SD-09-07 11/4/14	SD-09-08 11/4/14	SD-09-09 11/4/14
Methylene chloride	µg/kg	57,000	2.9	*4.5J*	*2.0J*	<0.16UJ	*6.1J*	*3.2J*	*2.0J*	*5.2J*	*7.3J*	<0.48
Tetrachloroethene	µg/kg	24,000	5.1	<0.27	<0.32	<0.33	**9.9**	**23**	**5.6**	*2.6J*	<0.33	<0.33

Notes:

µg/kg = micrograms per kilogram
USEPA = United States Environmental Protection Agency
RRSL = USEPA Residential Regional Screening Level (November 2018) - Hazard Quotient of 1
SSL = Risk-Based Soil Screening Level (November 2018) - Hazard Quotient of 1
Bold values indicate detections above the Reporting Limit
Italic values are estimated between the Minimum Detection Limit and Reporting Limit ("J" Flag)
J = Value is estimated
U = not detected, value is the detection limit
Light green shaded values indicate exceedance of SSL

Prepared By/Date: SEA 08/30/19
Checked By/Date: PSJ 08/30/19

TABLE 2.5

Summary of 2015 AOC #9 Groundwater Laboratory Analytical Results
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Constituents	**Laboratory Method**	**Units**	**SCDHEC MCL**	**USEPA TWRSL**	**Max. Detection**	MW-09-06 1/28/15	MW-09-07 7/17/15	MW-09-08D 7/17/15	MW-09-09 1/28/15	MW-09-10 1/28/15	MW-09-11 1/28/15	MW-09-12D 1/28/15	MW-09-13 1/28/15	MW-09-14 1/28/15	MW-09-15 1/25/15	MW-09-16D 1/28/15	MW-09-17 1/28/15	MW-09-18D 1/28/15	MW-09-19D 1/28/15	MW-09-25 7/17/15
Carbon disulfide	8260	µg/L	NE	810	*3.4J*	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	*3.4J*	<0.60
Chloroform	8260	µg/L	80		*0.86J*	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	*0.86J*	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38
Tetrachloroethene	8260	µg/L	5		1,100	<0.42	**1,100**	<0.42	**7.4**	<0.42	**54**	<0.42	<0.42	<0.42	**67**	<0.42	<0.42	<0.42	<0.42	<0.42

Notes:
µg/L = micrograms per liter
SCDHEC = South Carolina Department of Health and Environmental Control
MCL = Maximum Contaminant Level (State Primary Drinking Water Regulations: R.61-58, October 2014)
USEPA = United States Environmental Protection Agency
TWRSL = USEPA Tap Water Regional Screening Level (May 2019)
NE = Not established
NA = Not applicable (not sampled for this constituent)
Bold values indicate detections above the Reporting Limit
Italic values are estimated between the Minimum Detection Limit and Reporting Limit ("J" Flag)
Light green shaded values exceed MCL
J = Value is estimated
< = not detected, value is the detection limit

Prepared By/Date: SEA 08/30/19
Checked By/Date: PSJ 08/30/19

TABLE 2.6

Summary of Groundwater Field Screening Laboratory Analytical Results
Former Vermont Bosch Site
Fountain Inn, South Carolina
Wood Project 6251161022.0402

Constituent	Units	SCDHEC MCL	Sample ID and Interval								
			GW-09-02		GW-09-03		GW-09-04			GW-09-05	
			26-30'	46-50'	26-30'	46-50'	26-30'	36-40'	46-50'	26-30'	
2-Butanone	µg/L	NE[1]	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	
Acetone	µg/L	NE[2]	< 20	< 20	< 20	< 20	*12J*	*15J*	< 20	< 20	
Methylene Chloride	µg/L	5	*1.0J*	*1.2J*	< 5.0	*1.1J*	*1.0J*	*1.4J*	< 5.0	*1.2J*	
Tetrachloroethene	µg/L	5	**3.0**	< 1.0	**2.4**	< 1.0	**130**	**2.6**	< 1.0	< 1.0	

Constituent	Units	SCDHEC MCL	Sample ID and Interval								
			GW-09-05A			GW-09-06	GW-09-07		GW-09-08		GW-09-09
			26-30'	36-40'	46-50'	46-50'	26-30'	36-40'	26-30'	36-40'	26-30'
2-Butanone	µg/L	NE[1]	< 10	< 10	< 10	< 10	< 10	**15**	< 10	< 10	< 10
Acetone	µg/L	NE[2]	**26**	< 20	< 20	< 20	< 20	*20J*	< 20	< 20	< 20
Methylene Chloride	µg/L	5	< 5.0	< 5.0	< 5.0	*0.93J*	< 5.0	< 5.0	< 5.0	*1.2J*	*1.0J*
Tetrachloroethene	µg/L	5	< 1.0	< 1.0	**6.9**	*0.99J*	**27**	< 1.0	**3.4**	< 1.0	< 1.0

Notes:
PCE = Tetrachloroethene (perchloroethylene)
µg/L = micrograms per liter
SCDHEC = South Carolina Department of Health and Environmental Control
MCL = Maximum Contaminant Level (South Carolina Primary Drinking Water Regulation R..61-58, October 2014)
[1] = United States Environmental Protection Agency Tap Water Regional Screening Level for 2-Butanone = 5,600 µg/L (May 2019)
[2] = United States Environmental Protection Agency Tap Water Regional Screening Level for Acetone = 14,000 µg/L (May 2019)
Sample intervals reported in feet below ground surface
Italicized values are estimated concentrations (J-Flagged) between laboratory Method Detection Limit (MDL) and Reporting Limit (RL)
Bold values represent concentrations above the laboratory RL
Light green shaded values indicate concentrations above the MCL

Prepared By/Date: SEA 08/30/19
Checked By/Date: PSJ 08/30/19

TABLE 2.7

Summary of Additional Monitoring Well Groundwater Sample Laboratory Analytical Results
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Constituents	**Laboratory Method**	**Units**	**SCDHEC MCL**	MW-09-26 2/14/17	MW-09-27 2/14/17	MW-09-28 2/14/17	MW-09-29 2/14/17	MW-09-30 2/14/17	MW-09-31 2/15/17	MW-09-32 2/15/17
Benzene	8260	µg/L	5	<50	<50	*0.40J*	<1.0	<1.0	<1.0	<1.0
Chloroform	8260	µg/L	80*	**730**	**1,100**	2.7U	<1.0	<1.0	1.1U	<1.0
Methylene Chloride	8260	µg/L	5	<250	<250	*2.2J*	<5.0	*2.0J*	<5.0	*1.7J*
Tetrachloroethene	8260	µg/L	5	<50	<50	**1.7**	<1.0	<1.0	<1.0	**30**
Toluene	8260	µg/L	1,000	<50	<50	**1.7**	<1.0	<1.0	<1.0	<1.0

Notes:
µg/L = micrograms per liter
SCDHEC = South Carolina Department of Health and Environmental Control
MCL = Maximum Contaminant Level (State Primary Drinking Water Regulations: R.61-58, October 2014)
* MCL for trihalomethanes
Bold values indicate detections above the Reporting Limit
Italic values are estimated between the Method Detection Limit and Reporting Limit ("J" Flag)
J = value is estimated
< = not detected, value is detection limit
Light green shaded values exceed the MCL

Prepared By/Date: SEA 08/30/19
Checked By/Date: PSJ 08/30/19

TABLE 2.8

Summary of Groundwater Laboratory Analytical Results (October 2018)
Former Vermont Bosch Site
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Constituent	Laboratory Method	Units	SCDHEC MCL	USEPA TWRSL	B-1 10/03/18	MW-08-01 10/03/18	MW-08-2D 10/03/18	MW-08-03 10/03/18	MW-08-04 10/03/18	MW-08-05 10/03/18	MW-09-06 10/03/18	MW-09-07 10/03/18	MW-09-08D 10/03/18	MW-09-09 10/03/18	MW-09-10 10/02/18	MW-09-11 10/02/18	MW-09-12D 10/02/18	MW-09-13 10/02/18
1,1-Dichloroethane	8260	µg/L	NE	2.8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	8260	µg/L	NE	NE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	*0.54J*
Chloroform	8260	µg/L	80	---	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**1.4**
Isopropylbenzene	8260	µg/L	NE	NE	< 1.0	**1.3**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethene	8260	µg/L	5	---	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**1900**	< 1.0	**3.3**	< 1.0	**36**	< 1.0	< 1.0
Toluene	8260	µg/L	1000	---	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Notes:
µg/L = micrograms per liter
SCDHEC = South Carolina Department of Health and Environmental Control
MCL = Maximum Contaminant Level (State Primary Drinking Water Regulations: R.61-58, September 2014)
USEPA = United States Environmental Protection Agency
TWRSL = USEPA Tap Water Regional Screening Level (May 2018)
NE = Not established
Bold values indicate detections above the Reporting Limit
Italic values are estimated between the Minimum Detection Limit and Reporting Limit ("J" Flag)
Yellow shaded values exceed MCL
J = Value is estimated
U = not detected, value is the detection limit

Prepared By/Date: PSJ 10/12/18
Checked By/Date: ZJD 10/30/18

TABLE 2.8

Summary of Groundwater Laboratory Analytical Results (October 2018)
Former Vermont Bosch Site
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Constituent	**Laboratory Method**	**Units**	**SCDHEC MCL**	**USEPA TWRSL**	MW-09-14 10/02/18	MW-09-15 10/02/18	MW-09-16D 10/02/18	MW-09-17 10/02/18	MW-09-18D 10/02/18	MW-09-19D 10/03/18	MW-03-20 10/03/18	MW-03-21 10/03/18	MW-04-22 10/03/18	MW-04-23 10/03/18	MW-02-24 10/03/18	MW-09-25 10/02/18	MW-09-26 10/02/18	MW-09-27 10/02/18
1,1-Dichloroethane	8260	µg/L	NE	2.8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	8260	µg/L	NE	NE	< 1.0	*0.53J*	*0.63J*	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform	8260	µg/L	80	---	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene	8260	µg/L	NE	NE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethene	8260	µg/L	5	---	< 1.0	**43**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**4.5**	< 1.0	< 1.0	< 1.0	< 1.0	**1.2**
Toluene	8260	µg/L	1000	---	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.1U	< 1.0	< 1.0	< 1.0	< 1.0

Notes:
µg/L = micrograms per liter
SCDHEC = South Carolina Department of Health and Environmental Control
MCL = Maximum Contaminant Level (State Primary Drinking Water Regulations: R.61-58, September 2014)
USEPA = United States Environmental Protection Agency
TWRSL = USEPA Tap Water Regional Screening Level (May 2018)
NE = Not established
Bold values indicate detections above the Reporting Limit
Italic values are estimated between the Minimum Detection Limit and Reporting Limit ("J" Flag)
Yellow shaded values exceed MCL
J = Value is estimated
U = not detected, value is the detection limit

Prepared By/Date: PSJ 10/12/18
Checked By/Date: ZJD 10/30/18

TABLE 2.8

Summary of Groundwater Laboratory Analytical Results (October 2018)
Former Vermont Bosch Site
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Constituent	**Laboratory Method**	**Units**	**SCDHEC MCL**	**USEPA TWRSL**	MW-09-28 10/02/18	MW-09-29 10/02/18	MW-09-30 10/02/18	MW-09-31 10/03/18	MW-09-32 10/03/18
1,1-Dichloroethane	8260	µg/L	NE	2.8	< 1.0	< 1.0	*0.79J*	< 1.0	< 1.0
1,3-Dichlorobenzene	8260	µg/L	NE	NE	*0.52J*	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform	8260	µg/L	80	---	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene	8260	µg/L	NE	NE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethene	8260	µg/L	5	---	**28**	**1.2**	< 1.0	< 1.0	< 1.0
Toluene	8260	µg/L	1000	---	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Notes:
µg/L = micrograms per liter
SCDHEC = South Carolina Department of Health and Environmental Control
MCL = Maximum Contaminant Level (State Primary Drinking Water Regulations: R.61-58, September 2014)
USEPA = United States Environmental Protection Agency
TWRSL = USEPA Tap Water Regional Screening Level (May 2018)
NE = Not established
Bold values indicate detections above the Reporting Limit
Italic values are estimated between the Minimum Detection Limit and Reporting Limit ("J" Flag)
Yellow shaded values exceed MCL
J = Value is estimated
U = not detected, value is the detection limit

Prepared By/Date: PSJ 10/12/18
Checked By/Date: ZJD 10/30/18

TABLE 3.1

Identification of Chemicals of Potential Concern
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251121022.04.02

		Media					COPC Screening			ARAR/TBC							
Type	COPC	SS	SB	SD	GW	SW	Exceed Residential RSLs	Exceed Tap Water RSLs	Exceed USEPA AWQC	Exceed USEPA SSLs	Detected In GW	Exceed USEPA MCLs	Exceed SCDHEC MCLs	Exceed SCDHEC WQC	Exceed USEPA VISL	Exceed SC Background	Retained as CPOC
	Arsenic	x					Yes	--	--	Yes	No	--	--	--	--	No	Yes
	Barium	x			x		No	No	--	Yes	Yes	No	No	--	--	No	No
	Cadmium	x					No	--	--	Yes	No	--	--	--	--	No	No
	Chromium, Total	x	x		x		Yes	No	--	Yes	Yes	No	No	--	--	Yes	Yes
Inorganics	Lead	x					No	--	--	Yes	No	--	--	--	--	No	No
	Nickel	x					No	--	--	Yes	No	--	--	--	--	Yes	No
	Mercury				x		--	No	--	--	--	No	No	--	Yes	--	No
	Nitrite		x				No	--	--	No	No	--	--	--	--	--	No
	Nitrate	x	x				No	--	--	No	No	--	--	--	--	--	No
	Acetone	x	x				No	--	--	Yes	No	--	--	--	--	--	No
	2-Butanone		x				No	--	--	No	No	--	--	--	--	--	No
	Carbon Disulfide				x		--	No	--	--	--	No		--	No	--	No
	Chlorobenzene				x		--	No	--	--	--	No	No	--	No	--	No
VOCs	Chloroform				x		--	Yes	--	--	--	No	No	--	Yes	--	Yes
	Isopropylbenzene				x		--	No	--	--	--	No	No	--	No	--	No
	Methylene Chloride	x	x	x			No	--	--	Yes	No	--	--	--	--	--	No
	Tetrachloroethene	x	x	x	x	x	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	--	Yes
	Benzo(a)anthracene	x					No	--	--	Yes	No	--	--	--	--	--	No
	Benzo(a)pyrene	x					Yes	--	--	Yes	No	--	--	--	--	--	Yes
	Benzo(b)fluoranthene	x					No	--	--	Yes	No	--	--	--	--	--	No
	Benzo(g,h,i)perylene	x					No	--	--	No	No	--	--	--	--	--	No
	Bis(2-ethylhexyl)phthalate	x	x				No	--	--	No	No	--	--	--	--	--	No
	Butylbenzyl phthalate	x					No	--	--	Yes	No	--	--	--	--	--	No
SVOCs	Chrysene	x					No	--	--	No	No	--	--	--	--	--	No
	Diethyl phthalate	x	x		x		No	No	--	Yes	No	No	No	--	--	--	No
	Dimethyl phthalate	x					No	--	--	Yes	No	--	--	--	--	--	No
	Di-n-butyl phthalate	x					No	--	--	Yes	No	--	--	--	--	--	No
	Fluoranthene	x					No	--	--	No	No	--	--	--	--	--	No
	Indeno(1,2,3-cd)pyrene	x					No	--	--	No	No	--	--	--	--	--	No
	Pyrene	x					No	--	--	No	No	--	--	--	--	--	No

Notes:
COPC = Constituent of Potential Concern
SS = Surface Soil
SB = Subsurface Soil
SD = Sediment
GW = Groundwater
SW = Surface Water
RLS = Regional Screening Level
USEPA = United States Environmental Protection Agency
ARAR/TBC = Applicable or Relevant and Appropriate Requirements/To Be Considered
AWQC = Ambient Water Quality Criteria
SSL = Soil Screening Level
MCL = Maximum Contaminant Level
SCDHEC = South Carolina Department of Health and Environmental Control
WQC = Water Quality Criteria
VISL = Vapor Intrusion Screening Level
SC = South Carolina

Prepared By/Date: PSJ 09/05/19
Checked By/Date: SAE 09/09/19

TABLE 3.2

Potential Chemical-Specific ARARs and TBCs
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Requirement or Standard	Reference	Description of Requirement	Status	Action
Soil				
Regional Screening Levels and Soil Screening Levels	USEPA RSLs and SSLs	Provide generic risk-based screening concentrations for protection of human health using multiple contact pathways.	TBC	Provides guidance regarding soil concentrations protective of current and future residents and site workers.
Groundwater				
South Carolina Primary Drinking Water Regulation	South Carolina Code of Regulations (SCCR) 61-58	Establishes standards for public water supplies, including maximum concentration limits (MCLs).	Applicable	Groundwater at the site is not used for drinking water and a public water supply serves the area. Deed restrictions could be implemented to prevent potable use of groundwater.
National Secondary Drinking Water Standards	40 CFR Part 143	Establishes secondary standards for public water supplies, i.e. secondary maximum concentration limits (SMCLs).	Applicable	Groundwater treatment may alter factors such as odor, taste, color, or scaling tendencies.
National Primary Drinking Water Standards	40 CFR Part 141	Establishes standards for public water supplies, including maximum concentration limits (MCLs).	Applicable	Groundwater at the site is not used for drinking water and a public water supply serves the area. Deed restrictions could be implemented to prevent potable use of groundwater.

TABLE 3.2

Potential Chemical-Specific ARARs and TBCs
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Requirement or Standard	Reference	Description of Requirement	Status	Action
Vapor Intrusion Screening Levels	USEPA Vapor Intrusion Screening Level Calculator Version 3.4 (November 2015)	Allows estimation of groundwater concentration thresholds which can constitute a vapor intrusion hazard to businesses and residences.	TBC	Contamination is migrating off-Site. Groundwater concentrations near businesses and residences must not create an excessive vapor intrusion hazard.
Surface Water				
South Carolina Water Classification Standards	SCCR, 61-68	Establishes procedures for classification and protection of waters of the state for current and potential future uses.	Applicable	Groundwater at the site discharges to surface water in the unnamed tributary to the south of the site.
Ambient Water Quality Criteria	40 CFR Part 131	Establishes procedures for classification and protection of waters of the U.S. for current and potential future uses.	Applicable	Groundwater at the site discharges to surface water in the unnamed tributary to the south of the site.
Waste				
SC Hazardous Waste Management Regulations	SCCR 61-79	Identifies wastes which must be managed as hazardous.	Applicable	Disposal or ex-situ treatment of contaminated media or residuals may constitute hazardous waste generation.
Identification and Listing of Hazardous Waste	40 CFR Part 261	Identifies wastes which must be managed as hazardous under 40 CFR Parts 262-264.	Applicable	Disposal or ex-situ treatment of contaminated media or residuals may constitute hazardous waste generation.

TABLE 3.2

Potential Chemical-Specific ARARs and TBCs
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Requirement or Standard	Reference	Description of Requirement	Status	Action
RCRA Land Disposal Restrictions	40 CFR Part 268	Defines restrictions for land disposal of hazardous wastes based on "underlying constituent" concentrations.	Applicable	Hazardous waste must comply with land disposal restrictions where offsite land disposal is used.
Air				
South Carolina Ambient Air Quality Standards	Department of Health and Environmental Control; Regulation 61-62.5	Air quality standards to protect the public health.	Applicable	Emissions from treatment of contaminated media may require controls.
National Primary and Secondary Ambient Air Quality Standards	40 CFR Part 50	Air quality standards to protect the public health.	Applicable	Emissions from treatment of contaminated media may require controls.

Notes:
ARAR = Applicable or Relevant and Appropriate Requirement
TBC = To Be Considered
RCRA = Resource Conservation and Recovery Act
CFR = Code of Federal Regulations
RSL = Regional Screening Level
SSL = Soil Screening Level

Prepared By/Date: SEA 08/30/19
Checked By/Date: PSJ 08/30/19

TABLE 3.3

Potential Action-Specific ARARs
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.02.04

Requirement or Standard	Reference	Description of Requirement	Status	Action
South Carolina Air Pollution Control Regulations	Department of Health & Environmental Control, Regulation 61-62	Prohibits harmful emissions from remediation.	Applicable	Determine potential emissions from remediation and utilize appropriate permits and controls.
National Emission Standards for Hazardous Air Pollutants (NESHAPs)	40 CFR 61	Emissions from remediation activities may require permits or controls at relevent emission thresholds.	Applicable	Determine potential emissions from remediation and utilize appropriate permits and controls.
Generators Management of Hazardous Waste for Offsite Treatment, Storage, or Disposal	40 CFR Part 262 and 263	Hazardous wastes must be managed and transported as required by regulation.	Applicable	Excavated soil may be a listed hazardous waste unless a "contained-out" determination is obtained.
Land Disposal Restrictions	40 CFR Part 268	Defines restrictions for land disposal of hazardous wastes based on "underlying constituent" concentrations.	Applicable	Hazardous waste must comply with land disposal restrictions where offsite land disposal is used.
National Pollutant Discharge Elimination System (NPDES)	40 CFR 122	Establishes criteria and permit requirements for discharges to surface water.	Potentially Applicable	Discharge of treated groundwater to waters of the U.S. must comply with the regulation.

TABLE 3.3

Potential Action-Specific ARARs
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.02.04

Requirement or Standard	Reference	Description of Requirement	Status	Action
South Carolina NPDES Permit Regulations	SCCR 61-9	Establishes criteria and permit requirements for discharges to surface water.	Potentially Applicable	Discharge of treated groundwater to waters of the state must comply with the regulation.
Underground Injection Program (Safe Drinking Water Act)	40 CFR 144.12	Establishes standards and permit requirements for underground injection to groundwater.	Applicable	Injection of remediation amendments or treated groundwater must comply with the regulation.
South Carolina Underground Injection Control Regulations	SCCR 61-87	Establishes standards and permit requirements for underground injection to groundwater.	Applicable	Injection of remediation amendments or treated groundwater must comply with the regulation.
South Carolina Well Standards	SCCR 61-71	Establishes standards and permit requirements for construction and operation of monitoring and extraction wells.	Applicable	Wells constructed must comply with the regulation.
South Carolina Hazardous Waste Management Regulations	SCCR, 61-79	Identifies wastes which must be managed as hazardous.	Applicable	Disposal or ex-situ treatment of contaminated media or residuals may constitute hazardous waste generation.

TABLE 3.3

Potential Action-Specific ARARs
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.02.04

Requirement or Standard	Reference	Description of Requirement	Status	Action
Occupational Safety and Health Administration (OSHA) Hazardous Waste Site Operations	29 CFR 1910	Establishes rules for worker and site safety while performing remediation.	Relevant and Appropriate	Rule is appropriate to all remediation and monitoring activities.

Notes:
ARAR = Applicable or Relevant and Appropriate Requirement
CFR = Code of Federal Regulations

NPDES = National Pollutant Discharge Elimination System

Prepared By/Date: SEA 08/30/19
Checked By/Date: PSJ 08/30/19

TABLE 3.4

Potential Location-Specific ARARs
Former Robert Bosch Tool Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Requirement or Standard	Reference	Description of Requirement	Status	Action
Protection of Wetlands and Floodplains	40 CFR Part 6, Appendix A	Requires action to prevent or mitigate impacts to wetlands. Plans for disturbance of wetlands require regulatory and public review.	Applicable	Remediation of groundwater may require activities to be conducted close to the south drainage tributary. Disturbance will be avoided or mitigated during construction.

Notes:
ARAR = Applicable or Relevant and Appropriate Requirement
CFR = Code of Federal Regulations

Prepared By/Date: SEA 08/30/19
Checked By/Date: PSJ 08/30/19

TABLE 4.1

Initial Soil Remedial Technology Screening
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

General Response Action	Technology Type	Process Options	Description	Retain?	Screening Rationale
No Action/Institutional Controls	No Action	No Action	No Action	Y	Baseline for comparison of alternatives.
	Institutional Controls	Deed Restrictions	Limits type of future land usage	Y	Potential Application.
		Access Restrictions	Construct fencing, install warning signage	Y	Potential Application.
Containment	Capping	Concrete	Concrete slabs installed over contaminated areas	Y	Potential Application.
	Vertical Barriers	Grout injection	Subsurface barriers to deter migration of contaminants	N	Does not achieve RAO.
Ex-Situ Treatment / Removal	Removal	Excavation	Direct removal of contaminated soils for subsequent onsite or offsite treatment/disposal	Y	Potential Application.
	Ex-Situ Biological	Biopiles	Excavated soils are mixed with amendments and enclosed. The piles may be aerated with blowers or vacuums to promote biodegredation.	Y	Potential Application.
		Fungal Biodegredation	Use of fungus (white rot) on excavated soils to degrade organic contaminants.	Y	Potential Application.
		Land Farming	The periodic mixing of soils to aerate the waste to promote biodegredation	N	Chlorinated organics are resistant to aerobic degradation
		Slurry Phase Biotreatment	Mix contaminated soils with water to create a slurry. Slurry is fed to a reactor with suspended microorganisms and subsequently decomposed.	Y	Potential Application.

TABLE 4.1

Initial Soil Remedial Technology Screening
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

General Response Action	Technology Type	Process Options	Description	Retain?	Screening Rationale
Ex-Situ Treatment / Removal (continued)	Ex-Situ Chemical	Chemical Extraction	Application of an organic solvent, solvent mixture, or acid to extract contaminants from soil.	N	Not effective in clay or silty soil. Geology is not conducive to recovery of fluids.
	Ex-Situ Chemical (continued)	Electrokinetic Separation	Application of direct current to soils. Ionized contaminants will move to electrodes.	N	Not proven effective in field applications.
		Chemical Oxidation or Reduction	Application of oxidizing or reducing agents to promote a chemical reaction to convert contaminants to less toxic forms.	Y	Potential Application.
	Ex-Situ Physical	Physical Separation / Reduction	Separation of soils by grain-size using sieves and screens. Contaminants will bind to fines for subsequent disposal or treatment.	Y	Potential Application.
		Soil Washing	Scrub soils with water/surfactants to dissolve contaminants.	N	Not applicable to silty/clayey soils.
		Soil Vapor Extraction	Apply a vacuum to excavated materials to enhance volatilization and remove VOCs and SVOCs.	Y	Potential Application.
	Ex-Situ Stabilization/ Solidification	Encapsulation with Activated Carbon & Cement	Physically binding contaminants with cement to form a stabilized mass. Activated carbon added for organic stabilization.	Y	Potential Application.
		Vitrification	Applying heat to solid media to achieve glassification to encapsulate inorganics. Pyrolysis may also be achieved simultaneously.	N	Not Applicable for organic contaminants

TABLE 4.1

Initial Soil Remedial Technology Screening
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

General Response Action	Technology Type	Process Options	Description	Retain?	Screening Rationale
Ex-Situ Treatment / Removal (continued)	Ex-Situ Thermal	Pyrolysis	Applying heat in absence of oxygen to decompose organics.	N	VOCs readily desorb at lower temperatures
		Open Burn	Destruction of flammable or explosive materials by direct deflagration	N	Not Applicable for high flash-point halogenated organic contaminants
	Ex-Situ Thermal (continued)	Incineration	Volatilization and combustion of organics with high temperatures (870 to 1200 ^{o}C)	Y	Potential Application.
		Steam Reforming	Two stage thermal process using steam to remove contaminants from the soil and then at higher temperatures for destruction.	N	VOCs readily desorb at lower temperatures
		High Temperature Thermal Desorption	Transfer of contaminants to vapor phase by applying heat at 320 to 560 ^{o}C	N	VOCs readily desorb at lower temperatures
		Low Temperature Thermal Desorption	Transfer of contaminants to vapor phase by applying heat at 90 to 320 ^{o}C	Y	Potential Application.
		Calcination	Thermal process to remove contaminants from fine soil particles using a horizontal kiln.	N	VOCs readily desorb at lower temperatures
In-Situ Treatment	Natural Attenuation	Natural Attenuation	Monitoring of natural subsurface processes such as volatilization, degradation, dilution, and chemical reaction.	Y	Potential Application.
	In-Situ Biological	Bioventing	Provide additional oxygen or gaseous substrate to subsurface to stimulate oxidation or reduction.	N	Not readily applicable to chlorinated VOCs.

TABLE 4.1

Initial Soil Remedial Technology Screening
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

General Response Action	Technology Type	Process Options	Description	Retain?	Screening Rationale
In-Situ Treatment (continued)		Biostimulation	Degradation of contaminants by enhancing natural biodegradation process of indigenous organisms	Y	Potential Application.
		Bioaugmentation	Degradation of contaminants by enhancing natural biodegradation through the addition of inoculated organisms.	Y	Potential Application.
	In-Situ Biological (continued)	Phytoremediation	Use of plants to remove, transfer, or destroy contaminants in soil or water.	Y	Contaminants located beneath root zone on-Site. Off-Site locations are potentially amenable.
	In-Situ Physical	Pneumatic Fracturing	Enhancement mechanism for in situ treatment by creating new fractures and fissures and by enlarging existing ones.	N	Not necessary with open surface access.
		Soil Vapor Extraction	Apply vacuum to vadose zone soils to enhance volatilization and remove VOCs and SVOCs.	Y	Potential Application for VOCs
	In-Situ Chemical	Chemical Oxidation	Application of oxidizing agent(s) to promote a chemical reaction to convert contaminants to less toxic forms.	Y	Potential Application.
		Chemical Reduction	Application of reducing agent(s) to promote a chemical reaction to convert contaminants to less toxic forms.	Y	Potential Application.
	In-Situ Thermal	Enhanced Soil Vapor Extraction	Raising subsurface temperature to aid in removal of SVOCs by employing SVE.	N	VOCs readily desorb at lower temperatures

TABLE 4.1

Initial Soil Remedial Technology Screening
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

General Response Action	Technology Type	Process Options	Description	Retain?	Screening Rationale
In-Situ Treatment (continued)		Vitrification	Application of heat to the subsurface to glassify contaminated soil. Organics may undergo pyrolysis simultaneously.	N	VOCs readily desorb at lower temperatures
	In-Situ Stabilization/ Solidification	Cement-Based Deep Mixing	Immobilization of contaminants by injecting immobilizing agents to the subsurface.	Y	Cement can be utilized to stabilize soil following in-situ chemical blending
	In-Situ Stabilization/ Solidification (continued)	Grout Injection	Injection of grout into the subsurface area of contamination. This serves as an in-situ encapsulation method.	N	Grout does not immobilize VOCs and can mobilize chromium due to an increase in pH.

Key:

RAO = Remedial Action Objective
SVE = Soil Vapor Extraction
SVOCs = Semivolatile Organic Compounds
VOCs = Volatile Organic Compounds
^{o}C = degrees Celsius

N = Alternative not retained for consideration in the detailed analysis
Y = Alternative retained for consideration in the detailed analysis

Prepared By/Date: SEA 08/30/19
Checked By/Date: PSJ 08/30/19

TABLE 4.2

Initial Groundwater Remedial Technology Screening
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

General Response Action	Technology Type	Process Options	Description	Retain?	Screening Rationale
No Action / Institutional Response	No Action	No Action	No Action	Y	Baseline for comparison of alternatives.
	Institutional Control	Alternate Water Supply	Extension of City water supply to service the area.	N	No private wells have been identified in the plume area.
		Deed Restrictions	Property deed restiction would include no drinking water wells.	Y	Retained. This alternative is retained for a baseline comparison with other alternatives.
Containment	Horizontal Barriers	Pumping	Use of a series of extraction wells to control plume migration. Combine with treatment or disposal.	Y	Potential Application.
		Slurry Walls	Trench around contaminated areas is filled with a bentonite slurry.	N	Lithology does not provide a vertical barrier to key slurry walls into. Based on overall downward vertical hydraulic gradient, contaminants could eventually migrate beneath the wall.
		Grout Curtain	Pressure injection of grout in a pattern of drilled holes.	N	Lithology does not provide a vertical barrier to key grout curtain walls into. Based on overall downward vertical hydraulic gradient, contaminants could eventually migrate beneath the wall.

TABLE 4.2

Initial Groundwater Remedial Technology Screening
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

General Response Action	Technology Type	Process Options	Description	Retain?	Screening Rationale
Containment (continued)		Sheet Piling	Drive a wall of sheet piling into the soil to divert groundwater flow.	N	Lithology does not provide a vertical barrier to key sheet piling into. Based on overall downward vertical hydraulic gradient, contaminants could eventually migrate beneath the wall.
	Vertical Barriers	Grout Injection	Injection of grout through directionally drilled wells beneath the area of contamination.	N	Not applicable. Weathered transition zone prevents even distribution of grout.
		Block Displacement	Injection of slurry in notched injection holes (in conjunction with vertical barriers).	N	Not applicable. Weathered transition zone prevents even distribution of slurry.
Ex-Situ Treatment / Disposal	Extraction	Extraction Wells	Extract groundwater from wells to hydraulically control plume migration and to remove contaminated groundwater for subsequent treatment.	Y	Potential Application.
		Extraction Trenches	Extract groundwater from horizontal trenches to control plume migration and to remove contaminated groundwater for subsequent treatment.	N	Depth to water and space available is not amenable to extraction trench construction.
	Ex-Situ Biological	Bioreactors	Degradation of contaminants is achieved by pumping contaminated groundwater into an attached or suspended biological reactor.	N	Contaminant concentrations are not high enough to maintain a biological system.

TABLE 4.2

Initial Groundwater Remedial Technology Screening
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
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General Response Action	Technology Type	Process Options	Description	Retain?	Screening Rationale
Ex-Situ Treatment / Disposal (continued)		Constructed Wetlands	Developing a man-made wetland to mimic natural degradation processes of a true wetland.	N	Topography and property access are not conducive for constructed wetlands application.
	Ex-Situ Physical	Adsorption / Absorption	Groundwater is pumped and passed through adsorption vessels. Adsorption materials commonly used are granular activated carbon, forage sponge, sorptive clays, or resins.	Y	Potential Application.
	Ex-Situ Physical (continued)	Air Stripping	Volatile organics are removed from the liquid phase to air. Common methods include packed towers, diffused aerators, tray aeration, or spray aeration.	Y	Potential Application.
		Separation	Contaminants are detached from their medium by a variety of methods including: distillation, filtration, crystallization, membrane evaporation, and reverse osmosis.	N	Not readily applicable for organics.
	Ex-Situ Chemical	Ion Exchange	Removal of ions from the aqueous phase by the exchange of cations and anions between contaminants and exchange medium.	N	Not applicable for organics.
		Precipitation / Flocculation / Coagulation	Transformation of dissolved contaminants to an insoluble solid. Removal is facilitated by sedimentation or filtration. Solids are formed by pH control, chemical precipitants, and flocculant.	N	Not applicable for organics.

TABLE 4.2

Initial Groundwater Remedial Technology Screening
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
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General Response Action	Technology Type	Process Options	Description	Retain?	Screening Rationale
Ex-Situ Treatment / Disposal (continued)		Chemical Oxidation / Reduction	Chemical conversion of contaminants to less toxic forms by treatment with oxidizing agents (i.e. peroxides, hypochlorites, permanganate) or reducing agents (ferrous sulfate, hydrogen sulfide).	Y	Potential Application.
		UV / Peroxide Advanced Oxidation	Oxidation of contaminants by appliying ultraviolet light and hydrogen peroxide to generate hydroxyl radicals as it flows through a reactor.	Y	Potential application. Requires pretreatment.
	Discharge	Local Stream or Ditch	Extracted water discharged to stream or ditch on or near the site.	Y	Potential Application, requires NPDES permit.
		Infiltration Gallery	Extracted water discharged to an infiltration gallery.	Y	Potential Application.
		Injection Wells	Extracted water discharged to injecton well system.	Y	Potential Application.
		POTW	Extracted water discharged to local POTW for treatment.	Y	Potential Application.
In-Situ Treatment	Natural Attenuation	Natural Attenuation	Monitoring of the natural subsurface processes such as dilution, volatilization, biodegredation, adsorption, and chemical reactions.	Y	Potential Application.
	In-Situ Biological	Enhanced Bioremediation (anaerobic)	Increase naturally occuring biodegradation rates by increasing the concentration of electron donors in targeted groundwater.	Y	Potential Application.

TABLE 4.2

Initial Groundwater Remedial Technology Screening
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

General Response Action	Technology Type	Process Options	Description	Retain?	Screening Rationale
In-Situ Treatment (continued)		Co-metabolic Degradation	The injection of dilute primary substrates (dextrose, methane, methanol) into the aquifer to support the breakdown of compounds through secondary degradation.	Y	Potential Application.
		Bioaugmentation	Innoculation of contaminant-degrading organisms into the aquifer.	Y	Potential Application.
		Phytoremediation	The use of plants to remove, transfer, stabilize, and destroy contaminants.	Y	Potential Application near drainage ditch.
	In-Situ Physical	Air Sparging (AS)	Injection of air into a contaminated aquifer to create subsurface volatilization of contaminants. This process may be coupled with a vapor recovery system.	Y	Potential Application.
	In-Situ Physical (continued)	Dual Phase Extraction (DPE)	Use of high vacuum system to remove liquid and vapor contaminants from the subsurface simultaneously.	Y	Potential Application.
		Aggressive Fluid Vapor Recovery (AFVR)	Similar to DPE, but uses a vacuum truck in discrete events instead of a dedicated system.	Y	Potential Application.
		Hydrofracturing	Injection of pressurized water through wells to create fissures to be filled with porous material. This is an enhancement technique for SVE, pump and treat, and bioremediation.	Y	Potential Application.

TABLE 4.2

Initial Groundwater Remedial Technology Screening
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

General Response Action	Technology Type	Process Options	Description	Retain?	Screening Rationale
In-Situ Treatment (continued)		In-Well Air Stripping with Density-Driven Convection (ART wells)	Groundwater is circulated through a single well by extraction at one depth, treatment at the well head via air stripping, and reinjection at another depth. Use of drop-pipe and diffuser to inject clean air into the groundwater and to induce recirculating convective flow in the surrounding aquifer.	Y	Potential Application.
	In-Situ Chemical	Oxidation	Injection of oxidizing agent to degrade recalcitrant groundwater contaminants.	Y	Potential Application.
		Advanced Oxidation	Injection of combined or catalyzed oxidizing agents (e.g., hydrogen peroxide and UV light) to degrade recalcitrant groundwater contaminants.	Y	Potential Application for use with ART wells or extraction wells.
	In-Situ Chemical (continued)	Reduction	Injection of reducing agent (i.e., zero valent iron) to degrade recalcitrant groundwater contaminants.	Y	Potential Application for mitigating surface water discharge.

Key:

ART = Advanced Remediation Technology
NPDES = National Pollutant Discharge Elimination System
POTW = Publicly Owned Treatment Works
UV = Ultraviolet

N = Process Option not retained for a more detailed secondary screening
Y = Process Option retained for a more detailed secondary screening

Prepared By/Date: SEA 08/30/19
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TABLE 5.1

Secondary Screening of Soil Remediation Technologies
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

General Response Action	Technology Type	Process Options	Effectiveness	Implementability	Cost	Retain?	Screening Rationale
No Action/ Institutional Control	No Action	No Action	Not Effective.	Not Applicable.	No capital, No O&M	N	Not effective in reducing impacts to groundwater.
	Institutional Control	Deed Restrictions	Effective regulatorily for preventing exposure to contaminants.	Would involve clauses in the property deed stating all restrictions. Land use would be restricted and residential use would not be an alternative.	Low capital, Low O&M	N	No excessive direct risks to human health identified by contact with soils or with surface water.
		Access Restrictions	Effective for preventing exposure to contaminants.	Fencing already exists along the property boundary. Add fence and signage around the source area.	Low capital, Low O&M	N	No risks to human health identified by contact with soils or with surface water.
Containment	Capping	Concrete, clay, or synthetic	Effective but contamination remains and requires inspections.	Requires land clearing prior to on-Site placement. Standard procedure for off-Site TSDF.	Moderate to High capital, Low O&M	Y	Standard procedure for off-Site TSDF.
Ex-Situ Treatment/ Disposal	Removal	Excavation	Effective for contaminant removal.	Requires slab demolition and excavation sloping or shoring.	Moderate capital, No O&M	Y	Limited source area and exterior location make excavation relatively easy.
	Ex-Situ Biological	Biopiles	Has been demonstrated to be effective on many organics, but effectiveness on site soils requires pilot testing.	Excavated soils are mixed with amendments and enclosed. The piles may be aerated with blowers or vacuums to promote biodegredation.	Moderate capital, Low O&M	N	Effectiveness is uncertain and time and space requirements are excessive.
		Fungal Biodegradation	Has been demonstrated to be effective on many organics, but effectiveness on site soils requires pilot testing.	Excavated soils are mixed with fungal amendments. The piles may be aerated with blowers or vacuums to promote degredation.	Moderate capital, Low O&M	N	Effectiveness is uncertain and time and space requirements are excessive.
		Slurry-Phase Biotreatment	Has been demonstrated to be effective on many organics, but effectiveness on site soils requires pilot testing.	Mix contaminated soils with water to create a slurry, which is fed to a reactor to be subsequently decomposed.	High capital, Low to moderate O&M	N	Creates a secondary waste stream which may also require treatment.

TABLE 5.1

Secondary Screening of Soil Remediation Technologies
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

General Response Action	Technology Type	Process Options	Effectiveness	Implementability	Cost	Retain?	Screening Rationale
Ex-Situ Treatment/ Disposal (continued)	Ex-Situ Chemical (continued)	Chemical Oxidation or Reduction	Effectiveness is dependent upon complete contact between the contaminants and the oxidant.	Soil is mixed with water and reagent, mixed and stabilized.	Moderate to High capital; No O&M	Y	Standard procedure at off-Site TSDF for satisfying land ban requirements
	Ex-Situ Physical	Physical Separation/ Volume Reduction	Effective for volume reduction if large rocks are suspected.	Soil is screened to separate large particles from small.	High Capital; No O&M	N	Large rocks not expected. Soils mainly fine clay and silts. Requires off-Site disposal at TSDF.
		Soil Vapor Extraction	Effective for VOC removal.	Requires space for treatment vessels, excavation similar to removal.	Moderate capital; Moderate O&M	N	Not competitive with in-situ SVE.
	Ex-Situ Stabilization/ Solidification	Encapsulation	Effective for stabilizing all contaminants.	Activated carbon and cement are added to the soil mixture in batches to stabilize contaminants.	High capital; No O&M	N	Land use would be permanently altered and final elevations higher than
	Ex-Situ Thermal	Incineration	Effective, but requires offgas treatment.	Requires extensive permitting. May be an option for land disposal restriction compliance.	High capital; No O&M	N	Complex permitting with listed waste. Likely would not be approved.
		Low Temperature Thermal Desorption	Effective at removing VOCs.	Requires offgas treatment to remove or destroy VOCs.	Moderate capital; No O&M	N	Complex permitting with listed waste. May not be approved.
In-Situ Treatment	Natural Attenuation	Natural Attenuation	Lack of PCE breakdown products indicates that conditions favoring natural degradation in soil are not present.	Easy to implement	Low capital, Low O&M	N	Lack of breakdown products indicates that current conditions favoring natural degradation not present. May be part of Site remedy following completion of active remediation.

TABLE 5.1

Secondary Screening of Soil Remediation Technologies
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
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General Response Action	Technology Type	Process Options	Effectiveness	Implementability	Cost	Retain?	Screening Rationale
In-Situ Treatment (continued)	In-Situ Biological	Biostimulation	Effective for low-concentrations of VOCs.	Soils must maintain both adequate moisture(i.e., flooding of the soil to be treated) and adequate TOC to foster dechlorination of PCE and degradation of daughter products.	Moderate capital, Low O&M	N	Conditions are not readily suitable for application. Typically applied in groundwater setting. Extensive pilot testing would be required to demonstrate effectiveness.
		Bioaugmentation	Lack of PCE breakdown products indicates that indigenous organisms have not degraded contaminants. Foreign organisms may not be suited to soil conditions.	Requires creation of suitable conditions for cultured organisms. Requires adequate moisture (i.e., flooding of the soil to be treated) and elevated TOC to permit growth of biomass.	Low capital, Moderate O&M	N	Conditions are not readily suitable for application. Typically applied in groundwater setting. Extensive pilot testing would be required to demonstrate effectiveness.
		Phytoremediation	Effective for altering groudwater flow and intercepting VOCs; however, effectiveness for impacted vadose zone soils is uncertain without pilot testing.	Requires access, possibly to multiple off-Site properties. Must plant densely spaced saplings in sufficient numbers to intercept emerging groundwater. Tree uptake is small before 2-5 years.	Moderate capital, Low O&M	N	Potentially effective, but requires access and control of off-Site properties. Changes in land use must not remove trees.
	In-Situ Physical/ Chemical	Soil Vapor Extraction	Effective for VOC removal.	May require initial offgas treatment, but low total VOC mass in soil should make requirement short-term.	Moderate capital; Low to moderate O&M	Y	Effective on VOCs in soils and minimizes impacts on site use. Most effective on highly permeable soils. Requires closer spacing and higher vacuum in less permeable soil.

TABLE 5.1

Secondary Screening of Soil Remediation Technologies
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

General Response Action	Technology Type	Process Options	Effectiveness	Implementability	Cost	Retain?	Screening Rationale
In-Situ Treatment (continued)	In-Situ Physical/ Chemical (continued)	In-Situ Chemical Oxidation	Effective for VOC removal.	Requires efficient contact between oxidant and VOC contaminants. Injection point spacing must be reduced with less permeable soils or must employ soil blending. No aboveground infrastructure required.	Moderate capital; No O&M	N	Effective on VOCs in soils if contact can be achieved. Requires closer horizontal and vertical spacing of injections in less permeable soil. In-situ soil blending can achieve adequate contact for clays, silts, and sands.
		In-Situ Chemical Reduction	Effective for VOC removal.	Requires efficient contact between reductant and VOC contaminants. Injection point spacing must be reduced with less permeable soils or must employ soil blending.	Moderate capital; No O&M	N	Difficult to maintain proper reducing conditions in naturally aerobic soils present at the site.
	In-Situ Stabilization/ Solidification	Cement-based Mixing	Not fully effective at the immobiliztion VOCs; however, can be used to stablize soils following in-situ chemical blending.	Cement (approximately 5% by weight) must be throughly mixed with previously treated soil to provide adequate stabilization.	Moderate capital; No O&M	N	Difficult to maintain proper reducing conditions in naturally aerobic soils present at the site.

Key:

O&M = Operations and Maintenance
PCE = Tetrachloroethene
SVE = Soil Vapor Extraction
TOC = Total Organic Carbon
VOCs = Volatile Organic Compounds

TSDF = Treatment, Storage, and Disposal Facility
N = Not retained for consideration in alternatives development
Y = Retained for consideration in alternatives development

Prepared By/Date: SEA 08/30/19
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TABLE 5.2

Secondary Screening of Groundwater Remediation Technologies
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

General Response Action	Technology Type	Process Options	Effectiveness	Implementability	Cost	Retain?	Screening Rationale
No Action / Institutional Response	No Action	No Action	Not effective.	Not applicable.	No capital, No O&M	Y	Baseline for comparison.
	Institutional Control	Deed Restrictions	Effectiveness depends on continued future implementation. Does not reduce contamination.	Requires land use compliance monitoring to ensure that deed restrictions are adhered to by current and future owners.	Low capital, Low O&M	Y	Required for human health protection.
Containment	Hydraulic	Pumping	Effective in preventing contaminant discharge to the surface water.	Conventional construction. Extracted groundwater will require treatment through an aboveground treatment train.	Moderate capital, High O&M	Y	May be required if discharge to surface water is not corrected by other means. Retain for contingency.
Ex-Situ Treatment / Disposal	Extraction	Extraction Wells	Effective in preventing future contaminant migration. Rate of contaminant reduction is limited by concentration gradients.	Conventional construction. Extracted groundwater will require treatment through an aboveground treatment train.	Moderate capital, High O&M	Y	May be required if discharge to surface water cannot be corrected by any other means. Retain for contingency.
	Ex-Situ Physical	Adsorption / Absorption	Effective for treatment of organic contaminants.	Conventional construction and local vendors maintain competitive costs.	Moderate capital, Low O&M	N	Cost is not competitive with in-situ treatment.
		Air Stripping	Effective for treatment of VOCs only.	Conventional construction and local vendors maintain competitive costs.	Moderate capital, Moderate O&M	Y	Effective treatment technology for VOCs.
	Ex-Situ Chemical	Chemical Oxidation / Reduction	Effective for treatment of organic contaminants. A common wastewater treatment technique.	Conventional application.	Moderate capital, Moderate O&M	N	Cost is not competitive with in-situ treatment.
		UV / Peroxide Advanced Oxidation	Effective for treatment of organic contaminants.	Conventional application.	Moderate capital, Moderate O&M	N	Cost not competitive with in-situ treatment.

TABLE 5.2

Secondary Screening of Groundwater Remediation Technologies
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

General Response Action	Technology Type	Process Options	Effectiveness	Implementability	Cost	Retain?	Screening Rationale
Ex-Situ Treatment / Disposal (continued)	Discharge	Local Stream	Effective for discharge.	Conventional application; however, discharge to the local stream will require an NPDES permit and monitoring. Stream may not be big enough to accommodate discharge.	Moderate capital, Moderate O&M.	Y	The permitting process and monitoring may be costly. Retain for contingency.
		Infiltration Gallery	Effectiveness for discharge is site specific.	Conventional application. May be placed appropriately to enhance an extraction system or to recirculate treatment chemicals.	Moderate capital, Moderate O&M.	Y	Infiltration galleries have proven to be effective at similar sites. Retain for contingency.
	Discharge	Sewer / POTW	Effective for discharge.	Conventional application, may require excessive piping for conveyance. Depends on available capacity of POTW.	Moderate capital, Low O&M.	Y	May be cost prohibitive if high tariff or not available if POTW is conserving capacity. Retain for contingency.
		Injection Wells	Effective for discharge.	Conventional application; however, requires a UIC permit and monitoring.	Moderate capital, Moderate O&M.	Y	Proven effectiveness at similar sites. Retain for contingency.
In-Situ Treatment	In-Situ Biological	Natural Attenuation / Monitoring	May be effective if time is not of concern. Natural degradation of organic contaminants is very slow at the site and biodegradation is not readily apparent.	Implementation is becoming widespread and is accepted by the EPA. Requires a monitoring plan to collect appropriate natural attenuation monitoring parameters.	Low capital, Low O&M	Y	Not currently effective as a sole remedy; however, could become part of the overall remedy following source area remediation.

TABLE 5.2

Secondary Screening of Groundwater Remediation Technologies
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

General Response Action	Technology Type	Process Options	Effectiveness	Implementability	Cost	Retain?	Screening Rationale
In-Situ Treatment (continued)	In-Situ Biological (continued)	Enhanced Bioremediation (anaerobic)	Effective for accelerating dechlorination of CVOCs under appropriate geochemical conditions.	Requires the injection of an electron donor material into the groundwater (oils, hydrocarbons, hydrogen, propane, etc.) to deplete oxygen and create reducing conditions favorable for dechlorination. Indigenous organisms may be unable to achieve complete dechlorination, requiring creation of both anaerobic and aerobic treatment zones or bioaugmentation. Pilot testing would be needed to determine if applicable.	Moderate capital, Moderate O&M	N	The targeted aquifer geochemical conditions (pH, DO, ORP) are not readily conducive for biodegradation without extensive adjustments to raise the aquifer pH and to deplete the concentration of oxygen present.
		Co-metabolic Degradaton	Effective for accelerating dechlorination of CVOCs under appropriate geochemical conditions.	The injection of dilute primary substrates (dextrose, methane, methanol) into the aquifer to support the biological breakdown of compounds through secondary degradation by organisms already naturally present in the targeted aquifer.	Moderate capital, Moderate O&M	N	The targeted aquifer geochemical conditions (pH, DO, ORP) are not readily conducive for bioaugmentation without extensive adjustments to raise the aquifer pH and to deplete the amount of oxygen present.

TABLE 5.2

Secondary Screening of Groundwater Remediation Technologies
Former Robert Bosch Tool Corporation Fountain Inn Division
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Wood Project 6251161022.04.02

General Response Action	Technology Type	Process Options	Effectiveness	Implementability	Cost	Retain?	Screening Rationale
In-Situ Treatment (continued)	In-Situ Biological (continued)	Bioaugmentation	Effective for accelerating degradation of CVOCs under appropriate geochemical conditions.	Application will require the use of cultured bacteria to degrade contaminants of concern. Bench or pilot testing required to establish suitable conditions, verify survival of the cultured organisms, and determine amendment demand.	Moderate capital, Moderate O&M	N	The targeted aquifer geochemical conditions (pH, DO, ORP) are not readily conducive for bioaugmentation without extensive adjustments to raise the aquifer pH and to deplete the amount of oxygen present.
		Phytoremediation	May be effective for shallow contamination. Would require years to become effective.	Requires planting a high density of suitable trees along the stream tributary on the neighboring property. Property owner must allow.	Moderate capital, Low O&M	N	Will require years to be effective and not likely to achieve RAOs as sole remedy.
	In-Situ Physical	Air Sparging (AS)	Effective for volatile organic compounds. Most effective if used in conjunction with a vapor recovery system. Pilot test needed to evaluate effectiveness and design parameters.	Conventional construction with groundwater being treated in-situ. Requires air sparge and vapor extraction wells tied into a treatment system. May require aboveground vapor treatment. Pilot testing recommended.	Moderate capital, Moderate to high O&M	Y	Tighter soil at the top of the aquifer to be treated may limit overall effectiveness. Vapor intrusion risk increases if structures are built within the vicinity of the treatment area.
		Dual-Phase Extraction (DPE)	Effective in preventing future contaminant migration from source area. Treatment of the aquifer is enhanced due to 3 dimensional flow paths.	Use of a dedicated system with a liquid ring pump to product a deep vacuum. Would require pilot testing.	High capital, High O&M	N	Can be effective for CVOCs; however, likely to be limited based on the aquifer characteristics.

TABLE 5.2

Secondary Screening of Groundwater Remediation Technologies
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

General Response Action	Technology Type	Process Options	Effectiveness	Implementability	Cost	Retain?	Screening Rationale
In-Situ Treatment (continued)	In-Situ Physical (continued)	Aggressive Fluid Vapor Recovery (AFVR)	Effective in preventing future contaminant migration. Treatment of the aquifer is enhanced due to 3 dimensional flow paths.	Can be implemented using existing and newly installed wells. Similar to DPE, but using a vacuum truck in discrete events instead of a dedicated system.	Low capital, Low O&M	N	Can be effective for CVOCs; however, timeframe to achieve RAOs is highly uncertain.
		Hydraulic Fracturing	Can be effective when combined with SVE and/or pump and treat.	Use of specialized equipment needed to produce fractures that are filled with porous material such as sand. Requires intensive monitoring to understand where fractures actually occur.	Moderate to High capital; No O&M	N	Exact placement of fractures is uncertain. Potential to spread groundwater plume contamination beyond current configuration.
		In-Well Air Stripping with Density-Driven Convection (ART Wells)	Effective for volatile organic compounds. Pilot testing would be required to evaluate effectiveness and design parameters.	Unconventional construction. Application will require the use of a patented technology. Biological growth and plugging of the reinjection screen may lead to excessive O&M costs.	High capital, Moderate to High O&M	N	Effective for CVOCs; however, has not been shown to be very effective at sites with similar aquifer characteristics.
	In-Situ Chemical	Oxidation	Effective for mineralization of CVOCs. Overall effectiveness is a function of achieving adequate contact of the oxidant with the CVOCs.	Implementation would require the injection or blending of a chemical oxidant in the contaminated zones. Multiple injections likely needed to achieve RAOs.	Moderate capital, No O&M	Y	Most applicable to high-concentration source areas. May be combined with other treatments to achieve site RAOs.
		UV / Peroxide Advanced Oxidation	Effective for treatment of organic contaminants.	Conventional application.	Moderate capital, Moderate O&M	N	Not necessary to treat site-related CVOCs

TABLE 5.2

Secondary Screening of Groundwater Remediation Technologies
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

General Response Action	Technology Type	Process Options	Effectiveness	Implementability	Cost	Retain?	Screening Rationale
In-Situ Treatment (continued)	In-Situ Chemical (continued)	Reduction	Effective for the treatment of chromium and CVOCs. ZVI can overcome the natural aquifer geochemical conditions present at the site.	Use DPT borings to hydraulically emplace ZVI via a slurry. Place borings in rows perpendicular to groundwater flow. Creates preferential flow pathways towards ZVI borings.	Moderate capital, No O&M	Y	Has been effective at the treatment of CVOCs at sites with similar aquifer characteristics.

Key:

ART = Advanced Remediation Technology
CVOCs = Chlorinated Volatile Organic Compounds
DO = dissolved oxygen
DPT = Direct Push Type
NPDES = National Pollutant Discharge Elimination System
O&M = Operations and Maintenance

ORP = oxidation reduction potential
POTW = Publicly Owned Treatment Works
RAOs = Remedial Action Objectives
VOCs = Volatile Organic Compounds
UV = Ultraviolet
ZVI = zero valent iron

N = Not retained for alternatives development
Y = Retained for alternatives development

Prepared by/Date: SEA 08/30/19
Checked by/Date: PSJ 08/30/19

TABLE 5.3

Combined Remedial Technologies
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Process Option/Technology	Alternative 1 No Action	Alternative 2 SVE/AS ISCR with ZVI	Alternative 3 ISCO Blending ISCR with ZVI	Alternative 4 Mechanical Soil Excavation/Disposal ISCO Blending and ISCR with ZVI
Soil				
SVE		X		
ISCO Blending			X	
Mechanical Excavation				X
Off-Site Disposal				X
Source Area Groundwater				
AS		X		
ISCO Blending			X	X
ISCR with ZVI		X	X	X
Downgradient Groundwater				
ISCR with ZVI		X	X	X

Notes:
SVE = Soil Vacuum Extraction
AS = Air Sparging
ISCO = In Situ Chemical Oxidation
ISCR = In Situ Chemical Reduction
ZVI = Zero Valent Iron

Prepared By/Date: SEA 08/30/19
Checked By/Date: PSJ 08/30/19

TABLE 6.1 REVISED
(revised 06/09/2022)
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Evaluation Criteria	Alternative 1 No Action	Alternative 2 SVE/AS ISCR with ZVI	Alternative 3 ISCO Blending ISCR with ZVI	Alternative 4 Mechanical Soil Excavation/ Disposal ISCO Blending and ISCR with ZVI
Option Components				
VOCs in soil	No Action	SVE	ISCO Blending	Excavation/Offsite Disposal/ISCO Blending
VOCs in groundwater	No Action	AS and ISCR with ZVI	ISCR with ZVI	ISCR with ZVI
Narrative description of alternative	No monitoring, institutional controls, or remedial measures are employed.	Construct SVE/AS treatment system with vertical SVE wells and vertical AS wells installed using hollow stem auger drilling in source area. Install air distribution piping from wells to a mobile SVE/AS treatment system. Conduct shallow groundwater sparging and soil treatment by SVE until SVE exhaust is clean. Perform pulsed sparging to maximize stripping effects on VOCs dissolved in source area groundwater. Install ZVI barriers to treat on-site groundwater and the off-site, downgradient plume.	Treat VOC-impacted source area vadose zone soils (0 to 18 feet bgs) and shallow aquifer soils (18 to 25 feet bgs) by ISCO blending using potassium permanganate followed by stabilization of the treated soils. Treatment requires removal and disposal of the concrete pad associated with former hazardous waste accumulation building. Install ZVI barriers to treat on-site groundwater and the off-site, downgradient plume.	Demolish and dispose former hazardous waste accumulation building concrete slab and excavate source area vadose zone soils to a depth of 18 feet bgs. Dispose excavated soil at an off-site, regulated disposal facility. Treat shallow aquifer soils (18-25 feet bgs) with ISCO blending using potassium permanganate. Install ZVI barriers to treat on-site groundwater and the off-site, downgradient plume.
1. Protection of Human Health and Environment				
Criteria Score (1-6)	1	5	5	5
Human Health	Not protective of human health.	Risk is reduced by source area vadose zone soil treatment combined with on-site and off-site, downgradient groundwater treatment.	Risk is reduced by source area vadose zone soil treatment combined with on-site and off-site, downgradient groundwater treatment.	Risk is reduced by source area vadose zone soil treatment combined with on-site and off-site, downgradient groundwater treatment.
Environment	Not protective of the environment.	Risk of continuing impact to groundwater and surface water from site contaminants is reduced by soil and groundwater treatment.	Risk of continuing impact to groundwater and surface water from site contaminants is reduced by soil and groundwater treatment.	Risk of continuing impact to groundwater and surface water from site contaminants is reduced by soil and groundwater treatment.

TABLE 6.1 REVISED
(revised 06/09/2022)
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Evaluation Criteria	Alternative 1 No Action	Alternative 2 SVE/AS ISCR with ZVI	Alternative 3 ISCO Blending ISCR with ZVI	Alternative 4 Mechanical Soil Excavation/ Disposal ISCO Blending and ISCR with ZVI
2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)				
Criteria Score (1-6)	1	4	5	5
Chemical-Specific Regulations USEPA Regional Screening Levels - Soil Screening Levels (SSLs) South Carolina (SC) Drinking Water Standards SC Ambient Water Quality Criteria (WQC)	Alternative 1 will not comply with chemical-specific ARARs.	SVE is estimated to achieve maximum contaminant level (MCL)-based SSLs for source area vadose zone VOCs within 2 years. On-site groundwater is estimated to comply with MCLs in approximately 3 to 5 years. Off-site groundwater is estimated to comply with MCLs and SC Ambient WQC in approximately 2 to 4 years. Time frames are an estimate for comparison purposes only.	ISCO is estimated to achieve target soil SSL concentrations for source area VOCs within weeks. On-site groundwater is estimated to comply with MCLs in approximately 3 to 5 years. Off-site groundwater is estimated to comply with MCLs and SC Ambient WQC in approximately 2 to 4 years. Time frames are an estimate for comparison purposes only.	Excavation and ISCO blending are estimated to achieve SSL soil concentrations for source area VOCs within weeks. On-site groundwater is estimated to comply with MCLs in approximately 3 to 5 years. Off-site groundwater is estimated to comply with MCLs and SC Ambient WQC in approximately 2 to 4 years. Time frames are an estimate for comparison purposes only.
Action-Specific Regulations SC Ambient Air Quality Standards SC UIC Regulations SC Hazardous Waste Management Resource Recovery and Conservation Act (RCRA)	Action-specific ARARs are not applicable.	Treatment of SVE/AS system emissions for 2 years, if determined to be necessary per SC Ambient Air Quality Standards Groundwater treatment will comply with SC Underground Injection Control (UIC) regulations.	Soil and groundwater treatment will comply with SC UIC regulations.	Soil treatment and disposal will comply with RCRA and SC Hazardous Waste Management Regulations. Groundwater treatment will comply with SC UIC regulations.
Location-Specific Regulations	Location-specific ARARs are not applicable.	Not applicable.	Not applicable.	Not applicable.

TABLE 6.1 REVISED
(revised 06/09/2022)
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Evaluation Criteria	Alternative 1 No Action	Alternative 2 SVE/AS ISCR with ZVI	Alternative 3 ISCO Blending ISCR with ZVI	Alternative 4 Mechanical Soil Excavation/ Disposal ISCO Blending and ISCR with ZVI
3. Short Term Effectiveness				
Criteria Score (1-6)	1	3	4	3
Community Protection	No change in risk.	No significant risk to community.	No significant risk to community.	Soil excavation/disposal activities would potentially expose the community during transport to the disposal facility.
Worker Protection	No change in risk.	Potential risk from exposure to oxidants and ZVI and risks associated with construction equipment will be controlled during site work.	Potential risk from exposure to oxidants and ZVI and risks associated with construction equipment will be controlled during site work.	Soil excavation activities would potentially expose site workers to contamination. Potential risk from exposure to oxidants and ZVI and risks associated with construction equipment will be controlled during site work.
Environmental Impacts	No change to environmental impacts.	Air emissions during SVE/AS system operation will be monitored.	No adverse environmental impacts.	No adverse environmental impacts.
Estimated Time to Completion	Unknown; however, likely greater than 30 years.	On-site remediation: 3 to 5 years Off-site remediation: 2 to 4 years	On-site remediation: 3 to 5 years Off-site remediation: 2 to 4 years	On-site remediation: 3 to 5 years Off-site remediation: 2 to 4 years
4. Long Term Effectiveness and Permanence				
Criteria Score (1-6)	1	5	5	5
Residual Risk	Residual risk is not reduced from the current risk.	There is no current or future risk for contact with contaminated soils. Risk due to potential future contact and/or consumption of contaminated groundwater and potential future inhalation risk due to vapor intrusion caused by impacted groundwater are reduced by treatment.	There is no current risk for contact with contaminated soils. Risk due to potential future contact and/or consumption of contaminated groundwater and potential future inhalation risk due to vapor intrusion caused by groundwater are reduced by treatment.	There is no current risk for contact with contaminated soils. Risk due to potential future contact and/or consumption of contaminated groundwater and potential future inhalation risk due to vapor intrusion caused by groundwater are reduced by treatment.
Reliability of Controls	No controls are employed.	Reliability of SVE for source area soil volatile organic compound (VOC) removal is high in the vadose zone. Reliability of SVE for capillary fringe VOC treatment is moderate to high because it is combined with AS. Reliability of AS for removal of chlorinated VOCs from groundwater is moderate. Reliability of removal of chlorinated VOCs from groundwater using ZVI is high if contact is achieved.	Reliability of ISCO blending for VOCs in source area vadose zone soils (0 to 18 feet bgs) and in shallow aquifer soils (18 to 25 feet bgs) is high if sufficient contact is achieved. Reliability of removal of chlorinated VOCs from groundwater using ZVI is high if contact is achieved.	Reliability of excavation for VOC removal is high for source area vadose zone soils (0 to 18 feet bgs). Reliability of ISCO blending for removal of VOCs in source area shallow aquifer soils (18 to 25 feet bgs) is high if adequate contact is achieved. Reliability of removal of chlorinated VOCs from groundwater using ZVI is high if contact is achieved.

TABLE 6.1 REVISED
(revised 06/09/2022)
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Evaluation Criteria	Alternative 1 No Action	Alternative 2 SVE/AS ISCR with ZVI	Alternative 3 ISCO Blending ISCR with ZVI	Alternative 4 Mechanical Soil Excavation/ Disposal ISCO Blending and ISCR with ZVI
5. Contaminant Reduction Potential				
Criteria Score (1-6)	1	5	6	6
Treatment Process Used	None.	VOCs removed from soil by SVE. VOCs removed from groundwater by a combination of AS and ISCR using ZVI.	VOCs removed from source area vadose zone soils and shallow aquifer soils by ISCO blending. VOCs removed from groundwater by ISCR using ZVI.	VOCs removed from vadose zone source area soils by excavation. VOCs removed from source area aquifer soils by ISCO blending. VOCs removed from groundwater by ISCR using ZVI.
Reduction of Toxicity, Mobility, and Volume	No reduction achieved except by natural attenuation, which is minimal. No monitoring is used to determine progress toward site Remedial Action Objectives (RAOs).	VOC toxicity, mobility, and volume are reduced in soil by SVE and in groundwater by AS, but transferred to vapor phase. VOC toxicity, mobility, and volume are reduced in groundwater by ISCR with ZVI.	VOC toxicity, mobility, and volume in vadose zone soils and shallow aquifer soils are reduced by ISCO blending. VOC toxicity, mobility, and volume are reduced in groundwater by ISCR with ZVI.	VOC toxicity, mobility, and volume in vadose zone soils and shallow aquifer soils are reduced by ISCO blending. VOC toxicity, mobility, and volume are reduced in groundwater by ISCR with ZVI.
Type & Quantity of Residuals	No residuals are created.	No residuals are anticipated.	No residuals are anticipated.	No residuals are anticipated.
Irreversible Treatment	Reductions by natural attenuation are irreversible, but limited. No monitoring is used to detect attenuation.	Physical stripping of VOCs is permanent and irreversible. Reduction in concentration of VOCs is permanent and irreversible.	Oxidation of VOCs is permanent and irreversible. Reduction of VOCs is permanent and irreversible.	Excavated soils are not treated, but disposed off site. Oxidation and reduction of VOCs is permanent and irreversible.
Statutory Preference for Treatment	Does not satisfy.	Satisfies.	Satisfies.	The excavation of impacted soils with subsequent disposal at an off-site landfill does not fully satisfy the preference for treatment.

TABLE 6.1 REVISED
(revised 06/09/2022)
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Evaluation Criteria	Alternative 1 No Action	Alternative 2 SVE/AS ISCR with ZVI	Alternative 3 ISCO Blending ISCR with ZVI	Alternative 4 Mechanical Soil Excavation/ Disposal ISCO Blending and ISCR with ZVI
6. Implementability				
Criteria Score (1-6)	6	5	4	4
Ability to Construct and Operate	No construction, operation, or maintenance of a system is required.	SVE/AS treatment system installation, operation, and maintenance are routine. Direct Push Technology (DPT) injection of ZVI is relatively routine and several vendors have been identified.	ISCO blending requires demolition of concrete slab associated with the former hazardous waste accumulation building, stockpiling of soil to be treated, specialized blending equipment, and protection of personnel from exposure to chemicals. Several vendors have been identified that can perform this work. DPT injection of ZVI is relatively routine and several vendors have been identified.	Demolition of concrete slab associated with the former hazardous waste accumulation building is required. Depth of vadose zone excavation will require benching and sloping. ISCO blending requires specialized blending equipment and protection of personnel from exposure to chemicals. Several vendors have been identified. DPT injection of ZVI is relatively routine and
Ease of Doing More Action if Needed	Does not interfere with potential future remedial actions.	Relatively easy to expand SVE/AS system and/or perform extended operation. Relatively easy to conduct additional ZVI injections.	Easy to perform additional ISCO blending prior to demobilization of the equipment. More difficult and expensive if a second mobilization is required. Relatively easy to conduct additional ZVI injections.	Relatively easy to expand area of excavation before backfilling. Much more difficult afterward. Easy to conduct additional ISCO blending prior to demobilization of equipment. Relatively easy to perform additional ZVI injections.
Ability to Monitor Effectiveness	Provides no monitoring.	Proposed soil and groundwater monitoring will provide measurement of progress toward completion and compliance with RAOs.	Proposed soil and groundwater monitoring will provide measurement of progress toward completion and compliance with RAOs.	Proposed soil and groundwater monitoring will provide measurement of progress toward completion and compliance with RAOs.
Ease of Approvals	Not likely to gain approval as Alternative 1 is not protective of human health and the environment.	SVE is a proven and accepted method of soil remediation. Requires state concurrence that potential emissions are below permitting thresholds; otherwise, a permit is required. AS is a proven and accepted method of groundwater remediation. Requires a SC UIC permit. ISCR with ZVI is a proven and accepted method of groundwater remediation that requires a SC UIC permit.	ISCO blending and ISCR have proven to be successful at other sites for the destruction of chlorinated VOCs. ISCO blending and ISCR with ZVI will require a SC UIC permit.	Excavation, ISCO, and ISCR are commonly used for the treatment of VOCs in soils. ISCO blending and ISCR with ZVI will require a SC UIC permit.
Availability of Services & Capacities, Equipment, Specialists and Materials	None required.	Services required for drilling, well installation, SVE/AS treatment system installation are available from a large number of established vendors. Services required for ZVI injection via DPT are available from a limited number of established vendors.	Services for concrete slab demolition and disposal are numerous. Services required for ISCO blending and ZVI injection are available from a limited number of established vendors.	Services required for concrete slab demolition/disposal and vadose zone soil excavation/disposal are available from a large number of established vendors. Services required for ISCO blending are available from a limited number of established vendors. Services required for ZVI injection via DPT are available from a limited number of established vendors.

TABLE 6.1 REVISED
(revised 06/09/2022)
Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**
Evaluation Criteria	**No Action**	**SVE/AS ISCR with ZVI**	**ISCO Blending ISCR with ZVI**	**Mechanical Soil Excavation/ Disposal ISCO Blending and ISCR with ZVI**
7. Cost				
Criteria Score (1-6)	6	2	5	3
Estimated Duration (years)	30	5	5	5
Soil Capital Cost	$0	$251,500[1]	$135,000	$193,500[2]
Soil O&M	$0	$14,000	$0	$0
Groundwater Capital Cost	$0	$237,000	$237,000	$237,000
Groundwater O&M	$0	$108,500	$108,500	$108,500
Total Cost	**$0**	**$611,000**	**$480,500**	**$539,000**
8. and 9. Regulatory and Community Acceptance				
Acceptance by state and community	Likely not acceptable to the state or community.	Robert Bosch Tool Corporation (RBTC) and Wood Environment & Infrastructure Solutions, Inc. (Wood) will work to address community and regulatory concerns after receipt of comments from the South Carolina Department of Health and Environmental Control (SCDHEC). Anticipated issues include: - Limited impact to on-site and downgradient off site business tenants - Moderate traffic of short duration - Noise generated during drilling - Potential air emissions from SVE/AS system	RBTC and Wood will work to address community and regulatory concerns after receipt of comments from SCDHEC. Anticipated issues include: - Limited impact to on-site and downgradient off site business tenants - Moderate traffic of short duration - Noise and dust generated during ISCO blending activities	RBTC and Wood will work to address community and regulatory concerns after receipt of comments from SCDHEC. Anticipated issues include: - Limited impact to on-site and downgradient off site business tenants - Moderate traffic of short duration - Noise and dust generated during excavation activities
10 Summary of Comparison				
Total Criteria Score	17	29	34	31
Estimated Time to Completion	Unknown - likely greater than 30 years.	Up to 5 years.	Up to 5 years.	Up to 5 years.
Summary Comments	Not protective of human health or the environment.	Effectiveness for soil and groundwater VOC treatment has been established for sites with similar characteristics.	Effectiveness for soil and groundwater VOC treatment has been established for sites with similar characteristics.	Effectiveness for soil and groundwater VOC treatment has been established for sites with similar characteristics.

Notes:

(1) Does not include cost for a pilot study to determine zone of influence for the SVE and AS wells.

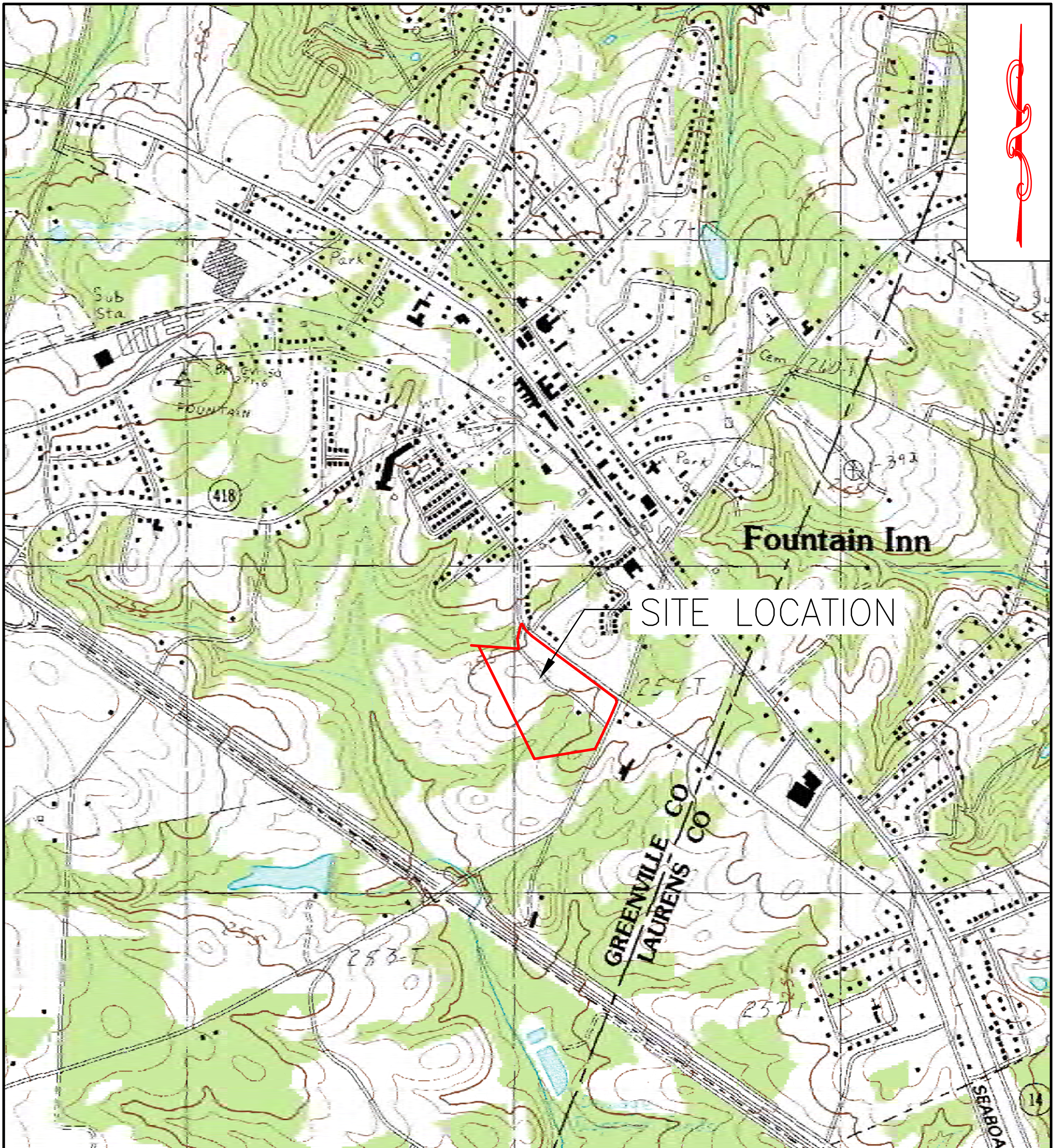
(2) Basic cost assumes that SCDHEC concurs that soil is nonhazardous based on concentration of "underlying hazardous constituents". If SCDHEC determines that soil is hazardous, then the capital cost is $540,000.

AS = air sparging
bgs = below ground surface
DPT = direct push technology
ISCO = in situ chemical oxidation
ISCR = in situ chemical reduction
MCL = Maximum Contaminant Level
O&M = Operation and Maintenance
RAOs = Remedial Action Objectives

RBTC = Robert Bosch Tool Corporation
SC = South Carolina
SCDHEC = South Carolina Department of Health and Environmental Control
SVE = soil vapor extraction
UIC = underground injection control
VOC = volatile organic compound
ZVI = zero valent iron

Prepared By/Date: SEA 08/30/19
Checked By/Date: PSJ 08/30/19
Revised By/Date: ESS 06/09/22

FIGURES



REFERENCE:
2001 DELORME STREET ATLAS USA

0.25 0.125 0 0.25 0.5
APPROXIMATE SCALE IN MILES

wood.

30 PATEWOOD DRIVE
SUITE 200
GREENVILLE, S.C. 29615
Phone: (864) 458-3600
Fax: (864) 458-3700

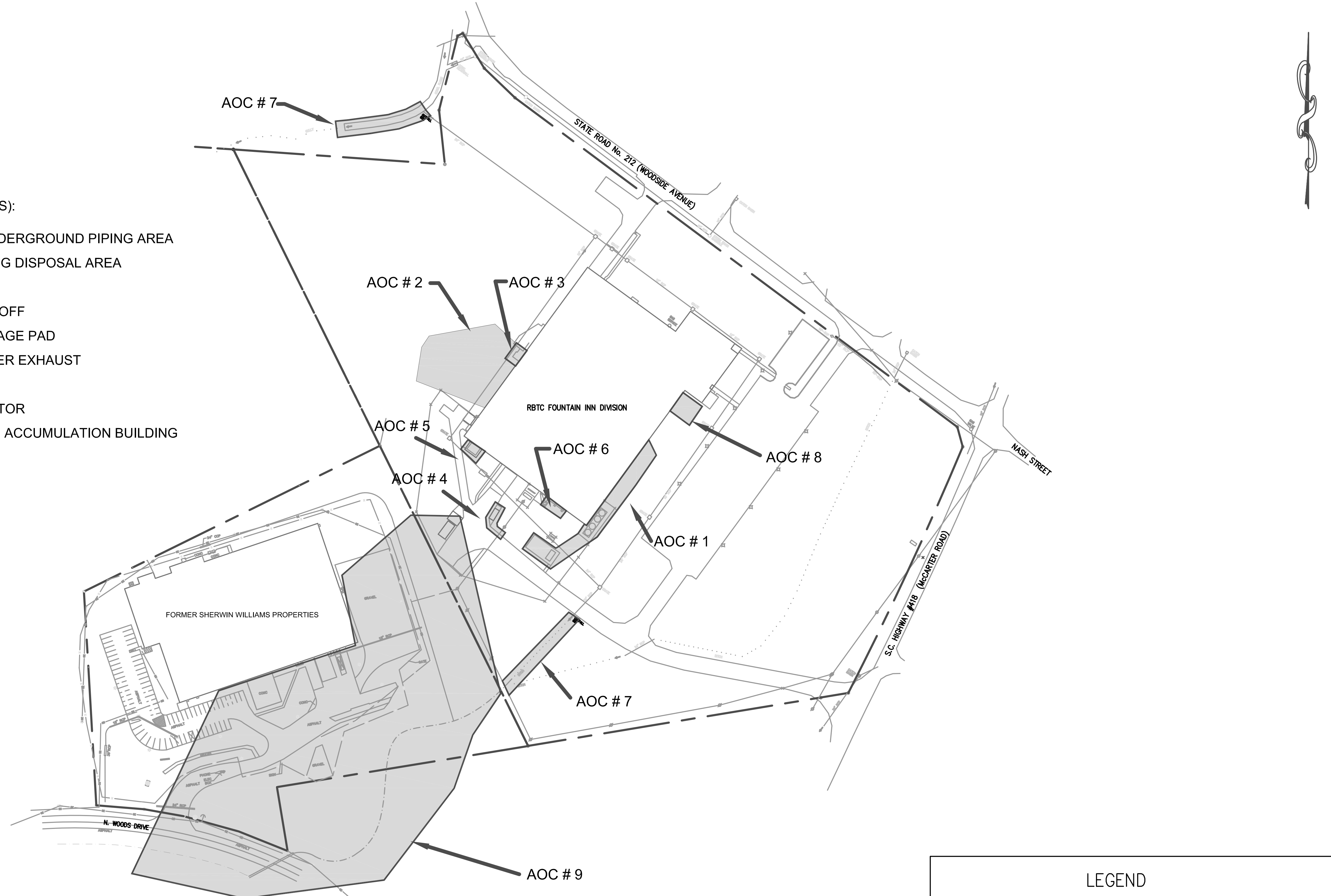
SITE LOCATION MAP
FORMER VERMONT BOSCH SITE
FOUNTAIN INN, SOUTH CAROLINA

FIGURE 2.1

FILE:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:	JOB NO:
FIGURE 1.DWG	CHB	PSJ	PSJ	5/14/12	6251161022.04.02

SITE AREAS OF CONCERN (AOCS):

AOC #1 TANK CONTAINMENT AND UNDERGROUND PIPING AREA
AOC #2 HEAT TREAT WATER CLEANING DISPOSAL AREA
AOC #3 FORMER METALS BAGHOUSE
AOC #4 FORMER SCRAP METAL ROLLOFF
AOC #5 FORMER EMPTY DRUM STORAGE PAD
AOC #6 COMPOUNDING ROOM BLOWER EXHAUST
AOC #7 STORM WATER OUTFALLS
AOC #8 FORMER OIL/WATER SEPARATOR
AOC #9 FORMER HAZARDOUS WASTE ACCUMULATION BUILDING



LEGEND

AREA OF CONCERN (AOC # 1)

200 100 0 200 400

SCALE 1" = 200'

DRAWN BY: CHB	DATE: 4/1/16
CHECKED BY: GWW	DATE: 4/1/16
PROJECT NO: 6251161022.04.02	

REVISIONS

No.	DESCRIPTION	BY

wood.

30 Patewood Drive
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Greenville, SC 29615
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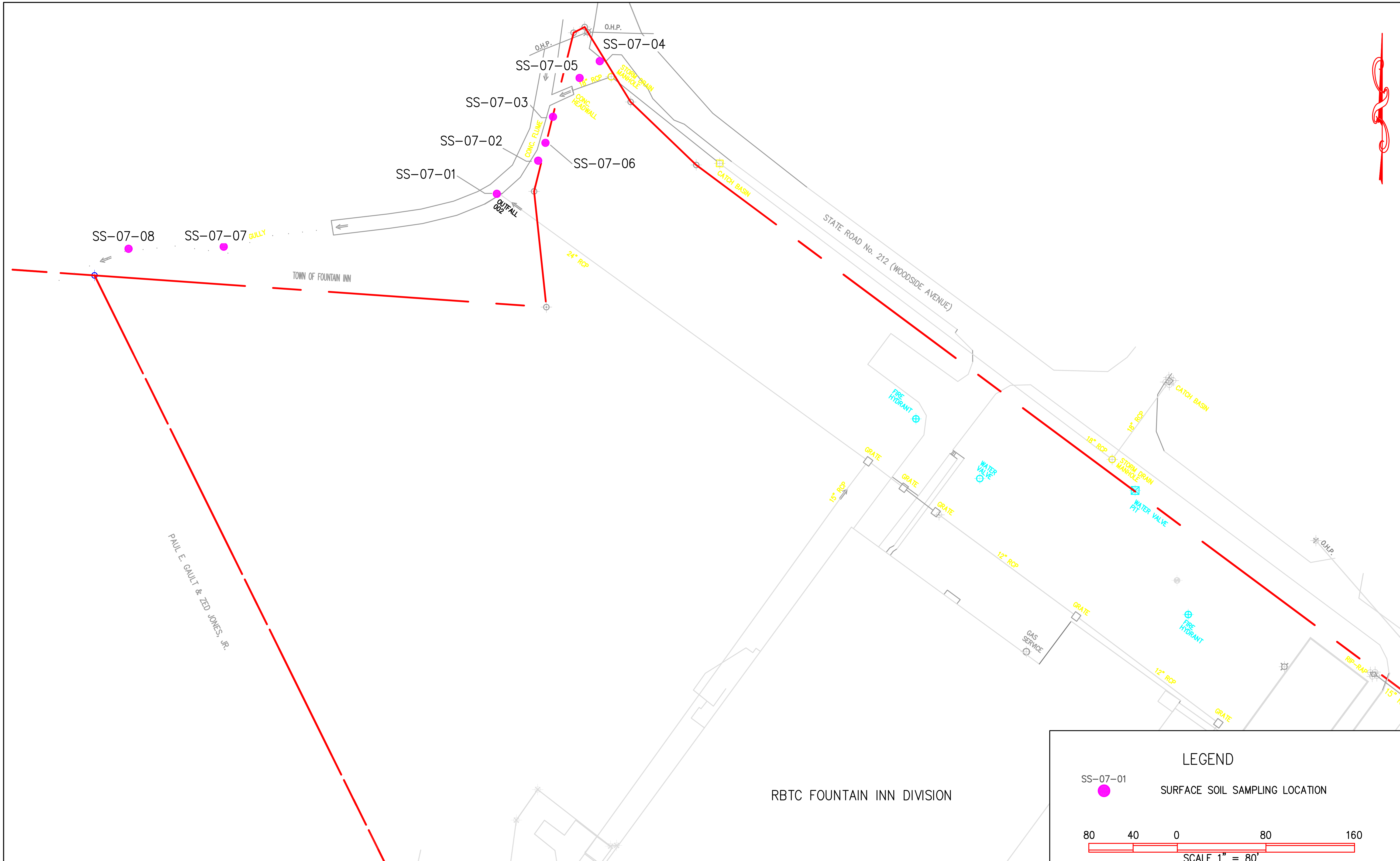
AREAS OF CONCERN LOCATION MAP
RBTC FOUNTAIN INN DIVISION/FORMER SHERWIN WILLIAMS PROPERTIES
FOUNTAIN INN, SOUTH CAROLINA

FIGURE 2.2



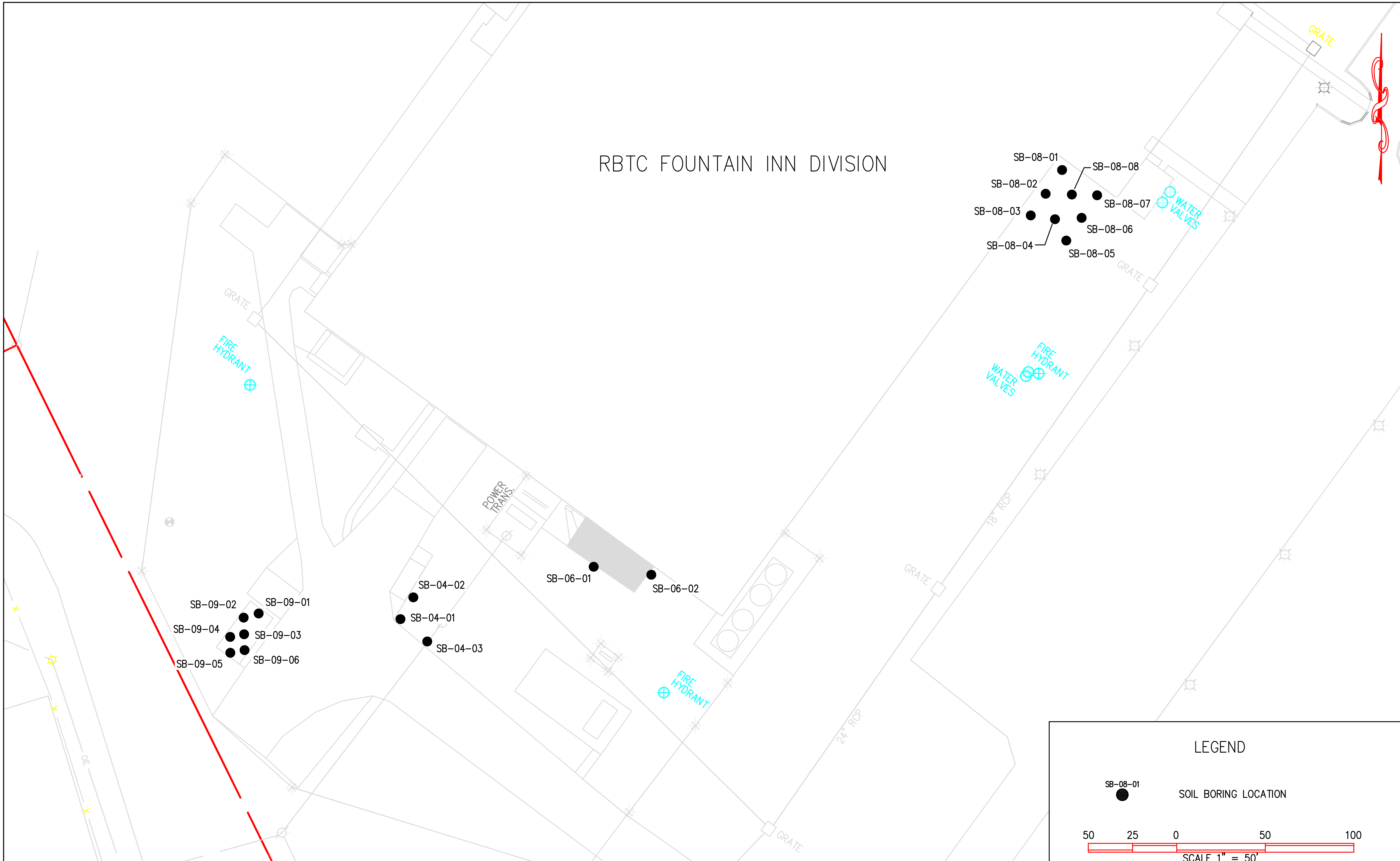
DRAWN BY: ZJD	DATE: 11/24/15	REVISIONS	
CHECKED BY: LLM	DATE: 11/24/15	No. DESCRIPTION BY	
PROJECT NO: 6251161022.04.02			

wood.

30 PATEWOOD DRIVE
SUITE 200
GREENVILLE, S.C. 29615
Phone: (864) 458-3600
Fax: (864) 458-3700

SURFACE SOIL SAMPLING LOCATION MAP
RBTC FOUNTAIN INN DIVISION/FORMER SHERWIN WILLIAMS PROPERTIES
FOUNTAIN INN, SOUTH CAROLINA

FIGURE 2.3



DRAWN BY: ZJD	DATE: 10/30/15		
CHECKED BY: CHB	DATE: 10/30/16		
PROJECT NO: 6251161022.04.02			

REVISIONS		
No.	DESCRIPTION	BY

wood.

30 PATEWOOD DRIVE
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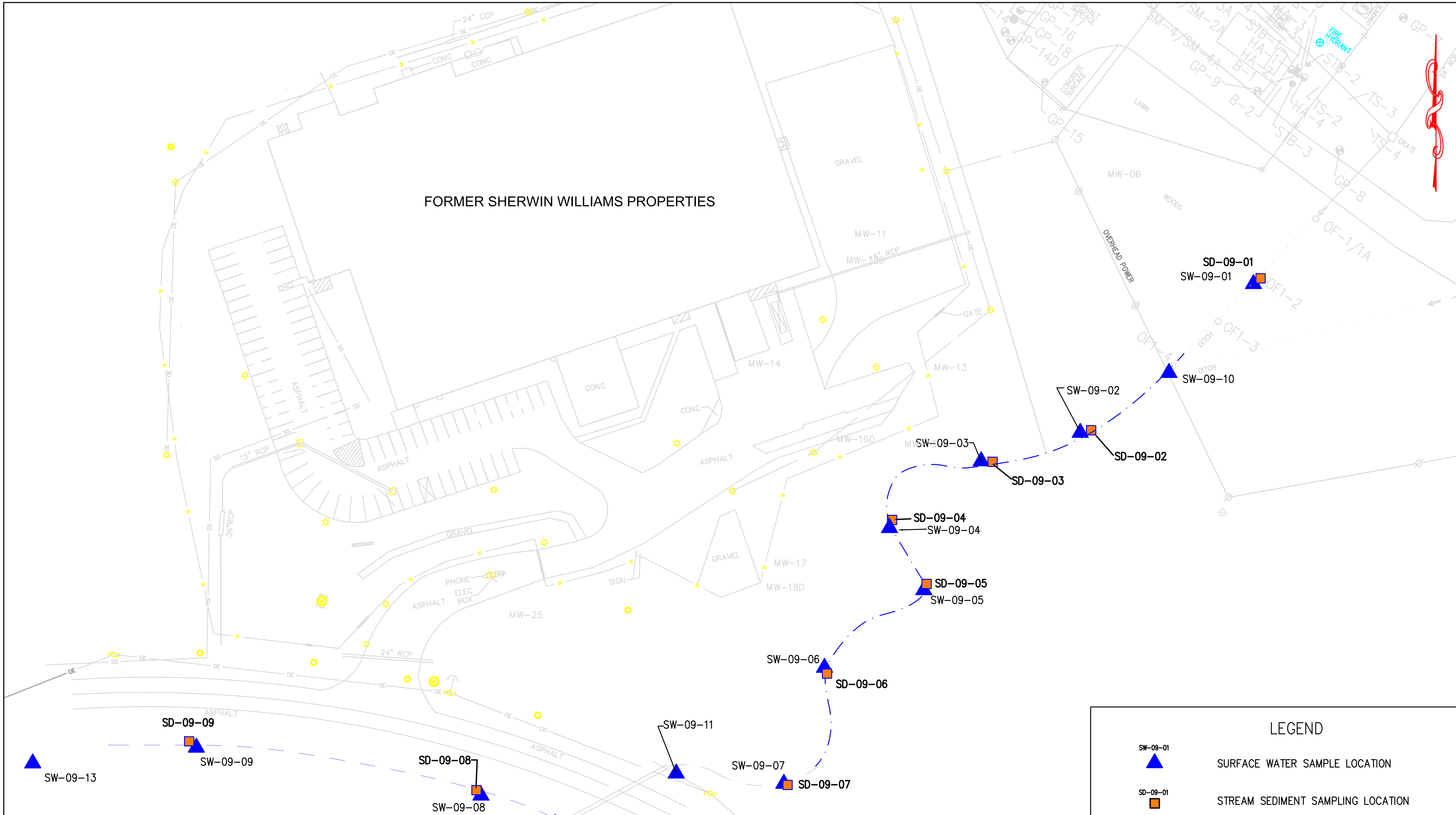
SOIL BORING LOCATION MAP
RBTC FOUNTAIN INN DIVISION/FORMER SHERWIN WILLIAMS PROPERTIES
FOUNTAIN INN, SOUTH CAROLINA

FIGURE 2.4



REFERENCES:

1. BOUNDARY AND AS-BUILT SURVEY FOR VERMONT AMERICAN CORPORATION, FOUNTAIN INN DIVISION, 8/24/01, PREPARED BY CAROLINA SURVEYING & MAPPING, AND MACTEC ENGINEERING & CONSULTING, INC. FIELD NOTES.
2. SAMPLE LOCATION MAP, SHERMAN WILLIAMS GRAPHIC ARTS DIVISION, FOUNTAIN INN, SOUTH CAROLINA, DRAWING NUMBER 63102-F2, SHEET 1, REVISION A, 2/25/02, PREPARED BY THE FLETCHER GROUP.

DRAWN BY: ZJD	DATE: 10/29/15		
CHECKED BY: CHB	DATE: 10/29/15		
PROJECT NO: 6251161022.04.02			

REVISIONS

No.	DESCRIPTION	BY

wood.

30 PATEWOOD DRIVE
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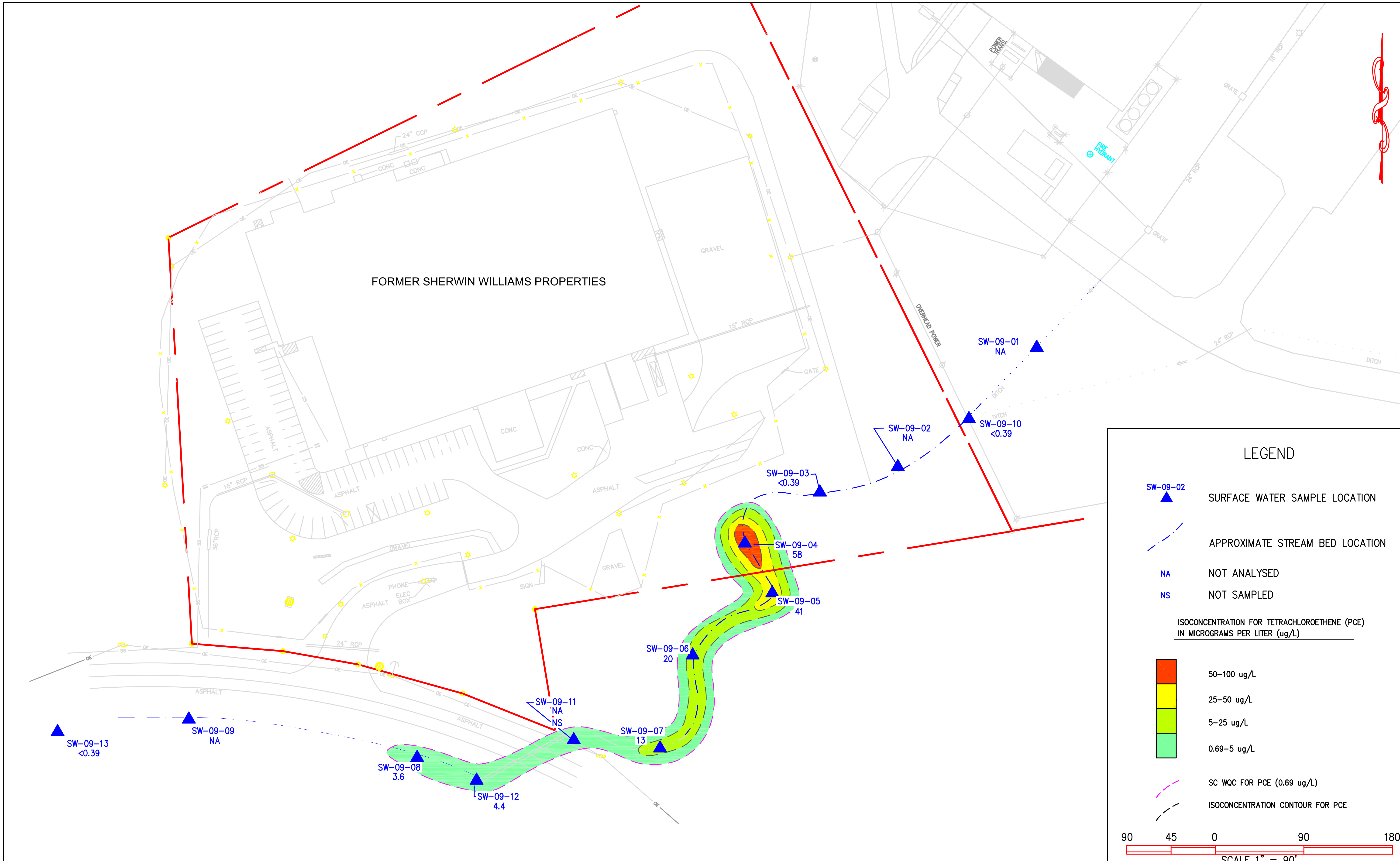
SURFACE WATER AND SEDIMENT SAMPLE LOCATION MAP
AUGUST 2015
RBTC FOUNTAIN INN DIVISION/FORMER SHERWIN WILLIAMS PROPERTIES
FOUNTAIN INN, SOUTH CAROLINA

FIGURE 2.5



DRAWN BY: ZJD	DATE: 10/28/15
CHECKED BY: PSJ	DATE: 10/28/15
PROJECT NO: 6251161022.04.02	

REVISIONS

No.	DESCRIPTION	BY

wood.

30 PATEWOOD DRIVE
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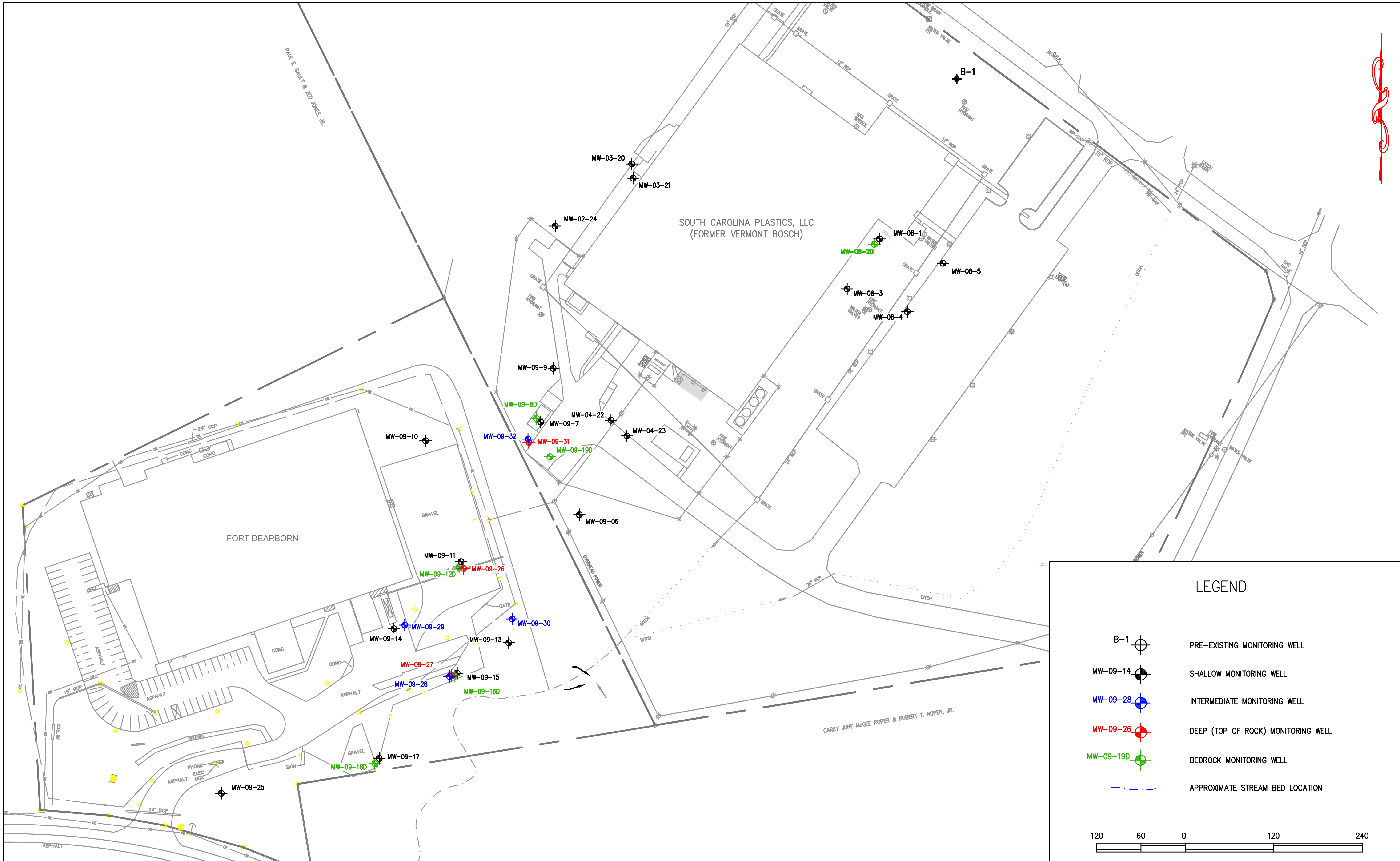
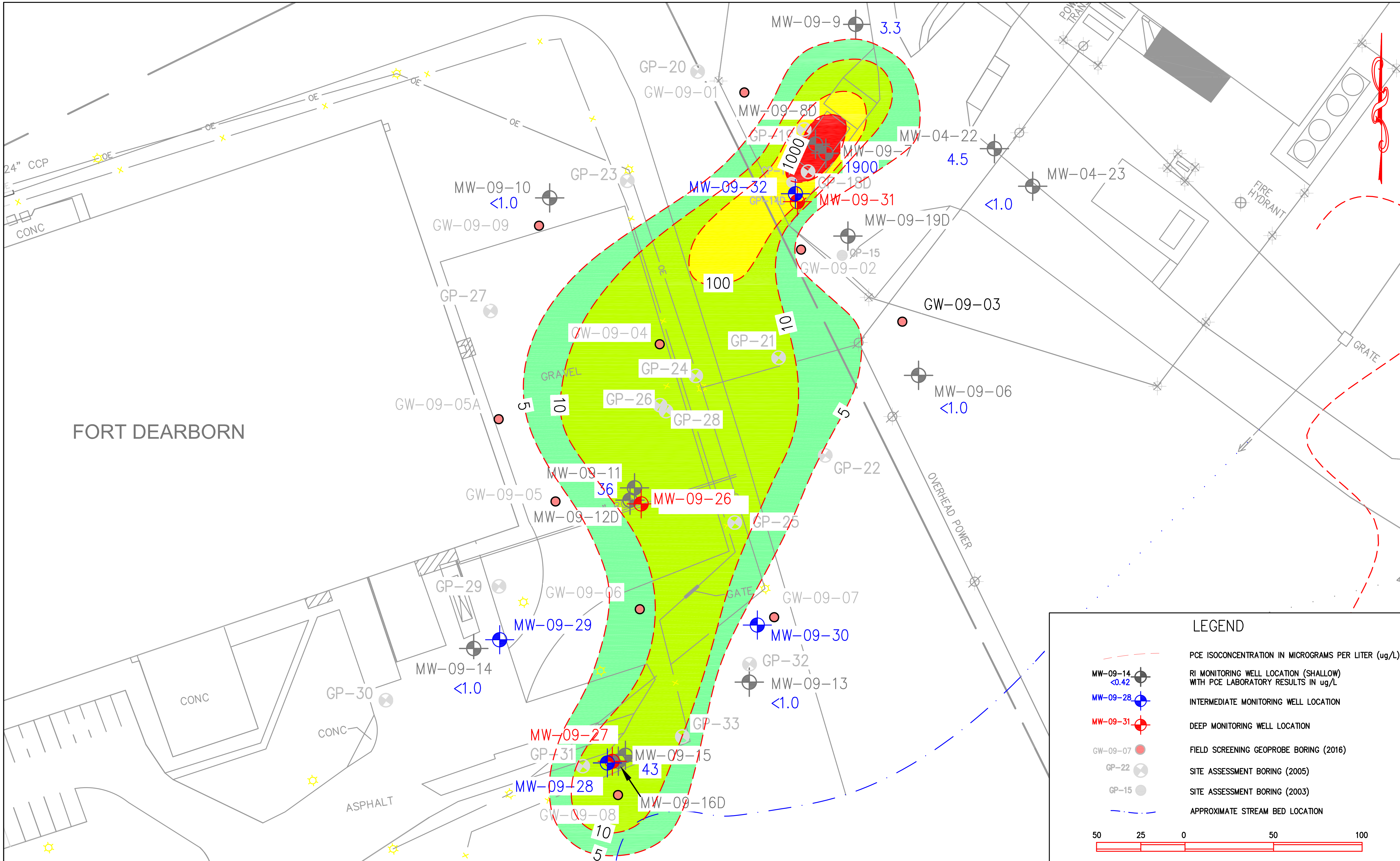
PCE-IMPACTED SURFACE WATER MAP
RBTC FOUNTAIN INN DIVISION/FORMER SHERWIN WILLIAMS PROPERTIES
FOUNTAIN INN, SOUTH CAROLINA

FIGURE 2.6



DRAWN BY: CHB	DATE: 03/09/17	REVISIONS: No. / DESCRIPTION / BY	wood.	30 PATEWOOD DRIVE SUITE 200 GREENVILLE, S.C. 29615 Phone: (864) 458-3600 Fax: (864) 458-3700	FIGURE
CHECKED BY: PSJ	DATE: 03/28/17			MONITORING WELL LOCATION MAP FORMER VERMONT BOSCH SITE/FORT DEARBORN PROPERTY FOUNTAIN INN, SOUTH CAROLINA	2.7
PROJECT NO: 6251161022.04.02					



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PROJECT NO:	6251161022.04.02			

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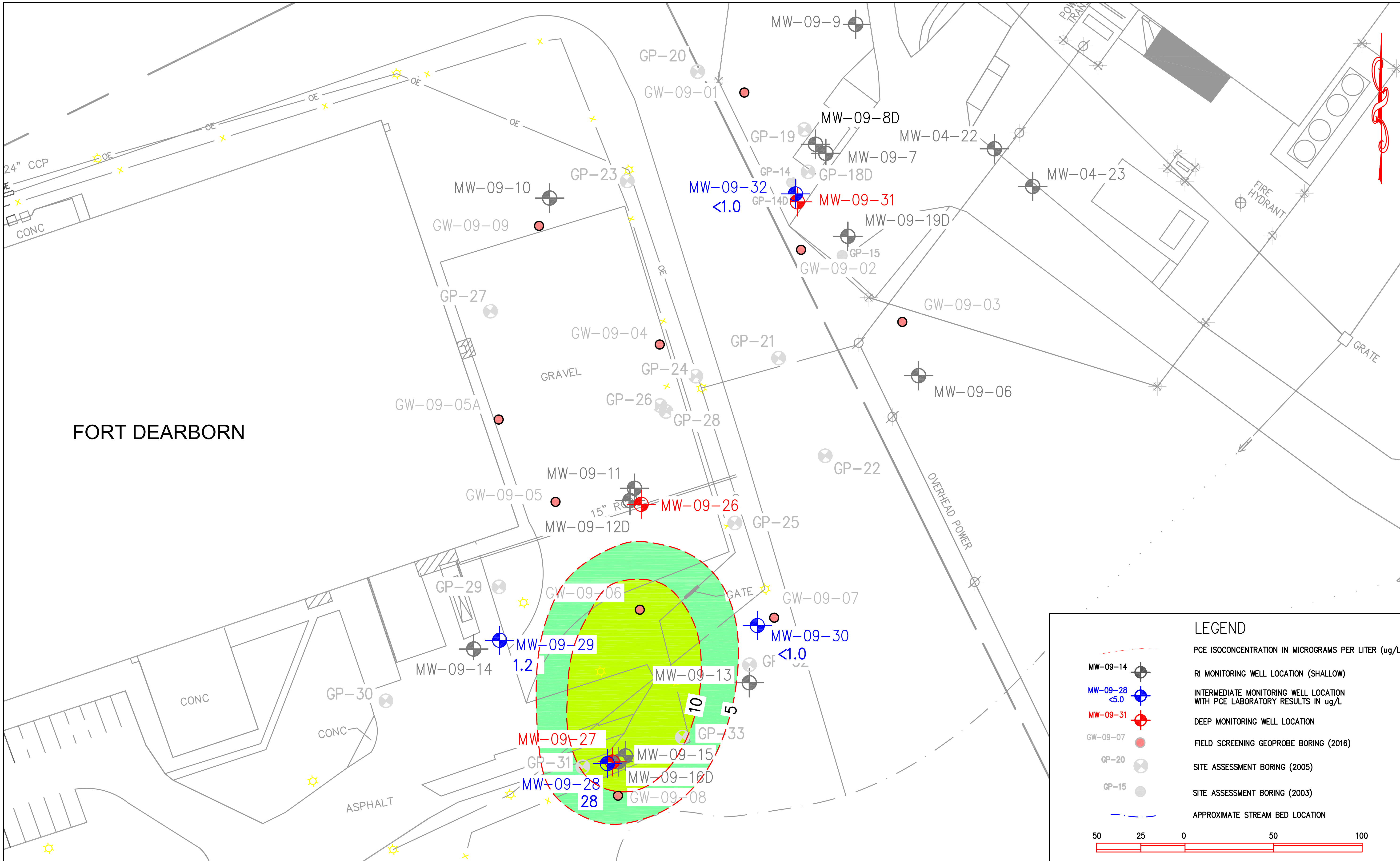
SHALLOW ZONE PCE ISOCONCENTRATION CONTOUR MAP
FORMER VERMONT BOSCH SITE/FORT DEARBORN PROPERTY
FOUNTAIN INN, SOUTH CAROLINA

FIGURE 2.8



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CHECKED BY:	ZJD	DATE:	10/30/18
PROJECT NO:	6251161022.04.02		

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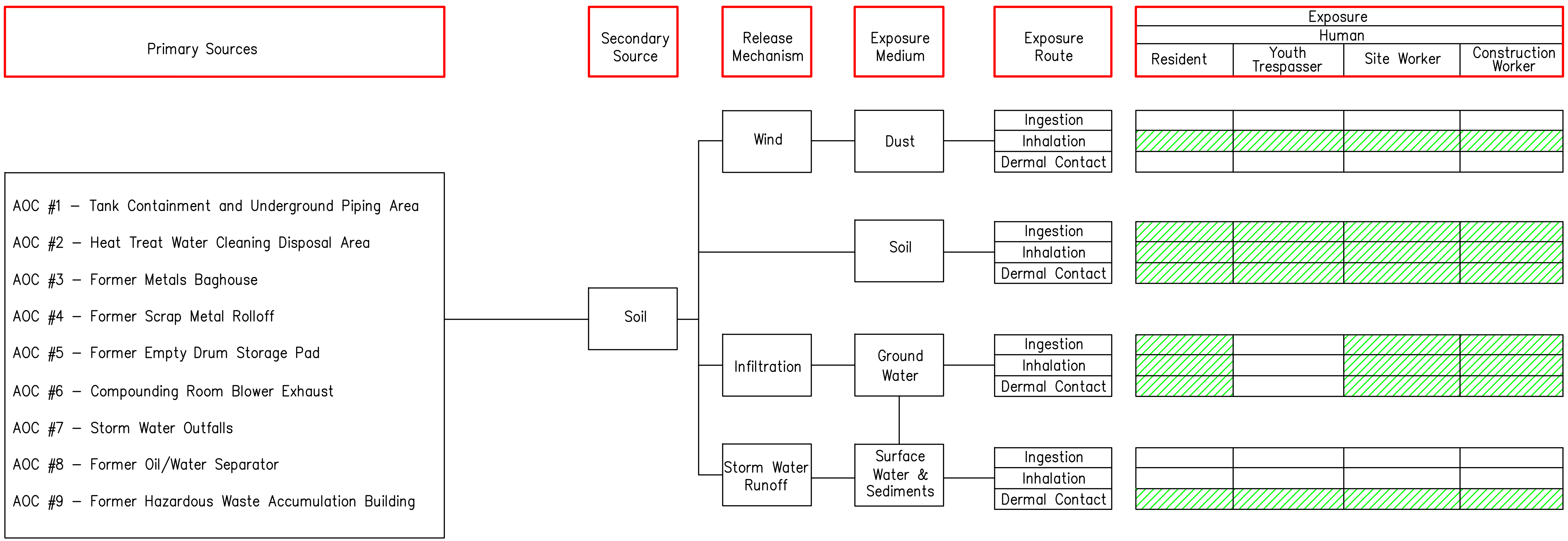
INTERMEDIATE ZONE PCE ISOCONCENTRATION CONTOUR MAP
FORMER VERMONT BOSCH SITE/FORT DEARBORN PROPERTY
FOUNTAIN INN, SOUTH CAROLINA

FIGURE 2.9



NOTE: Shaded area indicates potential human complete exposure pathways that will be retained for further evaluation.

DRAWN	CHB	DATE	3/1/16	
CHECKED	LWC	FILE	FIG 2.10.DWG	
		JOB NO:	6251161022.04.02	

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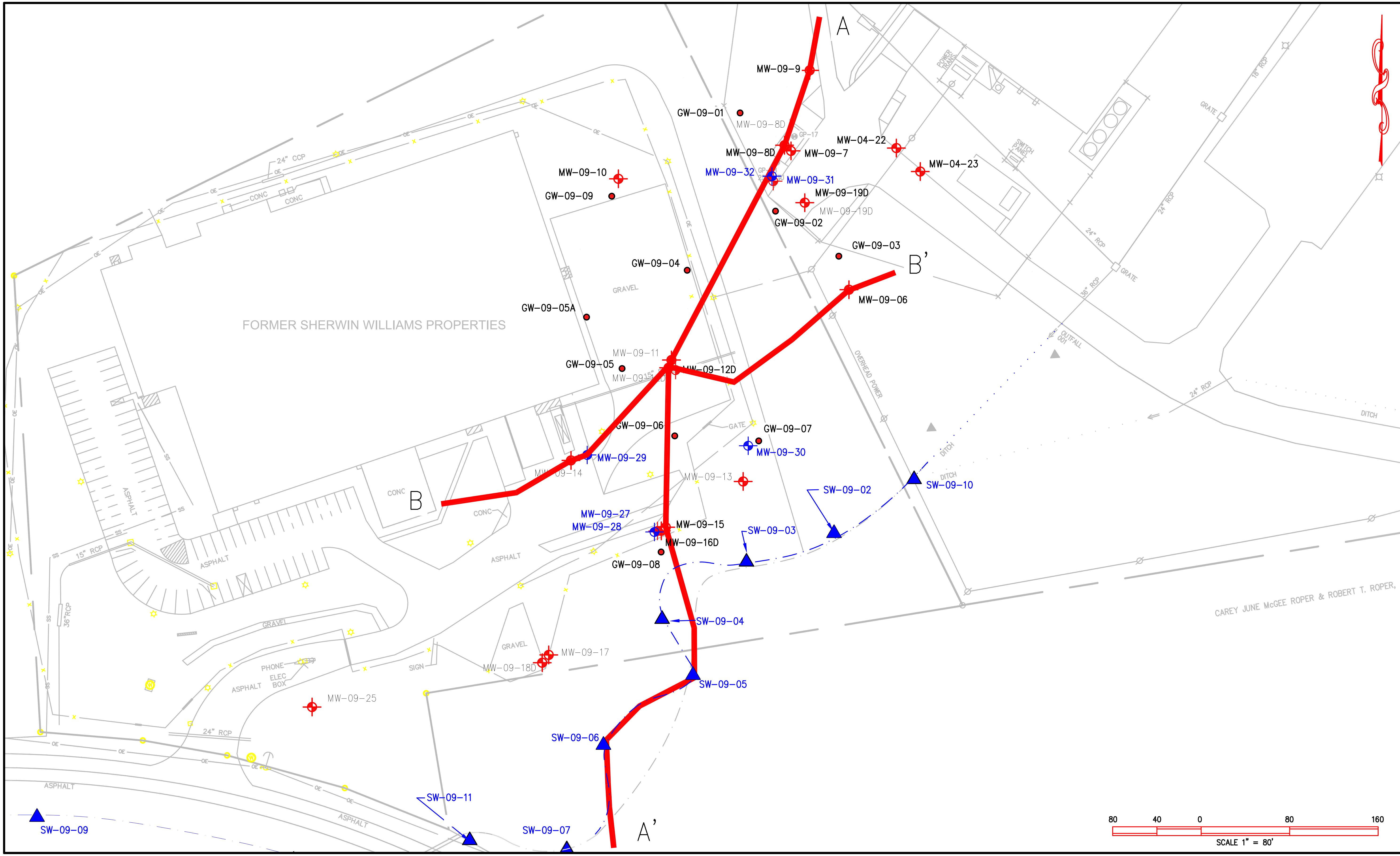
SITE CONCEPTUAL MODEL
RBTC FORMER FOUNTAIN INN DIVISION
FOUNTAIN INN, SOUTH CAROLINA

FIGURE
2.10



DRAWN BY: CHB	DATE: 07/05/17
CHECKED BY: TSR	DATE: 07/05/17
PROJECT NO: 6251161022.04.02	

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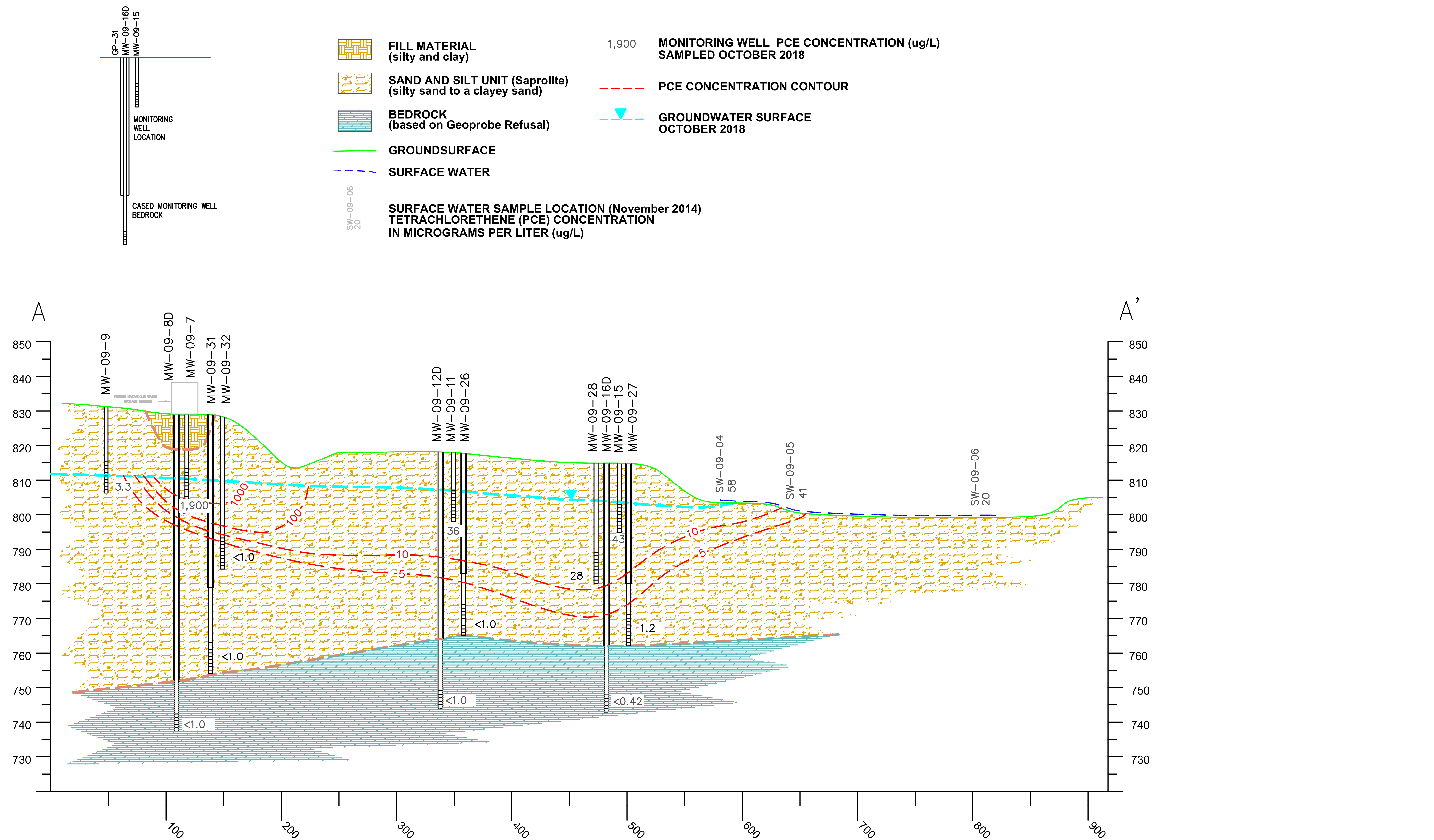
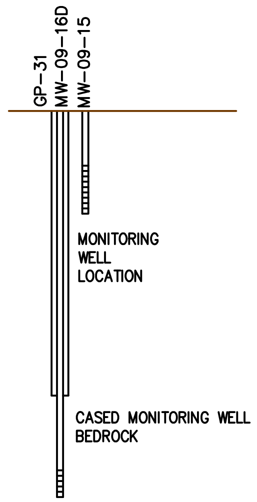
LOCATION OF LITHOLOGIC CROSS-SECTION LINES A-A' AND B-B'
FORMER RBTC FOUNTAIN INN DIVISION/FORMER SHERWIN WILLIAMS PROPERTIES
FOUNTAIN INN, SOUTH CAROLINA

FIGURE 2.11



DRAWN BY: CHB	DATE: 07/05/17	REVISIONS			30 PATEWOOD DRIVE SUITE 200 GREENVILLE, S.C. 29615 Phone: (864) 458-3600 Fax: (864) 458-3700	LITHOLOGIC CROSS-SECTION A-A' FORMER RBTC FOUNTAIN INN DIVISION/FORMER SHERWIN WILLIAMS PROPERTIES FOUNTAIN INN, SOUTH CAROLINA
CHECKED BY: TSR	DATE: 07/05/17	No.	DESCRIPTION	BY		FIGURE 2.12
PROJECT NO: 6251161022.04.02						



SAND AND SILT UNIT (Saprolite) (silty sand to a clayey sand)

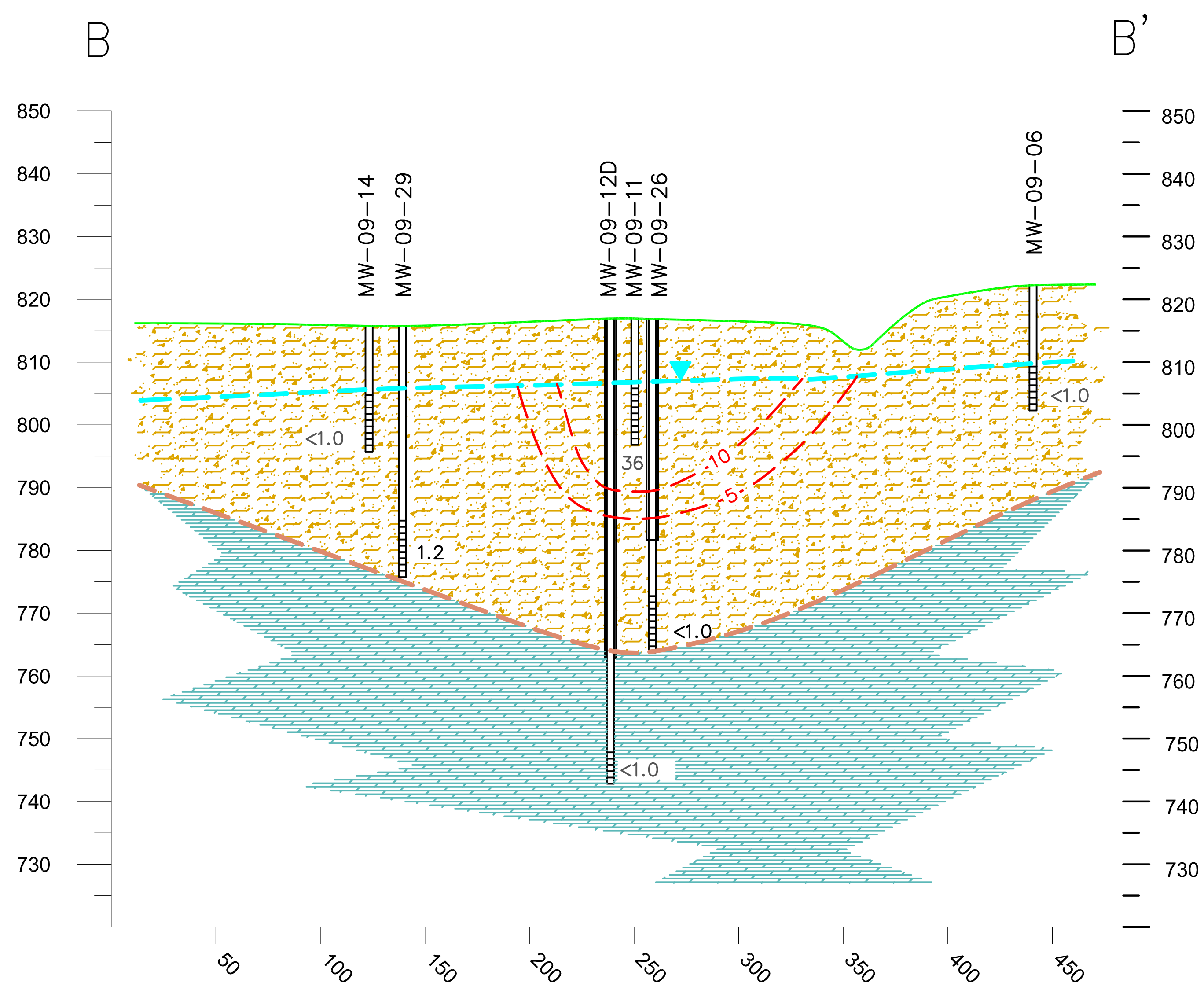
BEDROCK (based on Geoprobe Refusal)

GROUNDSURFACE

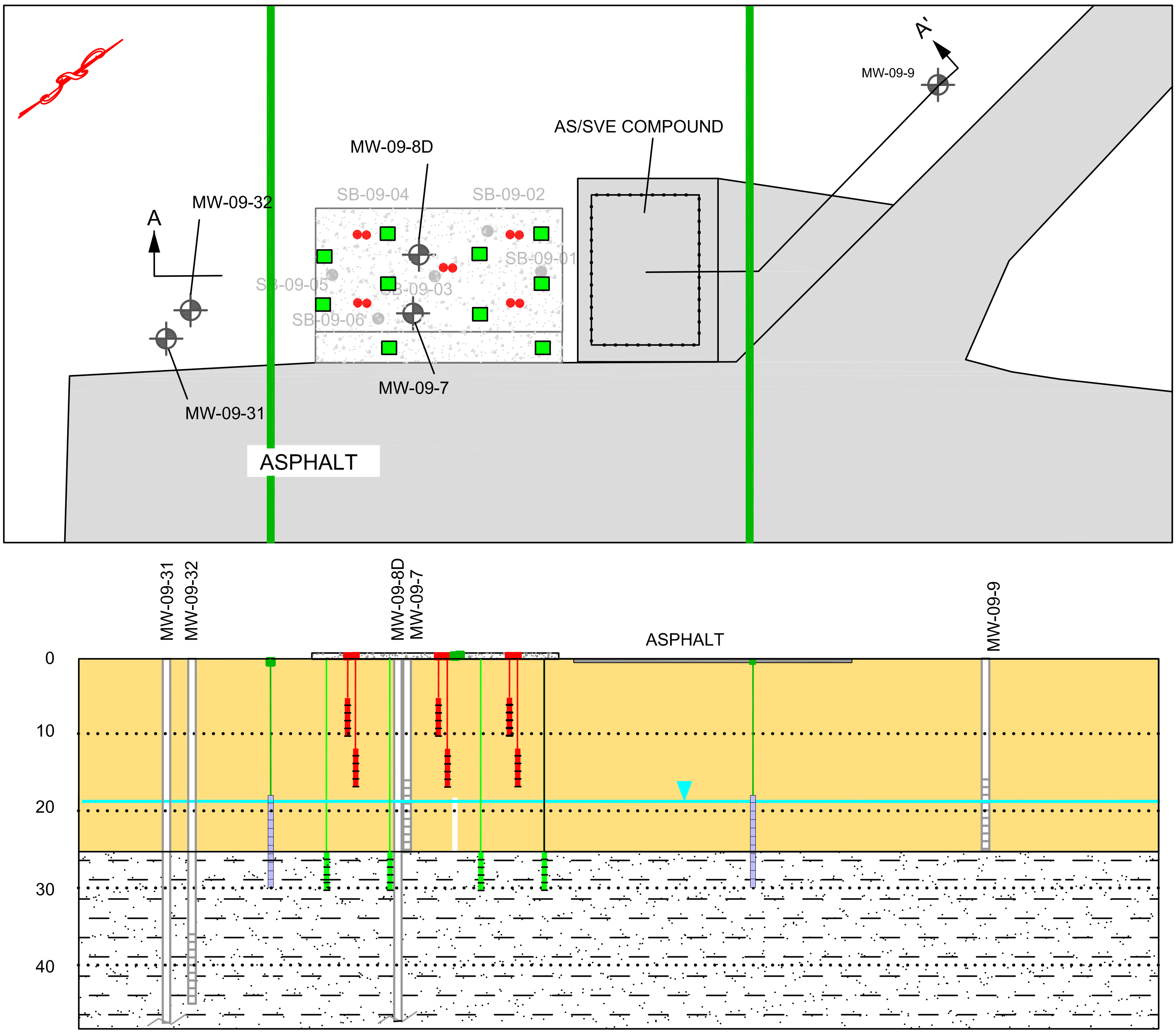
36 MONITORING WELL TETRACHLOROETHENE (PCE) CONCENTRATION IN MICROGRAMS PER LITER (ug/L) - SAMPLED OCTOBER 2018

PCE CONCENTRATION CONTOUR

GROUNDWATER SURFACE OCTOBER 2018



DRAWN BY: CHB	DATE: 07/05/17	REVISIONS			30 PATEWOOD DRIVE SUITE 200 GREENVILLE, S.C. 29615 Phone: (864) 458-3600 Fax: (864) 458-3700	LITHOLOGIC CROSS-SECTION B-B' FORMER RBTC FOUNTAIN INN DIVISION/FORMER SHERWIN WILLIAMS PROPERTIES FOUNTAIN INN, SOUTH CAROLINA
CHECKED BY: TSR	DATE: 07/05/17	No.	DESCRIPTION	BY	wood.	FIGURE 2.13
PROJECT NO: 6251161022.04.02						



SECTION A - A'

LEGEND

MW-09-14 MONITORING WELL LOCATION

PREVIOUS SOIL BORING LOCATION

PROPOSED SVE WELLS

PROPOSED AIR SPARGING (AS) WELLS

GROUNDWATER

PROPOSED ZERO VALENT IRON INJECTION ROWS

CLAY UNIT (silty clay to a sandy clay)

CONCRETE SLAB

SAND AND SILT UNIT (silty sand to a clayey sand)

ASPHALT PAVEMENT

20 10 0 20

HORIZONTAL SCALE 1" = 20'

wood.

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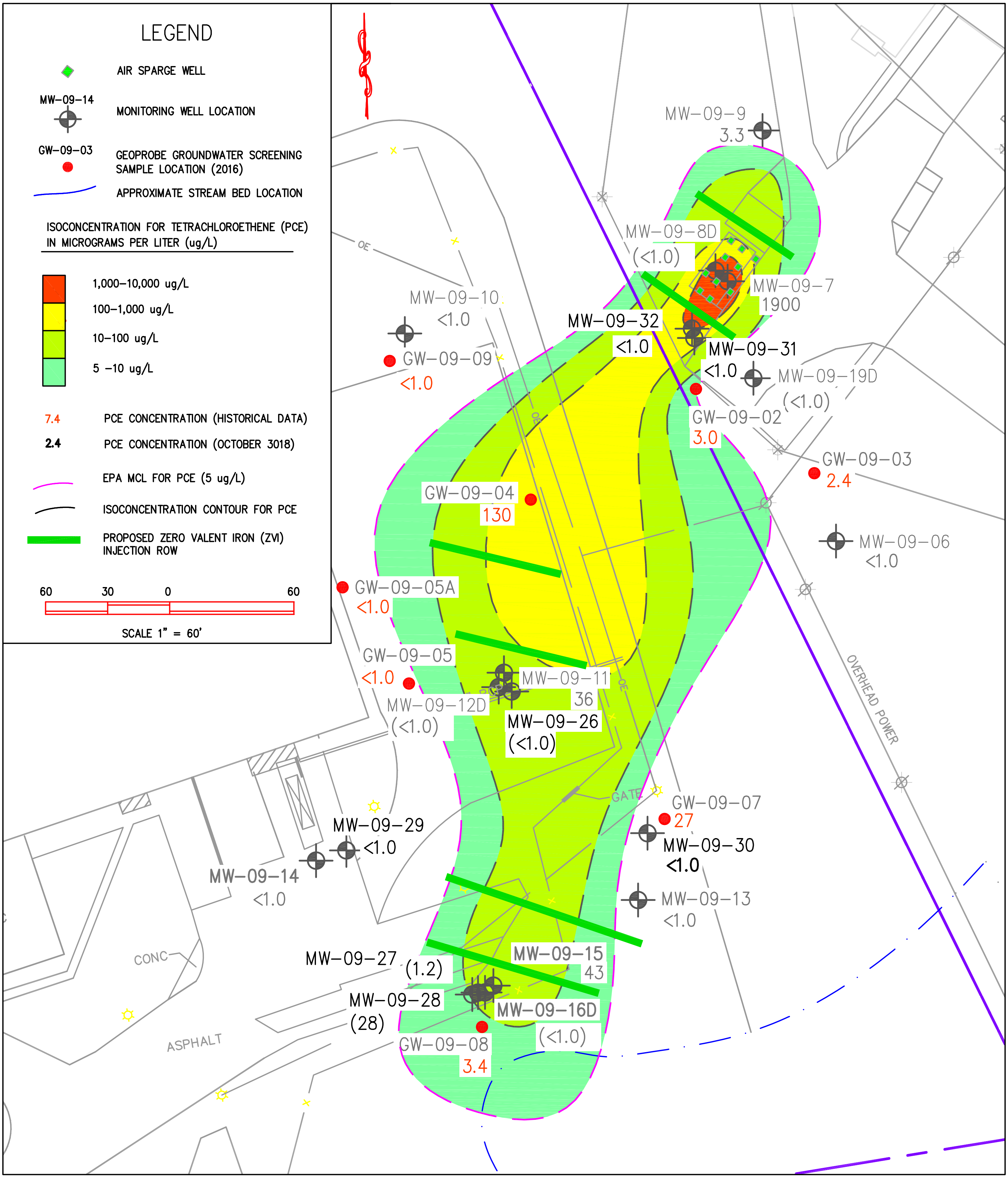
ALTERNATIVE 2 - SVE SOIL TREATMENT PLAN
RBTC FOUNTAIN INN DIVISION / FORMER SHERWIN WILLIAMS PROPERTIES
FOUNTAIN INN, SOUTH CAROLINA

FIGURE 5.1a

FILE: Fig 5.1a_alt-2	PREPARED BY: SEA	CHECKED BY: PSJ	DATE: 09-04-19	JOB NO: 6251161022.04.02



wood.

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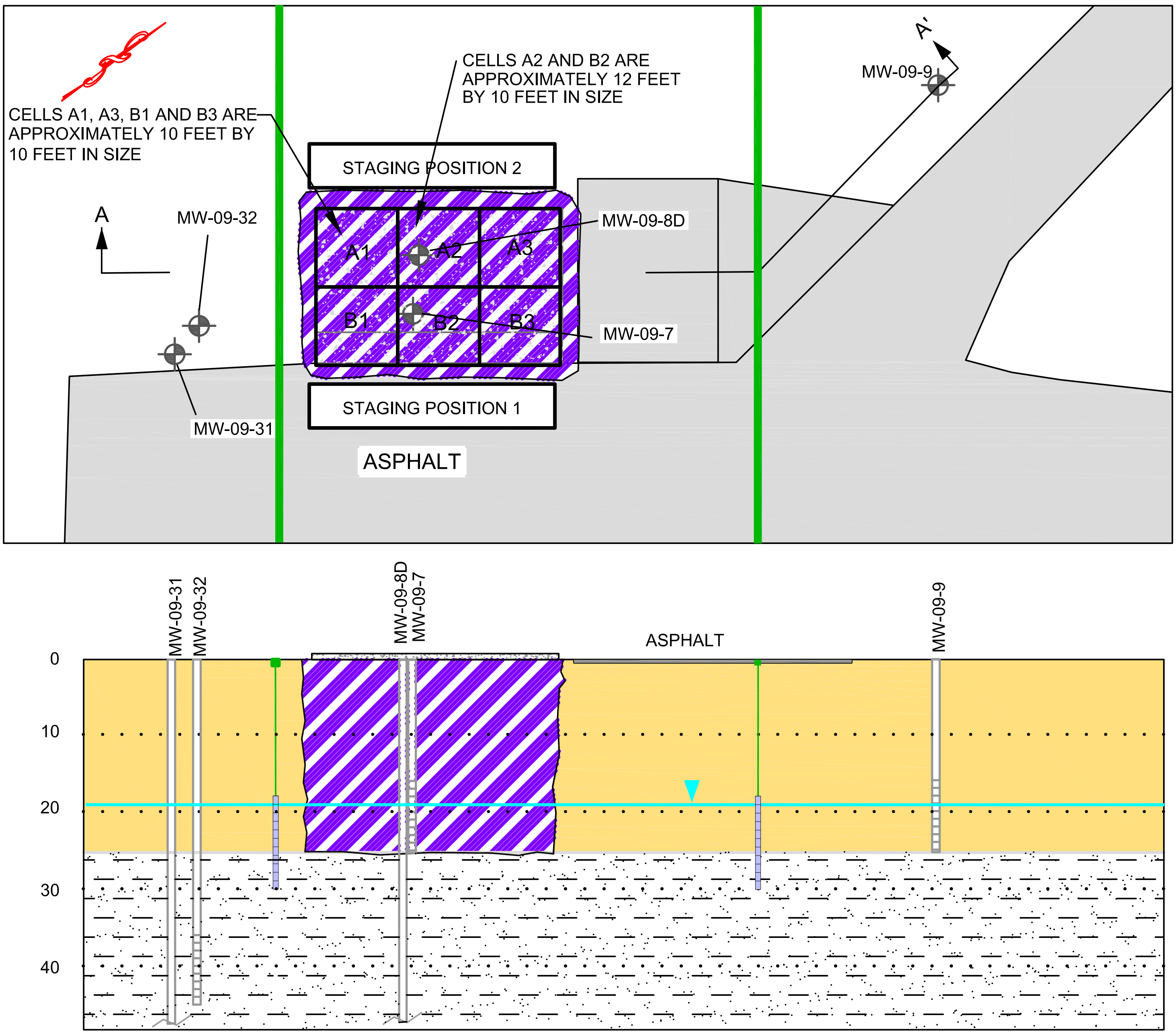
ALTERNATIVE 2 - AS AND ISCR GROUNDWATER TREATMENT PLAN

RBTC FOUNTAIN INN DIVISION / FORMER SHERWIN WILLIAMS PROPERTIES
FOUNTAIN INN, SOUTH CAROLINA

FIGURE 5.1b

FILE:	PREPARED BY:	CHECKED BY:	DATE:	JOB NO:
Fig 5.1b_alt2	SEA	PSJ	09-04-19	6251161022.04.02



SECTION A - A'

LEGEND

MW-09-14 MONITORING WELL LOCATION

PROPOSED ISCO SOIL BLENDING AREA

PROPOSED ZERO VALENT IRON INJECTION ROWS

GROUNDWATER

CLAY UNIT (silty clay to a sandy clay)

SAND AND SILT UNIT (silty sand to a clayey sand)

CONCRETE SLAB

ASPHALT PAVEMENT

20 10 0 20

HORIZONTAL SCALE 1" = 20'

wood.

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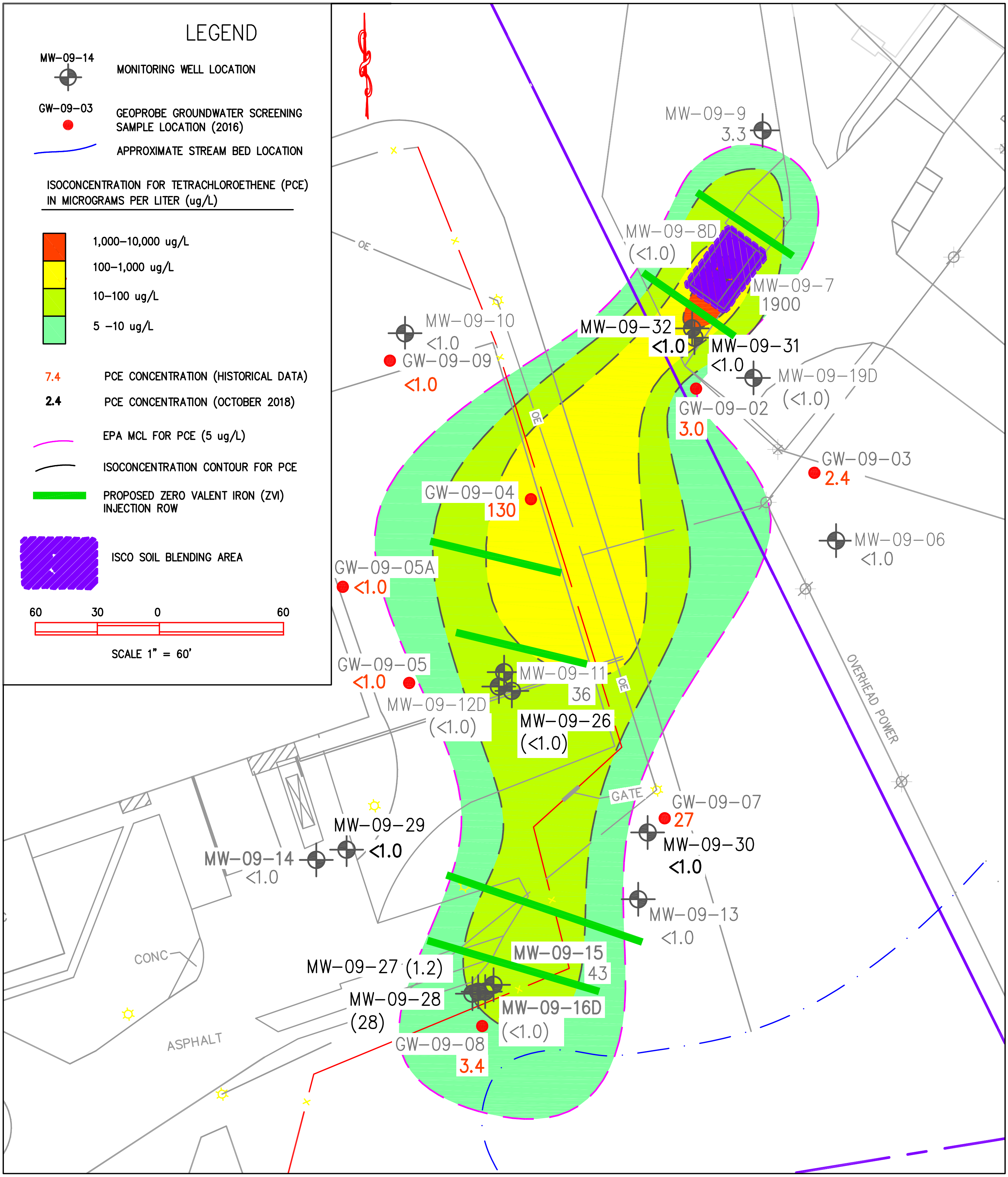
ALTERNATIVE 3 - ISCO BLENDING SOIL TREATMENT PLAN

RBTC FOUNTAIN INN DIVISION / FORMER SHERWIN WILLIAMS PROPERTIES
FOUNTAIN INN, SOUTH CAROLINA

FIGURE 5.2a

FILE:	PREPARED BY:	CHECKED BY:	DATE:	JOB NO:
Fig 5.2a_alt-3	SEA	PSJ	09-04-19	6251161022.04.02



wood.

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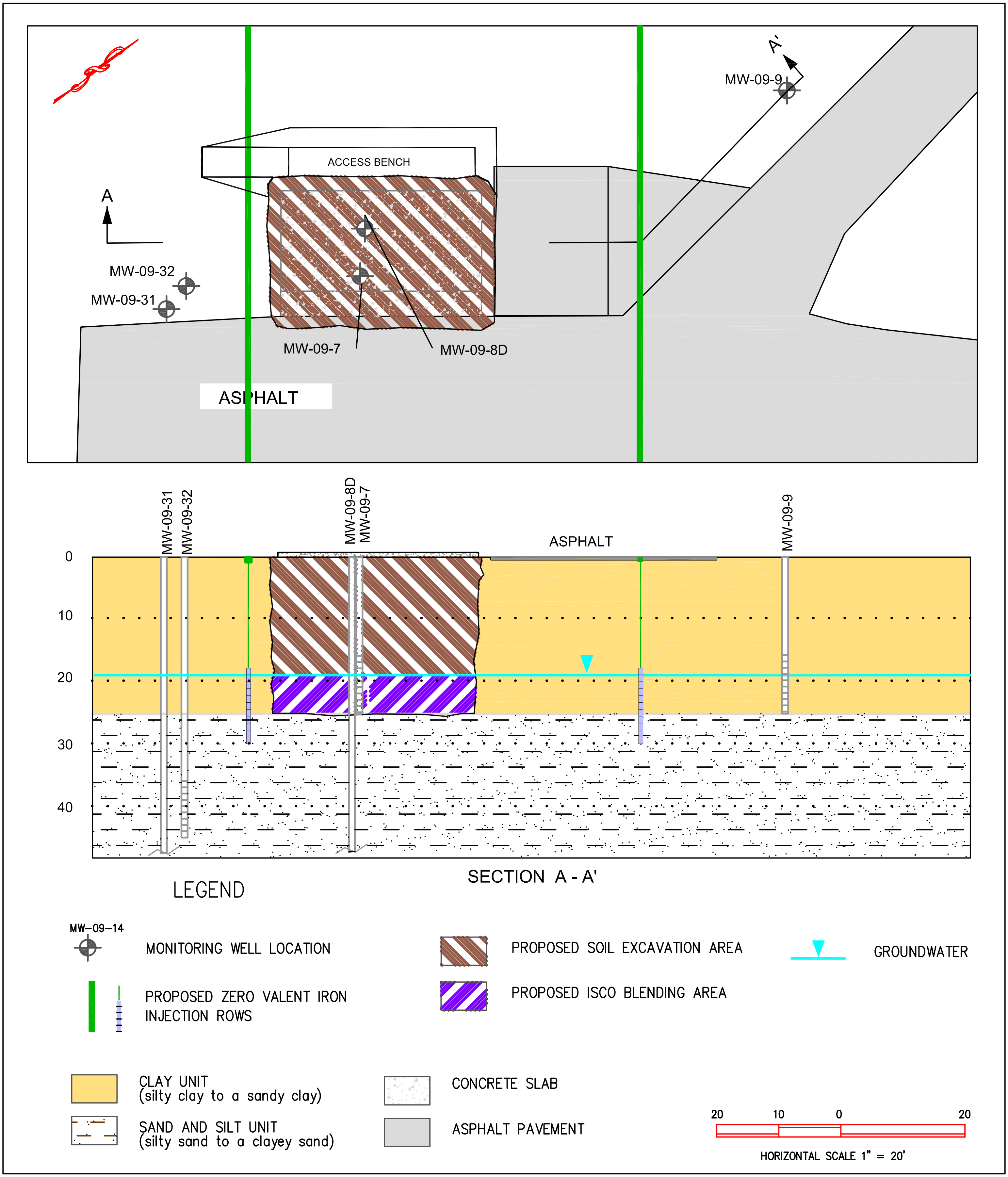
ALTERNATIVE 3 - ISCO BLENDING WITH ISCR GROUNDWATER TREATMENT PLAN

RBTC FOUNTAIN INN DIVISION / FORMER SHERWIN WILLIAMS PROPERTIES FOUNTAIN INN, SOUTH CAROLINA

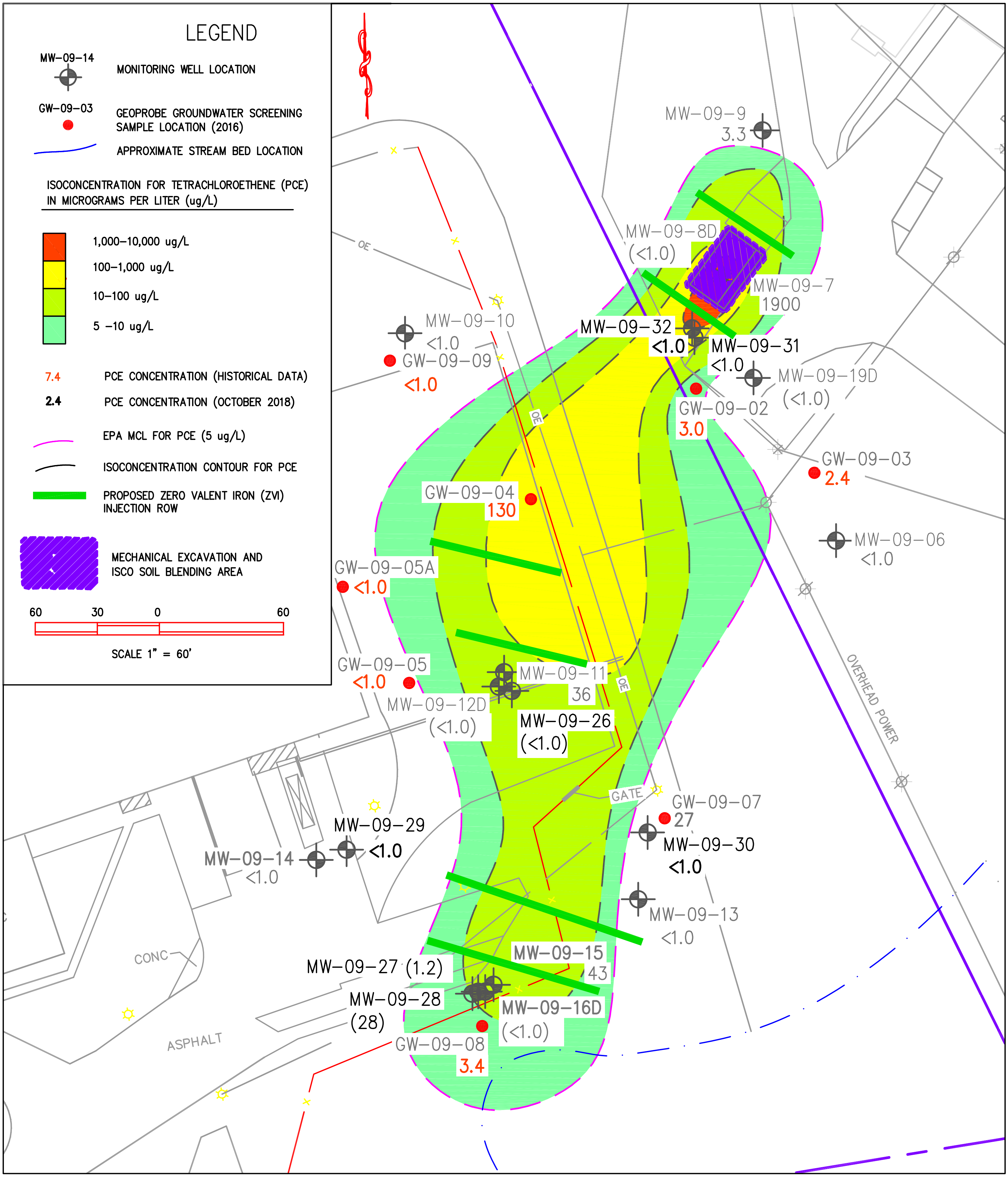
FIGURE 5.2b

FILE:	PREPARED BY:	CHECKED BY:	DATE:	JOB NO:
Fig 5.2b_alt3	SEA	PSJ	09-04-19	6251161022.04.02



wood.	30 PATEWOOD DRIVE SUITE 200 GREENVILLE, S.C. 29615 Phone: (864) 458-3600 Fax: (864) 458-3700	ALTERNATIVE 4 - EXCAVATION AND ISCO BLENDING TREATMENT PLAN RBTC FOUNTAIN INN DIVISION / FORMER SHERWIN WILLIAMS PROPERTIES FOUNTAIN INN, SOUTH CAROLINA	FIGURE 5.3a

FILE:	PREPARED BY:	CHECKED BY:	DATE:	JOB NO:
Fig 5.3a_alt-4	SEA	PSJ	09-04-19	6251161022.04.02



wood.

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Fax: (864) 458-3700

ALTERNATIVE 4 - EXCAVATION AND ISCO BLENDING WITH ISCR GROUNDWATER TREATMENT PLAN

RBTC FOUNTAIN INN DIVISION / FORMER SHERWIN WILLIAMS PROPERTIES
FOUNTAIN INN, SOUTH CAROLINA

FIGURE 5.3b

FILE: Fig 5.3b_alt4	PREPARED BY: SEA	CHECKED BY: PSJ	DATE: 09-04-19	JOB NO: 6251161022.04.02

APPENDIX A

ITEMIZED REMEDIAL ALTERNATIVE COSTS

APPENDIX A.1

Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Alternative 2 - Soil Treatment Costs (SVE/AS)

Figures 5.1a/5.1b -Source Area treatment with vertical SVE wells and AS wells (Estimated duration for 2 years)

Task	Qty	Unit	Unit Cost	Total Cost	Marked Up Cost
Utility locating	1	LS	$ 1,500	$ 1,500	$ 1,613
SVE wells (5 to 10 feet bgs)	50	Ft	$ 45	$ 2,250	$ 2,419
SVE wells (12 to 17 feet bgs)	85	Ft	$ 45	$ 3,825	$ 4,112
AS wells (25 to 30 feet bgs)	300	Ft	$ 45	$ 13,500	$ 14,513
Trenching and piping installation in concrete	200	Ft	$ 75	$ 15,000	$ 16,125
IDW - soil cuttings	1	LS	$ 1,760	$ 1,760	$ 1,892
SVE/AS treatment system installation	1	LS	$ 20,000	$ 20,000	$ 21,500
Electric service Installation	1	LS	$ 7,500	$ 7,500	$ 8,063
Fenced equipment compound Installation	1	LS	$ 15,000	$ 15,000	$ 16,125
SVE/AS treatment system rental	24	Mo	$ 3,500	$ 84,000	$ 90,300
Electric for SVE/AS treatment system	2	yrs	$ 6,000	$ 12,000	$ 12,000
Analytical laboratory	8	Ea	$ 225	$ 1,800	$ 1,935
SVE/AS effluent monitoring equipment (FID)	8	Ea	$ 100	$ 800	$ 860
Well abandonment (SVE and AS wells)	1	Ea	$ 13,350	$ 13,350	$ 14,351
Subcontractor Total (w/ 7.5% Mark Up)				$ 192,285	$ 206,000
Design					$ 10,000
Permitting					$ 8,000
Oversight/System Start Up					$ 20,000
Confirmation soil sampling event					$ 7,500
					$ 45,500
Total Capital					$ 251,500
Annual O&M	2	yrs	$ 5,000	$ 10,000	$ 10,000
Semi-Annual Reporting	2	yrs	$ 2,000	$ 4,000	$ 4,000
Total O&M				$ 14,000	$ 14,000
ROUNDED TOTAL					**$ 266,000**

Prepared By/Date: SEA 09/04/19
Checked By/Date: PSJ 09/04/19

APPENDIX A.2

Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Alternative 2, 3, and 4 - Groundwater Treatment Costs (ISCR with ZVI)

Figures 5.1b, 5.2b, 5.3b - Source and Downgradient Groundwater Treatment by ISCR (Assume 5 Year duration)

Task	Quantity	Unit	Unit Cost	Total Cost	Marked Up Cost
Utility locating	1	LS	$ 1,500	$ 1,500	$ 1,613
ZVI injection trailer and crew	1	LS	$ 105,000	$ 105,000	$ 112,875
Analytical loaboratory	1	LS	$ 23,775	$ 23,775	$ 25,558
Groundwater monitoring equipment	7	Ea	$ 975	$ 6,825	$ 7,337
Well abandonment	1	Ea	$ 31,920	$ 31,920	$ 34,314
Subcontractor Total (w/ 7.5% Mark Up)				$ 169,020	$ 182,000
Design					$ 28,000
Permitting					$ 7,000
Oversight					$ 20,000
					$ 55,000
Total Capital					$ 237,000
Semi-Annual Monitoring	3	yrs	$ 17,500	$ 52,500	$ 52,500
Semi-Annual Reporting	3	yrs	$ 10,000	$ 30,000	$ 30,000
Annual Monitoring	2	yrs	$ 8,000	$ 16,000	$ 16,000
Annual Reporting	2	yrs	$ 5,000	$ 10,000	$ 10,000
Total O&M					$ 108,500
ROUNDED TOTAL					**$ 346,000**

Prepared By/Date: SEA 09/04/19
Checked By/Date: PSJ 09/04/17

APPENDIX A.3

Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Alternative 3 - Soil Treatment Costs

Figure 5.2a - Source Area Soil Blending with Oxidant from ground surface to 25 feet bgs

Task	Quantity	Unit	Unit Cost	Total Cost	Marked Up Cost
Utility locating	1	LS	$ 1,500	$ 1,500	$ 1,613
Concrete slab demolition and disposal	512	Ft^2	$ 15	$ 7,680	$ 8,256
Water truck	1	Ea	$ 5,000	$ 5,000	$ 5,375
Water	10000	Gal	$ 0	$ 500	$ 538
ISCO soil blending and soil stabilization	1	Ea	$ 75,000	$ 75,000	$ 80,625
Analytical laboratory	30	Ea	$ 225	$ 6,750	$ 7,256
Geoprobe for confirmation soil sampling		Ea	$ 3,500	$ -	$ -
Well abandonment MW-09-08D (25-92 ft bgs)	67	Ft	$ 30	$ 2,010	$ 2,161
Well installation (0-25 ft bgs)	25	Ft	$ 50	$ 1,250	$ 1,344
Subcontractor Total (w/ 7.5% Mark Up)				$ 99,690	$ 107,000
Design					$ 5,000
Permitting					$ 5,000
Oversight					$ 7,500
Confirmation Soil Sampling Event					$ 4,500
Reporting (Included as part of ISCR groundwater report)					$ 6,200
					$ 28,200
ROUNDED TOTAL					**$ 135,000**

Prepared By/Date: SEA 09/04/19
Checked by/Date: PSJ 09/04/19

APPENDIX A.4

Former Robert Bosch Tool Corporation Fountain Inn Division
Fountain Inn, South Carolina
Wood Project 6251161022.04.02

Alternative 4 - Soil Treatment Costs (Non-hazardous soil)

Figure 5.3a - Source Area Excavation (0-18 ft bgs) and Non-hazardous Waste Disposal combined with ISCO blending (18-25 ft bgs)

Task	Quantity	Unit	Unit Cost	Total Cost	Marked Up Cost
Utility locating	1	LS	$ 1,500	$ 1,500	$ 1,613
Concrete slab demolition and disposal	512	Ft^2	$ 15	$ 7,680	$ 8,256
Mobilization	1	LS	$ 2,100	$ 2,100	$ 2,258
Excavation (0-18 ft bgs)	650	ton	$ 12	$ 7,800	$ 8,385
Backfill and compaction	500	CY	$ 45	$ 22,500	$ 24,188
Non-hazardous soil transportation & disposal	650	ton	$ 90	$ 58,500	$ 62,888
ISCO soil blending (18-25 ft bgs)	1	ea	$ 50,000	$ 50,000	$ 53,750
Water truck	1	ea	$ 3,000	$ 3,000	$ 3,225
Water	3500	gal	0.05	$ 175	$ 188
Analytical laboratory (from rolloff boxes)	10	ea	$ 100	$ 1,000	$ 1,075
Subcontractor Total (w/ 7.5% Mark Up)				$ 154,255	$ 166,000
Design					$ 7,500
Permitting					$ 5,000
Oversight					$ 7,500
Reporting (Included as part of ISCR groundwater report)					$ 7,500
					$ 27,500
ROUNDED TOTAL					**$ 193,500**

Prepared By/Date: SEA 09/04/19
Checked By/Date: PSJ 09/04/19