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**To:** Hornosky, Tim <hornostr@dhec.sc.gov>  
**Cc:** Hirshenson, Edward <Edward.Hirshenson@arcadis.com>  
**Subject:** Brenntag Charleston, SC RAWP Area #2 rev 1

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Mr. Hornosky

Please find enclosed revised version of the RAWP for Area #2 (Brenntag site in Charleston, SC). Edits are in italic which states the excavation is extending to the storm drain on west side. If you require a hard copy, let us know. Thank you.

Charles Lawson [PG] Project Scientist

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**SCANNED**

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Subject:  
Remedial Action Work Plan for Area #2-Revision 1  
Brenntag Southeast, Charleston, South Carolina

ENVIRONMENT

Date:  
6 July 2022

Dear Tim Hornosky:

Contact:  
Edward Hirshenson

Brenntag Southeast, Inc. has authorized ARCADIS U.S., Inc. to forward the enclosed one copy of the Remedial Action Work Plan for Area #2-Revision 1 for the Brenntag Southeast facility in Charleston, South Carolina.

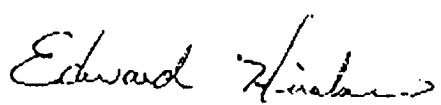
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Please call me at (706) 828-4421 if you have any questions.

Email:  
[Edward.hirshenson@arcadis.com](mailto:Edward.hirshenson@arcadis.com)

Sincerely,

Arcadis U.S., Inc.



**RECEIVED**

**JUL 08 2022**

Our ref:  
30084216

Edward Hirshenson  
Senior Scientist

SITE ASSESSMENT,  
REMEDICATION, &  
REVITALIZATION

Copies:

- Mr. Bill Kreckler/SCDHEC Water Pollution Enforcement (without report)
- Mr. Shawn Wiram/North America/Brenntag (with report)

90

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RECEIVED

JUL 08 2022

SITE ASSESSMENT,  
REMEDATION, &  
REVITALIZATION

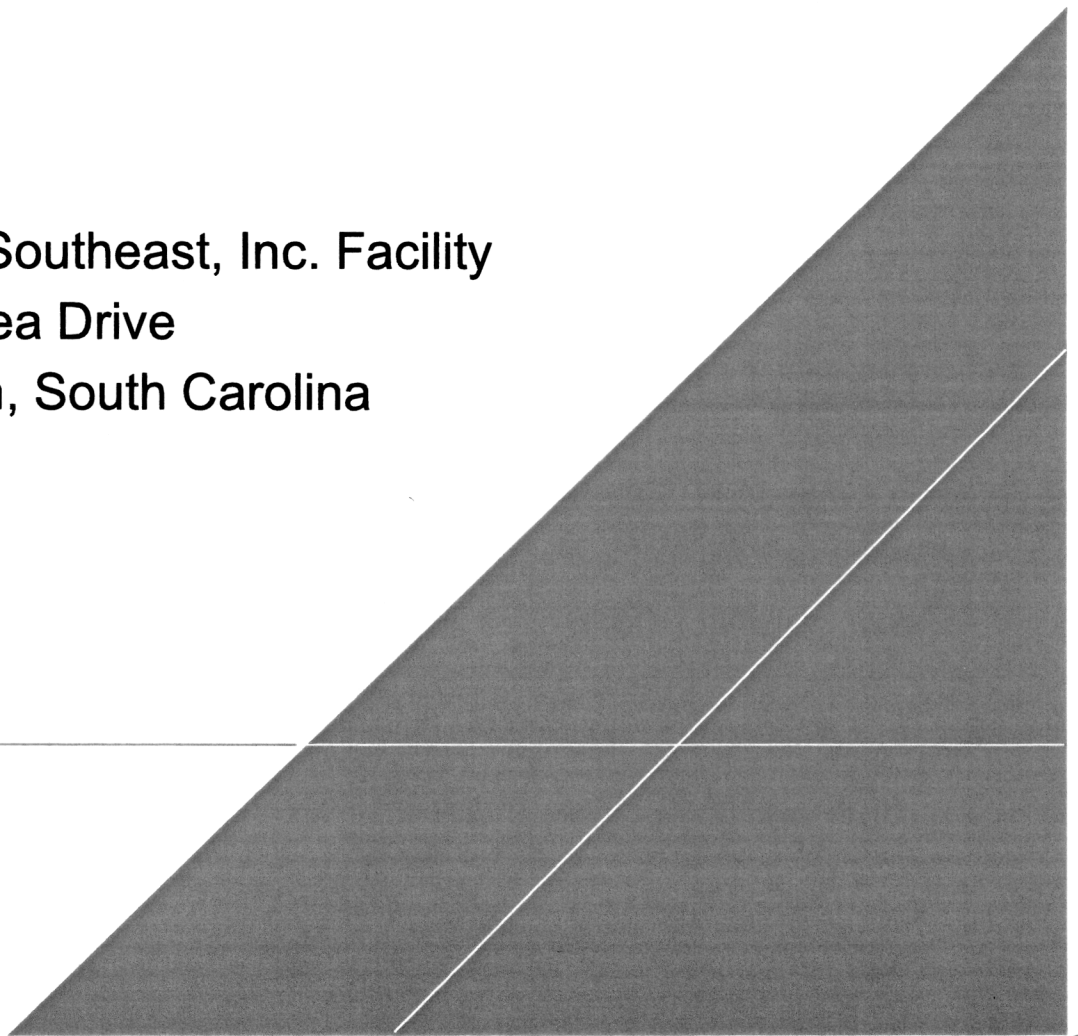
# REMEDIAL ACTION WORK PLAN

**Revision 1**

**Area #2**

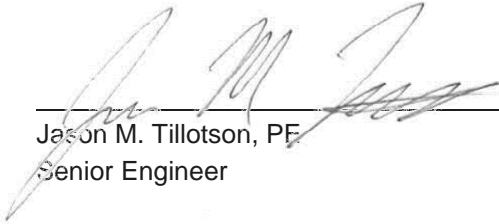
**Brenntag Southeast, Inc. Facility  
4200 Azalea Drive  
Charleston, South Carolina**

July 2022



## Remedial Action Work Plan

Revision 1



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Jason M. Tillotson, PE  
Senior Engineer

Area #2  
Brenntag Southeast, Inc. Facility  
4200 Azalea Drive  
Charleston, South Carolina

Prepared for:

Brenntag Southeast, Inc.

Prepared by:

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Charles Lawson, PG  
Project Geologist (SC#2360)

Our Ref:

30084216

Date:

July 2022



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Ed Hirshenson  
Senior Scientist / Project Manager (SC#2555)

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## ACRONYMS AND ABBREVIATIONS

µg/L	micrograms per liter
µg/kg	micrograms per kilogram
AFVR	aggressive fluid vapor recovery
amsl	above mean sea level
Arcadis	Arcadis U.S., Inc.
bgs	below ground surface
Brenntag	Brenntag Southeast, Inc.
BTEX	benzene, toluene, ethylbenzene, and xylenes
Burris	Burris Chemical Company
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cis-1,2-DCE	cis-1,2-dichloroethene
CVOC	chlorinated volatile organic compound
EAB	enhanced aerobic bioremediation
ft	foot/feet
ISSM	in situ soil mixing
ISSS	in situ soil stabilization
LNAPL	light non-aqueous phase liquid
MNA	monitored natural attenuation
O&M	operation and maintenance
ORM	oxygen-releasing material
PVC	polyvinyl chloride
RAWP	Remedial Action Work Plan
SCDHEC	South Carolina Department of Health and Environment Control
TCE	trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
VOC	volatile organic compound

# 1 INTRODUCTION

On behalf of Brenntag Southeast, Inc. (Brenntag), Arcadis U.S., Inc. (Arcadis) has prepared this Remedial Action Work Plan (RAWP) for Area #2 of the Brenntag facility (Site) located at 4200 Azalea Drive, Charleston, South Carolina (**Figure 1**). Using Site analytical data and existing information about currently available technologies, this RAWP examines the feasibility of various remedial alternatives for remediation of petroleum hydrocarbon impacts in soil and groundwater at Area #2. This RAWP serves as the principal document supporting the selection of a recommended remedial alternative and includes information on the design and implementation of the selected remedy.

## 1.1 Site Layout

A layout of the Site is provided on **Figure 2**. The Site currently operates as a chemical repackaging, distribution, and storage facility. The Site comprises approximately 8.5 acres of land and includes an office building, warehouse, oil packaging building, loading docks, and tank farms. The northern and western portions of the parcel are wooded.

The Site is bounded to the east by Industrial Drive, to the south by Azalea Drive, and to the west by Brickyard Creek. The Site and surrounding properties are zoned for industrial and commercial use. Neighboring properties adjacent to the Site include:

- William M. Bird & Company, Inc., a flooring manufacturing facility located to the south at 4210 Azalea Drive.
- A Charleston County Public Works facility located across Brickyard Creek to the west.
- The American Steel Fabricators facility located to the north at 2686 Industrial Avenue.
- A vacant warehouse located to the east at 2685 Industrial Avenue.
- NBS Media Systems, a company specializing in multimedia presentation system design and installation, located to the east at 2695 Industrial Avenue.

## 1.2 Investigation and Remedial History

The Burris Chemical Company (Burris) previously operated a chemical warehouse and distribution facility at the Site. Three phases of soil and groundwater investigation were conducted and two primary areas of concern were identified (Arcadis 2004). Area #1 is located in the central portion of the facility and is impacted with chlorinated volatile organic compounds. Area #2 is located in a former tank farm in the southern portion of the facility and is primarily impacted with petroleum hydrocarbons. The impacts from each area are distinct and do not co-mingle, and monitoring and remediation activities at Area #1 are discussed under separate cover (Arcadis 2020).

Burris sold part of the Site to Brenntag in 1994 and sold the remainder of the property to William M. Bird & Company in 1996; Burris retained responsibility for environmental impacts on the Bird property. Additional investigation on the Bird property indicated highly elevated concentrations of petroleum hydrocarbons and the presence of light non-aqueous phase liquid (LNAPL) at monitoring well MW-12 (**Figure 2**). Based on these results, an additional monitoring well (MW-14) was installed in the former tank farm in 2003. Results from this well confirmed the presence of elevated concentrations of petroleum hydrocarbons, particularly



toluene and total xylenes. Semi-annual groundwater monitoring has been conducted at Area #2 since 2003. Monitoring results since that time indicate that the groundwater plume is not expanding.

To speed remedial progress, 72-hour aggressive fluid vapor recovery (AFVR) events have been conducted quarterly at MW-14 since June 2018. During the September 2020 event, 3,727 gallons of fluids were recovered from MW-14, including approximately 15.3 gallons of source mass and 95.6 pounds of vapor (Arcadis 2021). In a letter dated April 15, 2020, the South Carolina Department of Health and Environmental Control (SCDHEC) concurred that AFVR events are having a beneficial effect on groundwater impacts in the vicinity of MW-14. However, additional soil and groundwater sampling was requested to better delineate Site impacts and aid development of a final remedy. A Geoprobe investigation event was conducted on both the Site and the adjacent Bird property in November 2020; the results from this investigation are summarized in the Second Semiannual 2020 Groundwater Report (Arcadis 2021). The distribution of impacts in soil and groundwater are discussed in Section 2.3.

## 2 CONCEPTUAL SITE MODEL

### 2.1 Site Topography and Drainage

Site topography generally slopes westward across the Site, with ground surface elevations of approximately 15 feet (ft) above mean sea level (amsl) along Industrial Avenue to approximately 5 ft amsl along Brickyard Creek. The Site is bound to the west by Brickyard Creek and to the north by a small unnamed intermittent creek/lowland area. Brickyard Creek drains southward into the Ashley River. Brickyard Creek is tidally influenced, and water level in the creek can fluctuate by several feet.

### 2.2 Site Geology and Hydrogeology

**Figure 3** shows the location of cross sections through Area #2, while the cross sections are presented in **Figures 4** and **5**, respectively. Unsaturated soils are composed of medium grained sand interbedded with fine sand, silt, and clay. The surficial aquifer is composed of layers of fine to medium grain sands and silty clays. The thickness of the saturated zone, as measured from the top of the water table to the Cooper Formation, is approximately 15 ft. Beneath the surficial aquifer are stiff clays representing the upper portion of the Cooper Formation, a regionally extensive confining layer that is reported to range between 260 and 280 ft thick in the vicinity of the Site. Groundwater in Area #2 is typically encountered at around 5 to 6 ft below ground surface (bgs) at an elevation of approximately 8 to 9 ft amsl. As shown in **Figure 6**, groundwater flow in the vicinity of Area #2 is primarily to the southwest.

### 2.3 Distribution of Site Impacts

Monitoring well MW-14 is the only on-Site well associated with Area #2 containing elevated concentrations of volatile organic compounds (VOCs). The majority of VOCs present at MW-14 are petroleum hydrocarbons, primarily toluene, ethylbenzene, and xylenes, though chlorinated VOCs (CVOs), primarily cis-1,2-dichloroethene (cis-1,2-DCE), are also present. Additional Geoprobe investigations were conducted in the vicinity of MW-14 in November 2020 to better delineate soil and groundwater impacts. During the November 2020 Geoprobe investigation, 26 soil borings were advanced

## REMEDIAL ACTION WORK PLAN

near Area #2. Soil analytical samples were collected at approximately 3 ft bgs and 5-6 ft bgs (i.e., just above the water table) from each boring, while groundwater analytical samples were collected at 7-10 ft bgs (i.e., the top of water table) and 17-20 ft bgs from 25 borings (A2-21 was not sampled, and the deeper groundwater sample at A2-18 ran dry). A comprehensive summary of VOCs in soil and groundwater at Area #2 is included in **Appendix A**. The horizontal delineation of petroleum hydrocarbons in soil and groundwater is presented on **Figures 7 and 8**, respectively, while horizontal delineation of CVOCs in soil and groundwater is presented on **Figures 9 and 10**, respectively. Vertical delineation of petroleum hydrocarbons and CVOCs in soil and groundwater along the cross sections are presented on **Figures 4 and 5**.

Soil and groundwater impacts were generally highest near the former tank farm between the warehouse and Area #2. Similar to MW-14, petroleum hydrocarbons were the primary source of soil and groundwater impacts in this area. Petroleum hydrocarbons were detected at concentrations up to 1,692,696 micrograms per kilogram ( $\mu\text{g}/\text{kg}$ ) in samples from 3 ft bgs and 31,778,510  $\mu\text{g}/\text{kg}$  in samples from 5-6 ft bgs. In groundwater, petroleum hydrocarbons were detected at concentrations up to 249,937 micrograms per liter ( $\mu\text{g}/\text{L}$ ) in the shallower sample (7-10 ft bgs) and 11,040  $\mu\text{g}/\text{L}$  in the deeper groundwater sample (17-20 ft bgs). The distribution of petroleum hydrocarbon impacts in groundwater generally matched the distribution in soil. At borings within and north of Area #2, soil petroleum hydrocarbon concentrations were generally one to three orders of magnitude higher in the deeper unsaturated samples (i.e., just above the water table) compared to the shallower unsaturated samples. Groundwater petroleum hydrocarbon concentrations were generally one to two orders of magnitude higher in the shallower sample (i.e., just below the water table) compared to the deeper sample. These results indicate that significant source mass, potentially including LNAPL, likely remains at the interface between the saturated and unsaturated zones.

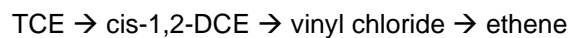
Total CVOCs were detected at concentrations up to 53,180  $\mu\text{g}/\text{kg}$  in samples from 3 ft bgs and 426,210  $\mu\text{g}/\text{kg}$  in samples from 5-6 ft bgs. In groundwater, total CVOCs were detected at concentrations up to 22,781  $\mu\text{g}/\text{L}$  in the shallower sample (7-10 ft bgs) and 552,966  $\mu\text{g}/\text{L}$  in the deeper groundwater sample (17-20 ft bgs). The distribution of CVOC impacts in soil generally matched the distribution of petroleum hydrocarbons, though soil CVOC concentrations were approximately three orders of magnitude lower than petroleum hydrocarbon concentrations. In groundwater, there appears to be a distinct CVOC signature in the southern portion of the property near the office building. At locations within and immediately north of Area #2 (A2-1 through A2-15 and A2-26), groundwater CVOC concentrations were generally less than 1,000  $\mu\text{g}/\text{L}$ , and concentrations in the shallow groundwater samples were generally greater than in the deeper groundwater samples. Near the office building (A2-16 through A2-25), groundwater CVOC concentrations were higher compared to near Area #2, and CVOC concentrations were generally one to three orders of magnitude higher in the deeper groundwater sample compared to the shallower groundwater sample. These results indicate the potential presence of another CVOC source near the southern area of the property. Additional borings are planned for this area to help determine whether the CVOC impacts originate on- or off-Site; results will be discussed in a future report.

As described in Section 2.2, the saturated zone is comprised of layers of clayey sands and silts, stiff clays, and sands. The clays and silts likely represent zones of greater VOC mass storage, with limited lateral migration, while the sands likely represent zones of greater VOC mass transport.

## 2.4 Fate of Site Impacts

Under aerobic conditions, petroleum hydrocarbons can be biodegraded using oxygen, forming carbon dioxide and water. Under reducing conditions, petroleum hydrocarbons can be converted anaerobically to benzoyl-CoA by fumarate addition, which can then be degraded by beta-oxidation pathways, utilized as biomass, and ultimately resulting in the production of carbon dioxide and water. Some petroleum hydrocarbons (e.g., toluene) are more readily degradable under anaerobic conditions than other compounds (i.e., benzene). Anaerobic petroleum hydrocarbon degradation rates are generally slower compared to aerobic rates.

Under anaerobic conditions, CVOCs can undergo a process called reductive dechlorination in which indigenous or augmented microorganisms degrade (metabolize) these compounds, converting them to innocuous end products. In this process, the dechlorinating microorganisms sequentially reduce the CVOC through a series of two-electron transfer reactions, whereby a chlorine atom is removed and replaced with a hydrogen atom. The sequential reduction of trichloroethene (TCE) will eventually produce ethene, a non-toxic end-product via the following transformation steps:



Reductive dechlorination of TCE generally results in production of cis-1,2-DCE, which is more energetically-favorable than production of other DCE isomers (i.e., trans-1,2-DCE and 1,1-DCE). Under aerobic conditions, some cometabolic reduction in CVOCs is possible, resulting in the production of highly transient epoxides, though degradation rates are generally slower and less reliable compared to reductive dechlorination.

## 3 SCREENING OF REMEDIAL TECHNOLOGIES

As requested in the letter from SCDHEC, an evaluation of active remedial measures is to be conducted following collection of the additional soil and groundwater samples. The remedial actions will be implemented near the former tank farm in the vicinity of monitoring well MW-14. Additional actions to investigate and/or address CVOCs in the southern portion of the facility will be discussed under separate cover following collection and analysis of additional soil and groundwater data. The goal of the active remedial measures will be to reduce source mass in soil and groundwater to allow monitored natural attenuation (MNA) to be a more viable corrective action. Potential remedial technologies are identified and evaluated in the following sections to determine the best corrective action for the Site. Once the technologies were screened, a proposed remedial action was developed using the selected remedial technology (Section 4).

### 3.1 Identification of Remedial Technologies

Based on Site media and constituents, the following remedial technologies were identified as potential corrective actions:

- Enhanced Aerobic Bioremediation (EAB);
- Excavation and Off-Site Disposal;
- In Situ Soil Mixing (ISSM); and

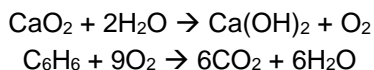
## REMEDIAL ACTION WORK PLAN

- In Situ Soil Stabilization (ISSS).

A brief summary of each remedial technology, including advantages and challenges, is summarized in the following sections.

### 3.1.1 Enhanced Aerobic Bioremediation

Under EAB, an oxygen-releasing material (ORM) is added to the subsurface, typically by physical mixing (e.g., with an excavator or backhoe) or injection through temporary injection points. Commercially available ORMs (e.g., IXPEN 70C, IXPEN 75C, Permeox Plus, ORC, etc.) typically include calcium peroxide, magnesium peroxide, and/or magnesium oxide. The ORMs (e.g., calcium peroxide) provide a 3- to 12-month source of oxygen that ambient microbes can use for biodegradation of petroleum hydrocarbons (e.g., benzene), resulting in carbon dioxide and water:



Advantages of conducting EAB at the Site include:

- Enhances naturally occurring degradation processes;
- Can result in significant reduction in petroleum hydrocarbon concentrations; and
- Can be used to target both unsaturated and saturated impacts.

Challenges associated with EAB at the Site include:

- Low injection rates due to Site lithology will likely limit injectability of the ORMs; and
- Repeated injections likely required to treat the groundwater plume without additional action.

### 3.1.2 Excavation and Off-Site Disposal

With this remedial technology, impacted soil would be excavated to near the top of the water table. Any saturated soil would need to be treated (i.e., dewatering, mixing with a solidifying polymer, or mixing with unsaturated soil) to pass a Paint Filter Test. Impacted soil and groundwater would be properly disposed of off-Site. Advantages of excavation and off-Site disposal include:

- Removal of source term, reducing leaching to groundwater and likelihood of rebound; and
- Additional substrates (e.g., ORMs or chemical oxidants) can be added to the excavation floor, enhancing degradation of any remaining source materials.

Challenges associated with excavation and off-Site disposal at the Site include:

- Some volume of soil and groundwater may be classified as hazardous material, resulting in increased costs; and
- Potential access issues due to Site usage and/or utilities may limit effectiveness.

### 3.1.3 In Situ Soil Mixing

Under ISSM, a strong chemical oxidant is mixed with soil and groundwater via excavators and/or augers. Use of the mixing equipment ensures adequate contact between the chemical oxidant and VOCs,

## REMEDIAL ACTION WORK PLAN

allowing for more efficient degradation than with conventional injection wells. Advantages of conducting ISSM at the Site include:

- Sufficient mixing ensures adequate contact with chemical oxidant;
- Complete destruction of VOCs; and
- Reduced likelihood of rebound.

Challenges associated with ISSM at the Site include:

- Potential access issues due to Site usage and/or utilities may limit effectiveness;
- Some off-Site disposal necessary due to soil bulking;
- Potential health and safety concerns with handling chemical oxidant and operating heavy machinery; and
- High capital costs compared to other remedial technologies.

### 3.1.4 In Situ Soil Stabilization

Under ISSS, a stabilizing agent (e.g., Portland cement) is mixed with soil and groundwater via excavators and/or augers, resulting in a significant reduction of permeability that prevents leaching of Site constituents to groundwater. Advantages of conducting ISSS at the Site include:

- Prevents future leaching of VOCs to groundwater; and
- Sufficient mixing ensures adequate contact with stabilizing agent.

Challenges associated with ISSS at the Site include:

- Potential access issues due to Site usage and/or utilities may limit effectiveness;
- Some off-Site disposal necessary due to soil bulking;
- Potential health and safety concerns with operating heavy machinery; and
- High capital costs compared to other remedial technologies.

## 3.2 Screening Process

The remedial technologies identified in the previous section were screened using the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) screening process. The CERCLA screening process involves evaluation of remedial technologies according to the following three criteria:

- **Effectiveness:** Each process option will be evaluated based on its potential effectiveness and proven reliability in relation to the nature and extent of Site constituents. The effectiveness evaluation also considers potential impacts to human health and the environment that might occur during the construction and implementation of the technology.
- **Implementability:** This evaluation addresses the technical and administrative feasibility of implementing a technology, including the availability of various materials and services required during its implementation. Technical feasibility includes the consideration of the reliability, maturity, prior application, and operational difficulties of a technology, as well as logistical, climate, and terrain limitations. Administrative feasibility includes the consideration of coordinating activities with regulatory agencies and obtaining permits, easements, right-of-way agreements, and zoning variances. The acceptance of a technology by regulatory agencies and the

community is also an important component in considering the implementability of a process option.

- **Cost:** The cost criterion addresses the relative magnitude of capital and operation and maintenance (O&M) costs and was based on engineering judgment and prior experience with cases of comparable scope and magnitude. Capital costs consist of direct and indirect costs. Direct costs include costs associated with construction, equipment, materials, transportation, disposal, analytical services, treatment, and operation. Indirect costs include expenses related to engineering, design, legal fees, permits, and start-up. O&M costs include costs associated with operation, maintenance, energy, residual disposal, monitoring, and support. Three cost ranges (low, moderate, and high) were utilized in the initial cost evaluation.

Of these criteria, the relative effectiveness and implementability of the process options are the most critical. Process options judged to be inferior in meeting these criteria were eliminated from further consideration.

### 3.3 Summary of Technology Screening

The screenings of remedial technologies for the Site are summarized in **Table 1**. Based on the screening, excavation and off-Site disposal was selected as the remedial technology to be used at the Site. Excavation and off-Site disposal is very effective as it permanently removes the soil source term, is readily implementable, and has moderate capital and low O&M costs.

## 4 REMEDIAL ACTION IMPLEMENTATION

The overall objective of the selected remedial action is to reduce source mass in soil and groundwater, decreasing the potential for long-term downgradient mass flux and allowing MNA to be a more viable corrective action. The layout for the proposed remedial actions is shown in **Figures 11** and **12**. The specific technical objectives of the remedial action include:

- Excavate, dewater, and dispose of impacted soil and groundwater up to approximately 8 ft bgs;
- Add calcium peroxide to the excavation floor to enhance biodegradation of petroleum hydrocarbons; and
- Backfill excavation with clean soil.

The proposed excavation area is approximately 3,500 square ft and represents the approximate extent of soil petroleum impacts greater than 1 mg/kg. *The excavation will be bounded to the north by the warehouse, to the east and south by the extent of elevated impacts (i.e., near Borings A2-14 and A2-20), and to the west by the Site property boundary; the Site property boundary will be surveyed prior to excavation. To ensure soil stability near the building and avoid an underground gas line, the excavation will be conducted at least 5 ft from the warehouse and gas line. A 4-inch polyvinyl chloride (PVC) storm drain in the excavation zone will be cut prior to excavation and repaired during Site restoration.*

Most of the excavation will be conducted to 8 ft bgs (e.g., 1-2 ft into the saturated zone); based on soil and groundwater concentrations, an approximate 300 square ft area between Borings A2-10 and A2-14 will only be excavated to the water table (approximately 6 ft bgs). The total volume of excavated soil is therefore anticipated to be 977 cubic yards. During excavation, any saturated soil would be mixed with

## REMEDIAL ACTION WORK PLAN

unsaturated soil and/or a solidifying polymer (e.g., MF006) so the excavated soil will pass the Paint Filter Test. If necessary, dewatering of saturated soil and/or the excavation pit may be conducted.

All soil and/or groundwater will be disposed of properly off-Site. Soil waste characterization samples were collected on July 30, 2021 near Borings A2-5 and A2-7 (i.e., borings with highly elevated petroleum hydrocarbons and/or CVOCs in soil) and analyzed for Toxicity Characteristic Leaching Procedure (TCLP) VOCs and metals. The TCLP results (**Table 2**) indicate no VOCs or metals exceeded hazardous waste limits; therefore, soil will be disposed of as non-hazardous.

Following excavation, soil samples will be collected from the excavation floor (1 sample per 750 square ft, approximately 5 samples total) and sidewalls (1 sample per 25 ft, approximately 10 samples total) and analyzed for VOCs. These samples will be used to assess concentrations remaining in soil; due to the proximity of the warehouse, these samples will not be used to potentially expand the excavation footprint. Following sample collection, a calcium peroxide substrate (e.g., IXPEN 75C) will be added to the excavation floor and mixed into the soil using an excavator or backhoe. The calcium peroxide will further decrease petroleum hydrocarbon concentrations by slowly releasing oxygen over a 3- to 12-month period, enhancing aerobic biodegradation processes. The amount of calcium peroxide required is based on the mass of petroleum hydrocarbons in soil and groundwater, using the following equations:

$$M_{O_2, \text{Soil}} = A * h * \rho * \text{SOD} * \text{SF} \quad (1)$$

$$M_{O_2, \text{GW}} = A * h * \text{PH}_{\text{GW}} * O_{2\text{RATIO}} * \text{SF} \quad (2)$$

$$M_{\text{CP, TOTAL}} = (M_{O_2, \text{Soil}} + M_{O_2, \text{GW}}) / \text{AO} \quad (3)$$

Where:

A = area of excavation (3,500 square ft)

AO = available oxygen of calcium peroxide (17%)

h = mixing thickness (2 ft)

$M_{\text{CP, GW}}$  = mass of calcium peroxide required to treat soil impacts in pounds

$M_{\text{CP, Soil}}$  = mass of calcium peroxide required to treat soil impacts in pounds

$M_{\text{CP, TOTAL}}$  = total mass of calcium peroxide required in pounds

$O_{2\text{RATIO}}$  = ratio of oxygen to hydrocarbons (3.1 grams oxygen per gram of petroleum hydrocarbon)

$\rho$  = soil bulk density (assumed to be 95 pounds per cubic foot)

$\text{PH}_{\text{GW}}$  = groundwater petroleum hydrocarbon concentration (using maximum of 249,937  $\mu\text{g/L}$ )

SOD = soil oxygen demand (conservatively assumed to be 0.2 grams per kilogram)

SF = safety factor (1.5)

Based on the assumptions listed above, the amount of calcium peroxide required is approximately 2,980 pounds.

Once the calcium peroxide has been mixed into the excavation floor, the excavation will be backfilled with clean fill from an off-Site source, and the Site will be restored to its original condition (e.g., asphalt). A geotextile fabric or large stones may be placed at the bottom of the excavation to improve stability and limit settling during Site restoration. Monitoring well MW-14 will be properly abandoned prior to excavation and re-installed following backfill. Replacement monitoring well MW-14R will be installed adjacent to the abandoned well to an approximate depth of 18 ft bgs using hollow-stem auger drilling techniques and will be constructed of 10-ft long, 2-inch diameter 0.01-inch slotted PVC screen and PVC riser. The replacement well will have an appropriately sized filter pack installed to 2 ft above the top of screen,

## REMEDIAL ACTION WORK PLAN

followed by a 2-ft thick bentonite seal. A bentonite/grout mix will then be installed to 3 ft bgs, with cement grout from 0 to 3 ft bgs. The well will be completed with a flush-mounted well vault. Following installation, the well will be developed using a combination of pumping and surging until water quality parameters are stabilized and the well is free of visible sediment. MW-14R will be sampled within one month of installation, and the replacement well will continue to be sampled in place of MW-14 as part of the Site-wide semi-annual monitoring program.

After all remedial actions have been implemented, the replacement well and excavation extents will be surveyed to establish location (northing and easting) and elevation (ground surface and top of casing).

## 5 REFERENCES

Arcadis. 2021. Second Semiannual 2020 Groundwater Report, Brenntag Southeast, Charleston, South Carolina. March 2.

Arcadis. 2020. Remedial Action Work Plan, Area #1, Brenntag Southeast, Charleston, South Carolina. December.

Arcadis. 2004. First Semiannual 2004 Monitoring Report, Brenntag Southeast, Charleston, South Carolina. April.

Arcadis. 2004. First Semiannual 2004 Monitoring Report, Brenntag Southeast, Charleston, South Carolina. April.



# TABLES



**Table 1**  
**Screening of Remedial Technologies**

**Brenntag Southeast, Inc.**  
**4200 Azalea Drive**  
**Charleston, South Carolina**

Remedial Technology	Technology Description	Effectiveness	Implementability	Cost <sup>1</sup>	Action
Enhanced Aerobic Bioremediation	Addition of oxygen-releasing materials to enhance naturally-occurring biodegradation processes.	Effective for treating petroleum hydrocarbons in groundwater. Multiple injection events will likely be needed to maintain elevated dissolved oxygen concentrations for efficient biodegradation.	Implementable. Would require either physical mixing (e.g., excavator or backhoe) or injection via temporary points. Hydraulic conductivity indicates injection may be difficult.	Moderate capital, moderate O&M	Retained, in concert with excavation, de-watering, and off-Site disposal.
Excavation, Dewatering, and Disposal	Excavation of soil to just below the water table and dewatering of saturated soil. Off-Site disposal of impacted soil and groundwater.	Very effective at removing impacted media.	Implementable. Would likely result in significant quantities of water to be disposed of. Based on the recent Geoprobe investigation, at least some groundwater and soil will likely be disposed of as hazardous waste. Potential access issues due to Site operation and subsurface utilities.	Moderate capital, low O&M	Retained.
In Situ Soil Mixing	Use excavators and/or large augers to mix soil and groundwater with chemical oxidant to mineralize Site constituents.	Effective technology to treat Site constituents. Mixing soil with chemical oxidant ensures direct contact with contaminant.	Implementable. Mixing equipment can easily reach depth of impacts. Potential access issues due to site operation and subsurface utilities.	High capital, low O&M	Eliminated, based on cost.
In Situ Soil Stabilization	Use excavators and/or large augers to mix soil and groundwater with stabilizing agent (e.g., Portland cement) to reduce permeability and prevent leaching of Site constituents.	Effective at reducing permeability to prevent leaching of Site constituents.	Implementable. Mixing equipment can easily reach depth of impacts. Potential access issues due to site operation and subsurface utilities.	High capital, low O&M	Eliminated, based on cost.

**Notes**

1. Costs were evaluated on engineering judgment and each process option was evaluated relative to other process options. Relative costs were then assigned as either low, moderate, or high.  
O&M = operation and maintenance

**Table 2**  
**TCLP Sample Results**



**Brenntag Southeast, Inc.**  
**4200 Azalea Drive**  
**Charletson, South Carolina**

Sample ID:	Toxicity	A2-5	A2-5	A2-7
Depth (ft bgs):	Characteristic	5-6	7-8	5-6
Date Sampled:	Regulatory Level <sup>1</sup>	7/21/2021	7/21/2021	7/21/2021
<b>TCLP Volatile Organic Compounds (mg/L)</b>				
Benzene	0.5	<0.010 U	<b>0.0297</b>	<0.010 U
2-Butanone (MEK)	200	<0.050 U	<0.050 U	<0.050 U
Carbon Tetrachloride	0.5	<0.010 U	<0.010 U	<0.010 U
Chlorobenzene	100	<0.010 U	<0.010 U	<0.010 U
Chloroform	6	<0.010 U	<0.010 U	<0.010 U
1,4-Dichlorobenzene	7.5	<b>0.254</b>	<b>0.171</b>	<b>0.0826</b>
1,2-Dichloroethane	0.5	<0.010 U	<0.010 U	<0.010 U
1,1-Dichloroethene	0.7	<0.010 U	<0.010 U	<0.010 U
Tetrachloroethene	0.7	<0.010 U	<b>0.0108</b>	<b>0.0027 J</b>
Trichloroethene	0.5	<b>0.0044 J</b>	<b>0.116</b>	<0.010 U
Vinyl chloride	0.2	<0.010 U	<0.010 U	<0.010 U
<b>TCLP Metals (mg/L)</b>				
Arsenic	5.0	<0.10 U	<0.10 U	<0.10 U
Barium	100	<2.0 U	<2.0 U	<2.0 U
Cadmium	1.0	<0.050 U	<0.050 U	<0.050 U
Chromium	5.0	<0.10 U	<0.10 U	<0.10 U
Lead	5.0	<b>0.14</b>	<0.050 U	<0.050 U
Mercury	0.20	<0.0050 UH	<0.0050 UH	<0.0050 UH
Selenium	1.0	<0.10 U	<0.10 U	<0.10 U
Silver	5.0	<0.10 U	<0.10 U	<0.10 U

**Notes**

1. As defined in 40 Code of Federal Regulations § 261.24

**Detections are in boldface**

ft bgs = feet below ground surface

J = Result is qualified as estimated

mg/L = Milligrams per liter

TCLP = Toxicity Characteristic Leaching Procedure

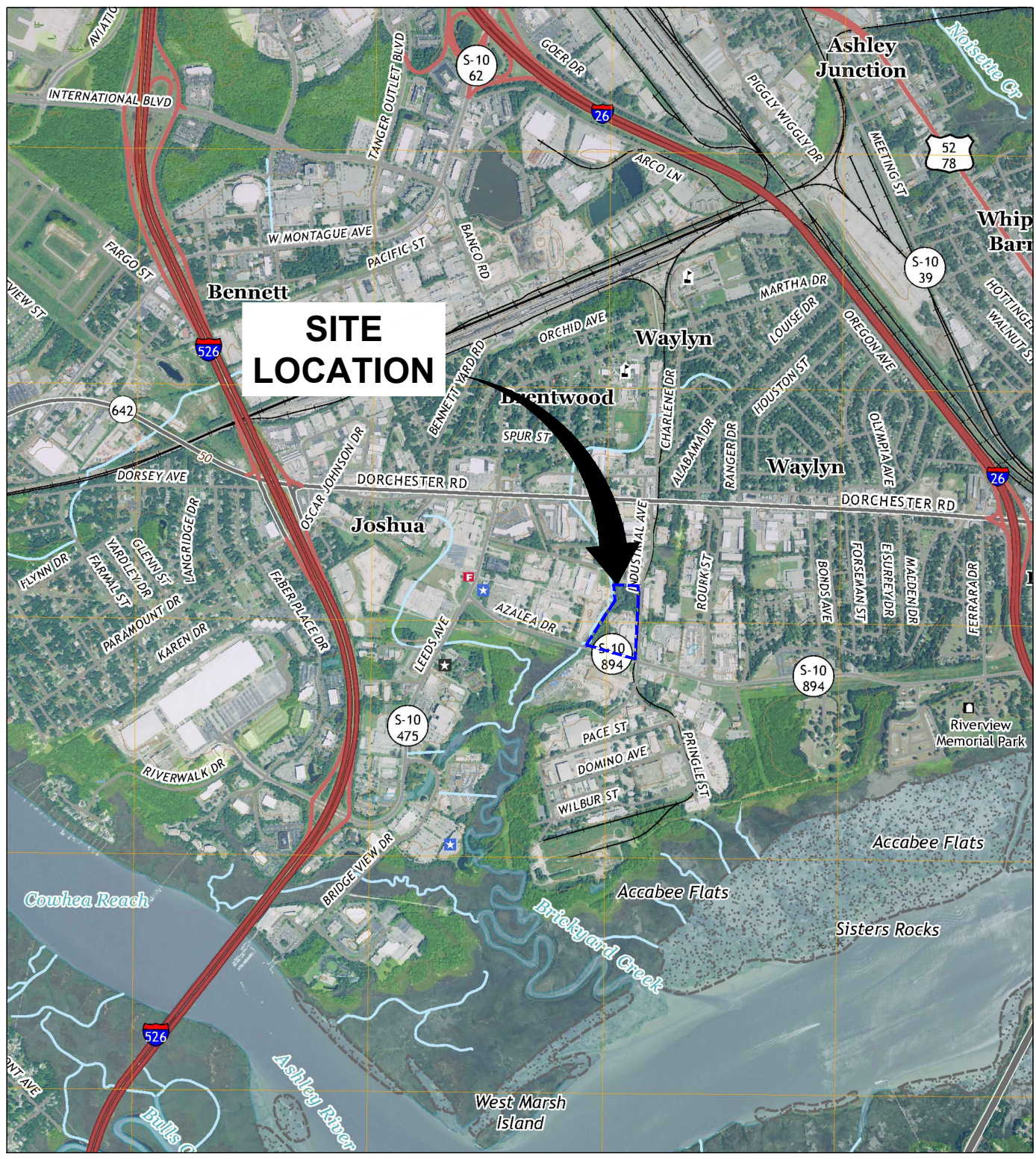
U = Analyte was not detected above the reporting limit

UH = Analyte was not detected above the reporting limit, hold time exceeded

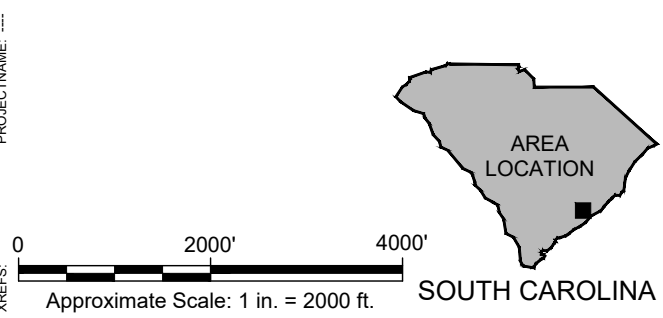
# FIGURES



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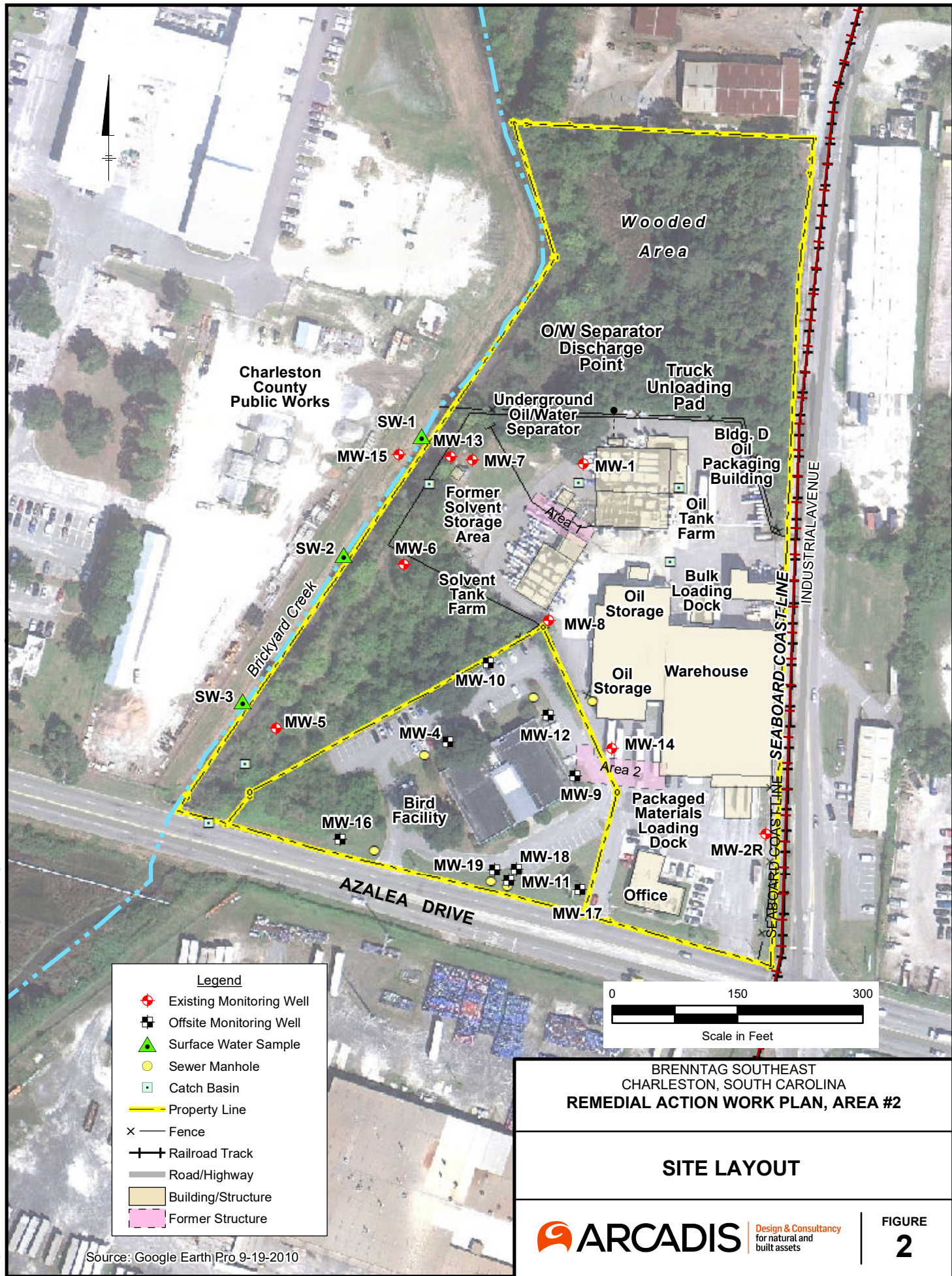


REFERENCE: BASE MAP USGS 7.5. MIN. TOPO. QUADS., CHARLESTON AND JOHNS ISLAND, SOUTH CAROLINA 2018.

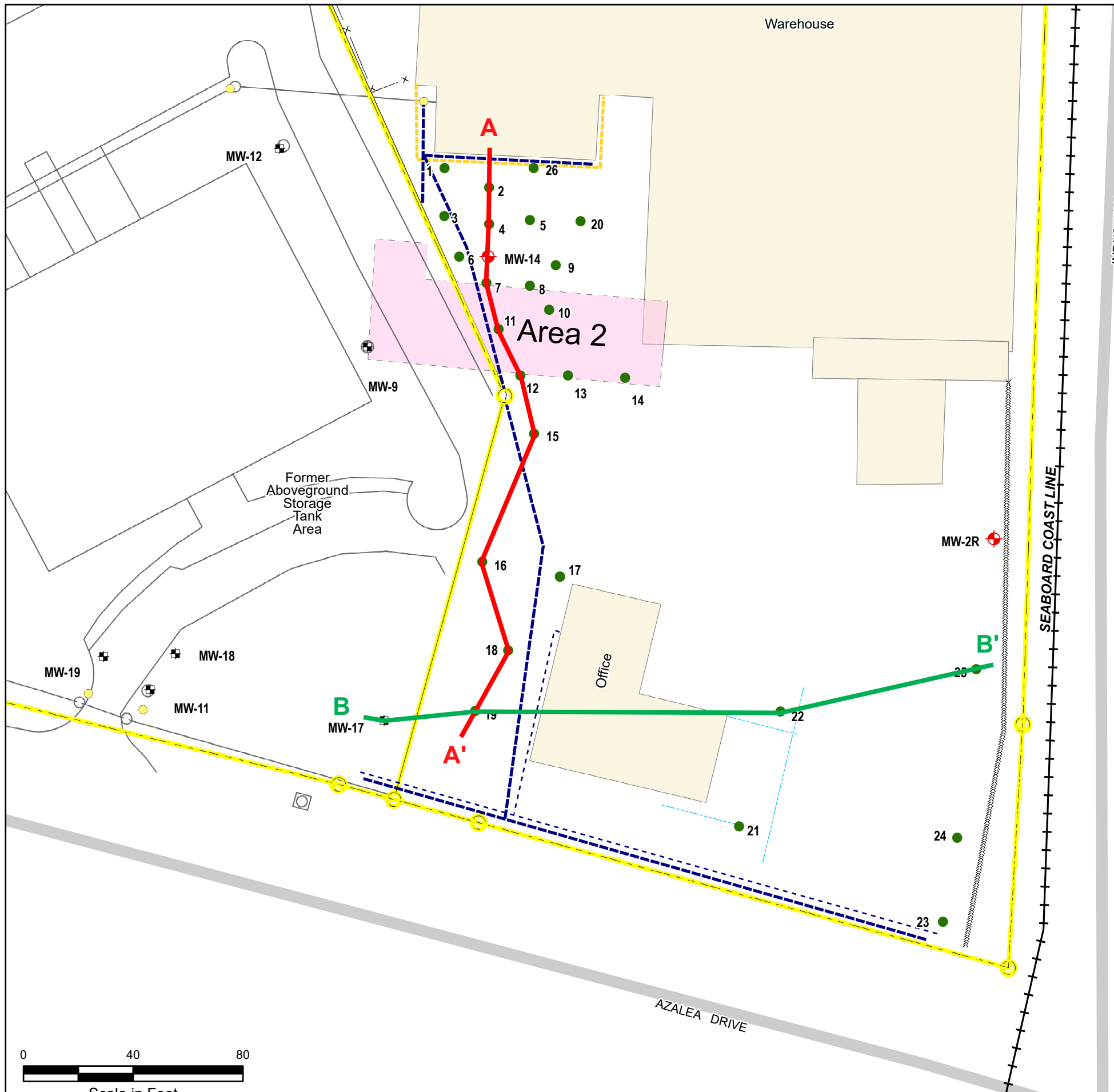


BRENNTAG SOUTHEAST CHARLESTON, SOUTH CAROLINA <b>REMEDIAL ACTION WORK PLAN, AREA #2</b>	
<b>SITE LOCATION</b>	
	Design & Consultancy for natural and built assets
FIGURE <b>1</b>	

PROJECTNAME: ---



CITY: AUGUSTA DIV/GROUP: ENV DB: A. Saul LD: A. Saul PIC: PM: TM: TR:  
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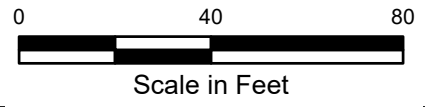
INDUSTRIAL AVENUE

SEABOARD COAST LINE

AZALEA DRIVE

**Legend**

- Geoprobe Borings on Brenntag Property
- ⊕ Existing Monitor Well
- ⊕ Offsite Monitor Well
- ▲ Surface Water Sample
- Sewer Manhole
- Catch Basin
- Property Line
- Bird Company Property
- ▭ Former Structure
- - - - - Approximate Water line
- - - - - Approximate Storm Drain
- - - - - Approximate Underground Utilities
- - - - - Approximate Gas Line

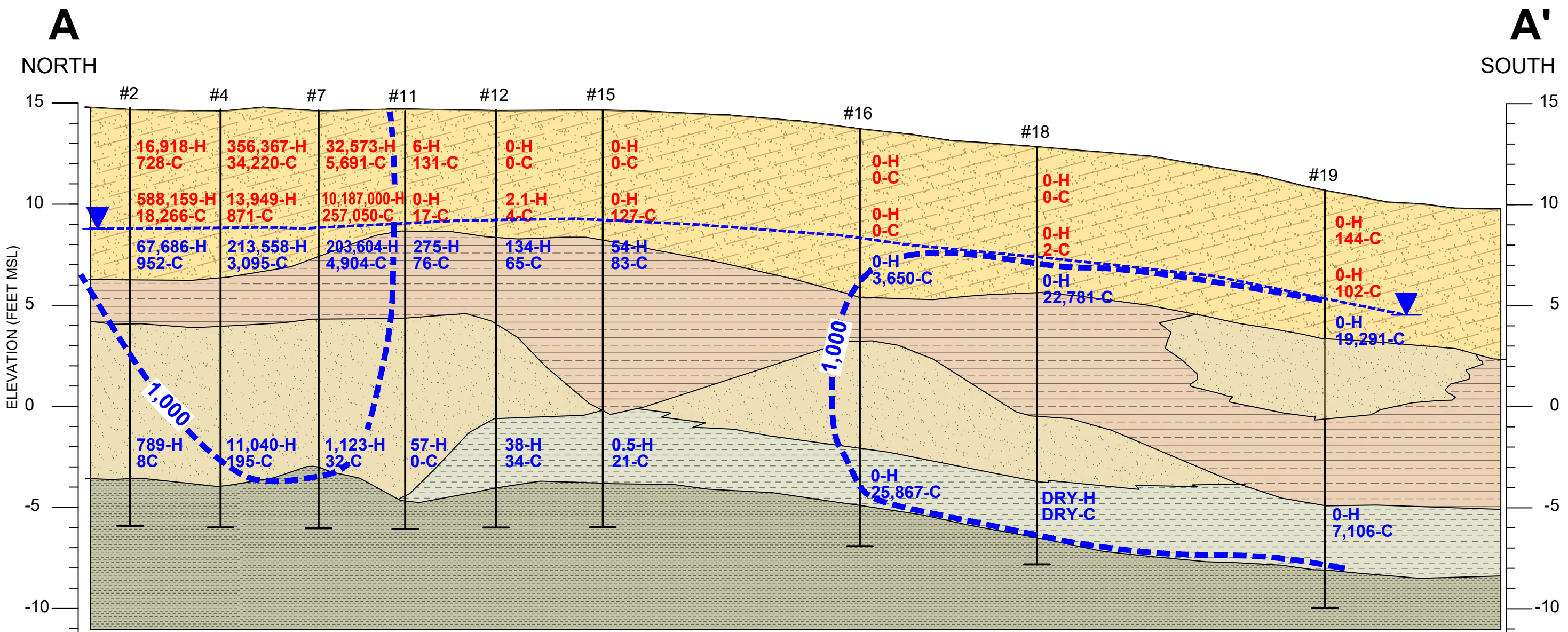


BRENTAG SOUTHEAST  
 CHARLESTON, SOUTH CAROLINA  
**REMEDIATION ACTION WORK PLAN, AREA #2**

**CROSS SECTION LOCATIONS**

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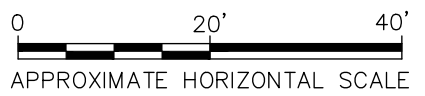
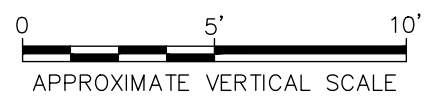
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**LEGEND:**

- MW-15 WELL/BORING ID
- APPROXIMATE GROUND SURFACE
- LITHOLOGIC CONTACT
- WATER LEVEL
- WELL SCREEN
- WELL/BORING BOTTOM
- SILTY SANDS
- SILTY CLAYS/SANDS
- SC STIFF GREEN CLAYS
- STIFF GREEN CLAYS
- TIGHT FINE GRAINED SANDS

- SOIL CONCENTRATION (µg/kg)
- 6 H (Hydrocarbons)
- 131 C (Chlorinated)
- GROUNDWATER CONCENTRATION (µg/L)
- 54 H (Hydrocarbons)
- 83 C (Chlorinated)
- 20 --- ISOCONCENTRATION CONTOUR (µg/L)



BRENNTAG SOUTHEAST  
 CHARLESTON, SOUTH CAROLINA  
**REMEDIAL ACTION WORK PLAN, AREA #2**

**CROSS SECTION A-A'**

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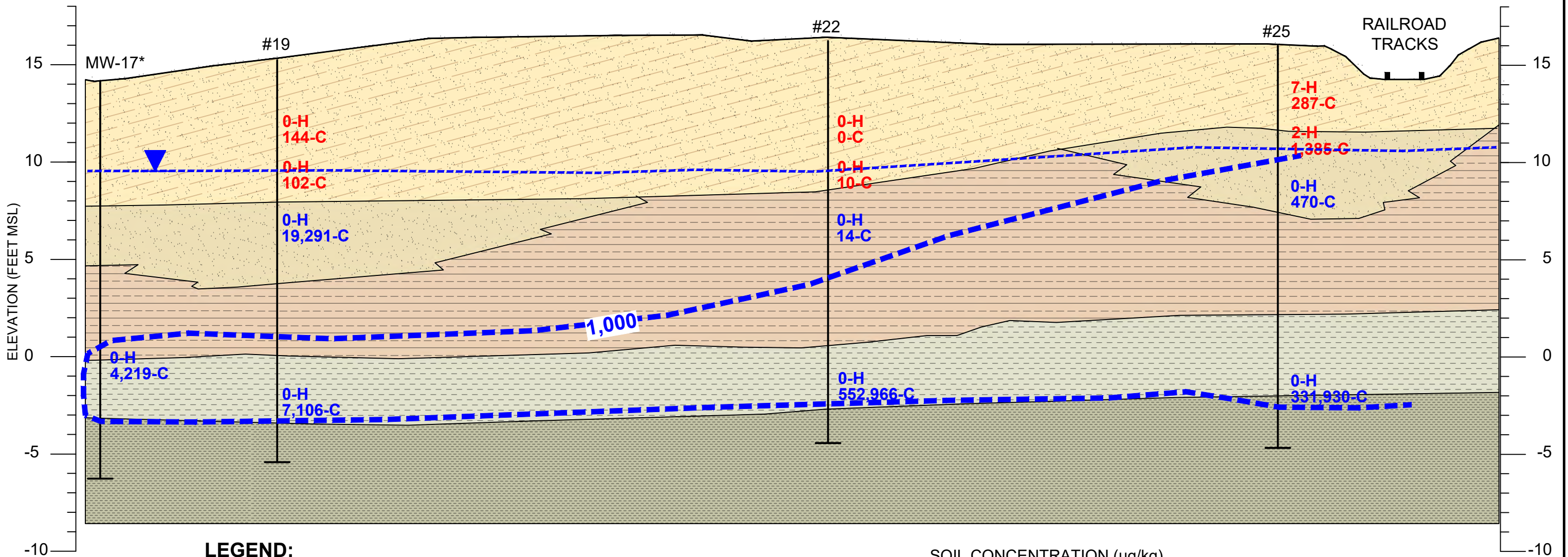
FIGURE  
**4**



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**B**  
WEST

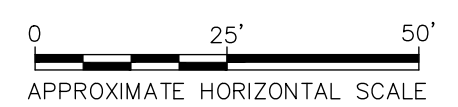
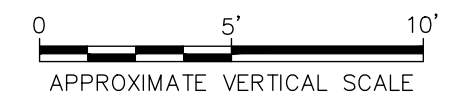
**B'**  
EAST



**LEGEND:**

- MW-15 WELL/BORING ID
- APPROXIMATE GROUND SURFACE
- LITHOLOGIC CONTACT
- WATER LEVEL
- WELL SCREEN
- WELL/BORING BOTTOM
- SILTY SANDS
- SILTY CLAYS/SANDS
- SC STIFF GREEN CLAYS
- STIFF GREEN CLAYS
- TIGHT FINE GRAINED SANDS

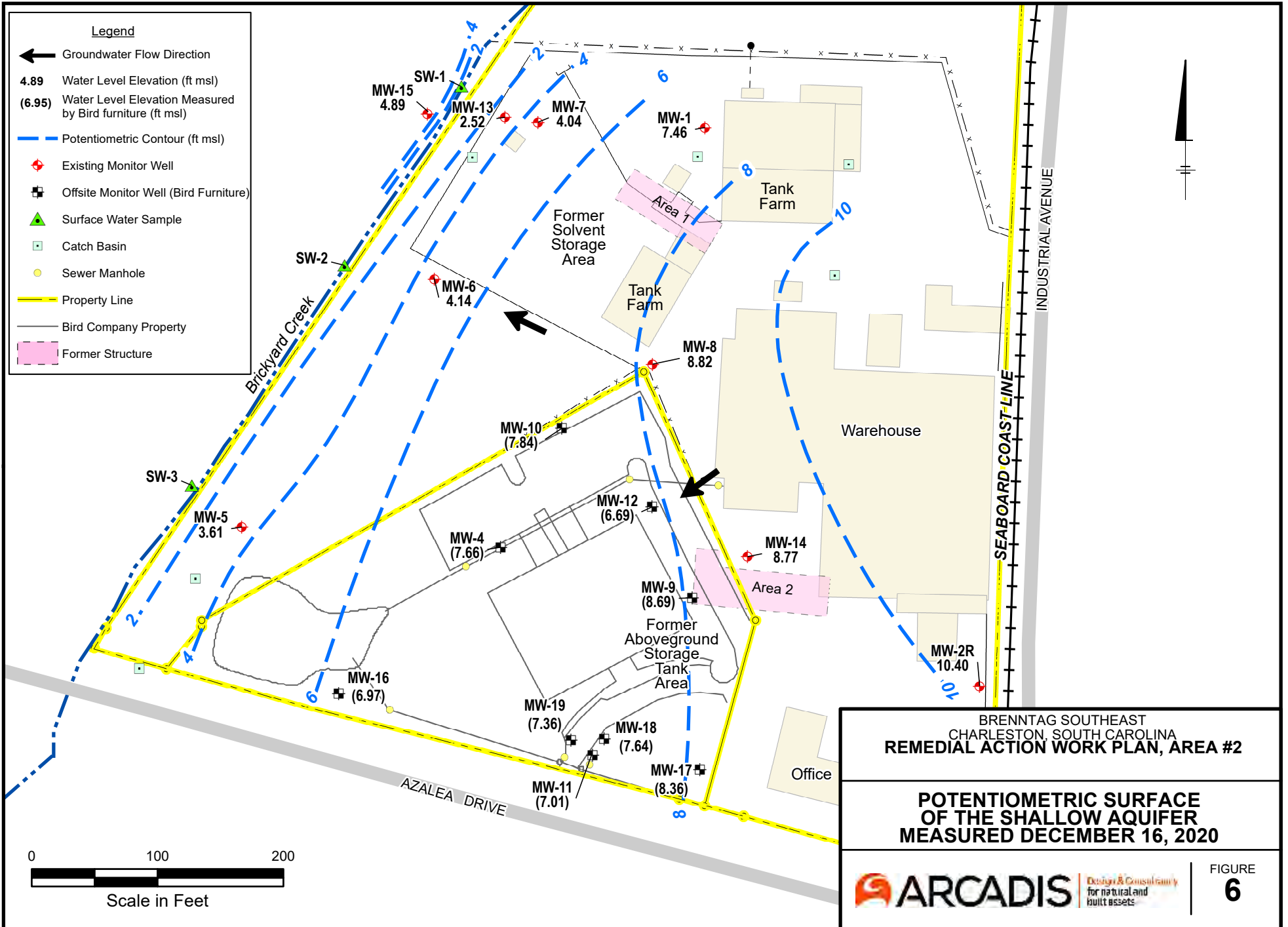
- SOIL CONCENTRATION (µg/kg)
- 7 H (Hydrocarbons)
- 287 C (Chlorinated)
- GROUNDWATER CONCENTRATION (µg/L)
- 0 H (Hydrocarbons)
- 470 C (Chlorinated)
- 1,000 - - - - - ISOCONCENTRATION CONTOUR (µg/L)



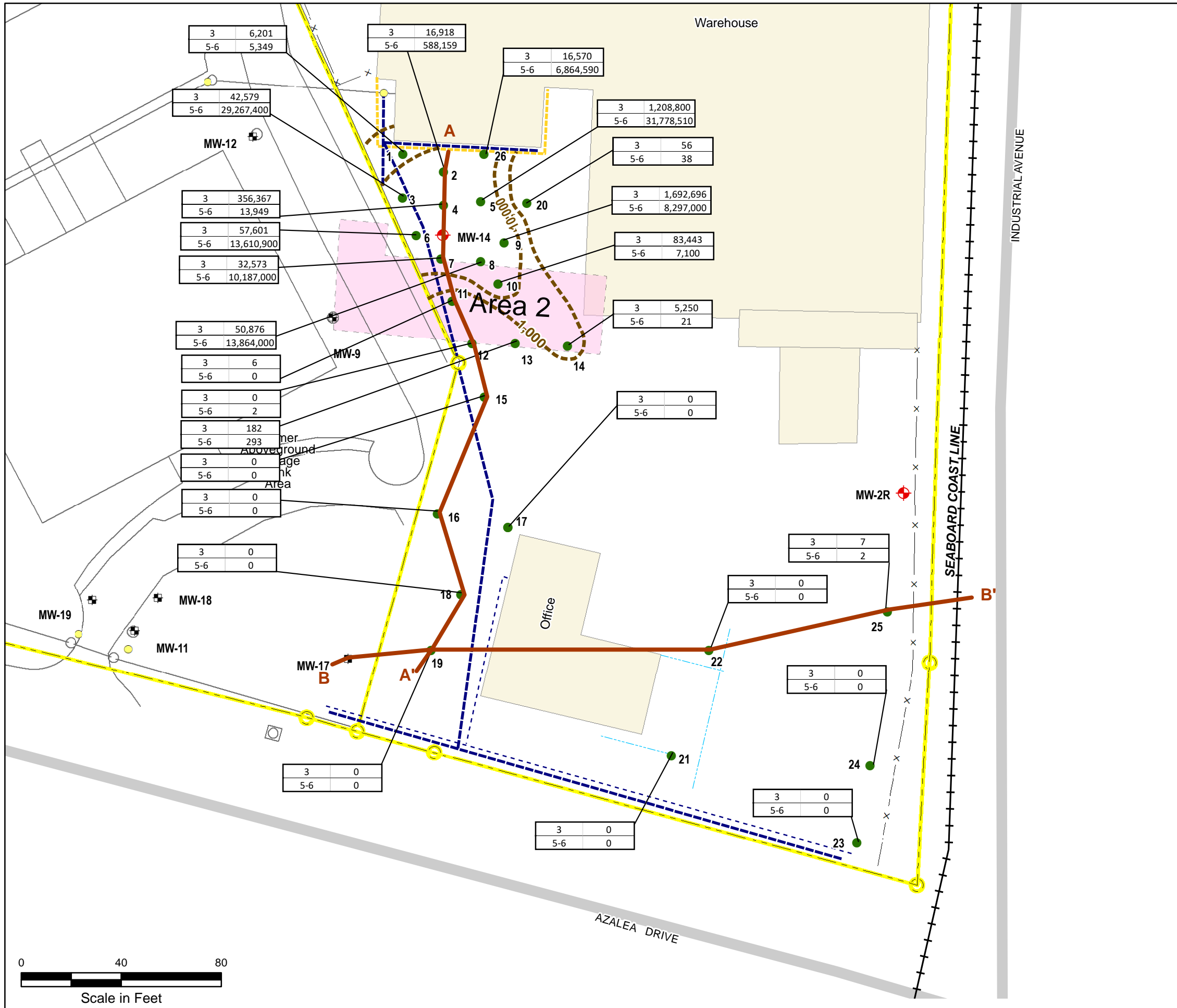
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**CROSS SECTION B-B'**





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**Legend**

- Geoprobe Borings on Brenntag Property
- ◆ Existing Monitor Well
- ⊠ Offsite Monitor Well
- ▲ Surface Water Sample
- Sewer Manhole
- Catch Basin
- Property Line
- Bird Company Property
- Former Structure
- - - Approximate Water line
- - - Approximate Storm Drain
- - - Approximate Underground Utilities
- - - Approximate Gas Line

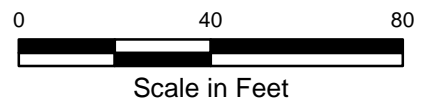
Depth in Feet	3	555	Chlorinated Solvent Concentration (µg/kg)
	5-6	163	

NS Not Sampled

--- 1,000 Isoconcentration Contour (µg/kg)

µg/kg Micrograms per Kilogram

A— A' Cross-Section Location



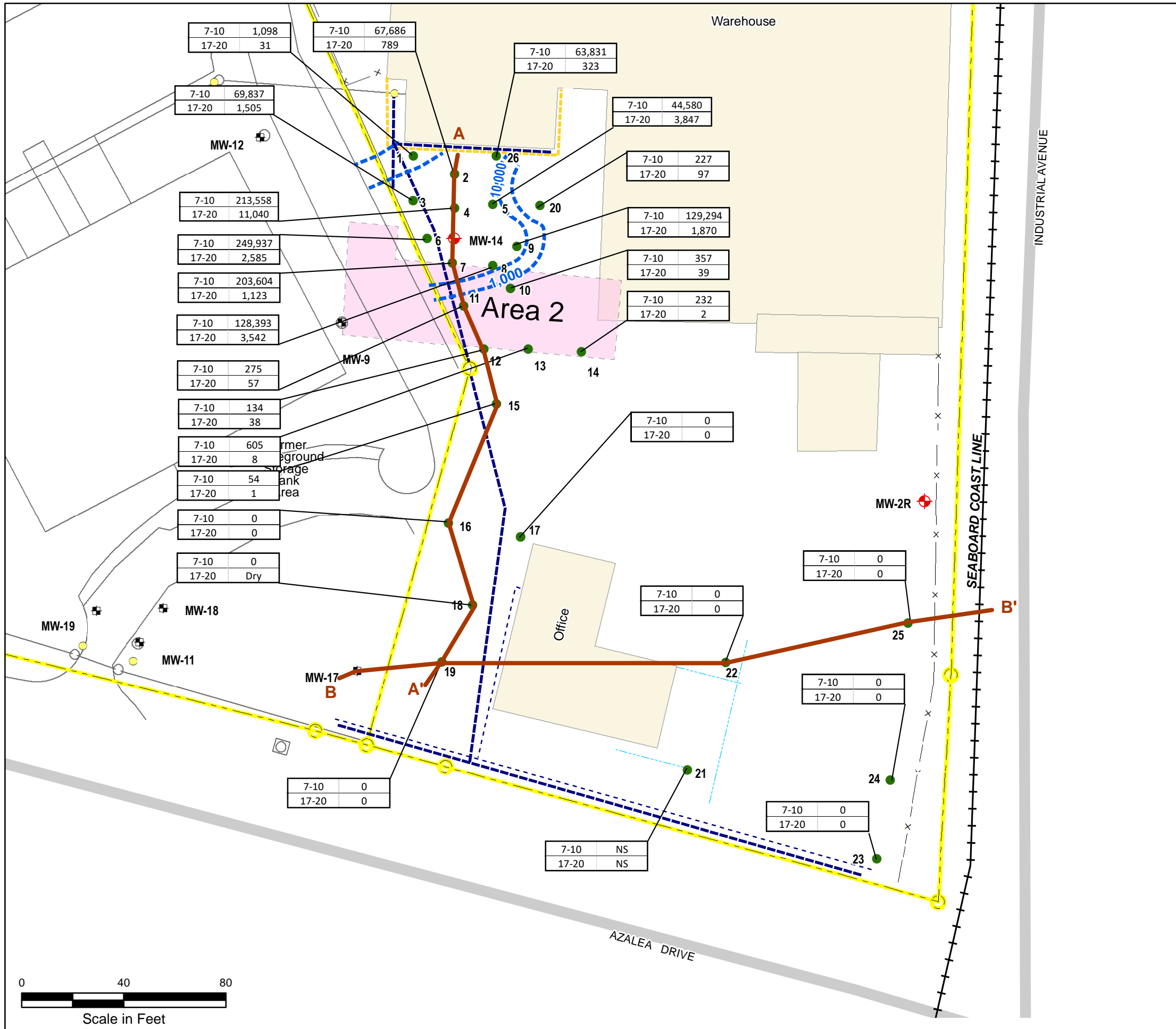
BRENNTAG SOUTHEAST  
CHARLESTON, SOUTH CAROLINA  
**REMEDIAL ACTION WORK PLAN, AREA #2**

**HYDROCARBON CONCENTRATIONS IN SOIL**

**ARCADIS** Design & Consultancy  
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FIGURE  
**7**

CITY: AUGUSTA DIV/GROUP: ENV DB: A. Saul LD: A. Saul PIC: PM: TM: TR: Project Number: Path: C:\BIM\OneDrive - ARCADIS\GIS\Brenntag\Brenntag Charleston SC GIS\2020\30016339\01-MXD\Dec 2020 Hydro GW Bird Prop4.mxd Date Saved: 4/6/2021 6:49:38 PM



**Legend**

- Geoprobe Borings on Brenntag Property
- ◆ Existing Monitor Well
- ⊕ Offsite Monitor Well
- ▲ Surface Water Sample
- Sewer Manhole
- Catch Basin
- Property Line
- Bird Company Property
- Former Structure
- - - Approximate Water line
- - - Approximate Storm Drain
- - - Approximate Underground Utilities
- - - Approximate Gas Line

Depth in Feet 

7-10	1,098
17-20	31

 Hydrocarbon Concentration (µg/L)

NS Not Sampled

- - - 1,000 Isoconcentration Contour (µg/L)

µg/L Micrograms per Liter

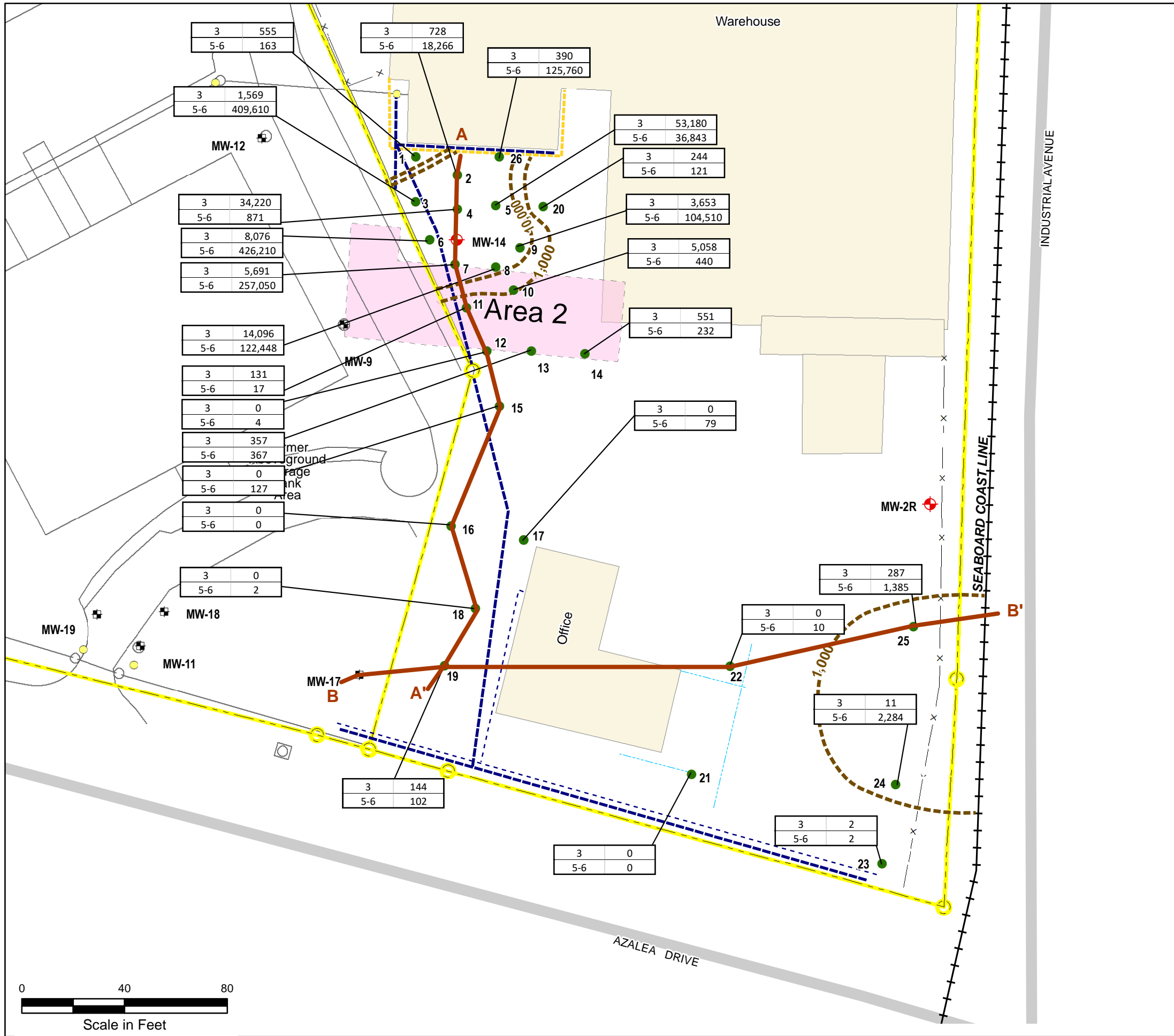
**A — A'** Cross-Section Location

BRENTAG SOUTHEAST  
CHARLESTON, SOUTH CAROLINA  
**REMEDIAL ACTION WORK PLAN, AREA #2**

**HYDROCARBON CONCENTRATIONS  
IN GROUNDWATER**



CITY: AUGUSTA DIV/GROUP: ENV DB: A. Saul LD: A. Saul PIC: PM: TM: TR: Project Number: Path: C:\BIM\OneDrive - ARCADIS\GIS\Brenntag\Brenntag Charleston SC GIS\2020\30016339\01-MXD\Dec 2020 Chlor SOIL Bird Prop4.mxd Date Saved: 4/6/2021 6:47:10 PM



**Legend**

- Geoprobe Borings on Brenntag Property
- ◆ Existing Monitor Well
- ⊕ Offsite Monitor Well
- ▲ Surface Water Sample
- Sewer Manhole
- Catch Basin
- Property Line
- Bird Company Property
- Former Structure
- - - Approximate Water line
- - - Approximate Storm Drain
- - - Approximate Underground Utilities
- - - Approximate Gas Line

Depth in Feet 

3	555
5-6	163

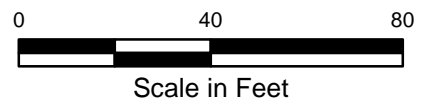
 Chlorinated Solvent Concentration (µg/kg)

NS Not Sampled

- - - 1,000 Isoconcentration Contour (µg/kg)

µg/kg Micrograms per Kilogram

A — A' Cross-Section Location



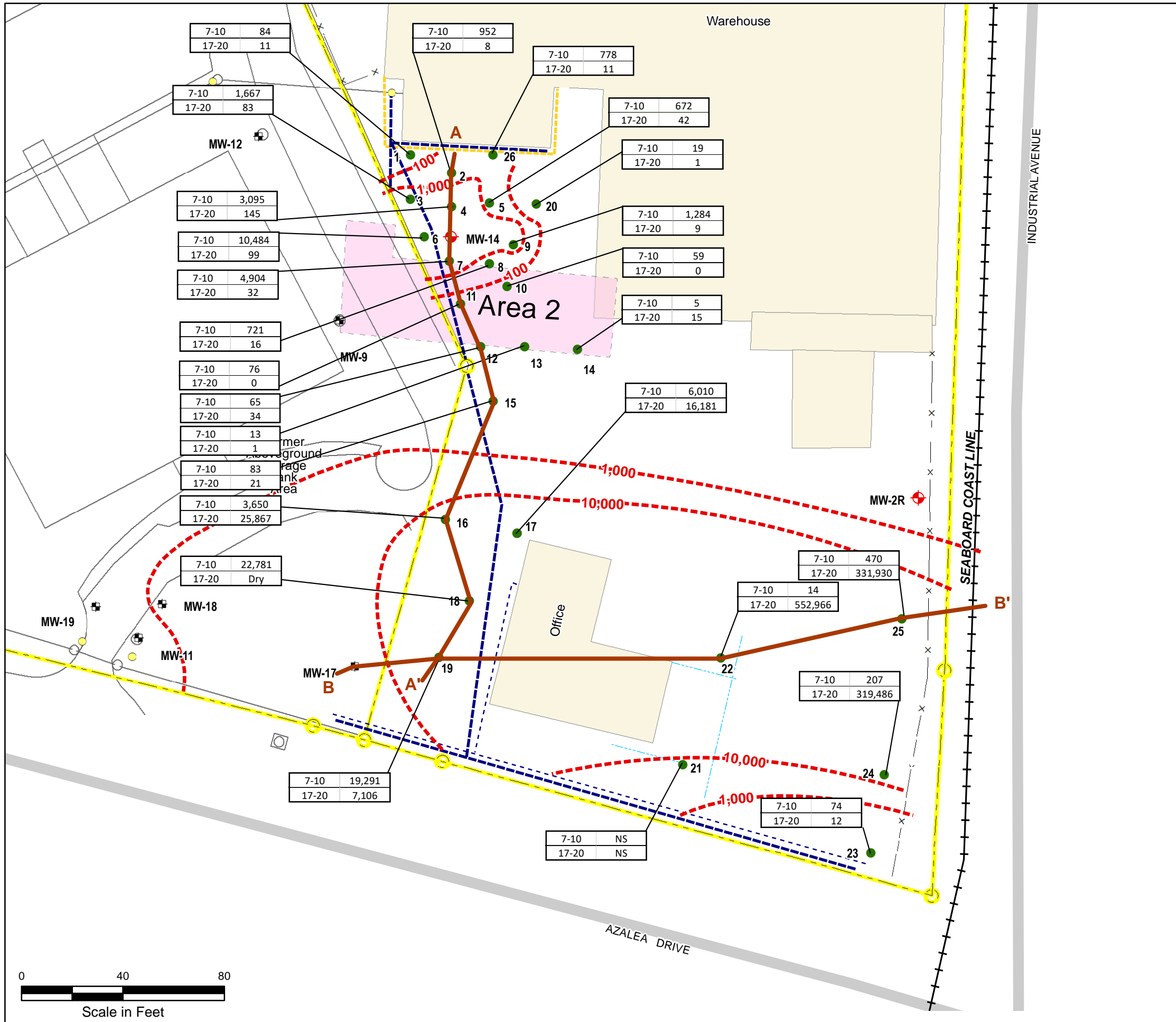
BRENTTAG SOUTHEAST  
CHARLESTON, SOUTH CAROLINA  
**REMEDIAL ACTION WORK PLAN, AREA #2**

**CVOC CONCENTRATIONS IN SOIL**

**ARCADIS** Design & Consultancy for natural and built assets

FIGURE **9**

CITY: AUGUSTA DIV/GROUP: ENV DB: A. Saul LD: A. Saul PIC: PM: TM: TR: Project Number: Path: C:\BIM\OneDrive - ARCADIS\GIS\Brenntag\Brenntag Charleston SC GIS\2020\30016339\01-MXD\Dec 2020 Chlor GW Bird Prop4.mxd Date Saved: 4/6/2021 8:58:47 PM



**Legend**

- Geoprobe Borings on Brenntag Property
- ⊕ Existing Monitor Well
- ⊕ Offsite Monitor Well
- ▲ Surface Water Sample
- Sewer Manhole
- Catch Basin
- Property Line
- Bird Company Property
- Former Structure
- - - Approximate Water line
- - - Approximate Storm Drain
- - - Approximate Underground Utilities
- - - Approximate Gas Line

Depth in Feet	7-10	17-20	Chlorinated Solvent Concentration (µg/L)
	1,098	31	

NS Not Sampled

--- 1,000 Isoconcentration Contour (µg/L)

µg/L Micrograms per Liter

— A — A' Cross-Section Location

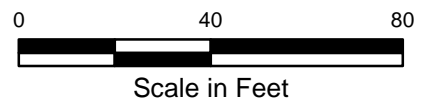
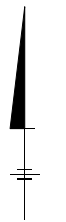
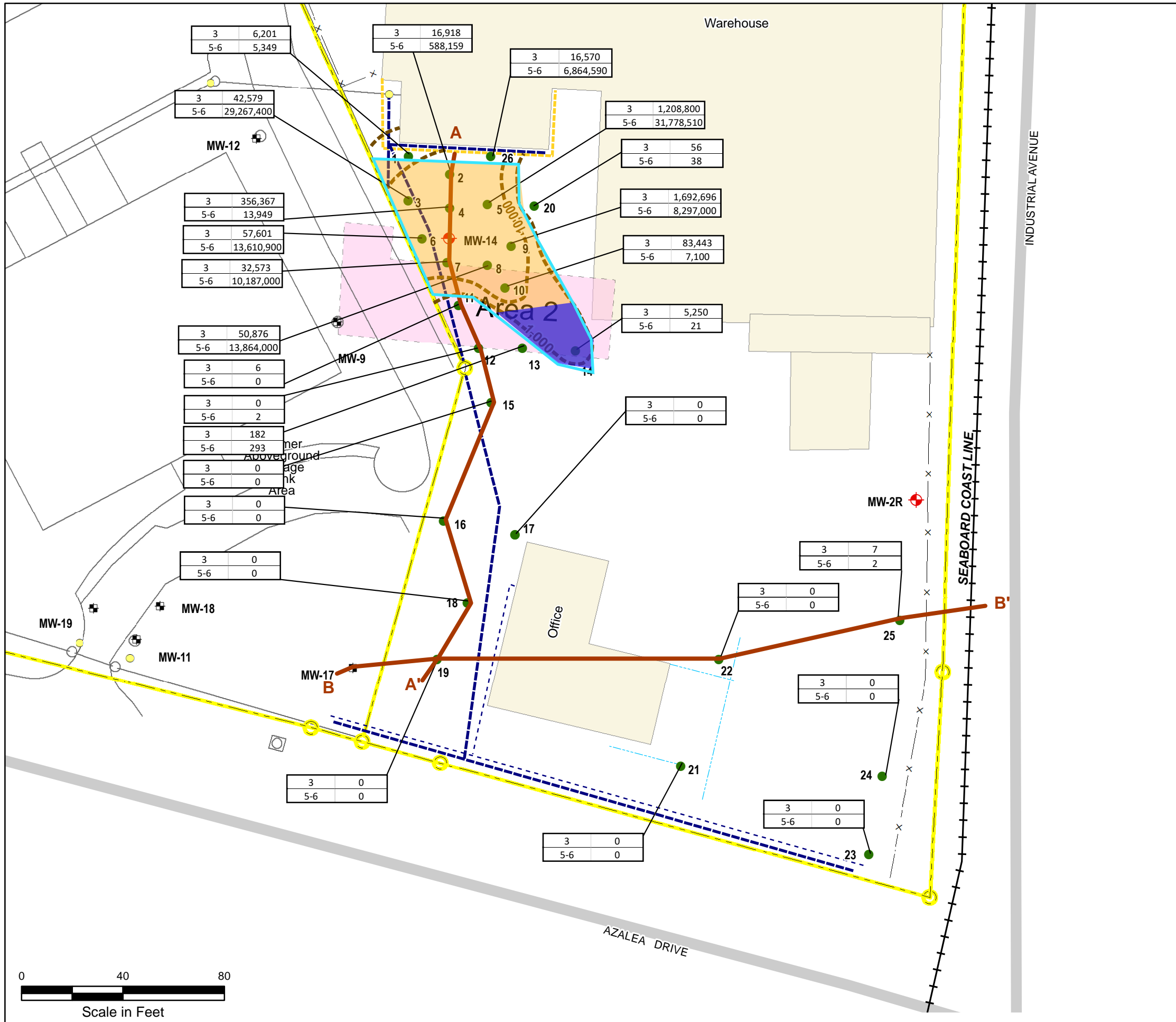
BRENTAG SOUTHEAST  
CHARLESTON, SOUTH CAROLINA  
**REMEDIATION ACTION WORK PLAN, AREA #2**

**CVOC CONCENTRATIONS  
IN GROUNDWATER**



FIGURE  
**10**

CITY: AUGUSTA DIV/GROUP: ENV DB: A. Saul LD: A. Saul PIC: PM: TM: TR: Project Number: Path: C:\BIM\OneDrive - ARCADIS\GIS\Brenntag\Brenntag Charleston SC GIS\2020\30016339\01-MXD\Dec 2020 Hydro SOIL Bird Prop4.mxd Date Saved: 4/6/2021 6:48:12 PM



Legend

- Geoprobe Borings on Brenntag Property
- ◆ Existing Monitor Well
- ⊕ Offsite Monitor Well
- ▲ Surface Water Sample
- Sewer Manhole
- Catch Basin
- Property Line
- - Bird Company Property
- █ Former Structure
- Approximate Water line
- Approximate Storm Drain
- Approximate Underground Utilities
- Approximate Gas Line

Depth in Feet	3	555	Chlorinated Solvent Concentration (µg/kg)
	5-6	163	

NS Not Sampled

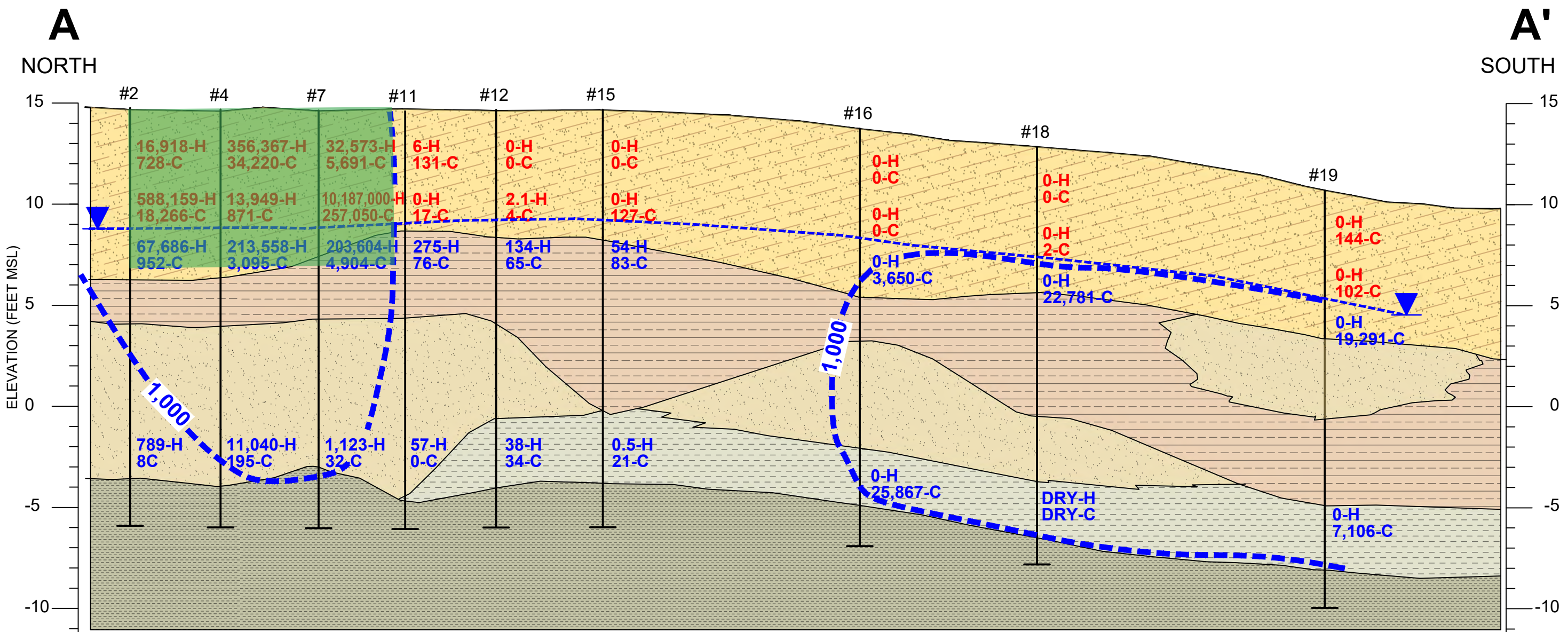
--- 1,000 Isoconcentration Contour (µg/kg)

µg/kg Micrograms per Kilogram

**A** — **A'** Cross-Section Location

- Excavation to 8 ft bgs
- Excavation to 6 ft bgs

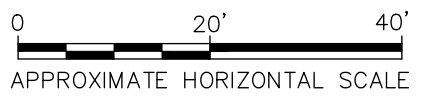
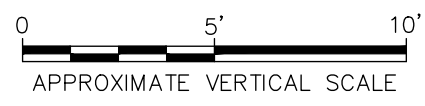
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**LEGEND:**

- MW-15 WELL/BORING ID
- APPROXIMATE GROUND SURFACE
- LITHOLOGIC CONTACT
- WATER LEVEL
- WELL SCREEN
- WELL/BORING BOTTOM
- SILTY SANDS
- SILTY CLAYS/SANDS
- SC STIFF GREEN CLAYS
- STIFF GREEN CLAYS
- TIGHT FINE GRAINED SANDS
- PROPOSED EXCAVATION EXTENT

- SOIL CONCENTRATION (µg/kg)
- 6 H (Hydrocarbons)
- 131 C (Chlorinated)
- GROUNDWATER CONCENTRATION (µg/L)
- 54 H (Hydrocarbons)
- 83 C (Chlorinated)
- 20 --- ISOCONCENTRATION CONTOUR (µg/L)



BRENNTAG SOUTHEAST  
CHARLESTON, SOUTH CAROLINA  
**REMEDIAL ACTION WORK PLAN, AREA #2**

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**PROPOSED EXCAVATION CROSS SECTION**

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FIGURE  
**12**



# APPENDIX A

## Historical Area #2 Analytical Results



Appendix A Historical Area #2 Analytical Results  
 Brenntag Southeast, Charleston, South Carolina  
 (revised 07/27/2021)

Sample ID	Depth (ft bls)	AC	Ben	CB	CH	C <sub>2</sub> Dis	Cyhex	1,1-DCA	1,1-DCE	Cis-1,2-DCE	trans-1,2-DCE	m-DCB	o-DCB	p-DCB	EB	IPB	MCH	MEK	1,1,1-TCA	1,2,4-TB	Toluene	PCE	TCE	VC	Xylene	Total	
A#2-1	Soils (ug/kg)																										
	3	312	40.5	116	<1.6	2.3	12.8	1.8 J	<0.80	3.5 J	<0.80	4.7	24.8	57.5	1490	17.1	<1.6	<5.8	<0.80	<0.80	90.8	<1.0	<0.80	2.5 J	4580	6,789	
A#2-1	5	71.7 J	15.7	33.6	<1.4	<0.71	4.6	<1.3	<0.71	3.8	<0.71	2.3 J	19.1	13.8	1050	5.1	<1.4	7.4 J	<0.71	<0.71	123	<0.91	<0.71	0.79 J	4160	5,513	
	Groundwater (ug/L)																										
A#2-1	7-9	<50	14.9	45.2	<3.3	<2.7	<2	<1.7	<1.6	20.1	<1.1	<1.1	3.6 J	4.4 J	230	8	<2.5	<10	<1.2	<2.5	25.7	<1.1	<1.7	2.7 J	827	1181.6	
	17-20	<10	26.8	6.3	<0.67	<0.53	1.1	<0.34	<0.32	0.67 J	0.39 J	<0.22	0.74 J	<0.26	0.89 J	1.5	<0.50	<2.0	<0.25	<0.50	0.45 J	<0.22	<0.35	0.59 J	2.7 J	41.2	
A#2-2	Soils (ug/kg)																										
	3	231	87.7	<0.66	<1.3	2.5 J	16.3	1.8 J	<0.66	4.9	<0.66	12.4	333	38.1	3450	55.1	<1.3	31.4	<0.66	<0.66	2080	<0.85	<0.66	1.9 J	11300	17,655	
A#2-2	5	<4700	344	<47	<94	<47	302	<83	<47	<65	<47	924	11300	2570	78700	3170	<94	<340	<47	215 J	25900	<60	<47	<47	483000	606,727	
	Groundwater (ug/L)																										
A#2-2	7-9	<2000	96.2 J	<40	<130	<110	<78	<68	<64	<55	<44	<43	615	139 J	9960	198 J	<100	<400	<50	<100	4830	<43	<69	<82	52800	68,638.20	
	17-19	<25	16.7	<0.50	<1.7	<1.3	<0.98	<0.85	<0.81	1.8 J	<0.55	<0.54	5.3	<0.64	115	1.3 J	<1.3	<5.0	<0.62	<1.3	76.6	<0.54	<0.86	<1.0	581	797.7	
A#2-3	Soil (ug/kg)																										
	3	<4600	259	71.2 J	<92	<46	<58	<82	<46	817	<46	<46	493	119 J	2920	68.9 J	<78	2670	<46	<46	17800	<59	<46	<46	21600	46,818	
A#2-3	5	<97000	27400	<970	<1900	<970	20800	<1700	<970	46700	<970	11600	146000	30900	2270000	90600	17900	10800	3010 J	<970	6270000	<1200	31300	<970	20700000	29,734,910	
	Groundwater (ug/L)																										
A#2-3	7-10	<5000	260 J	1000	<330	<270	<200	<170	<160	398 J	<110	<110	<160	<130	4940	137 J	<220	<1000	<120	<250	25300	<110	269 J	<200	39200	71,504	
	17-20	<100	18.5	9.3 J	<6.7	<5.3	<3.9	<3.4	<3.2	50.2	<2.2	<2.2	5.6 J	<2.6	91.6	<2.2	<4.4	<20	<2.5	<5.0	479	<2.2	7.2 J	10.4	916	1,588	
A#2-4	Soil (ug/kg)																										
	3	<5100	321	<51	<100	<51	166	<90	<51	624	<51	1550	19700	4060	42700	1080	<100	7040	<51	346	71000	<65	<51	<51	242000	390,798	
A#2-4	5	<5500	74.9	643	<110	<55	<69	<98	<55	<76	<55	<55	82.1 J	<64	1670	146 J	<610	<400	<55	<55	704	<71	<55	<55	11500	14,820	
	Groundwater (ug/L)																										
A#2-4	7-10	<5000	558	<100	<330	<270	<200	<170	<160	2140	<110	<110	765	<130	11200	<110	<1000	<110	<120	<250	84800	<110	190 J	<200	117000	216,653	
	17-20	<500	20.6 J	<10	<33	<27	<20	<17	<16	80.2	<11	<11	48 J	<13	679	<11	<100	<11	<12	<25	3540	<11	17.2 J	<20	6800	11,185	
A#2-5	Soil (ug/kg)																										
	3	<81000	<980	<810	<1600	<810	<1000	<1400	<810	<1100	<810	3150 J	38800	8490	95800	2740 J	<1400	<5900	<810	<810	151000	<1000	<810	<810	962000	1,261,980	
A#2-5	5	<230000	8510 J	<2300	<4500	<2300	10800 J	<4000	<2300	17700	<2300	16300	207000	43400	4080000	53200	14300	<16000	<2300	<2300	6790000	<2900	5730 J	<2300	20900000	32,146,940	
	Groundwater (ug/L)																										
A#2-5	7-10	<2000	120 J	<40	<130	<110	<78	<68	<64	419	<44	<43	156 J	<51	2660	<44	<87	<400	<50	<100	16400	<43	97.4 J	<82	25400	45,252	
	16-20	<200	<6.2	<4	<13	<11	<7.8	<6.8	<6.4	19.7 J	<4.4	<4.3	22.7	<5.1	267	<4.4	<8.7	<40	<5	<10	820	<4.3	<6.9	<8.2	2760	3,889	
A#2-6	Soil (ug/kg)																										
	3	<4200	361	341	<84	<42	<52	<74	<42	3990	<42	73.7 J	938	230	3340	79.9 J	<71	2290	<42	<42	25200	<54	<42	133 J	28700	66,145	
A#2-6	5	<490000	11900 J	20400 J	<9800	<4900	8660 J	<8700	<4900	93500	<4900	9070 J	129000	25500 J	859000	30900	12900 J	<36000	8180 J	<4900	4230000	<6300	88100	<4900	8510000	14,071,510	
	Groundwater (ug/L)																										
A#2-6	7-10	<10000	537 J	<200	<670	<530	<390	<340	<320	7750	<220	<220	596 J	<260	10400	<220	<440	<2000	388 J	<500	134000	<220	1750	<410	105000	260,421	
	17-20	<200	32.9	9.3 J	<13	<11	<7.8	<6.8	<6.4	67	<4.4	<4.3	<6.5	<5.1	142	<4.4	<8.7	<40	<5.0	<10	1180	<4.3	12.2 J	10.9 J	1260	2,714	
A#2-7	Soil (ug/kg)																										
	3	<5100	63.4 J	357	<100	<51	<63	<89	<51	1070	<51	111 J	1360	323	2380	60 J	<86	2410	<51	<51	7530	<65	<51	<51	22600	38,264	
A#2-7	5	<460000	<5600	32200	<9200	<4600	<5800	<8200	<4600	57200	<4600	7950 J	112000	21000 J	697000	26700	<7900	<34000	<4600	<4600	1540000	<5900	<4600	<4600	7950000	10,453,750	
	Groundwater (ug/L)																										
A#2-7	7-10	<2000	256	<40	<670	<110	<78	<68	<64	3320	<44	<43	486	<51	11000	148 J	<87	<400	108 J	<100	63200	<43	990	<82	129000	208,508	
	17-20	<50	23.4	5.5	<3.3	<2.7	<2.0	<1.7	<1.6	16	<1.1	<1.1	5.8	<1.3	71.4	1.3 J	<2.2	<10	<1.2	<2.5	227	<1.1	1.8 J	3 J	800	1,155	

Appendix A Historical Area #2 Analytical Results  
 Brenntag Southeast, Charleston, South Carolina  
 (revised 07/27/2021)

Sample ID	Depth (ft bls)	AC	Ben	CB	CH	C <sub>2</sub> Dis	Cyhex	1,1-DCA	1,1-DCE	Cis-1,2-DCE	trans-1,2-DCE	m-DCB	o-DCB	p-DCB	EB	IPB	MCH	MEK	1,1,1-TCA	1,2,4-TB	Toluene	PCE	TCE	VC	Xylene	Total	
A#2-8	Soil (ug/kg)																										
	3	6750 J	46.2 J	<37	<75	<37	<47	<66	<37	220	<37	<37	556	84.7 J	3230	84.7 J	<410	6400	<37	<37	11200	<48	<37	<37	36400	65,464	
	5	<91000	4000 J	<910	<1800	<910	<1100 J	<1600	<910	10300	<910	3710 J	50300	10100	1260000	28600	9440	7390 J	938 J	<910	2200000	<1200	1670 J	<910	10400000	13,990,258	
A#2-8	Groundwater (ug/L)																										
	7-10	<2000	122 J	<40	<130	<110	<78	<68	<64	264	<44	<43	457	<51	8770	101 J	<87	<400	<50	<100	28200	<43	<69	<82	91200	129,114	
	17-20	<200	<6.2	<4	<13	<11	<7.8	<6.8	<6.4	15.9 J	<4.4	<4.3	<6.5	<5.1	312	<4.4	<8.7	<40	<5	<10	1320	<4.3	<6.9	<8.2	3110	4,758	
A#2-9	Soil (ug/kg)																										
	3	<4600	96.3 J	777	<92	55.5 J	57.6 J	<81	<46	360	<46	232	803	920	14100	268	179 J	<330	<46	<46	18500	<59	<46	<46	1660000	1,696,348	
	6	<440000	<5400	<4400	<8900	<4400	<5500	<7900	<4400	<6100	<4400	4720 J	63800	13000 J	523000	15400 J	<7500	<32000	<4400	<4400	734000	<5700	7590 J	<4400	7040000	8,401,510	
A#2-9	Groundwater (ug/L)																										
	7-10	<2000	<62	<40	<130	<110	<78	<68	<64	186 J	<44	<43	774	<51	10700	93.8 J	<87	<400	50.4 J	<100	18500	<43	274	<82	100000	130,578	
	17-20	<100	<3.1	<2	<6.7	<5.3	<3.9	<3.4	<3.2	<2.8	<2.2	<2.2	9.2 J	<2.6	122	<2.2	<4.4	<20	<2.5	<5	278	<2.2	<3.5	<4.1	1470	1,879	
A#2-10	Soil (ug/kg)																										
	3	<4400	<54	1160	<89	<44	<55	<79	<44	<61	<44	286	1520	1080	16000	775	237	<320	<44	93.2 J	6850	<57	<44	<44	60500	88,501	
	6	<4200	<51	155 J	<83	<42	<52	<73	<42	<57	<42	<42	<42	53.8 J	1870	136 J	95 J	<300	<42	<42	1560	<53	<42	<42	5540	9,410	
A#2-10	Groundwater (ug/L)																										
	7-10	<20	18.8	23	<1.3	<1.1	3.6	<0.68	<0.64	6.2	<0.44	0.59 J	2.7	2.2	69.3	50.3	21	<4	<0.50	<1	13.8	<0.43	<0.69	<0.82	205	416.5	
	17-20	<10	1.3	<0.20	<0.67	<0.53	<0.39	<0.34	<0.32	0.40 J	<0.22	<0.22	<0.32	<0.26	4.7	0.31 J	<0.44	<2	<0.25	<0.50	3.7	<0.22	<0.35	<0.41	28.9	39.3	
A#2-11	Soil (ug/kg)																										
	3	75 J	1.3 J	28.8	1.5	1.2 J	1.9 J	<1.3	<0.73	1.2 J	<0.73	1.1 J	2.5 J	3.4 J	1.7 J	<0.73	4	8.1 J	<0.73	<0.73	<7.3	<0.94	<0.73	2.4 J	2.7 J	135.3	
	5	<76	<0.93	16.7	<1.5	<0.76	<0.95	<1.3	<0.76	<1.1	<0.76	<0.76	<0.76	<0.88	<0.76	<0.76	<1.3	<5.5	<0.76	<0.76	<7.6	<0.97	<0.76	<0.76	<1.6	16.7	
A#2-11	Groundwater (ug/L)																										
	7-10	<20	7.9	19.9	<1.3	<1.1	<0.78	<0.68	<0.64	45	<0.44	<0.43	1.8 J	1.2 J	77.1	12.1	3.1	<4.0	<0.50	<1.0	16.3	<0.43	<0.69	4.8	162	351.2	
	17-20	<20	6.2	<0.40	<1.3	<1.1	<0.78	<0.68	<0.64	<0.55	<0.44	<0.43	<0.65	<0.51	4.7	0.75 J	<0.87	<4.0	<0.50	<1.0	4.8	<0.43	<0.69	<0.82	40.9	57.3	
A#2-12	Soil (mg/kg)																										
	3	<70	<0.85	<0.70	<1.4	<0.70	<0.87	<1.2	<0.70	<0.96	<0.96	<0.70	<0.70	<0.80	<0.70	<0.70	<1.2	<5.1	<0.70	<0.70	<7	<0.89	<0.70	<0.70	<1.5	0	
	6	<81	2.1 J	4 J	<1.6	<0.81	<1	<1.4	<0.81	<1.1	<0.81	<0.81	<0.81	<0.93	<0.81	<0.81	<1.4	<5.9	<0.81	<0.81	<8.1	<1	<0.81	<0.81	<1.7	6.1	
A#2-12	Groundwater (ug/L)																										
	7-10	<20	2.3	<0.40	<1.3	<1.1	<0.78	<0.68	<0.64	62.1	<0.44	<0.43	0.79 J	<0.51	36.4	5.3	1.6 J	<4.0	<0.50	<1.0	3.8	<0.43	<0.69	6.5	86.3	205	
	17-20	27.1	<0.62	<0.40	<1.3	<1.1	<0.78	<0.68	<0.64	6.5	<0.44	<0.43	<0.65	<0.51	5.5	<0.44	<0.87	<4.0	<0.50	<1.0	3.3	<0.43	<0.69	<0.82	28.8	71	
A#2-13	Soil (ug/kg)																										
	3	293	<0.96	3.8 J	<1.6	7	<0.98	<1.4	<0.79	<1.1	<0.79	<0.79	4.6	4.5	47.8	9	2.9 J	32	<0.79	<0.79	28.2	<1	<0.79	<0.79	106	540	
	6	179	18.5	31.7	<1.6	2.7 J	5.2	<1.4	<0.78	<1.1	<0.78	1.8 J	2.6 J	8.1	86	59.5	54.3	22.2	<0.78	<0.78	44.7	<1	<0.78	<0.78	144	651.3	
A#2-13	Groundwater (ug/L)																										
	7-10	<50	3.8 J	<1.0	<3.3	<2.7	<2.0	<1.7	<1.6	9.8	<1.1	<1.1	<1.6	<1.3	259	17.6	3.2 J	<10	<1.2	<2.5	10.1	<1.1	<1.7	<2.0	314	617.5	
	17-20	<10	<0.31	<0.20	<0.67	<0.53	<0.39	<0.34	<0.32	1.3	<0.22	<0.22	<0.32	<0.26	3.1	0.36 J	<0.44	<2.0	<0.25	<0.50	<0.30	<0.22	<0.35	<0.41	4.7	9.5	
A#2-14	Soil (ug/kg)																										
	3	<5200	<63	<52	<100	<52	<65	<91	<52	<71	<52	<52	<52	<59	3200	332	219 J	<380	<52	<52	<520	<66	<52	<52	2050	5,801	
	6	<72	8.5	<0.72	<1.4	0.89 J	4	<1.3	<0.72	<1.0	<0.72	<0.72	2.1 J	<0.83	8.9	134	90.8	<5.2	<0.72	<0.72	<7.2	<0.92	<0.72	<0.72	4.3 J	253.5	
A#2-14	Groundwater (ug/L)																										
	7-10	<20	3.2	<0.40	<1.3	<1.1	<0.78	<0.68	<0.64	2.6	<0.44	<0.43	<0.65	<0.51	100	17.2	2.2	<4.0	<0.50	<1.0	<0.60	<0.43	<0.69	<0.82	112	237	
	17-20	14 J	<0.31	<0.20	<0.67	0.77 J	<0.39	<0.34	<0.32	0.44 J	<0.22	<0.22	<0.32	<0.26	1.1	<0.22	<0.44	<2.0	<0.25	<0.50	0.61 J	<0.22	<0.35	<0.41	<0.72	17	



Appendix A Historical Area #2 Analytical Results  
 Brenntag Southeast, Charleston, South Carolina  
 (revised 07/27/2021)

Sample ID	Depth (ft bls)	AC	Ben	CB	CH	C <sub>2</sub> Dis	Cyhex	1,1-DCA	1,1-DCE	Cis-1,2-DCE	trans-1,2-DCE	m-DCB	o-DCB	p-DCB	EB	IPB	MCH	MEK	1,1,1-TCA	1,2,4-TB	Toluene	PCE	TCE	VC	Xylene	Total	
A#2-23	Soil (ug/kg)																										
	3	<82	<1	<0.82	<1.6	<0.82	<1	<1.5	<0.82	<1.1	<0.82	<0.82	<0.82	<0.94	<0.82	<0.82	<1.4	<6	<0.82	<0.82	<8.2	<1	2.1 J	<0.82	<1.7	2.1	
	5	<72	<0.88	<0.72	<1.4	0.89 J	<0.90	<1.3	<0.72	<1	<0.72	<0.72	<0.72	<0.83	<0.72	<0.72	<1.2	<5.2	<0.72	<0.72	<7.2	<0.92	0.94 J	<0.72	<1.5	1.8	
A#2-23	Groundwater (ug/L)																										
	7-10	<25	<0.78	<0.50	<1.7	<1.3	<0.98	<0.85	<0.81	<0.69	<0.55	<0.54	<0.81	<0.64	<0.89	<0.55	<1.1	<5.0	<0.62	<1.3	<0.75	<0.54	74.2	<1.0	<1.8	74.2	
	17-20	<10	<0.31	<0.20	<0.67	<0.53	<0.39	<0.34	<0.32	<0.28	<0.22	<0.22	<0.22	<0.26	<0.36	<0.22	<0.44	<2.0	<0.25	<0.50	<0.30	<0.22	12.4	<0.41	<0.72	12.4	
A#2-24	Soil (ug/kg)																										
	3	<79	<0.96	<0.79	<1.6	<0.79	<0.99	<1.4	<0.79	<1.1	<0.79	<0.79	<0.79	<0.91	<0.79	<0.79	<1.3	<5.7	<0.79	<0.79	<7.9	<1	9.5	1.2 J	<1.7	10.7	
	6	<70	<0.85	<0.70	<1.4	2.8 J	<0.87	<1.2	2.6 J	2090	12.2	<0.70	<0.70	<0.80	<0.70	<0.70	<1.2	6.5 J	<0.70	<0.70	<7	<0.89	4.7	165 J	<1.5	2,284	
A#2-24	Groundwater (ug/L)																										
	7-10	<25	<0.78	<0.50	<1.7	<1.3	<0.98	<0.85	<0.81	191	1.4 J	<0.54	<0.81	<0.64	<0.89	<0.55	<1.1	<5.0	<0.62	<1.3	<0.75	<0.54	1.8 J	12.9	<1.8	207	
	17-20	<5000	<160	<100	<330	<270	<200	<170	345 J	2810	<110	<110	<160	<130	<180	<110	<220	<1000	<120	<250	<150	331 J	316000	<200	<360	319,486	
A#2-25	Soil (ug/kg)																										
	3	183	<0.80	<0.66	<1.3	1.2 J	<0.82	<1.2	<0.66	3.2 J	1.3 J	<0.66	<0.66	<0.75	1.9 J	1.6 J	<1.1	32.8	<0.66	<0.66	<6.6	<0.84	59	5.3	4.7 J	294	
	5	122	<0.99	<0.81	<1.6	3 J	<1	<1.4	<0.81	3.4 J	1.1 J	<0.81	<0.81	<0.93	<0.81	<0.81	<1.4	21	<0.81	<0.81	<8.1	<1	1230	4.2	1.9 J	1,287	
A#2-25	Groundwater (ug/L)																										
	7-10	<50	<1.6	<1.0	<3.3	<2.7	<2.0	<1.7	<1.6	442	7	<1.1	1.6	<1.3	<1.8	<1.1	<2.2	<10	<1.2	<2.5	<1.5	<1.1	<1.7	20.9	<3.6	470	
	17-20	<10000	<310	<200	<670	<530	<390	<340	460 J	17400	1070	<220	<320	<260	<360	<220	<440	<2000	<250	<500	<300	<220	313000	<410	<720	331,930	
A#2-26	Soil (ug/kg)																										
	3	<18000	<220	<180	<370	<180	<230	<320	<180	<250	<180	<180	390 J	<210	2970	<180	<310	<1300	<180	<180	<1800	<230	<180	<180	13600	16,960	
	6	<90000	1590 J	<900	<1800	<900	2190 J	<1600	<900	<1200	<900	5680	73900	15000	1020000	24900	2700 J	<6600	<900	<900	503000	<1200	1390 J	<900	5440000	7,090,350	
A#2-26	Groundwater (ug/L)																										
	7-10	<2000	<62	<40	<130	<110	<78	<68	<64	<55	<44	<43	611	167 J	9090	121 J	<87	<400	<50	<100	3220	<43	<69	<82	51400	64,609	
	17-20	<10	1.1	<0.20	<0.67	1 J	<0.39	<0.34	<0.32	8.6	<0.22	<0.22	1.8	<0.26	46.1	0.48 J	<0.44	<2.0	<0.25	<0.50	40.7	<0.22	<0.35	<0.41	235	335	

Ac=Acetone  
 Ben=Benzene  
 C<sub>2</sub>Dis=Carbon Disulfide  
 CB=Chlorobenzene  
 CH=Chloroethane  
 Cyhex=Cyclohexane  
 1,1-DCA=1,1-Dichloroethane  
 1,1-DCE=1,1-Dichloroethene  
 Cis-1,2-DCE=Cis-1,2-Dichloroethene  
 Trans-1,2-DCE=1,2-Dichloroethene  
 m-DCB=M-Dichlorobenzene  
 o-DCB=O-Dichlorobenzene  
 p-DCB=p-Dichlorobenzene  
 EB=Ethylbenzene  
 IPB=Isopropylbenzene  
 MCH=Methylcyclohexane  
 MEK=Methyl ethyl ketone  
 1,1,1-TCA=1,1,1-Trichloroethane  
 1,2,4-TB=1,2,4-Trichlorobenzene  
 PCE=Tetrachloroethylene  
 TCE=Trichloroethylene  
 VC=Vinyl Chloride  
 ft bls=feet below land surface  
 ug/kg=micrograms per kilograms  
 ug/L=micrograms per liter

Appendix A Historical Area #2 Analytical Results  
Brenntag Southeast, Charleston, South Carolina

Well Number	Date Sampled	1,1-DCE ug/L	c-1,2-DCE ug/L	t-1,2-DCE ug/L	1,2-DCA ug/L	1,1-DCA ug/L	TCE ug/L	PCE ug/L	CB ug/L	CH ug/L	1,2-DB ug/L	1,3-DB ug/L	1,4-DB ug/L	VC ug/L	Others mg/L
MW-14	10/13/03	<100	840.0	<100	<100	<100	730.0	<100	<100	<100	NA	NA	NA	<0.100	TCA (130), T (19000), EB (1900), X (21000)
	12/11/03	97.0	2900.0	27.0	150.0	200.0	1800.0	<5	<5	15.0	NA	NA	NA	0.1	MEK (6700), 4-m-2-p (2200), Ace (3100), EB (4400), X (4000), MC (200), T (65000)
	2/27/04	<20	4800.0	<20	160.0	150.0	6100.0	20.0	110.0	<50	450.0	<100	<100	0.1	Ac(2200), B(630), 2-But(9100), EB(6100) MC(95), 4-M-2-Pent(1700), T(96000) 1,1,1-T(780), 1,2,4-TMB(130) X(57000)
	8/26/04	<2	5.0	<2	<2	<2	<2	<2	<10	<5	<10	<10	<10	<2	EB(4), T(70), X(42)
	4/13/05	<1000	3400.0	<1000	<1000	<1000	1100.0	<1000	<1000	<1000	<1000	<1000	<1000	<1000	EB(5700), T(60000), X(54000)
	9/6/05	<500	3500.0	<500	<500	<500	1500.0	<500	<500	<500	<500	<500	<500	<500	EB(6800), T(71000), X(67000)
	2/2/06	<1000	2600.0	<1000	<1000	<1000	2100.0	<1000	<1000	<1000	<1000	<1000	<1000	<1000	EB(9100), T(90000)
	3/30/06	<2500	3800.0	<2500	<2500	<2500	<2500	<2500	<2500	<2500	<2500	<2500	<2500	<2500	B(610), EB(9500), T(81000), X(84000)
	10/4/06	<1000	6200.0	<1000	<1000	<1000	3100.0	<1000	<1000	<1000	<1000	<1000	<1000	<1000	EB(6700), T(90000), X(66000)
	1/23/07	90.0	9100.0	35.0	<1000	<1000	2400.0	<1000	110.0	12.0	<1000	23.0	65.0	<1000	EB(9000), T(96000), X(91000), CHL (1.4), IPB (55), MC
	8/1/07	<250	0.3	<250	<250	<250	350.0	<250	<250	<250	1200.0	76.0	220.0	<250	EB(4000), T(17000), X(36000)
	3/24/08	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	8/27/08	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	3/30/09	46.0	8240.0	19.0	<1	188.0	1560.0	<1	128.0	10.0	328.0	19.0	54.0	878.0	Ac(1.760), B(532), 2-But(5350), T-BB(1.3), S-BB(3.1), CS2(1.6), CHL(1.3), EB(6160), IPB(55.6), P-IP(22.1), MC(39.3), 4-M-2-Pent(2420), N(16.7), N-PB(30.9), T(86800), 1,1,1-TCA(514), 1,1,2-T(10), X(75600), 1,2-DCE(8860), 1,3,5-TMB(53), 1,2,4-TMB(122)
	11/5/09	63.0	J 8290.0	<100	142.0	198.0	650.0	<1	<100	<200	190.0	<100	37.0	J 414.0	Ac(1370 J), B(784), 2-But.(2270), EB(5580), IPB(59.6 J),
	4/30/10	<1000	14700.0	<1000	<1000	<1000	1670.0	<1000	<1000	<2000	542.0	J <1000	<1000	<1000	B(943 J), CHL(462 J), EB(8540), 4-M-2-Pent(2480 J),
	12/22/10	<2000	9000.0	<2000	<2000	<2000	1470.0	<2000	<2000	<4000	<2000	<2000	<2000	522.0	J B(630J), EB(5820), MEK(7220J), 1,1,1-TCA(570J),
	5/4/11	<2000	10600.0	<2000	<2000	<2000	1600.0	<2000	<2000	<4000	<2000	<2000	<2000	753.0	J B(747J), CS-(2220J), EB(6280) 1,1,1-TCA(753J), T(101,000), X(56400)
	12/28/11	<1000	8830.0	<1000	<1000	<1000	1240.0	<1000	<1000	<2000	<1000	<1000	<1000	697.0	J B(639J), EB(5420), MCH(2850J) MEK(5290), T(126,000), X(51100)
	5/18/12	<2000	10300.0	<2000	<2000	<2000	1870.0	<2000	<2000	<4000	<2000	<2000	<2000	<2000	B(827J), EB(5920), MEK(8630) T(113000), X(52900)
10/26/12	<500	9890.0	<500	145.0	J 202.0	J 810.0	<500	<500	<1000	121.0	J <500	<500	590.0	B(805), EB(4570), MCH(2520), 1,1,1-TCA(582)	
5/24/13	<2000	11000.0	<2000	<2000	<2000	1980.0	<2000	<2000	<4000	494.0	J <2000	<2000	<2000	B(812), EB(8300), 1,1,1-TCA(745), T(119000) X(77600)	
12/12/13	<2000	7540.0	<2000	<2000	<2000	889.0	J <2000	<2000	<4000	689.0	J <2000	<2000	<2000	B(641 J), EB(8620), T(135,000), X(86600)	
6/30/14	<2000	11500.0	<2000	<2000	<2000	1260.0	J <2000	<2000	<4000	770.0	J <2000	<2000	<2000	B(866J), EB(8980), 1,1,1-TCA(904J), T(124000), X(84100)	
12/22/14	<1000	10800.0	<1000	<1000	<1000	551.0	J <1000	<1000	<2000	927.0	J <1000	<1000	421.0	J B(863 J), EB(9650), 1,1,1-TCA(578 J), T(80100), X(80300)	
6/10/15	<1000	10800.0	<1000	<1000	233.0	J 266.0	J <1000	<1000	<2000	725.0	J <1000	<1000	547.0	J B(745), EB(8020), MC(3450J), 4-M-2-Pent(1670J) T(116000), 1,1,1-TCA(399J), X(76700)	
12/8/15	56.0	J 10600.0	<1000	143.0	243.0	539.0	<1000	<1000	<2000	1170.0	62.0	204.0	564.0	B(770), 2-But(1270), EB(9760), IPB(77.8 J) MC(294JB), 4-M-2-Pent(1380), Sy(176), 1,1,1-TCA(421), T(114000), X(86900)	
6/28/16	<1000	12600.0	<1000	<1000	<1000	444.0	J <1000	217.0	<2000	1000.0	<1000	<1000	672.0	J B(877J), EB(9630), 4-M-2-Pent(2000J) T(125000*), 1,1,1-TCA(436J), X(86100)	
12/14/16	<2000	9650.0	<2000	<2000	<2000	634.0	J <2000	<2000	<4000	1510.0	<2000	<2000	<2000	B(940J), EB(10400), T(103000), 1,1,1-TCA(426J) X(82400)	
6/5/17	<2000	7540.0	<2000	<2000	<2000	<2000	<2000	<2000	<4000	<2000	<2000	<2000	<2000	B(648J), EB(7110), T(101000), X (67600)	
12/26/17	<2000	9310.0	<2000	<2000	<2000	<2000	<2000	<2000	<4000	<2000	<2000	<2000	<2000	B(700), EB(8640), T(110000), X(80100)	
6/4/18	<2000	7450.0	<2000	<2000	<2000	<2000	<2000	<2000	<4000	<2000	<2000	<2000	<2000	CHL(1360J), EB(8840), T(102), X(84700)	
12/21/18	<500	3060.0	<500	<500	<500	221.0	J <500	<500	<500	613.0	<500	<500	<500	B(274), EB(7100), T(60100), 1,1,1-TCA(176) X(71400)	
6/12/19	<1000	5420.0	<1000	<1000	<1000	843.0	J <1000	<1000	<2000	525.0	J <1000	<1000	<1000	B(416J), EB(6890), T(68700), 1,1,1-TCA(312J), X(71400)	
12/20/19	<500	3820.0	<500	<500	<500	230.0	J <500	<500	<1000	379.0	J <500	<500	<500	B(299J), EB(4,480), T(45,300), 1,1,1-TCA(156J), X(49,400)	
6/4/20	<500	4950.0	<500	<500	<500	211.0	J <500	<500	<1000	570.0	<500	<500	<500	B(344J), MEK(1160), EB(4660), T(45200), 1,1,1,-TCA(188J), X (58200)	

**Appendix A Historical Area #2 Analytical Results  
Brenntag Southeast, Charleston, South Carolina**

Well Number	Date Sampled	1,1-DCE ug/L	c-1,2-DCE ug/L	t-1,2-DCE ug/L	1,2-DCA ug/L	1,1-DCA ug/L	TCE ug/L	PCE ug/L	CB ug/L	CH ug/L	1,2-DB ug/L	1,3-DB ug/L	1,4-DB ug/L	VC ug/L	Others mg/L
MW-14 (cont'd)	9/15/20	<500	1680.0	<500	<500	<500	345.0	J <500	<500	<1000	483.0	J <500	<500	<500	EB(2,220), T(25,000), X(20,000)
	9/17/20	<500	1110.0	<500	<500	<500	363.0	J <500	<500	<1000	485.0	J <500	<500	<500	EB(2780), T(25,600), X(25,300)
	9/23/20	<500	2380.0	<500	<500	<500	589.0	<500	<500	<1000	398.0	J <500	<500	<500	B(264), EB(4,110), T(43,900), X(38,800)
	12/16/20	<500	4820.0	<500	<500	<500	<500	<500	<500	<1000	568.0	<500	<500	<500	B(490J), EB(6270), T(61800), X(58500), 1,1,1-TCA(226J), MIBK(573J), MEK(1010J)
	6/7/21	<1000	4570.0	<1000	<1000	<1000	<1000	<1000	<1000	<2000	465.0	J <1000	<1000	<1000	B(523),2-But(2340), EB(7230),

**LIST OF ABBREVIATIONS**

Acetone	Ac	1,2-Dichloroethane	1,2-DCA	trans-1,2-Dichloroethene	t-1,2-DCE
Benzene	B	Ethylbenzene	EB	1,2,4-Trimethylbenzene	1,2,4-TMB
Bromobenzene	BB	Hydrocarbons (Mineral Spirits)	H-MIN	1,3,5-Trimethylbenzene	1,3,5-TMB
2-Butanone	2-But.	Isopropylbenzene	IPB	Toluene	T
Chlorobenzene	CB	Methyl Chloride	MC	Styrene	Sy
Chloroethane	CH	Methyl Bromide	MB	Vinyl Chloride	VC
Carbon Disulfide	CS <sub>2</sub>	Methyl ethyl ketone	MEK	Xylenes	X
Chloroform	CHL	4-Methyl-2-Pentanone	4-M-2-Pent	Methyl Tert Butyl Ether	MTBE
Chloromethane	CM	Methylcyclohexane	MCH	4-Methyl-2-pentanone	MIBK
cis-1,2-Dichloroethene	c-1,2-DCE	milligrams/Liter	mg/L	Not Sampled	NS
Cyclohexane	CHX	Naphthalene	N	Estimated value (result is between R Limit and Method Detection Limit)	J
1,2-Dichlorobenzene (O-DB)	1,2-DB	N-Propylbenzene	N-PB	Result is from Run# 2	a
1,3-Dichlorobenzene M-DB)	1,3-DB	P-CY	p-Cymene	Analyte found in associated method	u
1,4-Dichlorobenzene (P-DB)	1,4-DB	P-Isopropyltoluene	P-IP		
1,1-Dichloroethene	1,1-DCE	sec-Butylbenzene	S-BB		
1,2,4-Trichlorobenzene	1,2,4-B	tert-Butylbenzene	T-BB		
2-Chlorotoluene	2-CHT	Tetrachloroethene	PCE		
4-Chlorotoluene	4-CHT	Trichloroethene	TCE		
1,1-Dichloroethane	1,1-DCA	1,1,1-Trichloroethene	1,1,1-TCE		
		1,1,1-Trichloroethane	1,1,1-TCA		

# APPENDIX B

Laboratory Analytical Reports





The results set forth herein are provided by SGS North America Inc.

*e-Hardcopy 2.0*  
*Automated Report*

## Technical Report for

**ARCADIS Geraghty & Miller**

**Brenntag; Charleston, SC**

**SC000204.0011.00001**

**SGS Job Number: FA87744**

**Sampling Date: 07/30/21**



### Report to:

**ARCADIS Geraghty & Miller**  
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**ATTN: Charles Lawson**

**Total number of pages in report: 16**



Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

**Norm Farmer**  
**Technical Director**

**Client Service contact: Evita Martinez 407-425-6700**

Certifications: FL(E83510), LA(03051), KS(E-10327), NC(573), NJ(FL002), NY(12022), SC(96038001)  
DoD ELAP(ANAB L2229), AZ(AZ0806), CA(2937), TX(T104704404), PA(68-03573), VA(460177),  
AL, AK, AR, CT, IA, KY, MA, MI, MS, ND, NH, NV, OK, OR, UT, VT, WA, WV

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Test results relate only to samples analyzed.

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## Sample Summary

ARCADIS Geraghty & Miller

**Job No:** FA87744

Brenntag; Charleston, SC

Project No: SC000204.0011.00001

Sample Number	Collected Date	Time By	Received	Matrix Code	Type	Client Sample ID
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This report contains results reported as ND = Not detected. The following applies:  
 Organics ND = Not detected above the MDL

FA87744-1	07/30/21	17:00	CL	08/03/21	SO	Soil	A2-5 (5-6')
FA87744-2	07/30/21	17:10	CL	08/03/21	SO	Soil	A2-5 (7-8')
FA87744-3	07/30/21	17:20	CL	08/03/21	SO	Soil	A2-7 (5-6')

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Soil samples reported on a dry weight basis unless otherwise indicated on result page.

## Summary of Hits

**Job Number:** FA87744  
**Account:** ARCADIS Geraghty & Miller  
**Project:** Brenntag; Charleston, SC  
**Collected:** 07/30/21

Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
<b>FA87744-1</b>	<b>A2-5 (5-6')</b>					
1,4-Dichlorobenzene		0.254	0.010	0.0026	mg/l	SW846 8260B
Trichloroethylene		0.0044 J	0.010	0.0035	mg/l	SW846 8260B
<b>FA87744-2</b>	<b>A2-5 (7-8')</b>					
Benzene		0.0297	0.010	0.0031	mg/l	SW846 8260B
1,4-Dichlorobenzene		0.171	0.010	0.0026	mg/l	SW846 8260B
Tetrachloroethylene		0.0108	0.010	0.0022	mg/l	SW846 8260B
Trichloroethylene		0.116	0.010	0.0035	mg/l	SW846 8260B
<b>FA87744-3</b>	<b>A2-7 (5-6')</b>					
1,4-Dichlorobenzene		0.0826	0.010	0.0026	mg/l	SW846 8260B
Tetrachloroethylene		0.0027 J	0.010	0.0022	mg/l	SW846 8260B

Sample Results

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Report of Analysis

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# Report of Analysis

<b>Client Sample ID:</b> A2-5 (5-6')		<b>Date Sampled:</b> 07/30/21
<b>Lab Sample ID:</b> FA87744-1		<b>Date Received:</b> 08/03/21
<b>Matrix:</b> SO - Soil		<b>Percent Solids:</b> n/a
<b>Method:</b> SW846 8260B SW846 1311		
<b>Project:</b> Brenntag; Charleston, SC		

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	I70276.D	10	08/11/21 01:50	SO	08/05/21 11:00	OP86689	VI2277
Run #2							

Run #	Purge Volume
Run #1	5.0 ml
Run #2	

**VOA TCLP List**

**TCLP Leachate method SW846 1311**

CAS No.	Compound	Result	HW#	MCL	RL	MDL	Units	Q
71-43-2	Benzene	ND	D018	0.50	0.010	0.0031	mg/l	
78-93-3	2-Butanone (MEK)	ND	D035	200	0.050	0.020	mg/l	
56-23-5	Carbon Tetrachloride	ND	D019	0.50	0.010	0.0036	mg/l	
108-90-7	Chlorobenzene	ND	D021	100	0.010	0.0020	mg/l	
67-66-3	Chloroform	ND	D022	6.0	0.010	0.0030	mg/l	
106-46-7	1,4-Dichlorobenzene	0.254	D027	7.5	0.010	0.0026	mg/l	
107-06-2	1,2-Dichloroethane	ND	D028	0.50	0.010	0.0031	mg/l	
75-35-4	1,1-Dichloroethylene	ND	D029	0.70	0.010	0.0032	mg/l	
127-18-4	Tetrachloroethylene	ND	D039	0.70	0.010	0.0022	mg/l	
79-01-6	Trichloroethylene	0.0044	D040	0.50	0.010	0.0035	mg/l	J
75-01-4	Vinyl Chloride	ND	D043	0.20	0.010	0.0041	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	97%		83-118%
17060-07-0	1,2-Dichloroethane-D4	105%		79-125%
2037-26-5	Toluene-D8	99%		85-112%
460-00-4	4-Bromofluorobenzene	93%		83-118%

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
MCL = Maximum Contamination Level (40 CFR 261 7/1/11)      B = Indicates analyte found in associated method blank  
E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

## Report of Analysis

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<b>Client Sample ID:</b> A2-5 (7-8')	<b>Date Sampled:</b> 07/30/21
<b>Lab Sample ID:</b> FA87744-2	<b>Date Received:</b> 08/03/21
<b>Matrix:</b> SO - Soil	<b>Percent Solids:</b> n/a
<b>Method:</b> SW846 8260B SW846 1311	
<b>Project:</b> Brenntag; Charleston, SC	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	I70278.D	10	08/11/21 02:38	SO	08/05/21 11:00	OP86689	VI2277
Run #2							

Run #	Purge Volume
Run #1	5.0 ml
Run #2	

**VOA TCLP List**

**TCLP Leachate method SW846 1311**

CAS No.	Compound	Result	HW#	MCL	RL	MDL	Units	Q
71-43-2	Benzene	0.0297	D018	0.50	0.010	0.0031	mg/l	
78-93-3	2-Butanone (MEK)	ND	D035	200	0.050	0.020	mg/l	
56-23-5	Carbon Tetrachloride	ND	D019	0.50	0.010	0.0036	mg/l	
108-90-7	Chlorobenzene	ND	D021	100	0.010	0.0020	mg/l	
67-66-3	Chloroform	ND	D022	6.0	0.010	0.0030	mg/l	
106-46-7	1,4-Dichlorobenzene	0.171	D027	7.5	0.010	0.0026	mg/l	
107-06-2	1,2-Dichloroethane	ND	D028	0.50	0.010	0.0031	mg/l	
75-35-4	1,1-Dichloroethylene	ND	D029	0.70	0.010	0.0032	mg/l	
127-18-4	Tetrachloroethylene	0.0108	D039	0.70	0.010	0.0022	mg/l	
79-01-6	Trichloroethylene	0.116	D040	0.50	0.010	0.0035	mg/l	
75-01-4	Vinyl Chloride	ND	D043	0.20	0.010	0.0041	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	93%		83-118%
17060-07-0	1,2-Dichloroethane-D4	103%		79-125%
2037-26-5	Toluene-D8	107%		85-112%
460-00-4	4-Bromofluorobenzene	96%		83-118%

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
 MCL = Maximum Contamination Level (40 CFR 261 7/1/11)      B = Indicates analyte found in associated method blank  
 E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

# Report of Analysis

<b>Client Sample ID:</b> A2-7 (5-6')		<b>Date Sampled:</b> 07/30/21
<b>Lab Sample ID:</b> FA87744-3		<b>Date Received:</b> 08/03/21
<b>Matrix:</b> SO - Soil		<b>Percent Solids:</b> n/a
<b>Method:</b> SW846 8260B SW846 1311		
<b>Project:</b> Brenntag; Charleston, SC		

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	I70279.D	10	08/11/21 03:01	SO	08/05/21 11:00	OP86689	VI2277
Run #2							

Run #	Purge Volume
Run #1	5.0 ml
Run #2	

**VOA TCLP List**

**TCLP Leachate method SW846 1311**

CAS No.	Compound	Result	HW#	MCL	RL	MDL	Units	Q
71-43-2	Benzene	ND	D018	0.50	0.010	0.0031	mg/l	
78-93-3	2-Butanone (MEK)	ND	D035	200	0.050	0.020	mg/l	
56-23-5	Carbon Tetrachloride	ND	D019	0.50	0.010	0.0036	mg/l	
108-90-7	Chlorobenzene	ND	D021	100	0.010	0.0020	mg/l	
67-66-3	Chloroform	ND	D022	6.0	0.010	0.0030	mg/l	
106-46-7	1,4-Dichlorobenzene	0.0826	D027	7.5	0.010	0.0026	mg/l	
107-06-2	1,2-Dichloroethane	ND	D028	0.50	0.010	0.0031	mg/l	
75-35-4	1,1-Dichloroethylene	ND	D029	0.70	0.010	0.0032	mg/l	
127-18-4	Tetrachloroethylene	0.0027	D039	0.70	0.010	0.0022	mg/l	J
79-01-6	Trichloroethylene	ND	D040	0.50	0.010	0.0035	mg/l	
75-01-4	Vinyl Chloride	ND	D043	0.20	0.010	0.0041	mg/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	93%		83-118%
17060-07-0	1,2-Dichloroethane-D4	103%		79-125%
2037-26-5	Toluene-D8	99%		85-112%
460-00-4	4-Bromofluorobenzene	95%		83-118%

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
MCL = Maximum Contamination Level (40 CFR 261 7/1/11)      B = Indicates analyte found in associated method blank  
E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound



Misc. Forms

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Custody Documents and Other Forms

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Includes the following where applicable:

- Chain of Custody

Send Results to:	Contact & Company Name: <b>CHARLES WATSON ARCADIS</b>	Telephone: <b>706-929-4421</b>	Preservative:							Preservation Key: A. H <sub>2</sub> O B. HCL C. HNO <sub>3</sub> D. NaOH E. None F. Other: _____ G. Other: _____ H. Other: _____ Matrix Key: SO - Soil W - Water T - Tissue SE - Sediment SL - Sludge A - Air NL - NAPL/Oil SW - Sample Wipe Other: _____	
	Address: <b>1480 Greene St Ste 220</b>	Fax:	# of Containers:								
	City State Zip: <b>AUGUSTA GA 30909</b>	E-mail Address: <b>Charles.Watson@arcadis.com</b>	Container Information:								
	Project Name/Location (City, State): <b>Brewster Charlotte S.C.</b>	Project #: <b>30094217 30099999</b>	<b>PARAMETER ANALYSIS &amp; METHOD</b>								
Sampler's Printed Name: <b>Charles Watson</b>	Sampler's Signature: <i>CB Jew</i>	TCLP-VOC 4 Bins							REMARKS TCLP SA mpleg		
<b>Sample ID</b>	<b>Collection</b>									<b>Type (✓)</b>	<b>Matrix</b>
Date	Time									Comp	Grab
1 <b>A2-5 (5-6')</b>	7/30/21 17:00									X	SO
2 <b>A2-5 (7-8')</b>	7/30/21 17:10	X	"								
3 <b>A2-7 (5-6')</b>	7/30/21 17:20	X	"								
BILL DIRECTLY TO BREWSTER TAG											
Special Instructions/Comments: _____ <input type="checkbox"/> Special QA/QC Instructions(✓): _____											
INITIAL ASSESSMENT LABEL VERIFICATION <i>SP</i>											

Laboratory Information and Receipt		Relinquished By		Received By		Relinquished By		Laboratory Received By	
Lab Name: <b>SGS</b>	Cooler Custody Seal (✓) <input type="checkbox"/> Intact <input type="checkbox"/> Not Intact	Printed Name: <b>Charles Watson</b>	Signature: <i>CB Jew</i>	Printed Name: <b>FX</b>	Signature: <i>FX</i>	Printed Name: <b>FX</b>	Signature: <i>FX</i>	Printed Name: <b>Peter H.</b>	Signature: <i>Peter H.</i>
Specify Turnaround Requirements:	Sample Receipt: Condition/Cooler Temp: <b>3.6-14</b>	Firm: <b>ARCADIS</b>	Date/Time: <b>9/2/2021 12:00</b>	Firm/Courier:	Date/Time:	Firm/Courier:	Date/Time:	Firm: <b>SGS</b>	Date/Time: <b>8/3/21 9:30</b>
Shipping Tracking #:									

20730826 CotC AR Form 08.27.2015      Distribution:      **WHITE - Laboratory returns with results**      **YELLOW - Lab copy**      **PINK - Retained by Arcadis**

## SGS Sample Receipt Summary

Job Number: FA87744

Client: ARCADIS

Project: BRENNTAG

Date / Time Received: 8/3/2021 9:30:00 AM

Delivery Method: FX

Airbill #'s: 5061 4509 8043

Therm ID: IR 1;

Therm CF: 0.2;

# of Coolers: N/A

Cooler Temps (Raw Measured) °C: Cooler 1: (3.4);

Cooler Temps (Corrected) °C: Cooler 1: (3.6);

**Cooler Information**

Y or N

- |                             |                                     |                          |
|-----------------------------|-------------------------------------|--------------------------|
| 1. Custody Seals Present    | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 2. Custody Seals Intact     | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 3. Temp criteria achieved   | <input type="checkbox"/>            | <input type="checkbox"/> |
| 4. Cooler temp verification | <u>N/A</u>                          |                          |
| 5. Cooler media             | <u>N/A</u>                          |                          |

**Trip Blank Information**

Y or N N/A

- |                                |                          |                          |                                     |
|--------------------------------|--------------------------|--------------------------|-------------------------------------|
| 1. Trip Blank present / cooler | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2. Trip Blank listed on COC    | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                | <u>W or S</u>            |                          | <u>N/A</u>                          |
| 3. Type Of TB Received         | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

**Sample Information**

Y or N N/A

- |   |                                     |                                     |                                     |
|---|-------------------------------------|-------------------------------------|-------------------------------------|
| 1. Sample labels present on bottles                 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |                                     |
| 2. Samples preserved properly                       | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |                                     |
| 3. Sufficient volume/containers recvd for analysis: | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |                                     |
| 4. Condition of sample                              | <u>Intact</u>                       |                                     |                                     |
| 5. Sample recvd within HT                           | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |                                     |
| 6. Dates/Times/IDs on COC match Sample Label        | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |                                     |
| 7. VOCs have headspace                              | <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| 8. Bottles received for unspecified tests           | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |                                     |
| 9. Compositing instructions clear                   | <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| 10. Voa Soil Kits/Jars received past 48hrs?         | <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| 11. % Solids Jar received?                          | <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| 12. Residual Chlorine Present?                      | <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |

**Misc. Information**

Number of Encores: 25-Gram \_\_\_\_\_ 5-Gram \_\_\_\_\_ Number of 5035 Field Kits: \_\_\_\_\_ Number of Lab Filtered Metals: \_\_\_\_\_  
 Test Strip Lot #s: pH 0-3 230315 pH 10-12 219813A Other: (Specify) \_\_\_\_\_  
 Residual Chlorine Test Strip Lot #: \_\_\_\_\_

Comments

SM001 Rev. Date 05/24/17 Technician: PETERH Date: 8/3/2021 9:30:00 AM Reviewer: \_\_\_\_\_ Date: \_\_\_\_\_

**FA87744: Chain of Custody**

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## MS Volatiles

### QC Data Summaries

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Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

# Leachate Blank Summary

**Job Number:** FA87744  
**Account:** ARCGMSCA ARCADIS Geraghty & Miller  
**Project:** Brenntag; Charleston, SC

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP86689-LB	I70269.D	10	08/10/21	SO	08/05/21	OP86689	VI2277

The QC reported here applies to the following samples:

Method: SW846 8260B

FA87744-1, FA87744-2, FA87744-3

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	10	3.1	ug/l	
78-93-3	2-Butanone (MEK)	ND	50	20	ug/l	
56-23-5	Carbon Tetrachloride	ND	10	3.6	ug/l	
108-90-7	Chlorobenzene	ND	10	2.0	ug/l	
67-66-3	Chloroform	ND	10	3.0	ug/l	
106-46-7	1,4-Dichlorobenzene	ND	10	2.6	ug/l	
107-06-2	1,2-Dichloroethane	ND	10	3.1	ug/l	
75-35-4	1,1-Dichloroethylene	ND	10	3.2	ug/l	
127-18-4	Tetrachloroethylene	ND	10	2.2	ug/l	
79-01-6	Trichloroethylene	ND	10	3.5	ug/l	
75-01-4	Vinyl Chloride	ND	10	4.1	ug/l	

CAS No.	Surrogate Recoveries	Limits	
1868-53-7	Dibromofluoromethane	97%	83-118%
17060-07-0	1,2-Dichloroethane-D4	105%	79-125%
2037-26-5	Toluene-D8	98%	85-112%
460-00-4	4-Bromofluorobenzene	95%	83-118%

5.1.1  
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# Blank Spike Summary

**Job Number:** FA87744  
**Account:** ARCGMSCA ARCADIS Geraghty & Miller  
**Project:** Brenntag; Charleston, SC

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
VI2277-BS	I70265.D	1	08/10/21	SO	n/a	n/a	VI2277

The QC reported here applies to the following samples:

Method: SW846 8260B

FA87744-1, FA87744-2, FA87744-3

CAS No.	Compound	Spike ug/l	BSP ug/l	BSP %	Limits
71-43-2	Benzene	25	23.5	94	81-122
78-93-3	2-Butanone (MEK)	125	118	94	56-143
56-23-5	Carbon Tetrachloride	25	21.9	88	76-136
108-90-7	Chlorobenzene	25	23.5	94	82-124
67-66-3	Chloroform	25	21.4	86	80-124
106-46-7	1,4-Dichlorobenzene	25	22.9	92	78-120
107-06-2	1,2-Dichloroethane	25	22.8	91	75-125
75-35-4	1,1-Dichloroethylene	25	22.9	92	78-137
127-18-4	Tetrachloroethylene	25	24.5	98	76-135
79-01-6	Trichloroethylene	25	22.4	90	81-126
75-01-4	Vinyl Chloride	25	21.6	86	69-159

CAS No.	Surrogate Recoveries	BSP	Limits
1868-53-7	Dibromofluoromethane	101%	83-118%
17060-07-0	1,2-Dichloroethane-D4	102%	79-125%
2037-26-5	Toluene-D8	101%	85-112%
460-00-4	4-Bromofluorobenzene	94%	83-118%

\* = Outside of Control Limits.

# Matrix Spike/Matrix Spike Duplicate Summary

**Job Number:** FA87744  
**Account:** ARCGMSCA ARCADIS Geraghty & Miller  
**Project:** Brenntag; Charleston, SC

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
FA87744-1MS	I70284.D	10	08/11/21	SO	n/a	n/a	VI2277
FA87744-1MSD	I70285.D	10	08/11/21	SO	n/a	n/a	VI2277
FA87744-1	I70276.D	10	08/11/21	SO	08/05/21	OP86689	VI2277

The QC reported here applies to the following samples:

Method: SW846 8260B

FA87744-1, FA87744-2, FA87744-3

CAS No.	Compound	FA87744-1 ug/l	Spike Q ug/l	MS ug/l	MS %	Spike ug/l	MSD ug/l	MSD %	RPD	Limits Rec/RPD
71-43-2	Benzene	ND	250	233	93	250	237	95	2	81-122/14
78-93-3	2-Butanone (MEK)	ND	1250	1160	93	1250	1170	94	1	56-143/18
56-23-5	Carbon Tetrachloride	ND	250	213	85	250	219	88	3	76-136/23
108-90-7	Chlorobenzene	ND	250	233	93	250	239	96	3	82-124/14
67-66-3	Chloroform	ND	250	223	89	250	228	91	2	80-124/15
106-46-7	1,4-Dichlorobenzene	254	250	458	82	250	463	84	1	78-120/15
107-06-2	1,2-Dichloroethane	ND	250	226	90	250	230	92	2	75-125/14
75-35-4	1,1-Dichloroethylene	ND	250	227	91	250	237	95	4	78-137/18
127-18-4	Tetrachloroethylene	ND	250	217	87	250	222	89	2	76-135/16
79-01-6	Trichloroethylene	4.4	J 250	224	88	250	227	89	1	81-126/15
75-01-4	Vinyl Chloride	ND	250	208	83	250	215	86	3	69-159/18

CAS No.	Surrogate Recoveries	MS	MSD	FA87744-1	Limits
1868-53-7	Dibromofluoromethane	99%	98%	97%	83-118%
17060-07-0	1,2-Dichloroethane-D4	102%	103%	105%	79-125%
2037-26-5	Toluene-D8	104%	104%	99%	85-112%
460-00-4	4-Bromofluorobenzene	96%	97%	93%	83-118%

\* = Outside of Control Limits.

5.3.1  
5

# Duplicate Summary

**Job Number:** FA87744  
**Account:** ARCGMSCA ARCADIS Geraghty & Miller  
**Project:** Brenntag; Charleston, SC

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
FA87744-1DUP	I70277.D	10	08/11/21	SO	n/a	n/a	VI2277
FA87744-1	I70276.D	10	08/11/21	SO	08/05/21	OP86689	VI2277

The QC reported here applies to the following samples:

Method: SW846 8260B

FA87744-1, FA87744-2, FA87744-3

CAS No.	Compound	FA87744-1 DUP		Q	RPD	Limits
		ug/l	Q ug/l			
71-43-2	Benzene	ND	ND		nc	14
78-93-3	2-Butanone (MEK)	ND	ND		nc	18
56-23-5	Carbon Tetrachloride	ND	ND		nc	23
108-90-7	Chlorobenzene	ND	ND		nc	14
67-66-3	Chloroform	ND	ND		nc	15
106-46-7	1,4-Dichlorobenzene	254	244		4	15
107-06-2	1,2-Dichloroethane	ND	ND		nc	14
75-35-4	1,1-Dichloroethylene	ND	ND		nc	18
127-18-4	Tetrachloroethylene	ND	ND		nc	16
79-01-6	Trichloroethylene	4.4	J ND		200*	15
75-01-4	Vinyl Chloride	ND	ND		nc	18

CAS No.	Surrogate Recoveries	DUP	FA87744-1	Limits
1868-53-7	Dibromofluoromethane	95%	97%	83-118%
17060-07-0	1,2-Dichloroethane-D4	104%	105%	79-125%
2037-26-5	Toluene-D8	100%	99%	85-112%
460-00-4	4-Bromofluorobenzene	95%	93%	83-118%

\* = Outside of Control Limits.

5.4.1  
5



The results set forth herein are provided by SGS North America Inc.

*e-Hardcopy 2.0*  
*Automated Report*

## Technical Report for

ARCADIS Geraghty & Miller

Brenntag; Charleston, SC

SC000204.0011.00001

SGS Job Number: FA87744R

Sampling Date: 07/30/21

Report to:

ARCADIS Geraghty & Miller

jbeckner@arcadis-us.com

ATTN: Jeff Beckner

Total number of pages in report: **13**



Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

A handwritten signature in black ink that reads "Norm Farmer".

Norm Farmer  
Technical Director

Client Service contact: Evita Martinez 407-425-6700

Certifications: FL(E83510), LA(03051), KS(E-10327), NC(573), NJ(FL002), NY(12022), SC(96038001)  
DoD ELAP(ANAB L2229), AZ(AZ0806), CA(2937), TX(T104704404), PA(68-03573), VA(460177),  
AL, AK, AR, CT, IA, KY, MA, MI, MS, ND, NH, NV, OK, OR, UT, VT, WA, WV

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Test results relate only to samples analyzed.

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## Sample Summary

ARCADIS Geraghty & Miller

**Job No:** FA87744R

Brenntag, Charleston, SC

Project No: SC000204.0011.00001

Sample Number	Collected		Received	Matrix		Client Sample ID
	Date	Time By		Code	Type	
FA87744-1R	07/30/21	17:00 CL	08/03/21	SO	Soil	A2-5 (5-6')
FA87744-2R	07/30/21	17:10 CL	08/03/21	SO	Soil	A2-5 (7-8')
FA87744-3R	07/30/21	17:20 CL	08/03/21	SO	Soil	A2-7 (5-6')

---

Soil samples reported on a dry weight basis unless otherwise indicated on result page.

## Summary of Hits

**Job Number:** FA87744R  
**Account:** ARCADIS Geraghty & Miller  
**Project:** Brenntag; Charleston, SC  
**Collected:** 07/30/21

Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
---------------	------------------	-----------------	----	-----	-------	--------

**FA87744-1R**    **A2-5 (5-6')**

Lead	0.14	0.050	mg/l	SW846 6010D
------	------	-------	------	-------------

**FA87744-2R**    **A2-5 (7-8')**

No hits reported in this sample.

**FA87744-3R**    **A2-7 (5-6')**

No hits reported in this sample.

Sample Results

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Report of Analysis

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## Report of Analysis

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<b>Client Sample ID:</b> A2-5 (5-6') <b>Lab Sample ID:</b> FA87744-1R <b>Matrix:</b> SO - Soil <b>Project:</b> Brenntag; Charleston, SC	<b>Date Sampled:</b> 07/30/21 <b>Date Received:</b> 08/03/21 <b>Percent Solids:</b> n/a
--	---

### Metals Analysis, TCLP Leachate SW846 1311

Analyte	Result	HW#	MCL	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Arsenic	< 0.10	D004	5.0	0.10	mg/l	1	09/03/21	09/03/21 LM	SW846 6010D <sup>1</sup>	SW846 3010A <sup>3</sup>
Barium	< 2.0	D005	100	2.0	mg/l	1	09/03/21	09/03/21 LM	SW846 6010D <sup>1</sup>	SW846 3010A <sup>3</sup>
Cadmium	< 0.050	D006	1.0	0.050	mg/l	1	09/03/21	09/03/21 LM	SW846 6010D <sup>1</sup>	SW846 3010A <sup>3</sup>
Chromium	< 0.10	D007	5.0	0.10	mg/l	1	09/03/21	09/03/21 LM	SW846 6010D <sup>1</sup>	SW846 3010A <sup>3</sup>
Lead	0.14	D008	5.0	0.050	mg/l	1	09/03/21	09/03/21 LM	SW846 6010D <sup>1</sup>	SW846 3010A <sup>3</sup>
Mercury <sup>a</sup>	< 0.0050	D009	0.20	0.0050	mg/l	1	09/07/21	09/07/21 JC	SW846 7470A <sup>2</sup>	SW846 7470A <sup>4</sup>
Selenium	< 0.10	D010	1.0	0.10	mg/l	1	09/03/21	09/03/21 LM	SW846 6010D <sup>1</sup>	SW846 3010A <sup>3</sup>
Silver	< 0.10	D011	5.0	0.10	mg/l	1	09/03/21	09/03/21 LM	SW846 6010D <sup>1</sup>	SW846 3010A <sup>3</sup>

- (1) Instrument QC Batch: MA18007
- (2) Instrument QC Batch: MA18009
- (3) Prep QC Batch: MP39486
- (4) Prep QC Batch: MP39496

(a) Exceeded hold time.

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RL = Reporting Limit  
 MCL = Maximum Contamination Level (40 CFR 261 7/1/11)

## Report of Analysis

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3

<b>Client Sample ID:</b> A2-5 (7-8') <b>Lab Sample ID:</b> FA87744-2R <b>Matrix:</b> SO - Soil <b>Project:</b> Brenntag; Charleston, SC	<b>Date Sampled:</b> 07/30/21 <b>Date Received:</b> 08/03/21 <b>Percent Solids:</b> n/a
--	---

### Metals Analysis, TCLP Leachate SW846 1311

Analyte	Result	HW#	MCL	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Arsenic	< 0.10	D004	5.0	0.10	mg/l	1	09/03/21	09/03/21 LM	SW846 6010D <sup>1</sup>	SW846 3010A <sup>3</sup>
Barium	< 2.0	D005	100	2.0	mg/l	1	09/03/21	09/03/21 LM	SW846 6010D <sup>1</sup>	SW846 3010A <sup>3</sup>
Cadmium	< 0.050	D006	1.0	0.050	mg/l	1	09/03/21	09/03/21 LM	SW846 6010D <sup>1</sup>	SW846 3010A <sup>3</sup>
Chromium	< 0.10	D007	5.0	0.10	mg/l	1	09/03/21	09/03/21 LM	SW846 6010D <sup>1</sup>	SW846 3010A <sup>3</sup>
Lead	< 0.050	D008	5.0	0.050	mg/l	1	09/03/21	09/03/21 LM	SW846 6010D <sup>1</sup>	SW846 3010A <sup>3</sup>
Mercury <sup>a</sup>	< 0.0050	D009	0.20	0.0050	mg/l	1	09/07/21	09/07/21 JC	SW846 7470A <sup>2</sup>	SW846 7470A <sup>4</sup>
Selenium	< 0.10	D010	1.0	0.10	mg/l	1	09/03/21	09/03/21 LM	SW846 6010D <sup>1</sup>	SW846 3010A <sup>3</sup>
Silver	< 0.10	D011	5.0	0.10	mg/l	1	09/03/21	09/03/21 LM	SW846 6010D <sup>1</sup>	SW846 3010A <sup>3</sup>

- (1) Instrument QC Batch: MA18007
- (2) Instrument QC Batch: MA18009
- (3) Prep QC Batch: MP39486
- (4) Prep QC Batch: MP39496

(a) Exceeded hold time.

---

RL = Reporting Limit  
 MCL = Maximum Contamination Level (40 CFR 261 7/1/11)

## Report of Analysis

<b>Client Sample ID:</b> A2-7 (5-6') <b>Lab Sample ID:</b> FA87744-3R <b>Matrix:</b> SO - Soil <b>Project:</b> Brenntag; Charleston, SC	<b>Date Sampled:</b> 07/30/21 <b>Date Received:</b> 08/03/21 <b>Percent Solids:</b> n/a
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### Metals Analysis, TCLP Leachate SW846 1311

Analyte	Result	HW#	MCL	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Arsenic	< 0.10	D004	5.0	0.10	mg/l	1	09/03/21	09/03/21 LM	SW846 6010D <sup>1</sup>	SW846 3010A <sup>3</sup>
Barium	< 2.0	D005	100	2.0	mg/l	1	09/03/21	09/03/21 LM	SW846 6010D <sup>1</sup>	SW846 3010A <sup>3</sup>
Cadmium	< 0.050	D006	1.0	0.050	mg/l	1	09/03/21	09/03/21 LM	SW846 6010D <sup>1</sup>	SW846 3010A <sup>3</sup>
Chromium	< 0.10	D007	5.0	0.10	mg/l	1	09/03/21	09/03/21 LM	SW846 6010D <sup>1</sup>	SW846 3010A <sup>3</sup>
Lead	< 0.050	D008	5.0	0.050	mg/l	1	09/03/21	09/03/21 LM	SW846 6010D <sup>1</sup>	SW846 3010A <sup>3</sup>
Mercury <sup>a</sup>	< 0.0050	D009	0.20	0.0050	mg/l	1	09/07/21	09/07/21 JC	SW846 7470A <sup>2</sup>	SW846 7470A <sup>4</sup>
Selenium	< 0.10	D010	1.0	0.10	mg/l	1	09/03/21	09/03/21 LM	SW846 6010D <sup>1</sup>	SW846 3010A <sup>3</sup>
Silver	< 0.10	D011	5.0	0.10	mg/l	1	09/03/21	09/03/21 LM	SW846 6010D <sup>1</sup>	SW846 3010A <sup>3</sup>

- (1) Instrument QC Batch: MA18007
- (2) Instrument QC Batch: MA18009
- (3) Prep QC Batch: MP39486
- (4) Prep QC Batch: MP39496

(a) Exceeded hold time.

---

RL = Reporting Limit  
 MCL = Maximum Contamination Level (40 CFR 261 7/1/11)



Misc. Forms

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Custody Documents and Other Forms

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Includes the following where applicable:

- Chain of Custody

Send Results to:	Contact & Company Name: <b>CHARLES WATSON ARCADIS</b>	Telephone: <b>706-929-4421</b>	Preservative:							Preservation Key: A. H <sub>2</sub> O B. HCL C. HNO <sub>3</sub> D. NaOH E. None F. Other: _____ G. Other: _____ H. Other: _____ Matrix Key: SO - Soil IW - Water T - Tissue SE - Sediment SL - Sludge A - Air NL - NAPL/Oil SW - Sample Wipe Other: _____			
	Address: <b>1480 Greene St Ste 220</b>	Fax:	# of Containers:										
	City State Zip: <b>AUGUSTA GA 30909</b>	E-mail Address: <b>Charles.Watson@arcadis.com</b>	Container Information:										
	Project Name/Location (City, State): <b>Brenton Charleston S.C.</b>	Project #: <b>30094217 30099999</b>	<b>PARAMETER ANALYSIS &amp; METHOD</b>										
Sampler's Printed Name: <b>Charles Watson</b>	Sampler's Signature: <i>CB Jew</i>	TCLP-VOC 4 Bins							REMARKS  TCLP SA m ples   BILL DIRECTLY TO BREW TAG				
Sample ID	Collection									Type (✓)		Matrix	
	Date									Time	Comp	Grab	
1 2 3	A2-5 (5-6')									7/30/21	17:00	X	SO
	A2-5 (7-8')	7/30/21	17:10	X	"	1							
	A2-7 (5-6')	7/30/21	17:20	X	"	1							
Special Instructions/Comments: _____ <input type="checkbox"/> Special QA/QC Instructions (✓): _____													

Laboratory Information and Receipt		Relinquished By		Received By		Relinquished By		Laboratory Received By	
Lab Name: <b>SGS</b>	Cooler Custody Seal (✓) <input type="checkbox"/> Intact <input type="checkbox"/> Not Intact	Printed Name: <b>Charles Watson</b>	Signature: <i>CB Jew</i>	Printed Name: <b>FX</b>	Signature: <i>FX</i>	Printed Name: <b>FX</b>	Signature: <i>FX</i>	Printed Name: <b>Peter H.</b>	Signature: <i>P. H.</i>
Specify Turnaround Requirements:	Sample Receipt: Condition/Cooler Temp: <b>3.6-14</b>	Firm: <b>ARCADIS</b>	Date/Time: <b>9/2/2021 12:00</b>	Firm/Courier:	Date/Time:	Firm/Courier:	Date/Time:	Firm: <b>SGS</b>	Date/Time: <b>8/3/21 9:30</b>

20730826 CotC AR Form 08.27.2015      Distribution:      **WHITE** - Laboratory returns with results      **YELLOW** - Lab copy      **PINK** - Retained by Arcadis

## SGS Sample Receipt Summary

Job Number: FA87744

Client: ARCADIS

Project: BRENNTAG

Date / Time Received: 8/3/2021 9:30:00 AM

Delivery Method: FX

Airbill #'s: 5061 4509 8043

Therm ID: IR 1;

Therm CF: 0.2;

# of Coolers: N/A

Cooler Temps (Raw Measured) °C: Cooler 1: (3.4);

Cooler Temps (Corrected) °C: Cooler 1: (3.6);

**Cooler Information**

Y or N

- |                             |                                     |                          |
|-----------------------------|-------------------------------------|--------------------------|
| 1. Custody Seals Present    | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 2. Custody Seals Intact     | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 3. Temp criteria achieved   | <input type="checkbox"/>            | <input type="checkbox"/> |
| 4. Cooler temp verification | <u>N/A</u>                          |                          |
| 5. Cooler media             | <u>N/A</u>                          |                          |

**Trip Blank Information**

Y or N N/A

- |                                |                          |                          |                                     |
|--------------------------------|--------------------------|--------------------------|-------------------------------------|
| 1. Trip Blank present / cooler | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2. Trip Blank listed on COC    | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|                                | <u>W or S</u>            |                          | <u>N/A</u>                          |
| 3. Type Of TB Received         | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

**Sample Information**

Y or N N/A

- |   |                                     |                                     |                                     |
|---|-------------------------------------|-------------------------------------|-------------------------------------|
| 1. Sample labels present on bottles                 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |                                     |
| 2. Samples preserved properly                       | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |                                     |
| 3. Sufficient volume/containers recvd for analysis: | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |                                     |
| 4. Condition of sample                              | <u>Intact</u>                       |                                     |                                     |
| 5. Sample recvd within HT                           | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |                                     |
| 6. Dates/Times/IDs on COC match Sample Label        | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |                                     |
| 7. VOCs have headspace                              | <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| 8. Bottles received for unspecified tests           | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |                                     |
| 9. Compositing instructions clear                   | <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| 10. Voa Soil Kits/Jars received past 48hrs?         | <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| 11. % Solids Jar received?                          | <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| 12. Residual Chlorine Present?                      | <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |

**Misc. Information**

Number of Encores: 25-Gram \_\_\_\_\_ 5-Gram \_\_\_\_\_ Number of 5035 Field Kits: \_\_\_\_\_ Number of Lab Filtered Metals: \_\_\_\_\_  
 Test Strip Lot #s: pH 0-3 230315 pH 10-12 219813A Other: (Specify) \_\_\_\_\_  
 Residual Chlorine Test Strip Lot #: \_\_\_\_\_

Comments

SM001 Rev. Date 05/24/17 Technician: PETERH Date: 8/3/2021 9:30:00 AM Reviewer: \_\_\_\_\_ Date: \_\_\_\_\_

**FA87744R: Chain of Custody**

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4.1  
4

**Job Change Order: FA87744**

<b>Requested Date:</b>	9/1/2021	<b>Received Date:</b>	8/3/2021
<b>Account Name:</b>	ARCADIS Geraghty & Miller	<b>Due Date:</b>	8/17/2021
<b>Project Description:</b>	Brenntag; Charleston, SC	<b>Deliverable:</b>	COMMB
<b>CSR:</b>	EM	<b>TAT (Days):</b>	7

=====

<b>Sample #:</b>	FA87744-1,2,3	<b>Change:</b>	
<b>Dept:</b>			Per cleint, please add and run TCLPM
<b>TAT:</b>	7		

=====

**FA87744R: Chain of Custody**

**Page 3 of 4**

**Above Changes Per:** Charles Lawson

**Date/Time:** 9/1/2021 2:35:53 PM

To Client: This Change Order is confirmation of the revisions, previously discussed with the Client Service Representative.

Page 1 of 1

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**FA87744R: Chain of Custody**  
**Page 4 of 4**

Arcadis U.S., Inc.

1450 Greene Street

Suite 220

Augusta

Georgia 30901-5201

Tel 706 828 4421

Fax 706 828 7422