

# Annual Status Report

**Martha's Dry Cleaner  
4608 Skidaway Road  
Savannah, Chatham County, Georgia  
EPD HSI No. 10764**

February 27, 2015  
Terracon Project No. ES117125

**Prepared for:**

Bible Baptist Church  
Savannah, Georgia

**Prepared by:**

Terracon Consultants, Inc.  
Savannah, Georgia

[terracon.com](http://terracon.com)

**Terracon**

Environmental



Facilities



Geotechnical



Materials

February 27, 2015

Georgia Department of Natural Resources  
Environmental Protection Division  
Response and Remediation Program  
2 Martin Luther King, Jr. Drive, SE  
Suite 1462  
Atlanta, Georgia 30334-9000

Attn: Ms. Robin Futch, P.G., PMP  
P: (404) 657 8600

**Re: Annual Status Report**  
Martha's Dry Cleaner  
EPD HSI No. 10764  
4608 Skidaway Road  
Savannah, Chatham County, Georgia  
Terracon Project No. ES117125

Dear Ms. Futch:

Terracon Consultants, Inc. (Terracon) is pleased to submit the enclosed Annual Status Report for the above-referenced site. This report documents the field work conducted at the site during February 2015 and presents the current site conditions as of the report date.

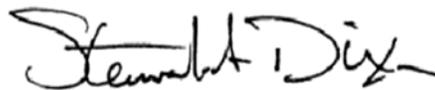
We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, please contact us at your earliest convenience.

Sincerely,

**Terracon Consultants, Inc.**



R. Luke Bragg  
Environmental Engineer



Stewart A. Dixon, P.G.  
Environmental Department Manager

Enclosures

cc: 1 – Client (PDF)  
1 – File



## TABLE OF CONTENTS

	Page
<b>1.0 INTRODUCTION</b> .....	<b>1</b>
<b>2.0 SITE COMPLIANCE SUMMARY</b> .....	<b>1</b>
2.1 Site Geology Summary .....	4
2.2 Risk Reduction Standards .....	4
<b>3.0 GROUNDWATER MONITORING</b> .....	<b>4</b>
3.1 February 2015 Annual Monitoring Event Methodology .....	5
3.2 Groundwater Flow Direction .....	6
<b>4.0 GROUNDWATER ANALYTICAL RESULTS</b> .....	<b>7</b>
<b>5.0 FATE AND TRANSPORT MODELING</b> .....	<b>7</b>
5.1 Model Parameters and Assumptions.....	8
5.1.1 Seepage Velocity.....	8
5.1.2 Dispersivity .....	8
5.1.3 Retardation Factor .....	9
5.1.4 Source Data Input Parameters .....	10
5.2 BIOCHLOR Model Simulations .....	11
5.2.1 Model Calibration.....	11
5.2.2 BIOCHLOR Model Results .....	11
<b>6.0 CONCLUSIONS AND RECOMMENDATIONS</b> .....	<b>12</b>

## APPENDICES

<b>APPENDIX A</b>	<b>FIGURES</b>
Figure 1:	Site Vicinity / Topographic Map
Figure 2:	Site Plan
Figure 3:	Potentiometric Surface Map – January 2014
Figure 4:	Potentiometric Surface Map – February 2015
Figure 5:	Groundwater Quality Map – January 2014
Figure 6:	Groundwater Quality Map – February 2015
Figure 7:	Geologic Cross Section – A-A'
Figure 8:	Geologic Cross Section – B-B'

## **TABLE OF CONTENTS (continued)**

### **APPENDIX B DATA TABLES**

Table 1: Groundwater Elevation Data

Table 2: Groundwater Analytical Data - VOCs

Table 3: Groundwater Analytical Data – Natural Attenuation Parameters

### **APPENDIX C GROUNDWATER LABORATORY ANALYTICAL DATA**

### **APPENDIX D MONITORING WELL FIELD SAMPLING DATA**

### **APPENDIX E BIOCHLOR MODEL DATA**

### **APPENDIX F INVOICES, HOURS WORKED, COST ESTIMATE**

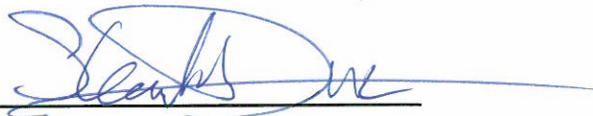
**REGISTERED PROFESSIONAL CERTIFICATION**

"I certify under penalty of law that this report and all attachments were prepared by me or under my direct supervision in accordance with the Voluntary Remediation Program Act (O.C.G.A. Section 12-8-101, et seq.). I am a professional engineer/professional geologist who is registered with the Georgia State Board of Registration for Professional Engineers and Land Surveyors/Georgia State Board of Registration for Professional Geologists and I have the necessary experience and am in charge of the investigation and remediation of this release of regulated substances.

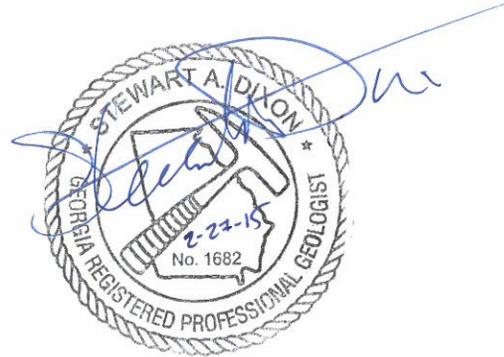
Furthermore, to document my direct oversight of the Voluntary Remediation Plan development, implementation of corrective action, and long term monitoring, I have attached a monthly summary of hours invoiced and description of services provided by me to the Voluntary Remediation Program participant since the previous submittal to the Georgia Environmental Protection Division.

The information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Name: Stewart A. Dixon

Signature: 

Date: 27 February 2015



Georgia Stamp

# **ANNUAL STATUS REPORT**

## **MARTHA'S DRY CLEANER HSI Site No. 10764 4608 Skidaway Road Savannah, Chatham County, Georgia**

**Terracon Project No. ES117125  
February 27, 2015**

### **1.0 INTRODUCTION**

The Martha's Dry Cleaner site is located at 4608 Skidaway Road, Savannah, Georgia (property) as shown in Figure 1 in Appendix A. The subject property is an approximately 1.5-acre parcel of land, previously identified on the Chatham County Tax Assessor's website as Tax Parcel ID 2-0120-01-001C, which is currently a portion of Tax Parcel ID 2-0120-01-004 and makes up the campus of Bible Baptist Church. Bible Baptist Church acquired the subject property in October 2004.

Historically, the property was developed and operated from 1986 to 2000 as a small shopping center that included Martha's Dry Cleaner, which rented the space until July 31, 2000. A number of environmental assessments had been conducted on the property between 1996 and 2008, which revealed the presence of tetrachloroethene (PCE) and trichloroethene (TCE) as contaminants of concern in soil and groundwater. The property was listed on the Hazardous Site Inventory in May 2003 as site number 10764.

The property is bound to the north by a church building and parking lot owned by Bible Baptist Church. The property is bound to the east by LaRoche Avenue and Savannah State University, which is located beyond LaRoche Avenue. The property is bound to the south by the Bible Baptist Church campus and a residential property owned by Thomas and Gretchen Alnutt. The property is bound to the west by Skidaway Road and residential properties. The property is located in an area of mixed land use with mostly residential, commercial, and retail properties.

### **2.0 SITE COMPLIANCE SUMMARY**

On March 31, 2003, Mr. J. Cary Lester of Discount Auto Parts issued a release notification for concentrations of PCE in soil and groundwater that exceeded the reportable quantities. PCE contamination at the property is believed to be related to the dry cleaning operations at the former Martha's Dry Cleaner located on the property. On May 5, 2003, Mr. Michael Medlock of

the Georgia EPD issued a memorandum recommending HSI listing for Martha's Dry Cleaner. On May 30, 2003, Mr. Harold F. Reheis of the Georgia EPD issued a letter stating that property was listed on the HSI.

EMC Engineering (EMC) conducted an assessment to delineate the soil on the property. The results of this assessment were presented in a report dated March 15, 2005 for Bible Baptist Church. EMC delineated the PCE contaminated soil at the site with respect to the Georgia EPD Type 1 Risk Reduction Standard for PCE (0.5 mg/kg). EMC determined that the horizontal extent of PCE contamination was approximately 0.4 acres.

S&ME conducted additional soil and groundwater assessment in October 2005. The results of this assessment were presented in a report dated December, 2005. Five (5) soil borings were advanced using direct-push Geoprobe™ technology. Groundwater samples were collected from these soil boring locations and analyzed for Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs), and Resource Conservation and Recovery Act (RCRA) Metals. S&ME recommended that additional soil and groundwater investigation were to be conducted to determine if metal contaminants were present in the soil and groundwater at the property.

S&ME collected groundwater samples from seventeen (17) groundwater monitoring wells on May 22 and 23, 2006. The sampling event showed that seven (7) volatile organic compounds (PCE, TCE, toluene, cis-1,2-DCE, trans-1,2-DCE, 1,1,2-trichlorethane, and xylenes) were detected in the groundwater samples. Soil samples were also collected from four (4) soil boring locations. The only VOC compound detected in the soil was acetone, which was known as a common laboratory contaminant. The four soil samples were also analyzed for RCRA metals. Arsenic, barium, chromium, lead, mercury, and silver were detected in the soil samples collected. Type 3 and 4 Risk Reduction Standards (RRSs) were calculated for all regulated constituents detected in groundwater and soil samples collected. The results of this assessment identified PCE and TCE as the primary contaminants of concern at the subject site. In addition, the assessment also recommended that the soils exceeding the established RRSs be delineated. Results of S&ME's assessment were provided to the Georgia EPD.

According to the Remediation Activities Report dated November 14, 2008, prepared by WPC, soil delineation and removal activities were performed at the subject property on June 18, 2008 until July 2, 2008. A total of 1,764.5 tons of contaminated soil was removed from the property and were disposed of at a permitted Subtitle D landfill. During the soil excavation activities, three (3) continuous air monitoring stations were set up to sample for contaminant vapors emanating from the soil excavation. The report concluded that the confirmation soil sampling showed that the soils located on the subject property had been effectively remediated to levels below the Type 1 risk reduction standards (RRSs). The results of these investigations were provided to the Georgia EPD. The Georgia EPD issued a letter dated April 20, 2010 concurring that the on-site soils met the residential Type 1 RRSs cleanup standards.

## Annual Status Report

Martha's Dry Cleaner ■ Savannah, Chatham County, Georgia

February 27, 2015 ■ Terracon Project No. ES117125



On October 2011, a Voluntary Investigation and Remediation Plan (VIRP) and Application was submitted to the Georgia EPD for the site. The site was accepted into the Voluntary Remediation Program (VRP) by the Georgia EPD based on the VIRP acceptance letter dated February 17, 2012. EPD granted the property owner a one (1) year extension to fulfill the requirements detailed in their February 17, 2012 letter. Because of the one (1) year extension, Terracon submitted a summary letter dated September 10, 2012 to Georgia EPD that included the most recent groundwater sampling data and a site plan with the location of the newly installed groundwater monitoring well (MW-24).

Terracon Consultants, Inc. (Terracon) submitted a Voluntary Remediation Program Semi-Annual Status Report to the Georgia EPD on February 20, 2014. This report documented field work conducted at the site from August 2012 through January 2014. A site-wide groundwater sampling event was conducted on January 27, 2014 through January 29, 2014. The groundwater samples were analyzed for carbon disulfide, trans-1,2-DCE, cis-1,2-DCE, TCE, 1,1,2-trichloroethane, and PCE. The groundwater samples were also analyzed for natural attenuation parameters in order to determine the rate of biotransformation at the site and to ensure that monitored natural attenuation (MNA) was a viable option for remediation at the site.

Laboratory analysis of the groundwater samples indicated that all VOC concentrations were either below the reporting limit of 1 µg/L or below the approved Type 1 RRS of 5 µg/L, with the exceptions of PCE concentrations in MW-21-S and MW-24. Although above the Type 1 RRS, PCE concentrations were shown to be stable or decreasing. The natural attenuation parameter results indicated limited evidence of anaerobic biodegradation (reductive dechlorination) of the chlorinated organics at the site.

A revised BIOCHLOR fate and transport model utilizing site specific parameters was included in the 2014 Voluntary Remediation Program Semi-Annual Status Report. The objective of this model was to understand the fate and transport of the groundwater plume in the absence of a source, since the source area soils have been previously remediated. This model was also used to determine whether MNA was a valid method of corrective action. The revised BIOCHLOR model indicated that PCE concentrations at the Type 1 RRS of 5 µg/L will travel 300 to 320 feet (approximately 56 feet beyond the property boundary) downgradient from the source area in the next 20 years.

Comments from the Georgia EPD in reference the above-mentioned report were submitted to Bible Baptist Church, Inc. (BBC) in a letter dated March 21, 2014. A brief summary of this comment letter is presented below:

- BBC may switch to annual sampling and reporting for wells MW-19, MW-21-S, and MW-24 beginning in January 2015. Collection of MNA parameters during subsequent sampling events will be no longer required.

- Vertical delineation has been satisfied by the installation and sampling of MW-21D. Horizontal delineation is complete except for the area of MW-24, which is slightly above the PCE Type 1 RRS. BBC may defer delineation to evaluate future monitoring results.
- A Uniform Environmental Covenant (UEC) to restrict the use of groundwater on the affected parcel will be required as part of the final site remedy.

In a letter dated January 27, 2015, the Georgia EPD stated that the UEC submitted for the former Martha's Dry Cleaners site had been approved and the fully executed original was enclosed with the letter. In accordance with O.C.G.A. 44-16-8, the executed UEC was filed with the Superior Court of Chatham County and recorded in the clerk's deed records on February 12, 2015.

This report documents the results of groundwater sampling conducted in February 2015 and presents the current site conditions as of the report date.

## **2.1 Site Geology Summary**

The subject property is included on the Savannah, Georgia, 7.5 minute series United States Geological Survey topographic quadrangle map (Figure 1). The site topography is relatively flat with the exception of two dry retention ponds located on the eastern portion of the property.

The borings completed at the property identified the shallow subsurface material as very stiff sand to clayey sand to an approximate elevation of 10 feet underlain by silty sands to an approximate elevation of -20 feet. Shallow geologic cross sections are presented in Figures 7 and 8. Depth to groundwater at the site typically ranges from 5.5 to 13.8 feet below ground surface (bgs) depending seasonal variations.

## **2.2 Risk Reduction Standards**

As the site and surrounding properties are used for residential purposes, Type 1 RRS (residential, site-specific) were developed in accordance with the HSRA rules. Concentrations of PCE currently and in the past have exceeded the Type 1 RRS in select shallow groundwater monitoring wells at the site.

## **3.0 GROUNDWATER MONITORING**

In accordance with the Georgia EPD letter dated March 21, 2014 and the provisions outlined in the executed UEC, monitoring wells MW-19, MW-21-S, and MW-24 are to be sampled on an annual basis. The sampling methodology and results for the February 2015 annual groundwater sampling event are presented in the following sections.

Site figures prepared from the data collected during the January 2014 and February 2015 monitoring events are included in Appendix A. Summaries of the potentiometric data and laboratory analytical results are included in Appendix B. The laboratory analytical data sheets and chain of custody documentation are included in Appendix C. Monitoring well field sampling data is included in Appendix D.

### **3.1 February 2015 Annual Monitoring Event Methodology**

The February 2015 annual monitoring event was performed by Terracon on February 6, 2015. Groundwater samples were collected from MW-19, MW-21-S, and MW-24. Depth to water data was collected from all seven (7) monitoring wells. Prior to sampling, each monitoring well was opened and allowed to equilibrate. An electronic water-level meter was used to measure the depth to water in all of the wells.

Groundwater samples were collected from MW-19, MW-21-S, and MW-24 using low-flow methodology with a peristaltic pump and disposable Teflon tubing. Groundwater was purged until a relatively non-turbid sample was produced. Groundwater monitoring activities at the site were conducted in accordance with *EPA Region 4, SESD Groundwater Sampling Operating Procedure (SESDPROC-301-R3), March 2013*.

The monitoring wells were purged using a peristaltic pump and disposable Teflon tubing. Before purging commenced, the groundwater level and total well depth was measured for each monitoring well to calculate the volume of the well. Once the well volume was calculated, purging commenced. During purging, the pump intake (Teflon tubing) was maintained within the mid-point of the screened interval and field parameters, including pH, specific conductance, temperature, ORP, and turbidity, were monitored. Pumping rate and drawdown were also monitored during purging activities.

An adequate purge was achieved when water quality parameters (pH, conductivity, temperature, and turbidity) stabilized in accordance with the EPA purging guidance and a minimum of three (3) well volumes were removed. However, additional purging of up to five (5) wells volumes was conducted if water quality parameter stabilization had not been achieved after three (3) well volumes. As stated in the *EPA Region 4, SESD Groundwater Sampling Operating Procedure, (SESDPROC-301-R3), March 2013*, groundwater samples were collected at the discretion of the environmental professional if stabilization had not occurred after the removal of five (5) well volumes. Water quality parameters were measured using an YSI 556 MPS equipped with a flow through cell. The February 2015 field sampling data sheets are attached in Appendix D.

Samples were collected from each monitoring well using a peristaltic pump and new disposable Teflon tubing via the "Straw Method." One end of the tubing was submerged within one-foot of the top of the water column of the monitoring well sampled, and the other end of the tubing was

momentarily attached to the pump to fill the tubing with water. After initial water was discharged through the pump head, the tubing was quickly removed from the pump and a gloved thumb was placed on the tubing to inhibit water flow inside the tube. The tubing was then removed from the well and the water contained inside the tubing was allowed to gravity drain into the appropriate sample vials.

Once the sample vials were filled and sealed correctly, the sample vials were immediately placed on ice in a laboratory supplied cooler, and delivered to Avery Laboratories & Environmental Services, LLC analytical laboratory in Savannah, Georgia. The samples were analyzed for the following parameters via EPA Method 8260B:

- Tetrachloroethylene
- Trichloroethylene
- 1,1-Dichloroethylene
- Cis-1,2-Dichloroethylene
- Trans-1,2-Dichloroethylene
- 1,1,2-Trichloroethylene
- Vinyl Chloride
- Ethene
- Ethane

The electronic water level meter was decontaminated prior to its initial use and after being used at each well by cleaning with a Liquinox and distilled water mixture, followed by a distilled water rinse. The purge water produced during sampling activities was contained in a clean, 55-gallon drum for future disposal.

### **3.2 Groundwater Flow Direction**

Water level measurements collected during the February 2015 monitoring event, in conjunction with the elevation of each monitoring well's top of casing reference point, were used to calculate the elevation of the water table at each monitoring well. A summary of the depth-to-groundwater measurements and corresponding groundwater elevation data are presented in Table 1.

A groundwater potentiometric surface map for the February 2015 monitoring event was prepared from the elevation data to estimate groundwater flow direction and horizontal hydraulic gradient for the surficial aquifer. The potentiometric surface map for the January 2014 monitoring event is included as Figure 3 in Appendix A and potentiometric surface map for the February 2015 monitoring event is included as Figure 4 in Appendix A. As shown on the

figures, groundwater elevations at the site have varied over time likely caused by yearly and seasonal variation in recharge and other mitigating geologic factors; however, the regional groundwater flow is generally to the west/southwest.

Based on the current data, the groundwater appears to be flowing generally in the west/southwest direction. This groundwater flow direction reflects the dominant direction determined in past investigations. The hydraulic gradient at the site based on the January 2014 potentiometric data was 0.001 ft/ft, while the hydraulic gradient based on the February 2015 potentiometric data is 0.002 ft/ft. Groundwater elevations are summarized on Table 1.

## **4.0 GROUNDWATER ANALYTICAL RESULTS**

The February 2015 groundwater analytical results are discussed below and a summary of the recent and historical groundwater analytical data is presented in Table 2. Historical natural attenuation analytical data is presented in Table 3. The January 2014 and February 2015 groundwater quality data is illustrated as Figures 5 and Figure 6, respectively. The laboratory analytical results and chain of custody documentation are presented in Appendix C.

The laboratory analytical data indicated the presence of PCE in the groundwater samples collected from MW-19 (1.29 µg/L), MW-21-S (163 µg/L), and MW-24 (5.27 µg/L). Monitoring well MW-21-S also contained a detectable concentration of TCE (1.29 µg/L). None of the other constituents were detected at concentrations in excess of the laboratory reporting limits.

PCE concentrations exceed the Type 1 RRS in two (2) wells (MW-21-S and MW-24). The PCE concentrations in MW-21-S and MW-24 have steadily decreased since the September 2011 monitoring event. Since the January 2014 monitoring event, the PCE concentration in MW-21-S has reduced from 188 µg/L to 163 µg/L (13.3% decrease). The PCE concentration in MW-24 has reduced from 6.82 µg/L to 5.27 µg/L (22.7% decrease). No other constituents were detected at concentrations in excess of the Type 1 RRS.

## **5.0 FATE AND TRANSPORT MODELING**

The BIOCHLOR fate and transport model submitted with the VIRP (October 2011) was revised in 2014 based on both the Georgia EPD review comments received in a letter dated February 17, 2012 and the collection of additional groundwater and on-site soil quality data. Our objective in using the BIOCHLOR model was to understand the fate and transport of the groundwater plume in the absence of a source, since the source area soils have been previously remediated and to help determine whether Monitored Natural Attenuation is a valid method of corrective action. The BIOCHLOR model has been further revised based on the February 2015 monitoring data.

The following sections provide a summary of the revised model parameters, assumptions, and the BIOCHLOR modeling procedures. Results and conclusions are presented at the end of this section. Documentation of calculations and model results is contained in Appendix E: Fate and Transport Model Documentation.

## 5.1 Model Parameters and Assumptions

The following items address the preliminary contaminant transport calculations necessary for fulfilling the data input requirements of the BIOCHLOR model. Actual aquifer specific data collected from the site was used to calculate the majority of the parameters discussed in the following sections.

### 5.1.1 Seepage Velocity

The velocity of groundwater movement through the surficial aquifer, or seepage velocity, was calculated using the following equation from Fetter (2001):

$$v_x = -\frac{Ki}{\eta}$$

Where

- $v_x$  is the seepage velocity (ft/yr)
- $K$  is the hydraulic conductivity (ft/yr)
- $i$  is the hydraulic gradient (ft/ft)
- $\eta$  is the effective porosity (dimensionless)

The hydraulic conductivity data was presented in the VIRP indicated that the average site hydraulic conductivity is  $2.8 \times 10^{-3}$  cm/sec or 7.82 ft/day, which was used in the original BIOCHLOR model presented in the VIRP (October 28, 2011). However, to be conservative the highest hydraulic conductivity value measured on-site of  $3.3 \times 10^{-3}$  cm/sec or 9.27 ft/day was used for the revised BIOCHLOR model.

Based on the groundwater elevation data collected during the September 2011 monitoring event, the hydraulic gradient ( $i$ ) was calculated at 0.006 ft/ft. An effective porosity ( $\eta$ ) of 0.2 was selected based on average values found in the BIOCHLOR User's Manual v1.0. As such, the seepage velocity was calculated at 101.7 ft/yr. This seepage velocity value has been retained in subsequent model revisions.

### 5.1.2 Dispersivity

Dispersivity values used in the model were based on guidance found in the BIOCHLOR User's Manual v1.0 based on the length of the plume from the field data. The plume length for the

subject site was estimated to be 300 feet based on the February 2015 groundwater sampling data. The Longitudinal dispersivity ( $\alpha_x$ ) was calculated in BIOCHLOR using the equation from (Xu and Eckstein, 1995; Al-Suwaiyan, 1996) as follows:

$$\alpha_x = 3.28 * 0.82 * \left[ \log_{10} \left( \frac{L_p}{3.28} \right) \right]^{2.446}$$

Where

$L_p$  is the plume length (ft)

Based on high reliability points from Gelhar et al (1992), transverse dispersivity ( $\alpha_y$ ) is calculated below:

$$\alpha_y = 0.1\alpha_x$$

Vertical dispersivity ( $\alpha_z$ ) is generally approximated at  $1 \times 10^{-99}$  feet, based on conservative estimates.

### 5.1.3 Retardation Factor

Concentration of dissolved contaminants can be reduced by adsorption to the aquifer media thereby retarding the flow of this contaminant through the subsurface. The retardation factor is the ratio of the groundwater seepage velocity to the rate that organic chemicals migrate in the groundwater. The adsorption to the aquifer media and resultant retardation of contaminant transport is controlled by the soil bulk density, effective porosity, organic carbon-water partition coefficient ( $K_{oc}$ ), distribution coefficient, and fraction of organic carbon ( $f_{oc}$ ) on uncontaminated soil.

As directed by the Georgia EPD in their letter, dated February 17, 2012 the following values and/or sources were used to for following input parameters:

- Soil bulk density – 1.5 kg/L
- $K_{oc}$ 
  - Tetrachloroethene 94.94 L/kg
  - Trichloroethene 60.7 L/kg
  - Dichloroethene (1,2-cis and 1,2-trans) 39.6 L/kg
  - Vinyl Chloride 21.73 L/kg

The  $k_{oc}$  values were taken from the U.S. Environmental Protection Agency (USEPA) Region 3 Regional Screening Level Tables, dated November 2013. The  $K_{oc}$  value used for ethene was the default value from the BIOCHLOR User's Manual v1.0.

### 5.1.3.1 Fraction of Organic Carbon

Three (3) total organic carbon (TOC) samples were collected from the surficial aquifer matrix on January 27, 2014. The laboratory analytical results confirmed the TOC samples were collected from an uncontaminated region of the site's surficial aquifer matrix. The samples contained TOC concentrations as follows: SS-1 – 2,200 mg/kg, SS-2 – 679 mg/kg, and a laboratory J-Flagged TOC estimated value for SS-3 of 295 mg/kg. Because the samples were collected within close proximity to each other and at the same relative depth, the J-Flagged estimated concentration 295 mg/kg was determined to be an outlier. Therefore, the TOC value from SS-2 was used to calculate the fraction of organic carbon ( $f_{oc}$ ).

A  $f_{oc}$  value of 0.00068 was calculated from the TOC value from SS-2 (679 mg/kg). This value was incorporated in the BIOCHLOR simulation to determine whether it was reasonable based on field conditions. The  $f_{oc}$  value of 0.00068 resulted in downgradient concentrations at MW-24 higher than those observed during the January 2014 sampling event without adjustment of the PCE half-life beyond the acceptable range of 0.58 to 9.9 years. As such the TOC concentrations from SS-1 and SS-2 were averaged to represent the site resulting in a  $f_{oc}$  of 0.000145, which allowed for model calibration to the observed downgradient concentration levels within the acceptable the range of PCE half-life values.

### 5.1.4 Source Data Input Parameters

Based on analytical data from the 2011, 2012, and 2014 monitoring events, the area in the vicinity of MW-21-S was selected as the "source" area. A PCE concentration of 270  $\mu\text{g/L}$  was selected as the source concentration, which was the highest concentration measured during the September 2011 monitoring event (first monitoring event post source soil remediation completed in 2008). In addition, monitoring MW-21-S is within the source removal soil remediation work area.

A source width of 90 feet was selected based on the distance between MW-21-S and MW-19 and the concentrations of PCE measured during the September 2011 sampling event. Using the historic shallowest depth to groundwater of approximately 7 feet below grade and the deepest screened interval depth of 20 feet below grade, a source vertical thickness ( $Z$ ) of 13 feet was selected. A plume length of 300 feet was calculated based on the distance between MW-21-S and MW-24 along the potentiometric surface.

The source area was modeled in 2014 as a decaying single planar source, because the groundwater monitoring data from the past three sampling events (2011, 2012, and 2014) showed evidence of a decaying source concentration and based on the past source soil remediation activities conducted at the site in the vicinity of MW-21-S. The 2015 groundwater analytical data indicates further decay of the source concentration. As such, modeling the

source area as a decaying single planar source remains valid and the 2015 data was utilized to further refine the source decay rate constant ( $k_s$ ) calculation.

The source decay constant was calculated using the guidance in BIOCHLOR User's Manual Addendum v2.2 (March 2002). The source decay rate constant was calculated by plotting temporal aqueous concentrations in the source area well (MW-21-S) on a semi-log plot and determining the slope (concentration plot included in Appendix E). Because Excel will calculate a slope in units of 1/days, the calculated slope value was converted to units of 1/years as required by BIOCHLOR 2.2, which results in a  $k_s$  of 0.03285/years.

## **5.2 BIOCHLOR Model Simulations**

### **5.2.1 Model Calibration**

Using the input parameters described in the previous sections along with the groundwater analytical data from the 2011 through 2015 sampling events, multiple BIOCHLOR simulations were run until the modeled concentration at the downgradient well (MW-24) approximately matched the actual observed concentrations. Please note the only changes between the 2014 model and 2015 model (current) are the simulation time (changed from three years to four years), revision to the source decay rate constant (revised from 0.0365/years to 0.03285/years), and the addition of the 2015 field data for comparative purposes.

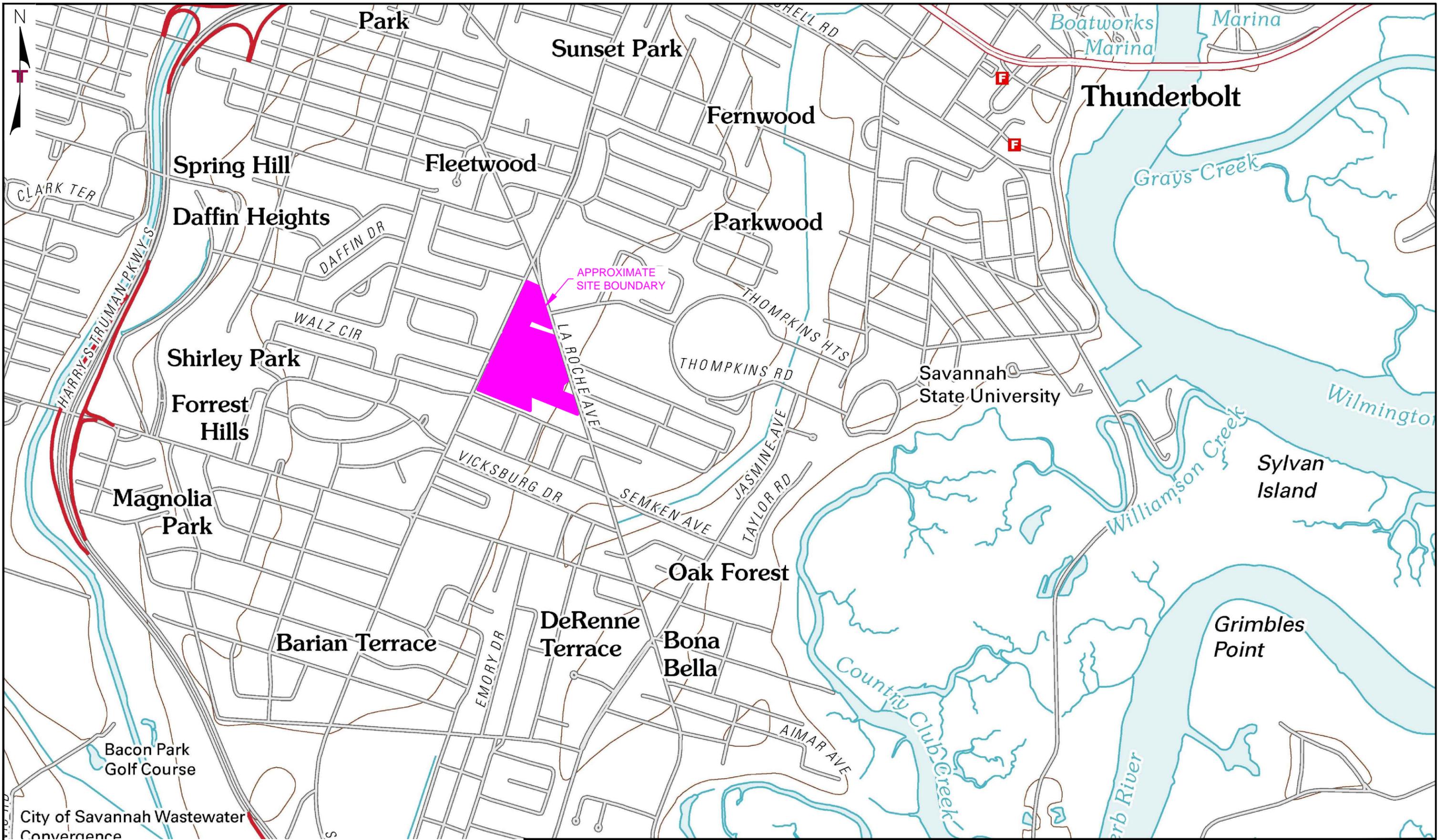
The calibration simulation run time was for four years (2011 to 2015). Calibration of the model was achieved by adjustment of the PCE half-life until the modeled concentration at MW-24 approximated the observed concentration from the February 2015 monitoring event. The calibrated four (4) year BIOCHLOR model predicts a PCE concentration of 15.0  $\mu\text{g/L}$  at a distance of 252 feet from the source well MW-21-S. The February 2015 monitoring results indicate a concentration of 5.27  $\mu\text{g/L}$  at MW-24 located 255 feet from the source area. As such, the model over predicts the downgradient concentration. Further adjustment of the half-life would have resulted in values below the typical lower threshold value of 0.58 years. Since the model input parameters calibrated based on the 2014 data and the model was accepted by the Georgia EPD, no further changes to the model were made.

### **5.2.2 BIOCHLOR Model Results**

The four (4) BIOCHLOR model simulation (assuming 1<sup>st</sup> order decay) predicts that PCE concentrations exceeding the Type 1 RRS are not confined to the subject property and extend approximately 317 feet downgradient from the source area (which is off site under Skidaway Road). Based on the February 2015 data, the PCE concentration within MW-24 (255 feet downgradient from the source area) was 5.27  $\mu\text{g/L}$ .

# **APPENDIX A**

## FIGURES



USGS TOPOGRAPHIC QUADRANGLE MAP  
 SAVANNAH, GEORGIA  
 MAP DATE: 2011

Project Mng:	SAD	Project No.	ES117125
Drawn By:	PTK	Scale:	1" = 1,000'
Checked By:	SAD	File No.	ES117125
Approved By:	WSA	Date:	February 2015

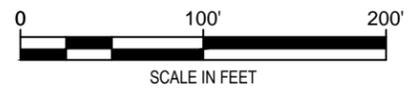
**Terracon**  
 Consulting Engineers and Scientists  
 2201 ROWLAND AVENUE SAVANNAH, GA 31404  
 PH. (912) 629-4000 FAX. (912) 629-4001

SITE VICINITY / TOPOGRAPHIC MAP  
 MARTHA'S DRY CLEANER  
 4608 SKIDAWAY ROAD  
 SAVANNAH, CHATHAM COUNTY, GEORGIA  
 HSI NO. 10764

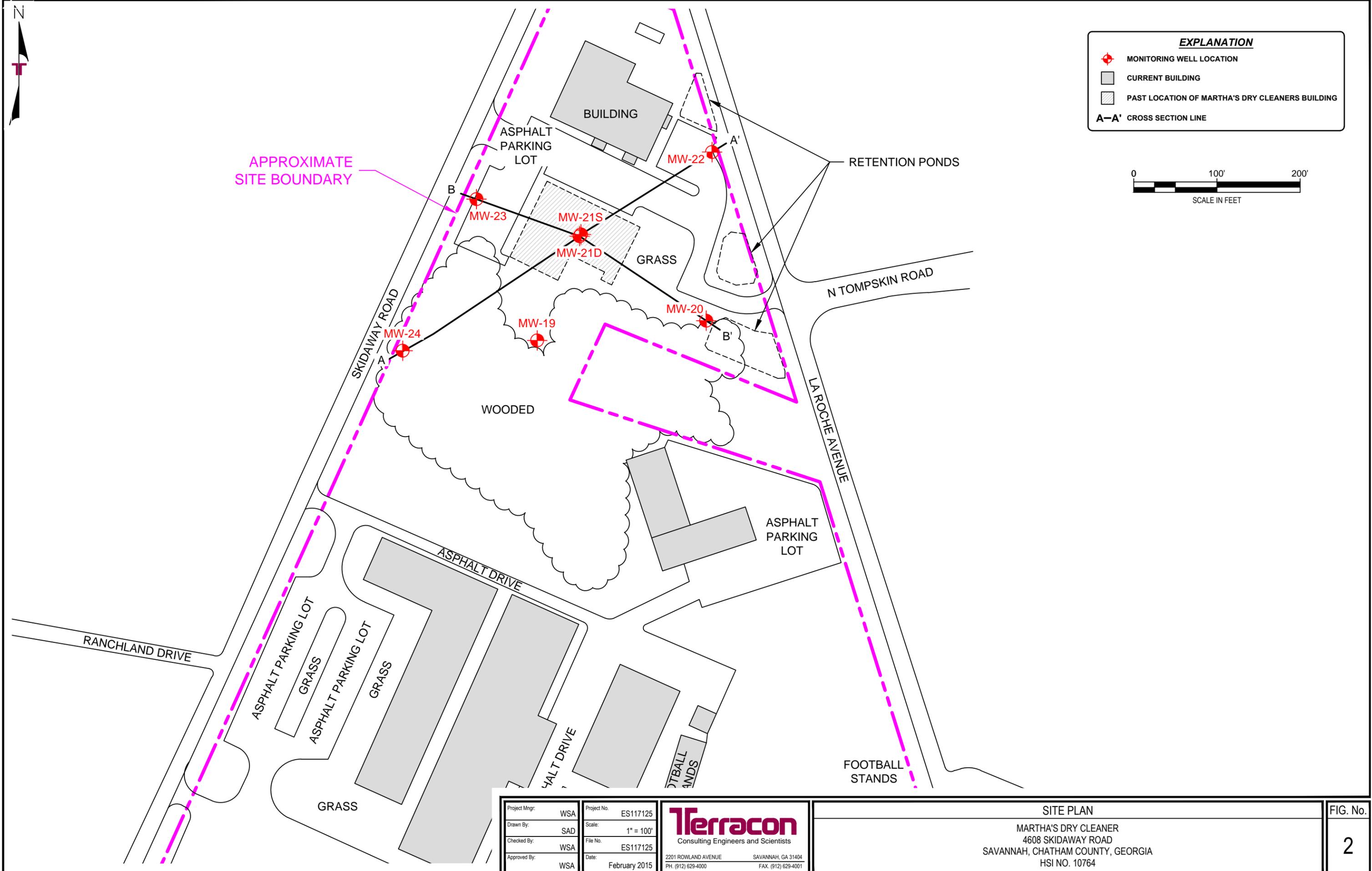
FIG. No.  
 1



EXPLANATION	
	MONITORING WELL LOCATION
	CURRENT BUILDING
	PAST LOCATION OF MARTHA'S DRY CLEANERS BUILDING
<b>A-A'</b>	CROSS SECTION LINE



APPROXIMATE SITE BOUNDARY



Project Mngr:	WSA	Project No.	ES117125
Drawn By:	SAD	Scale:	1" = 100'
Checked By:	WSA	File No.	ES117125
Approved By:	WSA	Date:	February 2015

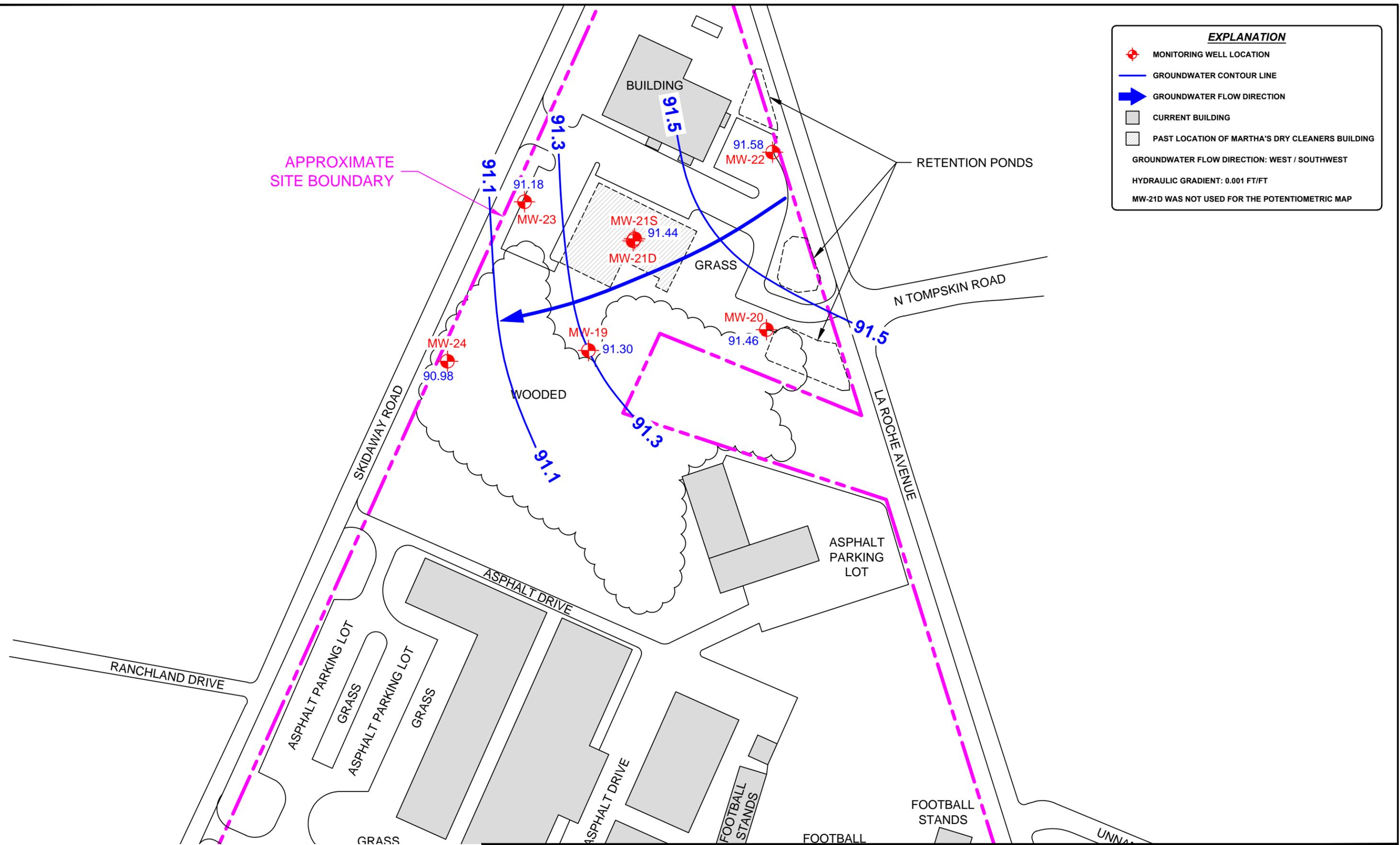
**Terracon**  
 Consulting Engineers and Scientists  
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 PH. (912) 629-4000 FAX. (912) 629-4001

SITE PLAN  
 MARTHA'S DRY CLEANER  
 4608 SKIDAWAY ROAD  
 SAVANNAH, CHATHAM COUNTY, GEORGIA  
 HSI NO. 10764

FIG. No.  
 2



EXPLANATION	
	MONITORING WELL LOCATION
	GROUNDWATER CONTOUR LINE
	GROUNDWATER FLOW DIRECTION
	CURRENT BUILDING
	PAST LOCATION OF MARTHA'S DRY CLEANERS BUILDING
GROUNDWATER FLOW DIRECTION: WEST / SOUTHWEST	
HYDRAULIC GRADIENT: 0.001 FT/FT	
MW-21D WAS NOT USED FOR THE POTENTIOMETRIC MAP	



Project Mng'r:	SAD	Project No.:	ES117125
Drawn By:	SAD	Scale:	1" = 100'
Checked By:	WSA	File No.:	ES117125
Approved By:	WSA	Date:	February 2015

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POTENTIOMETRIC SURFACE MAP - JANUARY 2014

MARTHA'S DRY CLEANER  
 4608 SKIDAWAY ROAD  
 SAVANNAH, CHATHAM COUNTY, GEORGIA  
 HSI NO. 10764

FIG. No.  
**3**



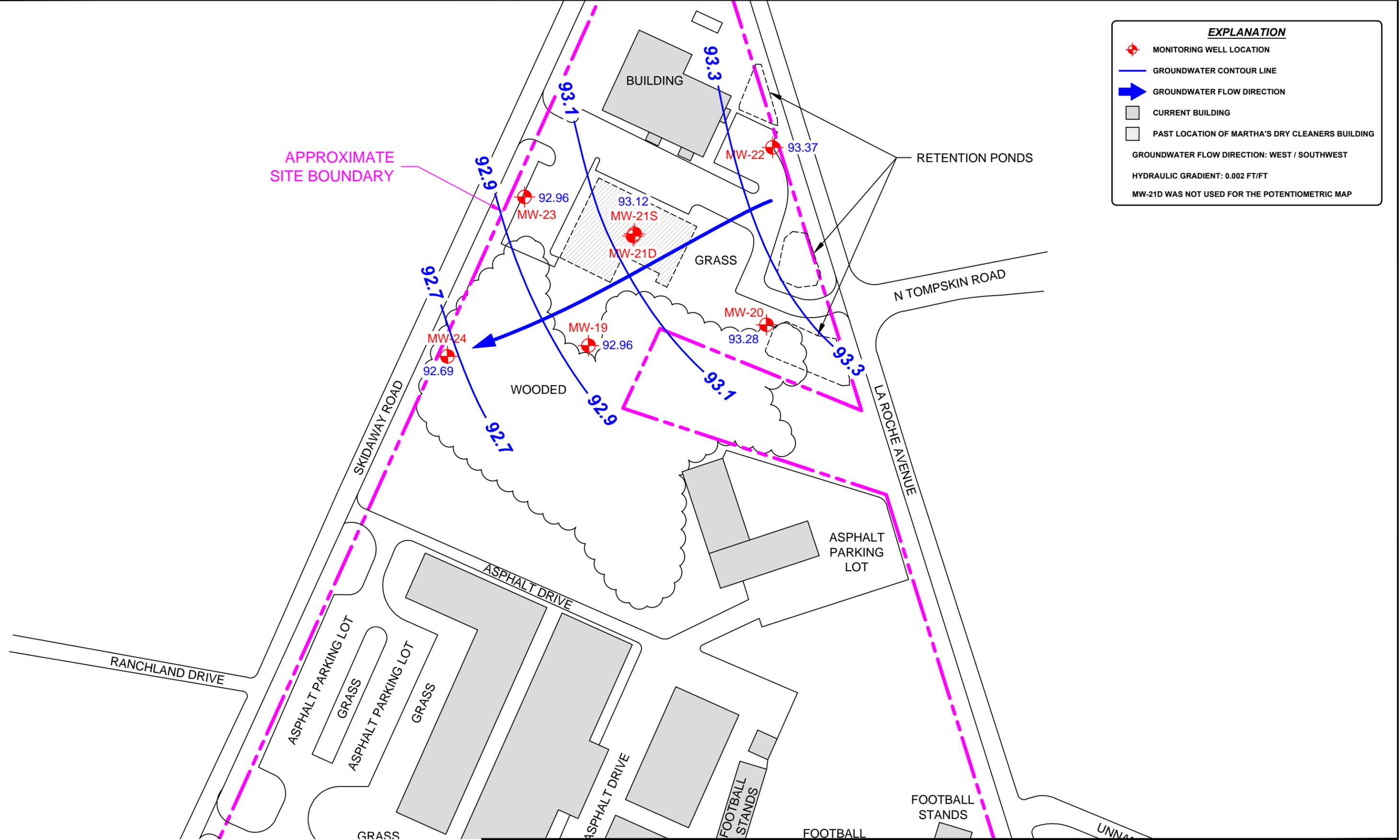
**EXPLANATION**

-  MONITORING WELL LOCATION
-  GROUNDWATER CONTOUR LINE
-  GROUNDWATER FLOW DIRECTION
-  CURRENT BUILDING
-  PAST LOCATION OF MARTHA'S DRY CLEANERS BUILDING

GROUNDWATER FLOW DIRECTION: WEST / SOUTHWEST

HYDRAULIC GRADIENT: 0.002 FT/FT

MW-21D WAS NOT USED FOR THE POTENTIOMETRIC MAP



Project Mngr:	SAD	Project No.:	ES117125
Drawn By:	SAD	Scale:	1" = 100'
Checked By:	WSA	File No.:	ES117125
Approved By:	WSA	Date:	February 2015

**Terracon**  
 Consulting Engineers and Scientists  
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POTENTIOMETRIC SURFACE MAP - FEBRUARY 2015

MARTHA'S DRY CLEANER  
 4608 SKIDAWAY ROAD  
 SAVANNAH, CHATHAM COUNTY, GEORGIA  
 HSI NO. 10764

FIG. No.  
 4



EXPLANATION	
	MONITORING WELL LOCATION
	CURRENT BUILDING
	PAST LOCATION OF MARTHA'S DRY CLEANERS BUILDING
10.2	CONCENTRATION IN µg/L
<1.0	BELOW REPORTING LIMIT
	APPROXIMATE TYPE 1 RRS BOUNDARY OF CONSTITUENTS OF INTEREST

Carbon disulfide	<1.0
trans-1,2-Dichloroethane	<1.0
cis-1,20-Dichloroethane	<1.0
Trichloroethene	<1.0
1,1,2-Trichloroethane	<1.0
Tetrachloroethene	2.29

Carbon disulfide	<1.0
trans-1,2-Dichloroethane	<1.0
cis-1,20-Dichloroethane	<1.0
Trichloroethene	<1.0
1,1,2-Trichloroethane	<1.0
Tetrachloroethene	<1.0

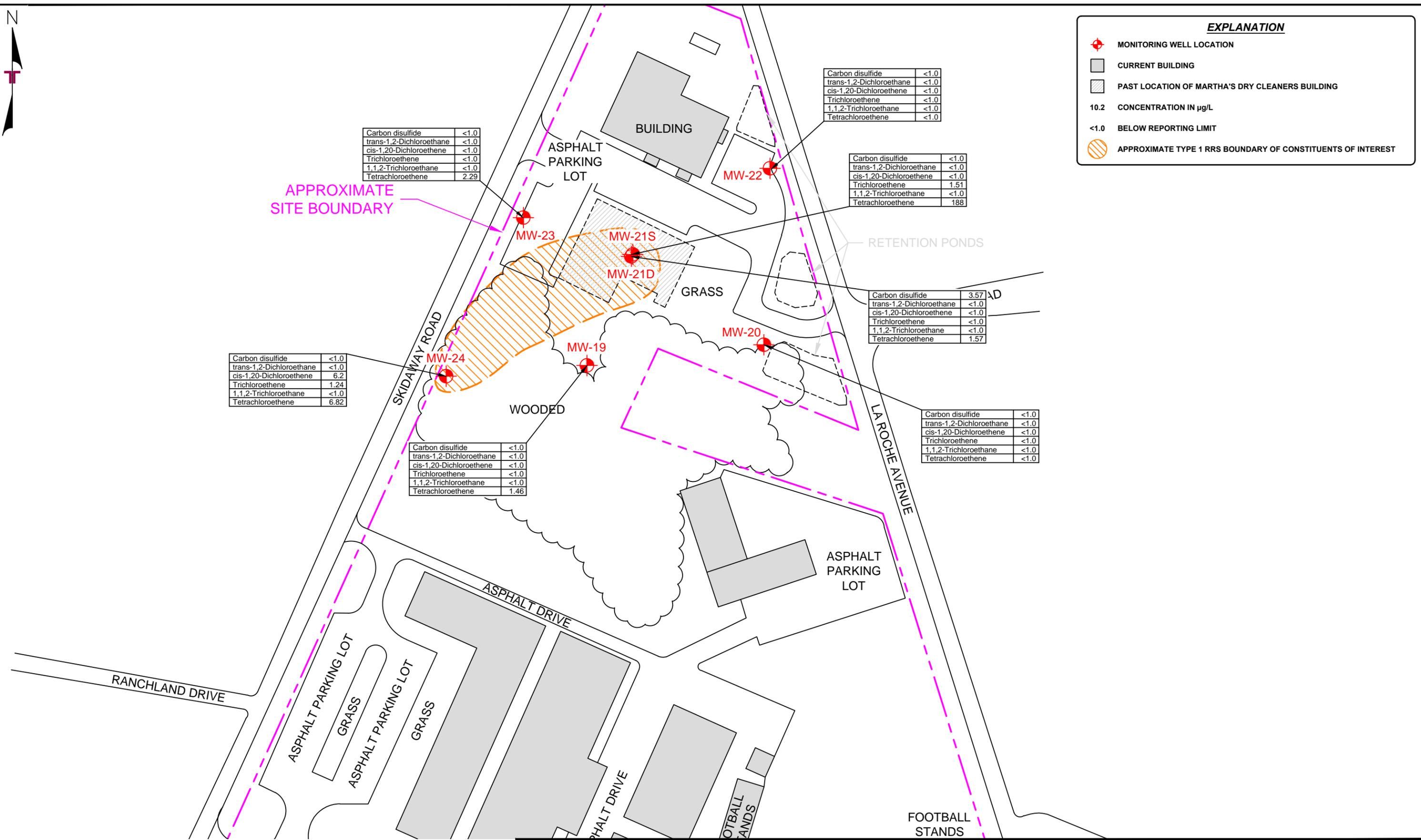
Carbon disulfide	<1.0
trans-1,2-Dichloroethane	<1.0
cis-1,20-Dichloroethane	<1.0
Trichloroethene	1.51
1,1,2-Trichloroethane	<1.0
Tetrachloroethene	188

Carbon disulfide	<1.0
trans-1,2-Dichloroethane	<1.0
cis-1,20-Dichloroethane	6.2
Trichloroethene	1.24
1,1,2-Trichloroethane	<1.0
Tetrachloroethene	6.82

Carbon disulfide	<1.0
trans-1,2-Dichloroethane	<1.0
cis-1,20-Dichloroethane	<1.0
Trichloroethene	<1.0
1,1,2-Trichloroethane	<1.0
Tetrachloroethene	1.46

Carbon disulfide	3.57
trans-1,2-Dichloroethane	<1.0
cis-1,20-Dichloroethane	<1.0
Trichloroethene	<1.0
1,1,2-Trichloroethane	<1.0
Tetrachloroethene	1.57

Carbon disulfide	<1.0
trans-1,2-Dichloroethane	<1.0
cis-1,20-Dichloroethane	<1.0
Trichloroethene	<1.0
1,1,2-Trichloroethane	<1.0
Tetrachloroethene	<1.0



Project Mng'r:	SAD	Project No.:	ES117125
Drawn By:	SAD	Scale:	1" = 100'
Checked By:	WSA	File No.:	ES117125
Approved By:	WSA	Date:	February 2015

**Terracon**  
 Consulting Engineers and Scientists  
 2201 ROWLAND AVENUE SAVANNAH, GA 31404  
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GROUNDWATER ANALYTICAL RESULTS - JANUARY 2014

MARTHA'S DRY CLEANER  
 4608 SKIDAWAY ROAD  
 SAVANNAH, CHATHAM COUNTY, GEORGIA  
 HSI NO. 10764

FIG. No.  
**5**

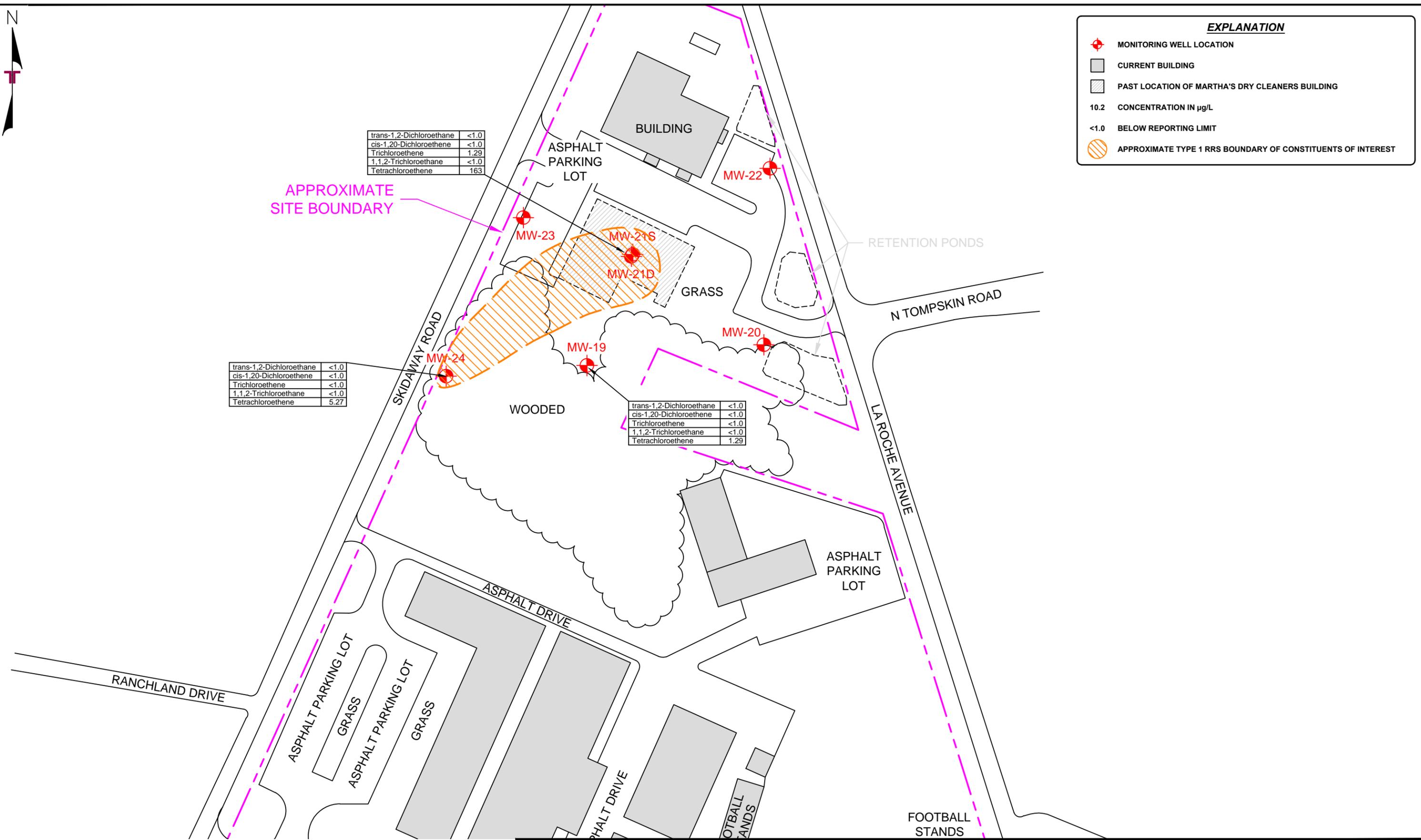


EXPLANATION	
	MONITORING WELL LOCATION
	CURRENT BUILDING
	PAST LOCATION OF MARTHA'S DRY CLEANERS BUILDING
10.2	CONCENTRATION IN µg/L
<1.0	BELOW REPORTING LIMIT
	APPROXIMATE TYPE 1 RRS BOUNDARY OF CONSTITUENTS OF INTEREST

trans-1,2-Dichloroethane	<1.0
cis-1,2-Dichloroethane	<1.0
Trichloroethene	1.29
1,1,2-Trichloroethane	<1.0
Tetrachloroethene	163

trans-1,2-Dichloroethane	<1.0
cis-1,2-Dichloroethane	<1.0
Trichloroethene	<1.0
1,1,2-Trichloroethane	<1.0
Tetrachloroethene	5.27

trans-1,2-Dichloroethane	<1.0
cis-1,2-Dichloroethane	<1.0
Trichloroethene	<1.0
1,1,2-Trichloroethane	<1.0
Tetrachloroethene	1.29



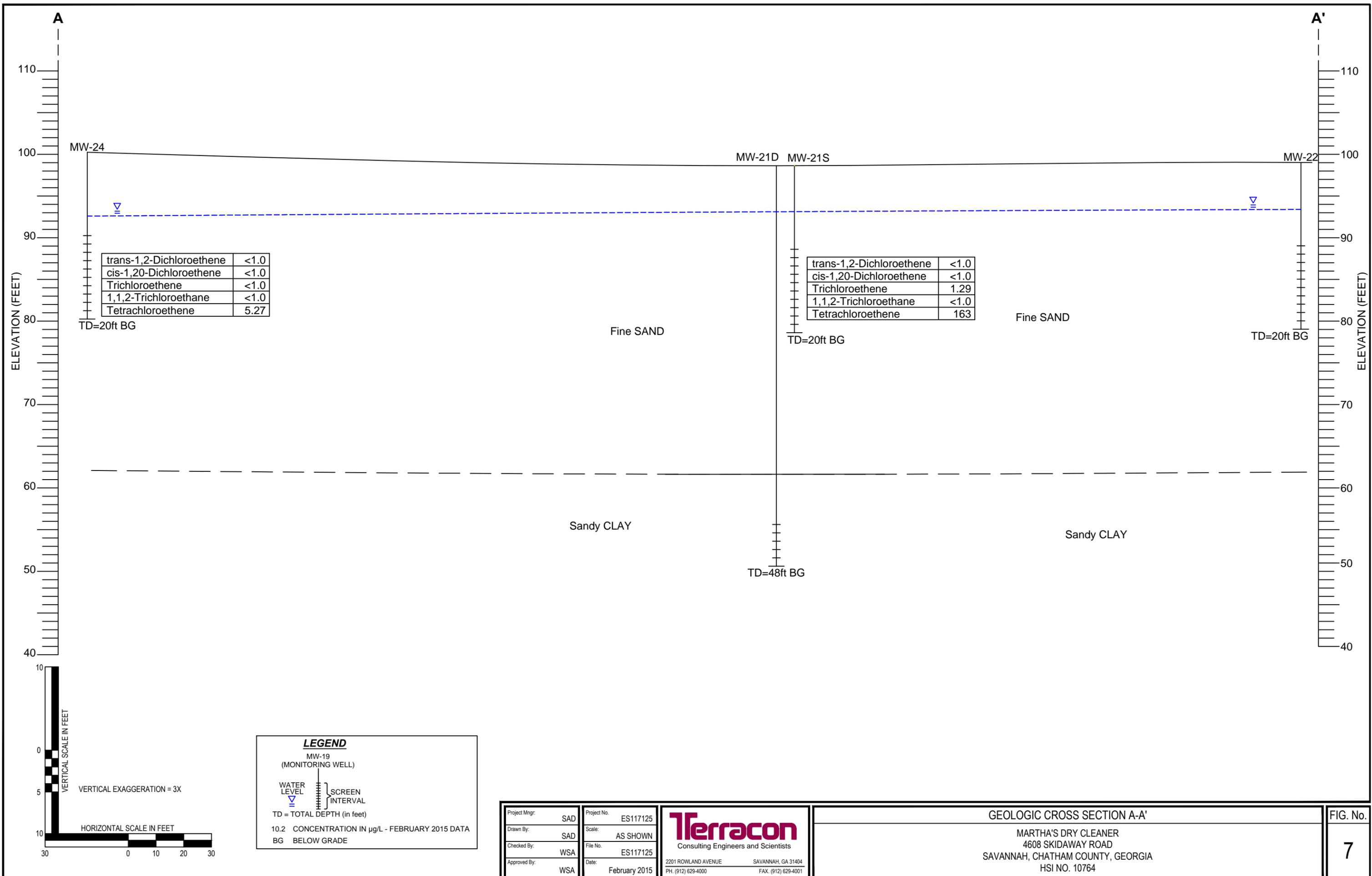
Project Mngr:	SAD	Project No.	ES117125
Drawn By:	SAD	Scale:	1" = 100'
Checked By:	WSA	File No.	ES117125
Approved By:	WSA	Date:	February 2015

**Terracon**  
 Consulting Engineers and Scientists  
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 PH. (912) 629-4000 FAX. (912) 629-4001

GROUNDWATER ANALYTICAL RESULTS - FEBRUARY 2015

MARTHA'S DRY CLEANER  
 4608 SKIDAWAY ROAD  
 SAVANNAH, CHATHAM COUNTY, GEORGIA  
 HSI NO. 10764

FIG. No.  
**6**



trans-1,2-Dichloroethene	<1.0
cis-1,20-Dichloroethene	<1.0
Trichloroethene	<1.0
1,1,2-Trichloroethane	<1.0
Tetrachloroethene	5.27

trans-1,2-Dichloroethene	<1.0
cis-1,20-Dichloroethene	<1.0
Trichloroethene	1.29
1,1,2-Trichloroethane	<1.0
Tetrachloroethene	163

**LEGEND**

MW-19  
(MONITORING WELL)

WATER LEVEL

SCREEN INTERVAL

TD = TOTAL DEPTH (in feet)

10.2 CONCENTRATION IN µg/L - FEBRUARY 2015 DATA

BG BELOW GRADE

Project Mng'r:	SAD	Project No.:	ES117125
Drawn By:	SAD	Scale:	AS SHOWN
Checked By:	WSA	File No.:	ES117125
Approved By:	WSA	Date:	February 2015

**Terracon**  
Consulting Engineers and Scientists

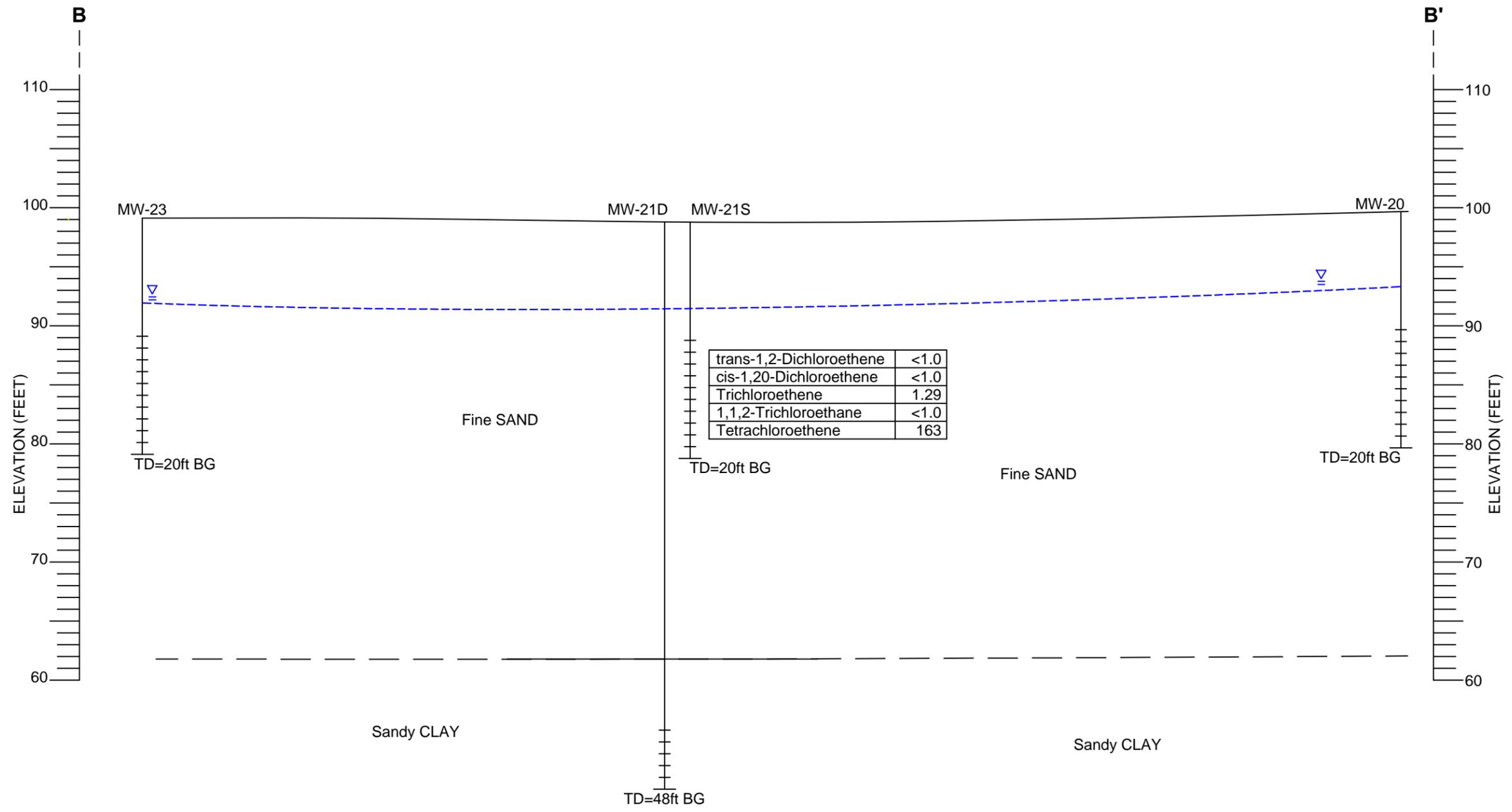
2201 ROWLAND AVENUE SAVANNAH, GA 31404  
PH. (912) 629-4000 FAX. (912) 629-4001

**GEOLOGIC CROSS SECTION A-A'**

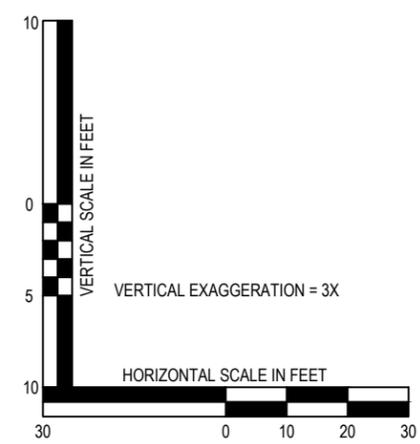
MARTHA'S DRY CLEANER  
4608 SKIDAWAY ROAD  
SAVANNAH, CHATHAM COUNTY, GEORGIA  
HSI NO. 10764

**FIG. No.**

**7**



trans-1,2-Dichloroethene	<1.0
cis-1,2-Dichloroethene	<1.0
Trichloroethene	1.29
1,1,2-Trichloroethane	<1.0
Tetrachloroethene	163



**LEGEND**

MW-24  
(MONITORING WELL)

WATER LEVEL  
SCREEN INTERVAL

TD = TOTAL DEPTH (in feet)  
BG BELOW GRADE

10.2 CONCENTRATION IN µg/L - FEBRUARY 2015 DATA

Project Mngr:	SAD	Project No.	ES117125
Drawn By:	SAD	Scale:	AS SHOWN
Checked By:	WSA	File No.	ES117125
Approved By:	WSA	Date:	February 2015

**Terracon**  
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**GEOLOGIC CROSS SECTION B-B'**

MARTHA'S DRY CLEANER  
4608 SKIDAWAY ROAD  
SAVANNAH, CHATHAM COUNTY, GEORGIA  
HSI NO. 10764

# **APPENDIX B**

## DATA TABLES

**Martha's Dry Cleaner**  
 4608 Skidaway Road  
 Savannah, Chatham County, Georgia  
 HSI Site No. 10764

**Table 1: SUMMARY OF WATER LEVEL DATA**

Well Number	Date Measured	Top of Casing Elevation (feet)	Depth to Water (feet)	Groundwater Elevation (feet)
MW-19	18-Oct-2011	99.45	9.20	90.25
	1-Aug-2012		10.56	88.89
	27-Jan-2014		8.15	91.30
	6-Feb-2015		6.49	92.96
MW-20	18-Oct-2011	99.08	7.67	91.41
	1-Aug-2012		8.59	90.49
	27-Jan-2014		7.62	91.46
	6-Feb-2015		5.80	93.28
MW-21-S	18-Oct-2011	100.00	9.28	90.72
	1-Aug-2012		10.65	89.35
	27-Jan-2014		8.56	91.44
	6-Feb-2015		6.88	93.12
MW-21-D	18-Oct-2011	100.13	12.67	87.46
	1-Aug-2012		13.82	86.31
	27-Jan-2014		11.60	88.53
	6-Feb-2015		9.97	90.16
MW-22	18-Oct-2011	98.90	7.31	91.59
	1-Aug-2012		8.63	90.27
	27-Jan-2014		7.32	91.58
	6-Feb-2015		5.53	93.37
MW-23	18-Oct-2011	99.11	8.96	90.15
	1-Aug-2012		10.43	88.68
	27-Jan-2014		7.93	91.18
	6-Feb-2015		6.15	92.96
MW-24	1-Aug-2012	100.25	11.94	88.31
	27-Jan-2014		9.27	90.98
	6-Feb-2015		7.56	92.69

Prepared by R. Luke Bragg Date 2/23/15  
 Reviewed by Stewart A. Dixon, P.G. Date 2/23/15

**NOTES:**  
 On-site benchmark of 100.00 feet

**Martha's Dry Cleaner**  
 4608 Skidaway Road  
 Savannah, Chatham County, Georgia  
 HSI Site No. 10764

**Table 2 - SUMMARY OF GROUNDWATER TESTING DATA**

Well Number	Date Sampled	Carbon disulfide µg/L	trans-1,2-Dichloroethene µg/L	cis-1,2-Dichloroethene µg/L	Trichloroethene µg/L	1,1,2-Trichloroethane µg/L	Tetrachloroethene µg/L
MW-19	9/23/2011	<1.0	<1.0	10.2	1.86	<1.0	<b>16.6</b>
	8/1/2012	<1.0	<1.0	1.96	<1.0	<1.0	3.39
	1/27/2014	<1.0	<1.0	<1.0	<1.0	<1.0	1.46
	2/6/2015	NT	<1.0	<1.0	<1.0	<1.0	1.29
MW-20	9/23/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	7/31/2012	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	1/27/2014	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
MW-21-S	9/23/2011	<2.0	<2.0	7.96	4.28	<2.0	<b>270</b>
	8/1/2012	<2.0	<2.0	7.56	<b>6.35</b>	<2.0	<b>253</b>
	1/27/2014	<1.0	<1.0	<1.0	1.51	<1.0	<b>188</b>
	2/6/2015	NT	<1.0	<1.0	1.29	<1.0	<b>163</b>
D-MW-21-S*	9/23/2011	<2.0	<2.0	9.08	5	<2.0	<b>324</b>
MW-21-D	9/23/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<b>10.5</b>
	8/1/2012	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	1/27/2014	3.57	<1.0	<1.0	<1.0	<1.0	1.57
MW-22	9/23/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	8/1/2012	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	1/27/2014	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
DUP 1 (MW-22)*	1/27/2014	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
MW-23	9/23/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	8/1/2012	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	1/27/2014	<1.0	<1.0	<1.0	<1.0	<1.0	2.29
MW-24	8/1/2012	<1.0	<1.0	1.87	1.55	<1.0	<b>7.82</b>
	1/27/2014	<1.0	<1.0	6.2	1.24	<1.0	<b>6.82</b>
	2/6/2015	NT	<1.0	<1.0	<1.0	<1.0	<b>5.27</b>
DUP-1 (MW-24)*	8/1/2012	<1.0	<1.0	1.65	1.36	<1.0	<b>6.61</b>
Applicable Standard**		4,000	100.00	70	5	5	5

**NOTES:**

< = Parameter not detected above the associated reporting limit

**BOLD** = Concentration is above the Type I Risk Reduction Standard for the Site

\* = Duplicate sample

\*\* = Georgia EPD HSRA Appendix III

NT = Parameter Not Tested

Prepared by: R. Luke Bragg

Date: 02/23/2015

Reviewed by: Stewart A. Dixon, P.G.

Date: 02/23/2015

**Martha's Dry Cleaner**  
 4608 Skidaway Road  
 Savannah, Chatham County, Georgia  
 HSI Site No. 10764

**Table 3 - SUMMARY OF NATURAL ATTENUATION PARAMETERS ANALYTICAL DATA**

Well Number	Date Sampled	Alkalinity mg/L	Carbon Dioxide mg/L	Chloride mg/L	Nitrate (Nitrate as N) mg/L	Nitrite (Nitrite as N) mg/L	Sulfate mg/L	Sulfide mg/L	Ethane µg/L	Ethene µg/L	Methane µg/L	Dissolved Oxygen mg/L	Iron II mg/L	ORP ±mV
MW-19	8/1/2012	<20	232	3.52	<0.5	<0.02	3.39	0.800 J	<0.02	3.39	64	0.51	0.24	144.7
	1/27/2014	<20	<20	13	<0.5	<0.02	19.3	<1.1	<1.0	<1.0	2.2	1.43	0.06	-29.0
	2/6/2015	NT	NT	NT	NT	NT	NT	NT	<2.0	<1.0	NT	0.93	NT	-42.1
MW-20	7/31/2012	<20	173	2.61	<0.5	<0.02	<2.5	4.00	<2.0	<1.0	40	0.51	0.11	171.5
	1/27/2014	<20	111	3.08	0.543	<0.02	<5.00	<1.1	<1.1	<1.0	0.76	1.02	0.09	-64.6
MW-21-S	8/1/2012	35.6	333	15.0	<0.5	<0.02	16.2	<2.0	<2.0	<1.0	11	0.54	0.14	-20.3
	1/27/2014	26.8	338	13.7	0.695	<0.02	30.5	<1.1	<1.1	<1.0	0.88	1.20	0.09	-59.1
	2/6/2015	NT	NT	NT	NT	NT	NT	NT	<2.0	<1.0	NT	2.84	NT	-41
MW-21-D	8/1/2012	25.1	178	3.53	<0.5	<0.02	<2.5	2.40	<2.0	<1.0	1,300	0.09	0.49	-116.1
	1/27/2014	23.4	296	3.58	<0.5	<0.02	<5.00	<1.1	<1.1	<1.0	320	0.17	0.54	-64.8
MW-22	8/1/2012	21.2	137	6.63	2.11	<0.02	7.00	0.600 J	<2.0	<1.0	51	0.4	0.36	64.1
	1/27/2014	27.6	215	3.87	<0.5	<0.02	7.65	<1.1	<1.1	<1.0	0.59	0.26	0.06	-73.5
MW-23	8/1/2012	<20	318	10.7	<0.5	<0.02	140	0.600 J	<2.0	<1.0	6	0.17	1.35	93.8
	1/27/2014	<20	231	10.7	<0.5	<0.02	118	<1.1	<1.1	<1.0	0.63	0.21	0.41	-66.9
MW-24	8/1/2012	22.9	151	7.39	<0.5	<0.02	16	<2.0	<2.0	<1.0	29	2.22	0.17	121.1
	1/27/2014	<20	231	22.9	<0.5	<0.02	45.5	1.2	<1.1	<1.0	6.3	1.00	0.09	-60.5
	2/6/2015	NT	NT	NT	NT	NT	NT	NT	<2.0	<1.0	NT	0.37	NT	-59.1

**NOTES:**

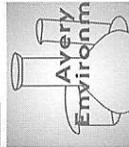
< = Parameter not detected above the associated reporting limit

NT = Parameter Not Tested

Prepared by: R. Luke Bragg Date: 02/23/2015  
 Reviewed by: Stewart A. Dixon, P.G. Date: 02/23/2015

## **APPENDIX C**

GROUNDWATER LABORATORY ANALYTICAL DATA

 <p><b>Avery Environmental Services, LLC</b></p>	<p><b>Ship To: 101 B Estus Dr. Savannah, Ga. 31404</b>  <b>T 912 944-3748 F 912 234-9294</b>  <b>email: pgrimm@averylab.com</b></p>	<p>Serial Number: <b>69515</b></p> <p>LAB NUMBER: <b>15020901</b></p>	
<p>Client Information</p> <p>Customer: <b>TENACOR</b></p> <p>Address: <b>2201 Rowland Ave</b></p> <p>City/State/Zip: <b>Savannah, GA 31404</b></p> <p>Contact: <b>Stewart Dixon</b></p> <p>Phone: <b>(912) 29-4000</b></p> <p>Email: <b>sdixon@tenacor.com</b></p> <p>Purchase Order #: <b>ES117125</b></p> <p>Project Manager: <b>Stewart Dixon</b></p>		<p>Project Name: <b>Martha's Dry Cleaners</b></p> <p>Project Number: <b>ES117125</b></p> <p>State where work originated: <b>GA</b></p>	
<p>Page <u>1</u> of <u>1</u></p> <p>Sampler: <b>JHC</b></p> <p>Turn Around Time (Place X below)</p> <p>24 Hours</p> <p>48 Hours</p> <p>72 Hours</p> <p>5 Working Days</p> <p>7 Working Days</p> <p>Other: <b>X</b></p>		<p>Subcontract Laboratory Name / Address / Phone</p> <p>N</p> <p>A</p> <p>P</p>	
<p><b>Sample Identification</b></p>			
Date	Time	Matrix	# of Containers
2/16/15	1642	W	3
↓	1233	↓	↓
↓	1440	↓	↓
<p>Matrix Type: A = Air W = Water S = Solid N = Nonaqueous (solvent, acid, etc.)</p> <p>Preservative: 1 = None 2 = H2SO4 3 = HNO3 4 = HCL 5 = MeOH 6 = NAHSO4 7 = Water 8 = Other</p>			
<p>Instructions or Special Requirements:</p>			
<p>Temperature: <b>4.0</b></p> <p>Relinquished by: <b>[Signature]</b></p> <p>Relinquished by: <b>[Signature]</b></p> <p>Relinquished by:</p>			
<p>Custody Seals: Yes No</p>		<p>Custody Seals Intact: Yes No</p>	
Date/Time: <b>2/16/15 1708</b>	Date/Time:	Date/Time: <b>26-15 1708</b>	Date/Time:
Date/Time:	Date/Time:	Date/Time:	Date/Time:

# LABORATORY ANALYSIS REPORT

Job ID : 15020901



2720 Gregory St. Unit 200 Savannah, Georgia 31404 Tel: (912) 944-3748 Fax: (912) 234-9294

**Client Project ID :**  
Martha Dry Cleaners

<b>Report To :</b>	Client Name: Terracon	Attn: Stewart Dixon
	Client Address: 2201 Rowland Ave.	P.O.#.:
	City, State, Zip: Savannah, GA, 31404	

Dear Stewart Dixon

The following test results meet all NELAP requirements for analytes for which certification is available. Any deviations from these quality systems will be noted in this case narrative. All analyses performed by Avery Laboratories & Environmental Services, LLC unless noted. Parameters not performed by Avery Laboratories will be listed on the Sample Summary section of the report.

For questions regarding this report, contact Robert Paul Grimm at (912)944-3748.

Sincerely,



This Laboratory is NELAP accredited.

I am the laboratory manager, or his/her designee, and I am responsible for the release of this data package. This laboratory data package has been reviewed and is complete and technically compliant with the requirements of the methods used, except where noted in the attached exception reports. I affirm, to the best of my knowledge that all problems/anomalies observed by this laboratory (and if applicable, any and all laboratories subcontracted through this laboratory) that might affect the quality of the data, have been identified in the Laboratory Review Checklist, and that no information or data have been knowingly withheld that would affect the quality of the data.

Date: 02/20/2015 14:04

Primary Accreditation State and Number: Florida E87941

# CLIENT SAMPLE RESULTS

Job ID : 15020901



■ 2720 Gregory St. Unit 200 ■ Savannah, Georgia 31404 ■ Tel: (912) 944-3748 ■ Fax: (912) 234-9294 ■

Client Name:	Terracon	Attn:	Stewart Dixon
Project ID:	Marthas Dry Cleaners	Date:	02/20/2015

Job ID :	15020901	Sample Matrix:	Aqueous
Client Sample ID:	MW-19	Date Collected:	02/06/2015
Job Sample ID:	15020901.01	Time Collected:	16:42
Other Information:			

Test Method	Parameter	Result	Units	DF	RL	Q	Date/Time Analyzed	Analyst
SW-846 8260B	1,1,2-Trichloroethane	BRL	ug/L	1	1		02/16/2015 17:44	RPG
SW-846 8260B	Tetrachloroethylene	1.29	ug/L	1	1		02/16/2015 17:44	RPG
SW-846 8260B	Trichloroethylene	BRL	ug/L	1	1		02/16/2015 17:44	RPG
SW-846 8260B	Vinyl Chloride	BRL	ug/L	1	1		02/16/2015 17:44	RPG
SW-846 8260B	1,1-Dichloroethylene	BRL	ug/L	1	1		02/16/2015 17:44	RPG
SW-846 8260B	cis-1,2-Dichloroethylene	BRL	ug/L	1	1		02/16/2015 17:44	RPG
SW-846 8260B	trans-1,2-Dichloroethylene	BRL	ug/L	1	1		02/16/2015 17:44	RPG
SW-846 8260B	Dibromofluoromethane(surr)	114	%	1	72.2-136		02/16/2015 17:44	RPG
SW-846 8260B	p-Bromofluorobenzene(surr)	118	%	1	79.2-137		02/16/2015 17:44	RPG
SW-846 8260B	Toluene-d8(surr)	120	%	1	84-136		02/16/2015 17:44	RPG

# CLIENT SAMPLE RESULTS

Job ID : 15020901



■ 2720 Gregory St. Unit 200 ■ Savannah, Georgia 31404 ■ Tel: (912) 944-3748 ■ Fax: (912) 234-9294 ■

Client Name:	Terracon	Attn:	Stewart Dixon
Project ID:	Marthas Dry Cleaners	Date:	02/20/2015

Job ID :	15020901	Sample Matrix:	Aqueous
Client Sample ID:	MW-21S	Date Collected:	02/06/2015
Job Sample ID:	15020901.02	Time Collected:	12:33
Other Information:			

Test Method	Parameter	Result	Units	DF	RL	Q	Date/Time Analyzed	Analyst
SW-846 8260B	1,1,2-Trichloroethane	BRL	ug/L	1	1		02/16/2015 18:10	RPG
SW-846 8260B	Tetrachloroethylene	163	ug/L	1	1		02/16/2015 18:10	RPG
SW-846 8260B	Trichloroethylene	1.29	ug/L	1	1		02/16/2015 18:10	RPG
SW-846 8260B	Vinyl Chloride	BRL	ug/L	1	1		02/16/2015 18:10	RPG
SW-846 8260B	1,1-Dichloroethylene	BRL	ug/L	1	1		02/16/2015 18:10	RPG
SW-846 8260B	cis-1,2-Dichloroethylene	BRL	ug/L	1	1		02/16/2015 18:10	RPG
SW-846 8260B	trans-1,2-Dichloroethylene	BRL	ug/L	1	1		02/16/2015 18:10	RPG
SW-846 8260B	Dibromofluoromethane(surr)	119	%	1	72.2-136		02/16/2015 18:10	RPG
SW-846 8260B	p-Bromofluorobenzene(surr)	107	%	1	79.2-137		02/16/2015 18:10	RPG
SW-846 8260B	Toluene-d8(surr)	117	%	1	84-136		02/16/2015 18:10	RPG

# CLIENT SAMPLE RESULTS

Job ID : 15020901



■ 2720 Gregory St. Unit 200 ■ Savannah, Georgia 31404 ■ Tel: (912) 944-3748 ■ Fax: (912) 234-9294 ■

Client Name:	Terracon	Attn:	Stewart Dixon
Project ID:	Marthas Dry Cleaners	Date:	02/20/2015

Job ID :	15020901	Sample Matrix:	Aqueous
Client Sample ID:	MW-24	Date Collected:	02/06/2015
Job Sample ID:	15020901.03	Time Collected:	14:40
Other Information:			

Test Method	Parameter	Result	Units	DF	RL	Q	Date/Time Analyzed	Analyst
SW-846 8260B	1,1,2-Trichloroethane	BRL	ug/L	1	1		02/17/2015 13:08	RPG
SW-846 8260B	Tetrachloroethylene	5.27	ug/L	1	1		02/17/2015 13:08	RPG
SW-846 8260B	Trichloroethylene	BRL	ug/L	1	1		02/17/2015 13:08	RPG
SW-846 8260B	Vinyl Chloride	BRL	ug/L	1	1		02/17/2015 13:08	RPG
SW-846 8260B	1,1-Dichloroethylene	BRL	ug/L	1	1		02/17/2015 13:08	RPG
SW-846 8260B	cis-1,2-Dichloroethylene	BRL	ug/L	1	1		02/17/2015 13:08	RPG
SW-846 8260B	trans-1,2-Dichloroethylene	BRL	ug/L	1	1		02/17/2015 13:08	RPG
SW-846 8260B	Dibromofluoromethane(surr)	121	%	1	72.2-136		02/17/2015 13:08	RPG
SW-846 8260B	p-Bromofluorobenzene(surr)	105	%	1	79.2-137		02/17/2015 13:08	RPG
SW-846 8260B	Toluene-d8(surr)	119	%	1	84-136		02/17/2015 13:08	RPG

# QUALITY CONTROL DATA

Job ID : 15020901



Avery Laboratories & Environmental Services, LLC

2720 Gregory St. Unit 200 Savannah, Georgia 31404 Tel: (912) 944-3748 Fax: (912) 234-9294

**Analysis:** Volatile Organic Compounds **Method:** SW-846 8260B **Reporting Units:** ug/L

**QC Batch ID:** Qb15021706 **Created Date:** 02/17/2015 17:19 **Created By:** PGrimm

**Samples in this QC Batch:** 15020901,01,02,03

Sample Preparation PB15021706 SW5030b PGrimm

QC Type: Method Blank								
	Parameter	CAS	Result	Units	DF	RL	MDL	Qual
Method Blank	1,1,2-Trichloroethane	79-00-5	BRL	ug/L	1	1.0		
Method Blank	1,1-Dichloroethylene	75-35-4	BRL	ug/L	1	1.0		
Method Blank	cis-1,2-Dichloroethylene	156-59-2	BRL	ug/L	1	1.0		
Method Blank	Tetrachloroethylene	127-18-4	BRL	ug/L	1	1.0		
Method Blank	trans-1,2-Dichloroethylene	156-60-5	BRL	ug/L	1	1.0		
Method Blank	Trichloroethylene	79-01-6	BRL	ug/L	1	1.0		
Method Blank	Vinyl Chloride	75-01-4	BRL	ug/L	1	1.0		
Method Blank	Dibromofluoromethane (Surr)	1868-53-7	57.8		1			
Method Blank	Toluene-d8 (Surr)	2037-26-5	60.9		1			
Method Blank	p-Bromofluorobenzene (Surr)	460-00-4	58.3		1			

QC Type: LCS/LCSD										
Parameter	LCS Spk		LCS %	LCSD Spk		LCS % Rec	RPD	RPD CtrLimit	% Rec CtrLimit	Qual
	Amt	LCS Result	Rec	Amt	LCSD Result					
1,1,2-Trichloroethane	50	53.6	107.0	50	51.9	104.0	3.20	30	83.6-124	
1,1-Dichloroethylene	50	48.8	97.6	50	46.7	93.4	4.40	30	56.5-137	
cis-1,2-Dichloroethylene	50	48	96.0	50	45.1	90.2	6.20	30	63-127	
Tetrachloroethylene	50	50	100.0	50	51.1	102.0	2.20	30	74.2-124	
trans-1,2-Dichloroethylene	50	50.5	101.0	50	48.6	97.2	3.80	30	64.4-126	
Trichloroethylene	50	48.3	96.6	50	48.1	96.2	0.40	30	77.4-121	
Vinyl Chloride	50	50.3	101.0	50	49.1	98.2	2.40	30	47.1-140	
Dibromofluoromethane (Surr)	50	61	122.0	50	57.6	115.0			72.2-136	
Toluene-d8 (Surr)	50	58.3	117.0	50	59.2	118.0			84-136	
p-Bromofluorobenzene (Surr)	50	60.7	121.0	50	61.7	123.0			79.2-137	

QC Type: MS/MSD													
QC Sample ID	Parameter	Sample Result	MS Spk		MS %		MSD		MSD % Rec	RPD	RPD CtrLimit	% Rec CtrLimit	Qual
			Amt	Result	Rec	Amt	Result						
MS 15021002.01	1,1,2-Trichloroethane	0	50	54.1	108.0	50	52.8	106.0		30	83.6-124		
MS 15021002.01	1,1-Dichloroethylene	0	50	48.4	96.8	50	45.7	91.4		30	56.5-137		
MS 15021002.01	cis-1,2-Dichloroethylene	0	50	48.4	96.8	50	44.8	89.6		30	63-127		
MS 15021002.01	Tetrachloroethylene	0	50	51.7	103.0	50	50.5	101.0		30	74.2-124		
MS 15021002.01	trans-1,2-Dichloroethylene	0	50	52.4	105.0	50	47.8	95.6		30	64.4-126		
MS 15021002.01	Trichloroethylene	0	50	48.5	97.0	50	48.6	97.2		30	77.4-121		
MS 15021002.01	Vinyl Chloride	BRL	50	47.5	95.0	50	45.6	91.2	4.10	30	47.1-140		
MS 15021002.01	Dibromofluoromethane (Surr)		50	62.1	124.0	50	59.3	119.0			72.2-136		

# QUALITY CONTROL DATA

Job ID : 15020901



2720 Gregory St. Unit 200 Savannah, Georgia 31404 Tel: (912) 944-3748 Fax: (912) 234-9294

**Analysis:** Volatile Organic Compounds      **Method:** SW-846 8260B      **Reporting Units:** ug/L

**QC Batch ID:** Qb15021706      **Created Date:** 02/17/2015 17:19      **Created By:** PGrimm

**Samples in this QC Batch:** 15020901,01,02,03

QC Type: MS/MSD													
	QC Sample ID	Parameter	Sample Result	MS Spk Amt	MS Result	MS % Rec	MS Spk Amt	MSD Result	MSD % Rec	RPD	RPD CtrlLimit	% Rec CtrlLimit	Qual
MS	15021002.01	Toluene-d8 (Surr)		50	58.6	117.0	50	59.5	119.0			84-136	
MS	15021002.01	p-Bromofluorobenzene (Surr)		50	65	130.0	50	61.9	124.0			79.2-137	

Refer to the Definition page for terms.

# CASE NARRATIVE

Job ID : 15020901



■ 2720 Gregory St. Unit 200 ■ Savannah, Georgia 31404 ■ Tel: (912) 944-3748 ■ Fax: (912) 234-9294 ■

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Client Name: Terracon  
Project ID: Martha Dry Cleaners  
Date Received: 02/06/2015  
Collected By: JHC

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There were no analytical problems encountered. All results and quality control were within the laboratory's established limits.

Released By: PGrimm

Title: Technical Director

# TERM AND QUALIFIER DEFINITION

Job ID : 15020901



2720 Gregory St. Unit 200 Savannah, Georgia 31404 Tel: (912) 944-3748 Fax: (912) 234-9294

## General Term Definition

Conc.	Concentration
DF	Dilution Factor - the factor applied to the reported data due to sample preparation, dilution, or moisture content
ND	Non Detect - Not Detected at or above adjusted reporting limit
J	Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit
RL	adjusted Reporting Limit (QL – Quantification Limit)
MDL	adjusted Method Detection Limit (LOD – Limit of Detection)
RegLimit	Regulatory Limit
mg/l	Milligrams per Liter
mg/kg	Milligrams per Kilogram
ppm	Parts per Million
µg/L	Micrograms per Liter
µg/g	Micrograms per Gram
ppb	Parts per Billion
gr/gal	Grains per Gallon
SU	Standard Units
CCU	Cobalt Color Units
NTU	Nephelometric Turbidity Units
µS/cm	Microsiemens per cm at 25C
P/A	Presence/Absence
CFU	Colony Forming Units
MPN	Most Probable Number
RB	Reagent Blank
MB	Method Blank
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LFM	Laboratory Fortified Matrix (MS – Matrix Spike)
LFMD	Laboratory Fortified Matrix Duplicate (MSD – Matrix Spike Duplicate)
DUP	Sample Duplicate
RPD	Relative Percent Difference
%Rec	Percent Recovery
TNTC	Too numerous to count
NC	Not Calculable
SG	Silica Gel - Clean-Up
BRL	Below Reporting Limit
BDL	Below Detection Limit

## Qualifier Definition

J1	Estimated value-The reported value failed the established quality control criteria for accuracy and /or precision.
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# SAMPLE SUMMARY

Job ID : 15020901

Avery Laboratories &  
Environmental Services, LLC

■ 2720 Gregory St. Unit 200 ■ Savannah, Georgia 31404 ■ Tel: (912) 944-3748 ■ Fax: (912) 234-9294 ■

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**Client Project ID :**

Martha Dry Cleaners

**Report To :**Client Name: Terracon  
Client Address: 2201 Rowland Ave.  
City, State, Zip: Savannah, GA, 31404Attn: Stewart Dixon  
P.O.#.:

---

The laboratory has analyzed the following samples:

Client Sample ID	Matrix	Sample ID	Date Received	Date Collected	Collected by
MW-19	Aqueous	15020901.01	2/6/2015 17:08	2/6/2015 16:42	JHC
MW-21S	Aqueous	15020901.02	2/6/2015 17:08	2/6/2015 12:33	JHC
MW-24	Aqueous	15020901.03	2/6/2015 17:08	2/6/2015 14:40	JHC

# SAMPLE PREPARATION INFORMATION

Job ID : 15020901



■ 2720 Gregory St. Unit 200 ■ Savannah, Georgia 31404 ■ Tel: (912) 944-3748 ■ Fax: (912) 234-9294 ■

Client Name:	Terracon	Attn:	Stewart Dixon		
Project Name:	Martha Dry Cleaners	Date:	02/20/2015		
Sample ID	Test	Prep Method	Date Prepared	Analyst	Prep Batch ID
15020901.01	VOC	SW5030b	02/16/2015 09:45	PGrimm	PB15021706
15020901.02	VOC	SW5030b	02/16/2015 09:45	PGrimm	PB15021706
15020901.03	VOC	SW5030b	02/16/2015 09:45	PGrimm	PB15021706

# SAMPLE CONDITION CHECKLIST

Job ID : 15020901



Avery Laboratories &  
Environmental Services, LLC

■ 2720 Gregory St. Unit 200 ■ Savannah, Georgia 31404 ■ Tel: (912) 944-3748 ■ Fax: (912) 234-9294 ■

<b>Client Name :</b> Terracon		<b>Contact :</b> Stewart Dixon
<b>Client Address :</b> 2201 Rowland Ave.		<b>Contact Phone :</b> 912 629-4000
<b>JobID :</b> 15020901	<b>Date Received :</b> 02/06/2015	<b>Time Received :</b> 05:08 PM
<b>Temperature :</b> 4.0	<b>Sample pH :</b>	
<b>ThermometerID :</b> 15953	<b>pHPaperID :</b>	

**Comments : Include actions taken to resolve discrepancies/problem:**

--

	Check Points	Yes	No	N/A
1	Bottle count on C-O-C matches bottle found.	✓		
2	C-O-C signed and dated.	✓		
3	Cooler seal present and signed.	✓		
4	If requested, sample(s) received with signed sample custody seal			✓
5	Sample amount is sufficient for analyses requested	✓		
6	Sample containers arrived in tact. (if no, comment)	✓		
7	Sample ID lables Match C-O-C ID's	✓		
8	Sample received at 6°C or Less	✓		
9	Sample(s) in a cooler.	✓		
10	Sample(s) were received at the proper pH.	✓		
11	Sample(s) were received in appropriate contatiner. (If no, comment)	✓		
12	Samples accepted.	✓		
13	Samples received within holding time for analysis requested	✓		
14	Zero headspace in liquid VOA vials	✓		

CheckIn By : Elizabeth Grimm

CheckIn Date : 02/09/2015

# COMMERCIAL LABORATORY STIPULATION

## Georgia Rules for Commercial Environmental Laboratory Accreditation Chapter 391-3-26

Job ID : 15020901



■ 2720 Gregory St. Unit 200 ■ Savannah, Georgia 31404 ■ Tel: (912) 944-3748 ■ Fax: (912) 234-9294 ■

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**Laboratory:** Avery Laboratories and Environmental Services, LLC  
**Accreditor:** NELAC: State of Florida, Department of Health, Bureau of Laboratories  
**Accreditation ID:** E87941  
**Scope:** NON-POTABLE WATER - EXTRACTABLE ORGANICS, NON-POTABLE WATER - GENERAL CHEMISTRY, NON-POTABLE WATER - METALS, NON-POTABLE WATER - PESTICIDES-HERBICIDES-PCB'S, NON-POTABLE WATER - VOLATILE ORGANICS, SOLID AND CHEMICAL MATERIALS - EXTRACTABLE ORGANICS, SOLID AND CHEMICAL MATERIALS - GENERAL CHEMISTRY, SOLID AND CHEMICAL MATERIALS - METALS, SOLID AND CHEMICAL MATERIALS - VOLATILE ORGANICS  
**Effective Date:** July 1, 2014 **Expiration Date:** July 1, 2015

As per the Georgia EPD Rules and Regulations for Commercial Laboratories, Avery Laboratories and Environmental Services - Savannah is accredited by the Florida Department of Health under the National Environmental Laboratory Approval Program (NELAP). If you have any further questions regarding accreditation status for Avery Laboratories and Environmental Services, please contact: Paul Grimm.

Avery Laboratories and Environmental Services, LLC  
101B Estus Drive  
Savannah, GA 31404  
Phone: (912) 944-3748  
Fax: (912) 234-9294



February 13, 2015

Robert Paul Grimm  
Avery Laboratories & Environmental Services, LLC  
101 B Estus Dr.  
Savannah GA 31404

TEL: (912) 944-3748  
FAX: (912) 234-9294

RE: Martha's Dry Cleaners

Dear Robert Paul Grimm:

Order No: 1502886

Analytical Environmental Services, Inc. received 3 samples on 2/10/2015 3:45:00 PM for the analyses presented in following report.

No problems were encountered during the analyses. Additionally, all results for the associated Quality Control samples were within EPA and/or AES established limits. Any discrepancies associated with the analyses contained herein will be noted and submitted in the form of a project Case Narrative.

AES' certifications are as follows:

- NELAC/Florida Certification number E87582 for analysis of Environmental Water, soil/hazardous waste, and Drinking Water Microbiology, effective 07/01/14-06/30/15.
- AIHA-LAP, LLC Laboratory ID: 100671 for Industrial Hygiene samples (Organics, Inorganics), Environmental Lead (Paint, Soil, Dust Wipes, Air), and Environmental Microbiology (Fungal) Direct Examination, effective until 09/01/15.

These results relate only to the items tested. This report may only be reproduced in full.

If you have any questions regarding these test results, please feel free to call.

Nicole Jessup  
Project Manager



**Analytical Environmental Services, Inc**

**Date:** 13-Feb-15

<b>Client:</b> Avery Laboratories & Environmental Services, LLC	<b>Client Sample ID:</b> MW-19
<b>Project Name:</b> Martha's Dry Cleaners	<b>Collection Date:</b> 2/6/2015 4:42:00 PM
<b>Lab ID:</b> 1502886-001	<b>Matrix:</b> Aqueous

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
<b>GC Analysis of Gaseous Samples SOP-RSK 175 (RSK175)</b>									
Ethane	BRL		2	9	ug/L	202980	1	02/10/2015 18:50	JM
Ethylene	BRL		1	7	ug/L	202980	1	02/10/2015 18:50	JM

**Qualifiers:**

- \* Value exceeds maximum contaminant level
- BRL Not detected at MDL
- H Holding times for preparation or analysis exceeded
- N Analyte not NELAC certified
- B Analyte detected in the associated method blank
- NC Not confirmed

- E Estimated value above quantitation range
- S Spike Recovery outside limits due to matrix
- J Estimated value detected below Reporting Limit
- > Greater than Result value
- < Less than Result value
- Narr See case narrative

**Analytical Environmental Services, Inc**

**Date:** 13-Feb-15

<b>Client:</b> Avery Laboratories & Environmental Services, LLC	<b>Client Sample ID:</b> MW-21S
<b>Project Name:</b> Martha's Dry Cleaners	<b>Collection Date:</b> 2/6/2015 12:33:00 PM
<b>Lab ID:</b> 1502886-002	<b>Matrix:</b> Aqueous

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
<b>GC Analysis of Gaseous Samples SOP-RSK 175</b>									
Ethane	BRL		2	9	ug/L	202980	1	02/10/2015 18:13	JM
Ethylene	BRL		1	7	ug/L	202980	1	02/10/2015 18:13	JM

**Qualifiers:**

- \* Value exceeds maximum contaminant level
- BRL Not detected at MDL
- H Holding times for preparation or analysis exceeded
- N Analyte not NELAC certified
- B Analyte detected in the associated method blank
- NC Not confirmed

- E Estimated value above quantitation range
- S Spike Recovery outside limits due to matrix
- J Estimated value detected below Reporting Limit
- > Greater than Result value
- < Less than Result value
- Narr See case narrative

**Analytical Environmental Services, Inc**

**Date:** 13-Feb-15

<b>Client:</b> Avery Laboratories & Environmental Services, LLC	<b>Client Sample ID:</b> MW-24
<b>Project Name:</b> Martha's Dry Cleaners	<b>Collection Date:</b> 2/6/2015 2:40:00 PM
<b>Lab ID:</b> 1502886-003	<b>Matrix:</b> Aqueous

Analyses	Result	Qual	MDL	Reporting Limit	Units	BatchID	DF	Date Analyzed	Analyst
<b>GC Analysis of Gaseous Samples SOP-RSK 175</b>				<b>(RSK175)</b>					
Ethane	BRL		2	9	ug/L	202980	1	02/10/2015 18:18	JM
Ethylene	BRL		1	7	ug/L	202980	1	02/10/2015 18:18	JM

**Qualifiers:**

- \* Value exceeds maximum contaminant level
- BRL Not detected at MDL
- H Holding times for preparation or analysis exceeded
- N Analyte not NELAC certified
- B Analyte detected in the associated method blank
- NC Not confirmed

- E Estimated value above quantitation range
- S Spike Recovery outside limits due to matrix
- J Estimated value detected below Reporting Limit
- > Greater than Result value
- < Less than Result value
- Narr See case narrative

Analytical Environmental Services, Inc.

Sample/Cooler Receipt Checklist

Client Avery Labs

Work Order Number 1502886

Checklist completed by [Signature] 2/10/15  
Signature Date

Carrier name: FedEx  UPS  Courier  Client  US Mail  Other

Shipping container/cooler in good condition? Yes  No  Not Present

Custody seals intact on shipping container/cooler? Yes  No  Not Present

Custody seals intact on sample bottles? Yes  No  Not Present

Container/Temp Blank temperature in compliance? (0°≤6°C)\* Yes  No

Cooler #1 35 Cooler #2 \_\_\_\_\_ Cooler #3 \_\_\_\_\_ Cooler #4 \_\_\_\_\_ Cooler#5 \_\_\_\_\_ Cooler #6 \_\_\_\_\_

Chain of custody present? Yes  No

Chain of custody signed when relinquished and received? Yes  No

Chain of custody agrees with sample labels? Yes  No

Samples in proper container/bottle? Yes  No

Sample containers intact? Yes  No

Sufficient sample volume for indicated test? Yes  No

All samples received within holding time? Yes  No

Was TAT marked on the COC? Yes  No

Proceed with Standard TAT as per project history? Yes  No  Not Applicable

Water - VOA vials have zero headspace? No VOA vials submitted  Yes  No

Water - pH acceptable upon receipt? Yes  No  Not Applicable

Adjusted? \_\_\_\_\_ Checked by \_\_\_\_\_  
Sample Condition: Good  Other(Explain) \_\_\_\_\_

(For diffusive samples or AIHA lead) Is a known blank included? Yes  No

See Case Narrative for resolution of the Non-Conformance.

\* Samples do not have to comply with the given range for certain parameters.

**Client:** Avery Laboratories & Environmental Services, LLC  
**Project Name:** Martha's Dry Cleaners  
**Workorder:** 1502886

**ANALYTICAL QC SUMMARY REPORT**

**BatchID: 202980**

Sample ID: <b>MB-202980</b>	Client ID:	Units: <b>ug/L</b>	Prep Date: <b>02/10/2015</b>	Run No: <b>285583</b>							
SampleType: <b>MBLK</b>	TestCode: <b>GC Analysis of Gaseous Samples SOP-RSK 175</b>	BatchID: <b>202980</b>	Analysis Date: <b>02/10/2015</b>	Seq No: <b>6059435</b>							
Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual

Ethane  
Ethylene  
Methane

BRL 9  
BRL 7  
BRL 4

Sample ID: <b>LCS-202980</b>	Client ID:	Units: <b>ug/L</b>	Prep Date: <b>02/10/2015</b>	Run No: <b>285583</b>							
SampleType: <b>LCS</b>	TestCode: <b>GC Analysis of Gaseous Samples SOP-RSK 175</b>	BatchID: <b>202980</b>	Analysis Date: <b>02/10/2015</b>	Seq No: <b>6059436</b>							
Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual

Ethane  
Ethylene  
Methane

138.2 9 200.0 69.1 41.2 115  
89.86 7 200.0 44.9 26.5 115  
144.2 4 200.0 72.1 45.1 115

Sample ID: <b>LCSD-202980</b>	Client ID:	Units: <b>ug/L</b>	Prep Date: <b>02/10/2015</b>	Run No: <b>285583</b>							
SampleType: <b>LCSD</b>	TestCode: <b>GC Analysis of Gaseous Samples SOP-RSK 175</b>	BatchID: <b>202980</b>	Analysis Date: <b>02/10/2015</b>	Seq No: <b>6059437</b>							
Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual

Ethane  
Ethylene  
Methane

139.6 9 200.0 69.8 41.2 115 138.2 1.05 20  
90.66 7 200.0 45.3 26.5 115 89.86 0.887 20  
144.9 4 200.0 72.5 45.1 115 144.2 0.482 20

Sample ID: <b>1502655-005BMS</b>	Client ID:	Units: <b>ug/L</b>	Prep Date: <b>02/10/2015</b>	Run No: <b>285583</b>							
SampleType: <b>MS</b>	TestCode: <b>GC Analysis of Gaseous Samples SOP-RSK 175</b>	BatchID: <b>202980</b>	Analysis Date: <b>02/10/2015</b>	Seq No: <b>6059449</b>							
Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual

Ethane  
Ethylene  
Methane

136.9 9 200.0 68.4 40.5 115  
90.22 7 200.0 45.1 25.1 115  
140.3 4 200.0 70.1 40.4 115

**Qualifiers:** > Greater than Result value < Less than Result value B Analyte detected in the associated method blank  
 BRL Below reporting limit E Estimated (value above quantitation range) H Holding times for preparation or analysis exceeded  
 J Estimated value detected below Reporting Limit N Analyte not NELAC certified R RPD outside limits due to matrix  
 Rpt Lim Reporting Limit S Spike Recovery outside limits due to matrix

**Client:** Avery Laboratories & Environmental Services, LLC  
**Project Name:** Martha's Dry Cleaners  
**Workorder:** 1502886

**ANALYTICAL QC SUMMARY REPORT**

**BatchID: 202980**

Sample ID: <b>1502655-005BMSD</b>	Client ID:	Units: <b>ug/L</b>	Prep Date: <b>02/10/2015</b>	Run No: <b>285583</b>							
SampleType: <b>MSD</b>	TestCode: <b>GC Analysis of Gaseous Samples SOP-RSK 175</b>	BatchID: <b>202980</b>	Analysis Date: <b>02/10/2015</b>	Seq No: <b>6059450</b>							
Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual

Ethane	131.1	9	200.0		65.5	40.5	115	136.9	4.34	20	
Ethylene	86.45	7	200.0		43.2	25.1	115	90.22	4.28	20	
Methane	134.4	4	200.0		67.2	40.4	115	140.3	4.29	20	

<b>Qualifiers:</b>	>	Greater than Result value	<	Less than Result value	B	Analyte detected in the associated method blank
	BRL	Below reporting limit	E	Estimated (value above quantitation range)	H	Holding times for preparation or analysis exceeded
	J	Estimated value detected below Reporting Limit	N	Analyte not NELAC certified	R	RPD outside limits due to matrix
	Rpt Lim	Reporting Limit	S	Spike Recovery outside limits due to matrix		

## **APPENDIX D**

### MONITORING WELL FIELD SAMPLING DATA

SITE NAME: Martha's Dry Cleaners  
 PROJECT NUMBER: ES117125  
 FIELD PERSONNEL: JHC

WELL NUMBER: MW-24

DATE: 2/6/15

Time	Depth to Water (Ft - BTOC)	Well Diameter (Inches)	Total Depth (Ft - BTOC)	Water Column Thickness (Feet)	Single Purge Volume (Gallons)	Total Volume Purged (Gallons)	Stick Up Height (Feet)	Groundwater Elevation (Feet)	PURGE METHOD: <u>Low Flow - Peristaltic</u>	
									Start Time	End Time
1255	7.56	2	19.77	12.21	1.99	6.12			1256	1437
									SAMPLER TYPE: <u>Low Flow - peristaltic</u>	
									1437	1440

Time	Pumping Rate (L/min or gpm)	Water Level (Feet - BTOC)	Dissolved Oxygen (mg/l)	ORP (mv)	Turbidity (NTU)	Specific Electrical Conductance (mS/cm)	pH	Temperature (Celsius)	Cumulative Volume Pumped (Gallons)	Stabilization Criteria * Required Parameters - USEPA SESDPROC-301-R2	
										Parameter	Criteria
1329	0.06 gpm	7.58	1.03	-56.1	1.36	0.340	5.19	18.27	2.04	pH *	+/- 0.1 unit
1403	0.06	7.58	0.45	-50.8	0.77	0.336	5.17	18.35	4.08	Electrical Conduct. *	+/- 5%
1437	0.06	7.58	0.37	-59.1	0.66	0.332	5.12	18.32	6.12	Turbidity	< 10 NTU
										ORP	+/- 10 mV
										Dissolved Oxygen	+/- 0.2 mg/l
NOTES: (Sample Numbers, Weather Conditions, Field Notes, and Deviations) <ul style="list-style-type: none"> <li>- Tubing set at ~ 14'</li> <li>- weather - 47° - Fair</li> <li>- Tubing used               <ul style="list-style-type: none"> <li>↳ Master Flex # 96410-15</li> <li>- Teflon line poly</li> </ul> </li> <li>- Sample time - 1440</li> <li>- Sampling Procedure               <ul style="list-style-type: none"> <li>↳ straw - methanol</li> </ul> </li> </ul>											

CONTAINER		PRESERVATIVE / PREPARATION	NUMBER	FILTERING	ANALYSIS
TYPE	VOLUME				
Glass	40m	HCC	3	NO	Tetrachloroethene, Trichloroethene, cis-1,2-dichloroethene, vinyl chloride, dichloroethylene, ethylene, ethene, 1,1,2-Trichloroethene, trans-1,2-dichloroethylene

For 2-inch wells: multiply the water column height by 0.1632 to get gallons for 1 casing volume  
 For 4-inch wells: multiply the water column height by 0.6528 to get gallons for 1 casing volume

Field Water Quality Meter IDs: Alexis peristaltic YSI 556 MPS  
HACH 2100 turbidimeter, Solinst water

SITE NAME: Martha's Dry cleaner  
 PROJECT NUMBER: ES117125  
 FIELD PERSONNEL: JHC

WELL NUMBER: MW-215

DATE: 2/6/15

Time	Depth to Water (Ft - BTOC)	Well Diameter (Inches)	Total Depth (Ft - BTOC)	Water Column Thickness (Feet)	Single Purge Volume (Gallons)	Total Volume Purged (Gallons)	Stick Up Height (Feet)	Groundwater Elevation (Feet)	PURGE METHOD: <u>Low Flow - Peristaltic</u>
1021	6.88	2	19.70	12.82	2.09	6.3			Start Time - 1025 End Time - 1231
									SAMPLER TYPE: <u>Low flow - Peristaltic</u>
									Start Time - 1231 End Time 1234

Time	Pumping Rate (L/min or gpm)	Water Level (Feet - BTOC)	Dissolved Oxygen (mg/l)	ORP (mv)	Turbidity (NTU)	Specific Electrical Conductance (mS/cm)	pH	Temperature (Celsius)	Cumulative Volume Pumped (Gallons)	Stabilization Criteria Required Parameters - USEPA SESDPROC-301-R2 *
1107	0.05 gpm	6.91	2.43	-42.7	2.43	0.252	5.47	19.67	2.1	pH * +/- 0.1 unit
1149	0.05 gpm	6.91	2.37	-38.4	1.36	0.256	5.41	19.94	4.2	Electrical Conduct. * +/- 5%
1231	0.05 gpm	6.91	<del>2.84</del> 2.84	-41.0	1.15	0.255	5.40	19.96	6.3	Turbidity < 10 NTU
										ORP +/- 10 mV
										Dissolved Oxygen +/- 0.2 mg/l
NOTES: (Sample Numbers, Weather Conditions, Field Notes, and Deviations) <ul style="list-style-type: none"> <li>- Tubing set at ~13'</li> <li>- weather - 39° - Sunny</li> <li>- Tubing used - Master Flex #96410-15</li> <li>- ReFlon line poly</li> <li>- Sample Time - 1233</li> <li>- Sampling procedure - straw-method</li> </ul>										

CONTAINER		PRESERVATIVE / PREPARATION	NUMBER	FILTERING	ANALYSIS
TYPE	VOLUME				
Glass	40 ml	HCL	3	NO	Tetrachloroethene, Trichloroethene, Cis-1,2-dichloroethene, vinyl chloride, <del>dichloroethene</del> dichloroethylene, ethylene, ethane, 1,1,2-Trichloroethene, Trans-1,2-dichloroethylene

For 2-inch wells: multiply the water column height by 0.1632 to get gallons for 1 casing volume  
 For 4-inch wells: multiply the water column height by 0.6528 to get gallons for 1 casing volume

Field Water Quality Meter IDs: Alexis Peristaltic Pump, YSI 556 MPS HACH 2100a Turbidimeter, Solinst water level meter

SITE NAME: Martha's Dry Cleaners  
 PROJECT NUMBER: ES117125  
 FIELD PERSONNEL: JHC

WELL NUMBER: MW-19

DATE: 2/6/15

Time	Depth to Water (Ft - BTOC)	Well Diameter (Inches)	Total Depth (Ft - BTOC)	Water Column Thickness (Feet)	Single Purge Volume (Gallons)	Total Volume Purged (Gallons)	Stick Up Height (Feet)	Groundwater Elevation (Feet)	PURGE METHOD: <u>Low Flow - Peristaltic</u>
1448	6.99	2	19.73	13.24	2.16	6.48			Start Time - 1450 End Time -
									SAMPLER TYPE: <u>Low Flow - Peristaltic</u>
									Start Time - End Time -

Time	Pumping Rate (L/min or gpm)	Water Level (Feet - BTOC)	Dissolved Oxygen (mg/l)	ORP (mv)	Turbidity (NTU)	Specific Electrical Conductance (mS/cm)	pH	Temperature (Celsius)	Cumulative Volume Pumped (Gallons)	Stabilization Criteria Required Parameters - USEPA SESDPROC-301-R2 *
1526	0.06gpm	6.52	0.93	-46.8	1.69	0.186	4.58	17.15	2.16	pH * +/- 0.1 unit
1602	0.06	6.52	1.02	-44.2	0.92	0.187	4.59	17.46	4.32	Electrical Conduct. * +/- 5%
1638	0.06	6.53	0.93	-42.1	0.93	0.188	4.55	16.87	6.48	Turbidity < 10 NTU
										ORP +/- 10 mV
										Dissolved Oxygen +/- 0.2 mg/l
NOTES: (Sample Numbers, Weather Conditions, Field Notes, and Deviations) <ul style="list-style-type: none"> <li>- Tubing set at ~14'</li> <li>- weather -</li> <li>- Tubing used</li> <li style="padding-left: 20px;">↳ MasterFlex # 96410-15</li> <li>- Teflon line poly</li> <li>- Sample Time - 1642</li> <li>- Sampling procedure -</li> <li style="padding-left: 20px;">- straw - method</li> </ul>										

CONTAINER		PRESERVATIVE / PREPARATION	NUMBER	FILTERING	ANALYSIS
TYPE	VOLUME				
Glass	40ml	HCL	3	NO	Tetrachloroethene, Trichloroethene, CIS-1,2 dichloroethene, vinyl chloride, dichloroethylene, ethylene, ethene, 1,1,2-Trichloroethene, TRANS-1,2-dichloroethylene

For 2-inch wells: multiply the water column height by 0.1632 to get gallons for 1 casing volume  
 For 4-inch wells: multiply the water column height by 0.6528 to get gallons for 1 casing volume

Field Water Quality Meter IDs: Alexis Peristaltic, YSI-556 MMS  
HACH 21000 Turbidimeter, Solinst water

# **APPENDIX E**

BIOCHLOR MODEL DATA

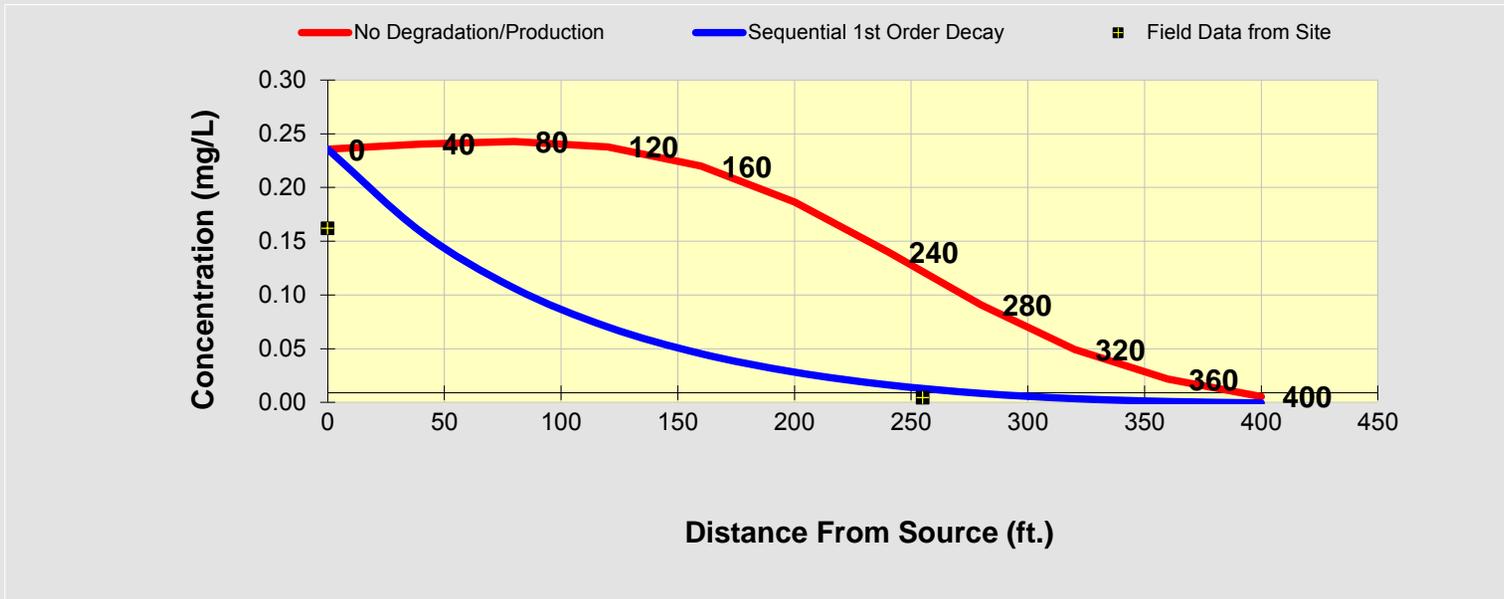


**DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0**

PCE	Distance from Source (ft)										
	0	40	80	120	160	200	240	280	320	360	400
<b>No Degradation</b>	0.237	0.241	0.244	0.239	0.221	0.188	0.141	0.092	0.050	0.023	0.007
<b>Biotransformation</b>	0.2368	0.160	0.107	0.071	0.046	0.029	0.017	0.009	0.004	0.002	0.001

Field Data from Site	Monitoring Well Locations (ft)										
	0	255									
	0.163	0.005									



- [See PCE](#)
- [See TCE](#)
- [See DCE](#)
- [See VC](#)
- [See ETH](#)

**Prepare Animation**

Time:

Log  Linear

**Return to Input**

**To All**

**To Array**

- Start Here** →  PCE  
 TCE  
 DCE  
 VC  
 ETH

### DISSOLVED SOLVENT CONCENTRATIONS IN PLUME

Transverse Distance (ft)  
↓

Distance from Source (ft)

	0	40	80	120	160	200	240	280	320	360	400
160	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
80	0.000	0.000	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.000	0.000
0	0.237	0.160	0.107	0.071	0.046	0.029	0.017	0.009	0.004	0.002	0.001
-80	0.000	0.000	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.000	0.000
-160	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<b>MASS RATE (mg/day)</b>	4.4E+2	2.6E+2	1.8E+2	1.2E+2	8.4E+1	5.5E+1	3.4E+1	1.9E+1	9.4E+0	4.0E+0	1.2E+0

Show No

Show

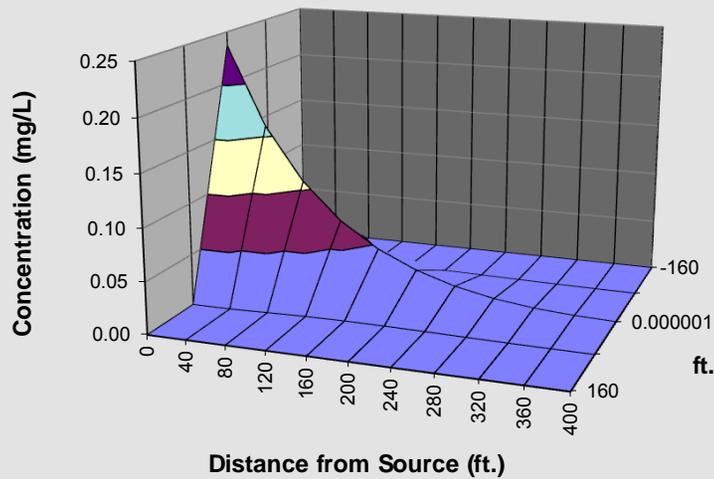
Displayed Compound

**MASS RATE**  
(mg/day)

Time:  yr

Target Level:  mg/L

Displayed Model:



Plot All Data

Plot Data > Target

Plume Mass (Order-of-Magnitude Accuracy)

See Plume Mass If No Degradation  (Kg)

- Plume Mass If Biotransformation/Production  (Kg)

Mass Removed  (Kg)

If "Can't Calc.",  
make model area  
longer

% Biotransformed =

% Change in Mass Rate =  (source to edge)

See  
acre-ft

Current Volume of Ground Water in Plume  MGal

Flow Rate of Water Through Source Area  MGD

Compare to Pump and Treat

Pumping Rate  (gpm)

# Pore Volumes Removed Per Yr.

# Pore Volumes to Clean-Up

Clean-Up Time  (yr)

Mass HELP

To Centerline

Return to Input

# BIOCHLOR Natural Attenuation Decision Support System

Version 2.2  
Excel 2000

Martha's Dry Cleaner  
HSI Site No. 107764  
Run Name

## Data Input Instructions:

115 → 1. Enter value directly...or  
↑ or 0.02 → 2. Calculate by filling in gray cells. Press Enter, then **C**  
(To restore formulas, hit "Restore Formulas" button )  
Variable\* → Data used directly in model.

Test if Biotransformation is Occurring → Natural Attenuation

TYPE OF CHLORINATED SOLVENT: Ethenes  Ethanes

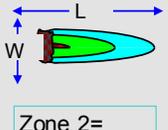
**1. ADVECTION**  
Seepage Velocity\* Vs  (ft/yr)  
**or**  
Hydraulic Conductivity K  (cm/sec)  
Hydraulic Gradient i  (ft/ft)  
Effective Porosity n  (-)

**2. DISPERSION**  
Alpha x\*  (ft)   
(Alpha y) / (Alpha x)\*  (-)  
(Alpha z) / (Alpha x)\*  (-)

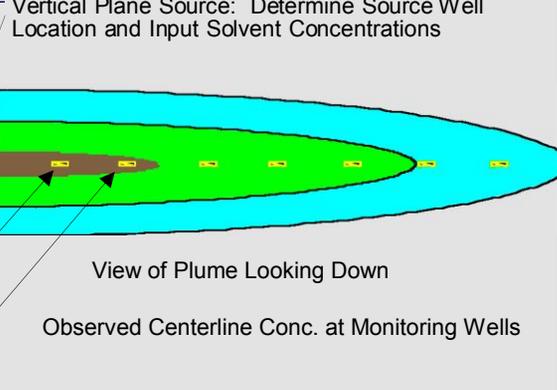
**3. ADSORPTION**  
Retardation Factor\*   
**or**  
Soil Bulk Density, rho  (kg/L)  
Fraction Organic Carbon, foc  (-)  
Partition Coefficient Koc  (L/kg)  (-)  
PCE  (L/kg)  (-)  
TCE  (L/kg)  (-)  
DCE  (L/kg)  (-)  
VC  (L/kg)  (-)  
ETH  
**Common R (used in model)\* =**

**4. BIOTRANSFORMATION**  
**Zone 1**  
PCE → TCE  (1/yr)  (yrs) Yield 0.79  
TCE → DCE  (1/yr)  (yrs) Yield 0.74  
DCE → VC  (1/yr)  (yrs) Yield 0.64  
VC → ETH  (1/yr)  (yrs) Yield 0.45  
**Zone 2**  
PCE → TCE  (1/yr)  (yrs)  
TCE → DCE  (1/yr)  (yrs)  
DCE → VC  (1/yr)  (yrs)  
VC → ETH  (1/yr)  (yrs)

**5. GENERAL**  
Simulation Time\*  (yr)  
Modeled Area Width\*  (ft)  
Modeled Area Length\*  (ft)  
Zone 1 Length\*  (ft)  
Zone 2 Length\*  (ft)  
Zone 2 = L - Zone 1



**6. SOURCE DATA**  
TYPE: Decaying Single Planar  
Source Options  
Source Thickness in Sat. Zone\*  (ft)  
Width\* (ft)   
Conc. (mg/L)\* C1  
PCE   
TCE   
DCE   
VC   
ETH   
k<sub>s</sub>\* (1/yr)  
PCE 0.033  
TCE 0.033  
DCE 0.033  
VC 0.033  
ETH 0.033



**7. FIELD DATA FOR COMPARISON**

Conc. (mg/L)	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
PCE Conc. (mg/L)	.163	.005								
TCE Conc. (mg/L)	.001	.001								
DCE Conc. (mg/L)	.001	.001								
VC Conc. (mg/L)										
ETH Conc. (mg/L)	0.0	.0								
Distance from Source (ft)	0	255								
Date Data Collected	2015									

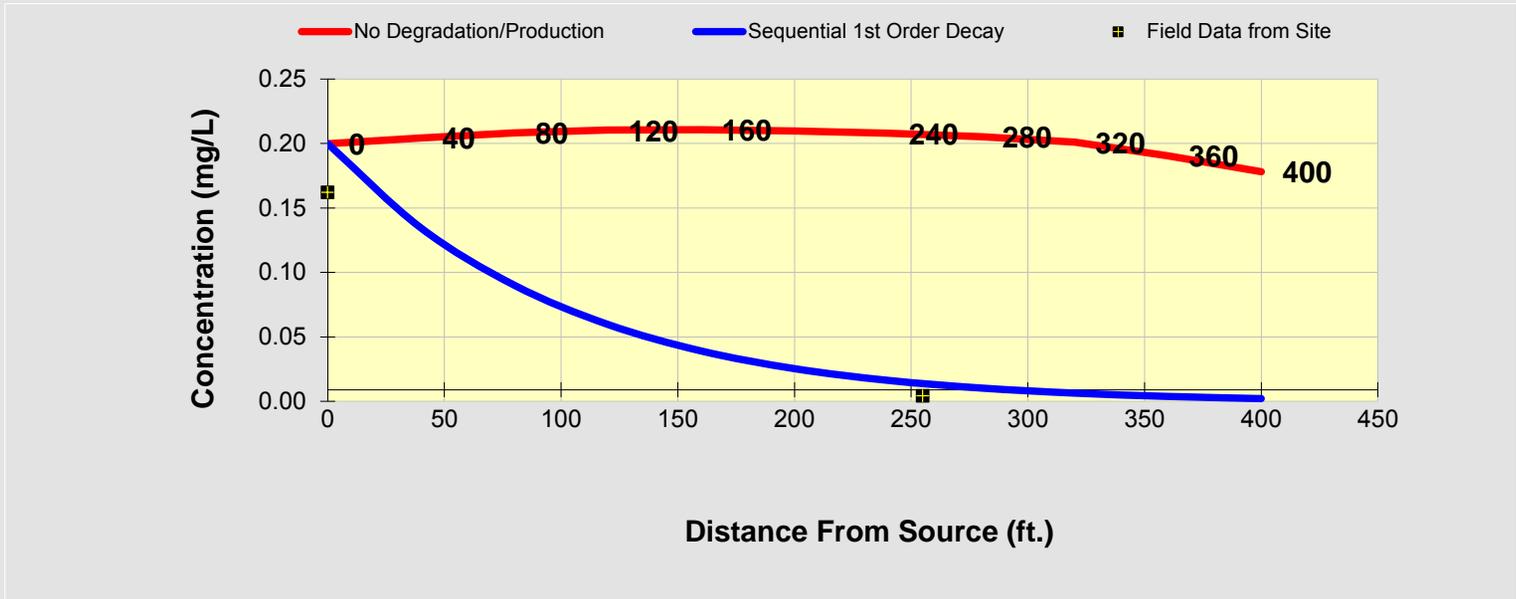
**8. CHOOSE TYPE OF OUTPUT TO SEE:**

**DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0**

PCE	Distance from Source (ft)										
	0	40	80	120	160	200	240	280	320	360	400
<b>No Degradation</b>	0.201	0.205	0.209	0.211	0.212	0.211	0.209	0.206	0.202	0.191	0.179
<b>Biotransformation</b>	0.2009	0.135	0.091	0.061	0.040	0.026	0.017	0.011	0.007	0.005	0.003

Field Data from Site	Monitoring Well Locations (ft)										
	0	255									
	0.163	0.005									



- [See PCE](#)
- [See TCE](#)
- [See DCE](#)
- [See VC](#)
- [See ETH](#)

**Prepare Animation**

**Time:**

**Return to Input**

**To All**

**To Array**

- Start Here** →  PCE  
 TCE  
 DCE  
 VC  
 ETH

### DISSOLVED SOLVENT CONCENTRATIONS IN PLUME

Transverse Distance (ft)

Distance from Source (ft)

	0	40	80	120	160	200	240	280	320	360	400
160	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
80	0.000	0.000	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001
0	0.201	0.135	0.091	0.061	0.040	0.026	0.017	0.011	0.007	0.005	0.003
-80	0.000	0.000	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001
-160	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<b>MASS RATE (mg/day)</b>	3.7E+2	2.2E+2	1.5E+2	1.1E+2	7.3E+1	5.0E+1	3.4E+1	2.3E+1	1.6E+1	1.1E+1	7.1E+0

Show No

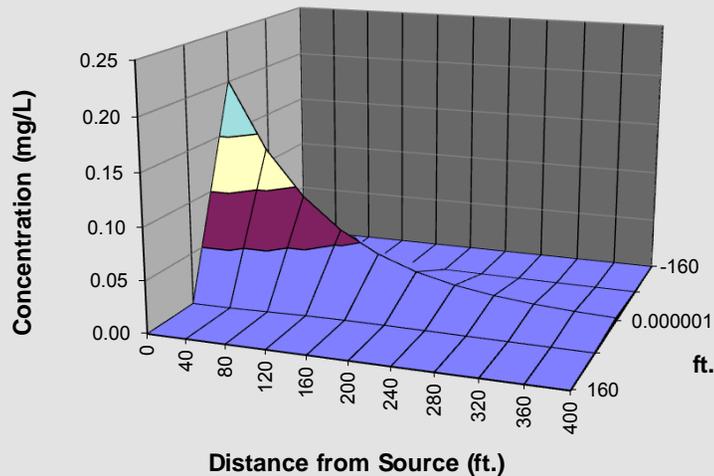
Show

Displayed Compound

Time:  yr

Target Level:  mg/L

Displayed Model:



#### Plume Mass (Order-of-Magnitude Accuracy)

See Plume Mass If No Degradation  (Kg)

- Plume Mass If Biotransformation/Production  (Kg)

Mass Removed  (Kg)

If "Can't Calc.", make model area longer

% Biotransformed =   
 % Change in Mass Rate =  (source to edge)

See acre-ft Current Volume of Ground Water in Plume  MGal  
 Flow Rate of Water Through Source Area  MGD

Compare to Pump and Treat Pumping Rate  (gpm)  
 # Pore Volumes Removed Per Yr.   
 # Pore Volumes to Clean-Up   
 Clean-Up Time  (yr)

Plot All Data

Plot Data > Target

Mass HELP

To Centerline

Return to Input

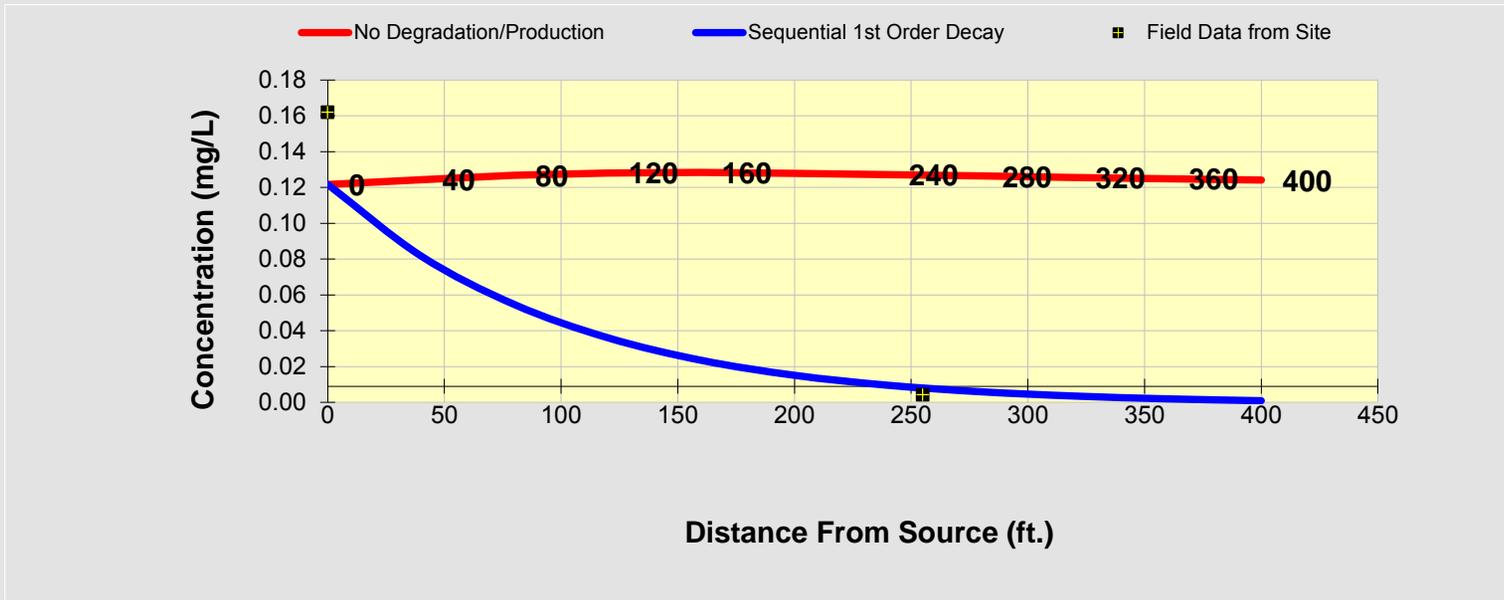


**DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0**

PCE	Distance from Source (ft)										
	0	40	80	120	160	200	240	280	320	360	400
No Degradation	0.123	0.125	0.128	0.129	0.129	0.129	0.128	0.127	0.127	0.126	0.125
Biotransformation	0.1227	0.083	0.056	0.037	0.025	0.016	0.011	0.007	0.005	0.003	0.002

Field Data from Site	Monitoring Well Locations (ft)										
	0	255									
	0.163	0.005									



- [See PCE](#)
- [See TCE](#)
- [See DCE](#)
- [See VC](#)
- [See ETH](#)

**Prepare Animation**

Time:

Log  Linear

**Return to Input**

**To All**

**To Array**

- Start Here** →  PCE  
 TCE  
 DCE  
 VC  
 ETH

### DISSOLVED SOLVENT CONCENTRATIONS IN PLUME

Transverse Distance (ft)  
↓

Distance from Source (ft)

	0	40	80	120	160	200	240	280	320	360	400
160	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
80	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000
0	0.123	0.083	0.056	0.037	0.025	0.016	0.011	0.007	0.005	0.003	0.002
-80	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000
-160	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<b>MASS RATE (mg/day)</b>	2.3E+2	1.4E+2	9.3E+1	6.4E+1	4.4E+1	3.0E+1	2.1E+1	1.4E+1	9.5E+0	6.5E+0	4.4E+0

Show No

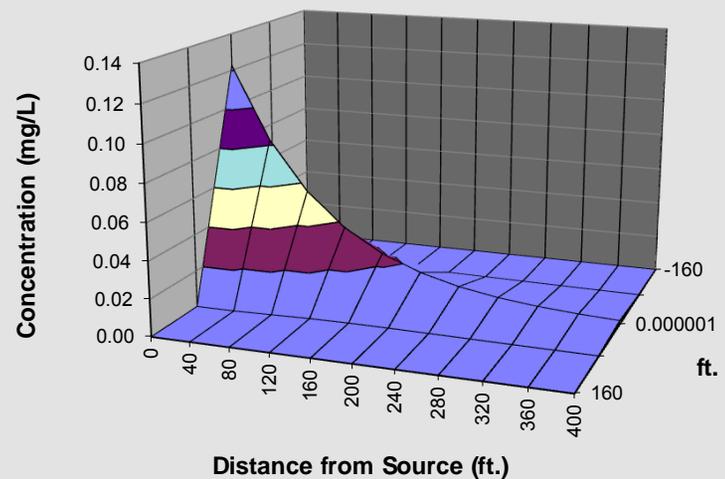
Show

Displayed Compound

Time:  yr

Target Level:  mg/L

Displayed Model:



#### Plume Mass (Order-of-Magnitude Accuracy)

**See** Plume Mass If No Degradation  (Kg)  
 - Plume Mass If Biotransformation/Production  (Kg)  
 -----  
 Mass Removed  (Kg)

If "Can't Calc.", make model area longer  
**% Biotransformed = +79.4%**  
**% Change in Mass Rate = 98.1 %** (source to edge)

**See acre-ft** Current Volume of Ground Water in Plume  MGal  
 Flow Rate of Water Through Source Area  MGD

**Compare to Pump and Treat** Pumping Rate  (gpm)  
 # Pore Volumes Removed Per Yr.   
 # Pore Volumes to Clean-Up   
 Clean-Up Time  (yr)

[Plot All Data](#)

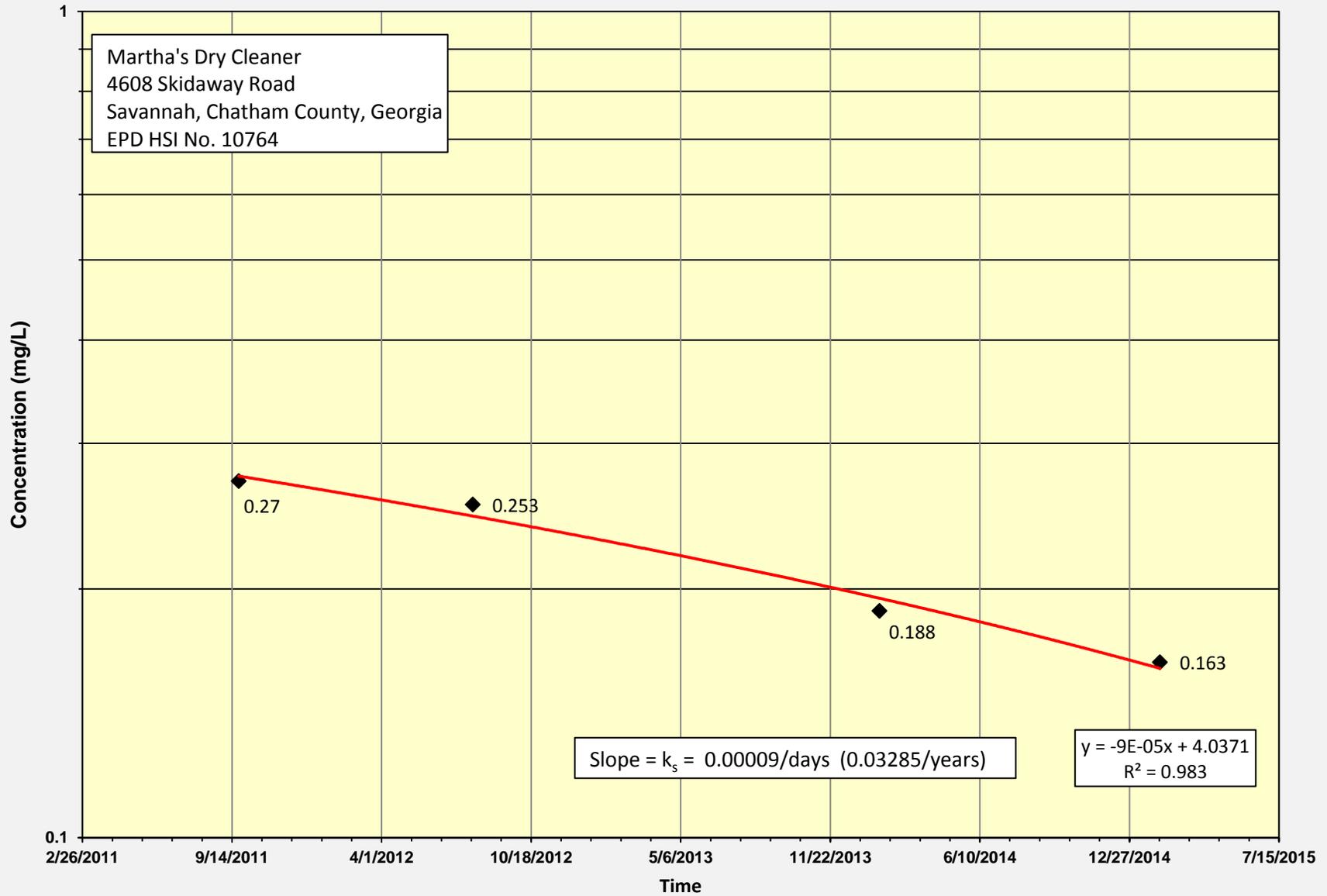
[Plot Data > Target](#)

[Mass HELP](#)

[To Centerline](#)

[Return to Input](#)

# Determination of $k_s$ , Using PCE Concentrations in Source Area Well MW-21S



## **APPENDIX F**

INVOICES, HOURS WORKED, AND COST ESTIMATE

**2015 SAMPLING EVENT COST ESTIMATE**  
**Voluntary Investigation and Remediation Plan**  
**Year 2015**  
**Former Martha's Dry Cleaners**  
**Savannah, Georgia**  
**Terracon Project No. ES117125**

Item	Unit	Unit Rate	Quantity	Cost	Subtotal
<b>TASK: Groundwater Monitoring</b>					
<i>Field Services (Groundwater Sampling)</i>					
Environmental Technician	hour	\$65.00	6	\$390.00	
Water Quality Meter	day	\$150.00	1	\$150.00	
Groundwater Disposal	drum	\$200.00	1	\$200.00	
				<b>Subtotal</b>	<b>\$740.00</b>
<i>Analytical Services (Groundwater)</i>					
Chlorinated Compounds	each	\$90.00	3	\$270.00	
				<b>Subtotal</b>	<b>\$270.00</b>
<i>Professional Services (Progress Report Preparation)</i>					
Senior Registered Engineer	hour	\$125.00	2	\$250.00	
CADD Technician	hour	\$65.00	1	\$65.00	
Project Engineer	hour	\$95.00	12	\$1,140.00	
				<b>Subtotal</b>	<b>\$1,455.00</b>
<b>Groundwater Sampling and Report</b>					<b>\$2,465.00</b>