EPS

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December 21, 2015

Mr. David Hayes
Environmental Protection Division
Land Protection Branch
2 Martin Luther King, Jr. Dr.
Suite 1054 East
Atlanta, GA 30334

Re: ***Voluntary Remediation Program Compliance Status Report, Revision 1 (Revised CSR)***
Color Spectrum, HSI Site No. 10831
29 Probasco Street
LaFayette, GA 30728
HSI # 10831

Dear Mr. Hayes:

This letter and the Revised CSR are submitted on behalf of CSI Realty, LLC in response to the Georgia Environmental Protection Division's (EPD's) comment letter dated April 23, 2015 and follow-up correspondence regarding the proposed CSR and the Uniform Environmental Covenant (UEC) for the site. The EPD's April 23rd comments regarding the CSR are presented below followed by a response. The final UEC was approved by EPD, filed in July 2015, and is not discussed in this letter.

<u>Compliance Status Report:</u>

<u>Risk Reduction Standards</u>

Comment 1*:* *The RRS values derived in Appendix H are correct for all constituents and approved for use at the site.*

Response: The Risk Reduction Standards (RRSs) are included in the attached Revised CSR.

EPS

BIOCHLOR Model

Comment 2 through Comment 8

Response: These comments were addressed in our June 26, 2015 letter titled *BIOCHLOR Model Revisions Based on EPD's April 23, 2015 Comment Letter*. The EPD approved these revisions in a letter dated October 20, 2015. The revised model is included in Appendix A of the Revised CSR.

Vapor Intrusion Screening

Comment 9 *EPD has reviewed the Johnson and Ettinger (J&E) model and determined that the toxicity and exposure factors used are correct.*

Response: These toxicity and exposure factors will continue to be used.

Comment 10 *Soil concentrations used in the non-residential vapor intrusion analysis are incorrect and inconsistent with residential values. Table 2 in Appendix C shows the maximum concentrations for PCE and Freon-113 as 0.3 mg/kg and 6.3 mg/kg, respectively. The current J&E model used the following values as inputs:*

PCE:	*Residential*	*0.3 mg/kg*
	Non Residential	*0.015 mg/kg*
Freon-113:	*Residential*	*6.34 mg/kg*
	Non Residential	*4.2 mg/kg*

Please amend these values to reflect the data in Table 2.

Response: The models have been re-calculated with the highest detected concentration for the constituents identified. The new values are included in Table 4 of the Revised CSR.

Comment 11 *The building dimensions used in the J&E model do not match those reported in the Walker County tax records for the site. Tax records state that the building is approximately 28,700 ft^2, rather than the 74,000 ft^2 used in the model. Please provide justification for non-residential building dimensions, or a description for how the model values were obtained.*

Response: EPS examined the Walker County Tax Records and concluded that the square footage on the tax records is incorrect. Field measurements and measurements from third party sources (Google Earth) confirm the 74,000 ft^2 dimensions used in the model.

Comment 12 *Vapor intrusion (VI) potential was only analyzed for two contaminants of concern (Freon-113 and PCE). In order to properly screen for VI risk, all volatile chemicals detected at the site should be considered.*

Response: EPS used the J&E model for the eight constituents detected in groundwater and the six constituents detected in soil. The results are discussed in section 4.4 of the Revised CSR. The model input and output pages are included in Appendix J of the Revised CSR.

EPS

General Comments

Comment 13 *The water levels in all monitoring wells should be gauged and a revised potentiometric surface map that includes monitoring well MW-14 should be submitted to EPD.*

Response: A potentiometric surface map has been prepared based on groundwater elevations measured in August 2014, which includes elevation data for MW-14. This potentiometric surface map is included as Figure 10 in Appendix C of the Revised CSR.

Comment 14 *Cross sections should be updated to include the newly installed monitoring well MW-14. Additionally, the cross sections should include isoconcentration contours.*

Response: Cross Section C-C', which includes MW-14, has been generated. Figure 9A, included in Appendix C of the Revised CSR, is a cross section location map, and Figures 9B, 9C, and 9D are Cross Sections A-A', B-B', and C-C', respectively. Soil and groundwater data are presented in data boxes on the cross sections, and the extent of the PCE is depicted on all four figures.

If you have any questions, please call.

Sincerely,

Justin Vickery
Associate

Attachment: Voluntary Remediation Program Compliance Status Report, Revision 1 (1 paper copy, 2 electronic copies)

cc: Tom Watters, CSI Realty, LLC
Andrea Rimer, Troutman Sanders

Prepared for:

CSI REALTY, LLC
1906 South Hamilton Street
Dalton, GA 30720

VOLUNTARY REMEDIATION PROGRAM COMPLIANCE STATUS REPORT REVISION 1

Color Spectrum
29 Probasco Street
LaFayette, GA 30728
(HSI #10831)

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December 2015

VOLUNTARY REMEDIATION PROGRAM
COMPLIANCE STATUS REPORT
REVISION 1

COLOR SPECTRUM
29 Probasco Street
LaFayette, GA 30728
(HSI #10831)

Prepared for:

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1906 South Hamilton Street
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December 2015

VOLUNTARY REMEDIATION PROGRAM COMPLIANCE STATUS REPORT
REVISION 1

COLOR SPECTRUM
29 Probasco Street
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December 2015

APPENDICES

Appendix A: Uniform Environmental Covenant
Appendix B: Groundwater Model
Appendix C: Figures

Figure 1	Site Location Map
Figure 2	Site Plan and Site Vicinity Map
Figure 3	USGS Quadrangle Map
Figure 4	Historical Soil Boring Groundwater Results
Figure 5	Soil Analytical Results
Figure 6	Historical Monitoring Well Results
Figure 7A	Groundwater Sampling Results (March 2013)
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Figure 8	Geologic Map of the Georgia Ridge and Valley
Figure 9A	Geologic Cross-Section Location Map
Figure 9B	Cross-Section A-A’
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Figure 10	Potentiometric Surface Map (August 2014)

Appendix D: Tables

Table 1	Summary of Groundwater Analytical Results
Table 2	Summary of Soil Analytical Results
Table 3	Groundwater Elevations
Table 4	Summary of Vapor Intrusion Modeling Results

Appendix E: Laboratory Analytical Reports
Appendix F: Well Development and Well Sampling Forms
Appendix G: Boring Logs and Well Diagrams
Appendix H: Slug Test Data
Appendix I: Wildlife Resources Division Letter
Appendix J: Vapor Intrusion Model

EPS

VOLUNTARY REMEDIATION PROGRAM COMPLIANCE STATUS REPORT
REVISON 1

COLOR SPECTRUM
29 Probasco Street
LaFayette, GA 30728
(HSI #10831)

December 2015

GROUNDWATER SCIENTIST STATEMENT

I certify that I am a qualified groundwater scientist who has received a baccalaureate or post-graduate degree in the natural sciences or engineering, and have sufficient training and experience in ground water hydrology and related fields, as demonstrated by state registration and completion of accredited university courses, that enable me to make sound professional judgments regarding groundwater monitoring and contaminant fate and transport. I further certify that this Voluntary Remediation Program Compliance Status Report for Color Spectrum, HSI #10831, was prepared by me and appropriate qualified subordinates working under my direction.

JUSTIN D. VICKERY
No. 1745
REGISTERED PROFESSIONAL

Certified by: ______________________
Justin D. Vickery, P.G.
Associate
No. 1745

Date: 12-21-15

VOLUNTARY REMEDIATION PROGRAM COMPLIANCE STATUS REPORT
REVISON 1

COLOR SPECTRUM
29 Probasco Street
LaFayette, GA 30728
(HSI #10831)

December 2015

CERTIFICATION OF COMPLIANCE WITH RISK REDUCTION STANDARDS

I certify under penalty of law that this report and all attachments were prepared under my direction in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, 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. Based on my review of the findings of this report with respect to the Risk Reduction Standards ("RRS") of the Rules for Hazardous Site Response, Rule 391-3-19-.07, I have determined that the Site is in compliance with groundwater Residential Risk Reduction Standards with controls.

Certified by: Tom Watters   Date: 12/17/15

Tom Watters
CSI Realty, LLC

1 INTRODUCTION

1.1 Background

A Voluntary Remediation Program Compliance Status Report (CSR) for the property located at 29 Probasco Street, LaFayette, Walker County, Georgia (the Site) was submitted to the Georgia Environmental Protection Division (EPD) in November 2014. The EPD issued a comment letter, dated April 23, 2015, requesting additional information. This Revised CSR is being submitted on behalf of CSI Realty, LLC to demonstrate compliance with the Risk Reduction Standards (RRSs) through the use of a Uniform Environmental Covenant (UEC) (Appendix A) and a groundwater model (Appendix B) in order to request that the Site be de-listed from the Hazardous Site Inventory (HSI).

The Site was listed on the HSI (#10831) in a letter from the EPD, dated February 10, 2006, due to a release of volatile organic compounds (VOCs) to groundwater, which occurred prior to CSI Realty's acquisition of the property. The Site was approved by the EPD for entry into the Voluntary Remediation Program on March 30, 2012. Title to the property is currently held by the Walker County Development Authority as part of a tax abatement agreement with CSI Realty. Numerous investigations have been conducted at the Site, and it has been determined that the Site is in compliance with applicable RRSs.

This Revised CSR demonstrates groundwater compliance with the RRSs, and a Certification of Compliance is included on Page 2. In a letter dated June 24, 2011, the EPD concurred that the Site was in compliance with Type 1 RRSs for soil; therefore, soil certification is not addressed herein.

1.2 Site Location and Description

The Site is located at 29 Probasco Street in LaFayette, Walker County, Georgia at latitude 34° 42' 45" N and 85° 17' 19" W, and according to the Walker County Tax Assessor Office, consists of two parcels as follows:

1. Walker County Tax Parcel ID # 1023087, 1.38 Acres; and
2. Portions of the Chattooga and Chickamauga Railway Right-of-Way.

The Site contact is:

CSI Realty, LLC
Tom Watters
P.O. Box 5695
Rome, Georgia 30162
706-290-4179 direct
tomwatters@syntecind.com

The Site is developed with one building, totaling approximately 74,000 square feet, which is used for winding and heat setting yarn. A loading dock and dumpster are located on the east side of the building. A pond is located in the northeastern portion of the Site, and a small stream, the headwaters of the Chattooga River, flows out of the pond to the east of the Site. A Site Location Map is included as Figure 1 (all figures are included in Appendix C), and a Site Plan and Site Vicinity Map, showing the Site and the surrounding properties, is included as Figure 2.

1.3 Site Use and Development History

The first known development of the Site was as a cotton mill which operated from the late 1800s until around 1980 when it was damaged by fire. The operations on the Site were then converted to twisting and heat setting of carpet yarns which has continued to the present day.

Historically, two fuel oil above ground storage tanks (ASTs) and one gasoline underground storage tank (UST) were utilized at the Site. The UST was used for fueling facility vehicles. The ASTs were used as a secondary fuel source for the facility's steam boilers. All tanks were removed in 2006, in accordance with EPD regulations.

The building is located in the area of the Site where the former cotton mill was originally constructed. Several expansions have occurred with the most recent being the addition of the warehouse in the mid-1990s.

1.4 Description of Adjacent Properties

Properties immediately adjacent to the Site as shown on Figure 2 are as follows:

- Towards the North: Vacant land, West Indiana Street, and the City of LaFayette maintenance department.
- Towards the South: A related manufacturing facility, followed by a vacant lot and a school (Head Start).
- Towards the East: A railroad right-of-way followed by a wooded, low lying area with an unnamed tributary.

- Towards the West: Residential to the northwest and west, an auto repair shop and auto salvage yard, fire station, and residences to the southwest.

Topographic elevations of the Site and surrounding properties are depicted on a USGS Quadrangle Map included as Figure 3.

1.5 Source Description and Constituents of Interest

Based on the location of the groundwater plume, the historical source of impacts appears to have occurred before the current building was constructed, in the vicinity of the current dumpster and the portion of the yarn twisting adjacent to the dumpster. The only known use of chlorinated solvents at the facility were associated with a parts cleaner, which was previously located in the maintenance area. The machine utilized Safety Kleen 105, which was a recycled cleaning solution that may contain up to 0.2 % tetrachloroethene (PCE). However, there has been no record of releases from the parts cleaner, all waste is picked up and recycled by the vendor, and samples in the vicinity of the parts cleaner do not indicate that it is a potential source. Therefore, the source of the VOCs is likely to be historical releases in connection with operations conducted in this area prior to construction of the current building.

Soil and groundwater samples have been collected for analysis of VOCs, polycyclic aromatic hydrocarbon (PAHs), arsenic, and lead. PAH constituents detected were related to a petroleum release from the former ASTs which held diesel fuel. The release from the ASTs was addressed in cooperation with the EPD Water Resources Branch and is not addressed in this Revised CSR. Regulated substances detected in groundwater at the Site consist of 1,1,1-trichloroethane (TCA), 1,1-dichloroethane (DCA), 1,1-dichloroethene (DCE), acetone, Freon-113, Freon-12, isopropylbenzene (IPB), tetrachloroethene (PCE), and lead. The one lead detection in groundwater appears to be a naturally occurring background concentration and not indicative of a release. These constituents and their associated results are summarize on Table 1 (Tables 1 through 4 are included in Appendix D).

2 SITE INVESTIGATIVE HISTORY

2.1 Overview

The findings of the subsurface investigation and monitoring conducted by EPS from October 2005 to August 2014 are discussed in this section. EPS is not aware of any previous environmental investigations performed at the Site. Site sampling was conducted in accordance with the United States Environmental Protection Agency's Field Branches Quality System and Technical Procedures (FBQSTP). Field methods for historical investigations were discussed in previous report submittals. Field methods for the August 2014 work are discussed in Section 2.3.

2.2 Historical Investigations and Monitoring

2.2.1 October 11, 2005 Sampling Event

On October 11, 2005, five soil borings, referred to as SB-1 through SB-5, were advanced to the water table on the Site and an adjacent parcel (refer to Figure 4). The soil borings were advanced using a truck-mounted direct push drilling device. Soil borings SB-1 through SB-3 were located topographically downgradient (east) of the two primary buildings. Boring SB-4 was located near the southern property boundary and SB-5 was located near the western property boundary, upgradient of the buildings.

A groundwater sample was collected from each soil boring. A surface water sample was also collected from the pond. All samples were analyzed by an independent laboratory for VOCs using EPA Method 8260B.

The laboratory detected TCA, DCA, and PCE in the groundwater sample collected from SB-1 at concentrations of 23 micrograms per liter (μg/L), 5.6 μg/L, and 6.4 μg/L, respectively. VOCs were not detected in the groundwater samples collected from SB-2 through SB-5, or in the pond sample. Sample results are shown on Figure 4 and summarized in Table 1.

2.2.2 October 24, 2005 Sampling Event

On October 24, 2005, six soil borings (SB-6 through SB-11) were advanced near the fuel tanks by direct push technology to assess the extent of the VOC impacts in groundwater detected in the October 11th sampling event. During advancement of the soil borings, No. 2 fuel oil was observed in the groundwater samples collected from three of the borings. The release of the No. 2 fuel oil was attributed to the ASTs, was addressed in cooperation with Water Resources Branch and is not included as part of this Revised CSR. Each of the six samples collected were analyzed for VOCs. Three of the samples were analyzed for PAHs using EPA Method 8270C. Laboratory results are as follows:

- TCA was detected in three samples, SB-6, SB-9, and SB-10 at concentrations below the Type 1 RRS.
- DCA was detected in SB-11 below the Type 1 RRS.
- Freon-113 was detected in all six samples at concentrations below the Type 1 RRS.
- PAHs were not detected in any samples.

Sample results are shown on Figure 4 and summarized in Table 1.

2.2.3 HSRA Notification

On December 2, 2005, a HSRA Release Notification was submitted for the Site by CSI Realty following its acquisition in November 2005. On February 10, 2006, the Site was added to the HSI.

2.2.4 July 2006 Sampling Event

On July 27, 2006, eight soil borings (SB-12 through SB-19) were advanced by direct push technology to further delineate VOCs in groundwater (refer to Figure 4). Laboratory results are as follows:

- Freon-113 was detected in SB-13 and SB-15 through SB-18, with the highest concentration being 1,800 μg/L, which is below the Type 1 RRS.
- TCA and DCA detections were below the Type 1 RRS.
- DCE was detected in SB-13 and SB-17 at concentrations of 9.0 μg/L and 7.1 μg/L, respectively, which are both above the Type 1 RRS but below the Type 2 RRS.
- PCE was detected in SB-13 and SB-16 at 7.6 μg/L and 20 μg/L, respectively, which are both above the Type 1 RRS. The detection in SB-16 slightly exceeds the Type 2 RRS but is below the Type 4 RRS.

VOCs were not detected in SB-12 and SB-14. A groundwater sample was not collected from SB-19. Sample results are shown on Figure 4 and summarized in Table 1. Based on the presence of regulated compounds in the groundwater above laboratory detection limits, additional groundwater delineation was required.

2.2.5 December 19-20, 2006 Sampling Event

On December 19-20, 2006 nine soil borings (SB-20 through SB-28) were advanced by direct push technology to the groundwater table (refer to Figure 4). Borings (SB-20 through SB-26) were advanced indoors in the vicinity of the maintenance area which housed a parts cleaner until 2009. Borings SB-27 and SB-28 were advanced outdoors to delineate the plume to the north and south. Temporary wells were constructed in borings SB-20 through SB-23, and SB-26 through SB-28 to determine groundwater flow direction. At each well and at three existing monitoring wells, MW-1 through MW-3 (installed to assess the AST fuel oil release), the top-of-casing elevation and groundwater depths were measured. The groundwater flow direction was determined to be to the east-southeast with a hydraulic gradient of 0.04 feet/foot.

After completing the groundwater depth measurements, groundwater samples were collected from each temporary well and MW-1 through MW-3 and analyzed for VOCs. Laboratory results are as follows:

- Freon-113 was detected in all ten samples with a maximum concentration of 27,000 μg/L, which is below the Type 1 RRS.
- TCA was detected in two samples below the Type 1 RRS. TCA was detected in SB-23 at 2,100 μg/L, which is above the Type 1 RRS but below the Type 2 RRS.
- DCA was detected in four samples below the Type 1 RRS.
- DCE was detected in four samples: two of which are below the Type 1 RRS and two of which are above the Type 2 RRS but below the Type 4 RRS.
- PCE was detected in in one sample below the Type 2 RRS and in two samples above the Type 4 RRS.

Sample results are shown on Figure 4 and summarized in Table 1.

During the December 2006 sampling event, soil samples were collected from three boring locations (SB-24, SB-25, SB-26) located adjacent to the PCE parts cleaner, a potential source area. Soil samples were collected continuously from these borings and field screened for VOCs using a photoionization detector (PID). A soil sample was collected for laboratory analysis from each boring where the highest VOC concentration was measured. In borings where VOCs were not detected with a PID, a sample was collected immediately above the water table. Soil borings MW-1, MW-4 through MW-9, TW-1, and TW-2 were not screened with a PID. VOCs were not detected in any of the samples above background and therefore, samples were collected from 7 feet below the ground surface (ft-bgs), immediately above the groundwater table. Soil sampling results are shown on Figure 5 and are summarized on Table 2.

After completion of the sampling, all temporary wells and soil borings were properly plugged and abandoned.

2.2.6 June 21-28, 2007 Sampling Event

In July 2007, six monitoring wells (MW-4 through MW-9), three temporary wells (TW-1 through TW-3), and one deep well (DW-1) were installed to complete horizontal and vertical delineation of the VOCs in groundwater (refer to Figure 6 and Table 1). The wells were installed by direct push, hand auger, hollow stem auger, or air rotary drilling. Groundwater elevations were measured in monitoring wells MW-1 through MW-9, DW-1, TW-1, and TW-2 to determine groundwater flow direction. TW-3 was advanced off-site in the low-lying area to the east of the railroad right-of-way. Groundwater samples were then collected from each well for VOC analysis. Laboratory results were as follows:

- Freon-113 was detected in seven groundwater samples with a maximum concentration of 3,900 µg/L, which is below the Type 1 RRS.
- TCA and DCA were each detected in two samples at concentrations below the respective Type 1 RRSs.
- DCE was detected in one sample below the Type 2 RRS.
- PCE was detected in two samples below the Type 2 RRS.
- IPB was detected in one sample below the Type 2 RRS.

Twenty soil samples were collected by direct push technology from ten borings (SB-29 through SB-37 and MW-7) to further delineate VOCs in soil. During boring installation, soil cores were continuously collected and field screened with a PID for VOCs. In each boring soil samples were collected from 1 ft-bgs and at an intermediate depth between the ground surface and the water table. Soil sampling results are shown on Figure 5 and summarized in Table 2.

Monitoring well top-of-casing elevations were measured on July 9, 2007 by Wardlaw Land Surveying of LaFayette, Georgia. Horizontal locations were surveyed relative to the state plain coordinates and the elevations were referenced to the National Geodetic Vertical Datum. Top-of-casing elevation data is summarized on Table 3.

2.2.7 October 6-7, 2009 Sampling Event

At the request of the EPD, in October 2009, a nested monitoring well pair, MW-10 and MW-11, was installed in the apparent source area to investigate the potential for Freon-113 dense non-aqueous phase liquid (DNAPL) in this area. The wells were installed using hollow stem auger methods. Well MW-10 was screened near the water table (10 – 12.5 ft-bgs) and MW-11 was screened on top of bedrock (17.5 – 20 ft-bgs). The well locations are shown on Figure 6. Freon-113 was detected in the shallow well at 6,100 µg/L and in the deeper well at 15,000 µg/L. These elevated concentrations suggested the potential presence of DNAPL[1] in this area;

[1] Freon-113 has a solubility of 170,000 µg/L. As a rule of thumb, DNAPL is potentially present when concentrations exceed 1% of the solubility, or 1,700 µg/L for Freon-113.

however, the concentrations are below the Type 1 RRS and no Freon-113 was detected in nearby deep well DW-1.

The groundwater samples were analyzed for VOCs, arsenic, and lead. Constituents detected in the groundwater samples included the following:

- TCA and DCA were detected in MW-10 and MW-11 below the Type 1 RRSs.
- DCE was detected in MW-10 and MW-11 below the Type 2 RRS.
- PCE was detected in MW-10 at a concentration below the Type 4 RRS and in MW-11 at a concentration above the Type 4 RRS.
- IPB was detected in MW-10 and MW-11 below the Type 2 RRS.
- Arsenic was not detected in either groundwater sample. In response to Comment #11 from the EPD's letter dated March 30, 2012, the original laboratory report for the samples collected on October 7, 2009 had an arsenic detection limit of 50 µg/L while the Type 1 RRS for arsenic is 10 µg/L. Included in Appendix E are revised data sheets from the original laboratory report showing results down to the method detection limits (MDLs). Arsenic was not detected at an MDL of 4.4 µg/L.
- Lead was detected in MW-11 at 15.6 µg/L; however, due to slow recharge, the well could not be properly developed and the turbidity level was 800 NTUs. The sample is, therefore, not considered to be valid. A filtered sampled was also collected from this well and no lead was detected.

Groundwater sample results are shown on Figure 6 and summarized in Table 1.

Six soil samples were collected by direct push technology from six borings (SO-1 through SO-6) to further delineate VOCs in soil. During boring installation, soil samples were continuously collected and field screened with a PID for VOCs. In each boring, soil samples were collected at depths above the water table where PID readings indicated the highest potential VOC concentrations. Soil sampling results are shown on Figure 5 and summarized on Table 2.

2.2.8 August/November 2011 Sampling Events

In August 2011, the groundwater monitoring wells MW-1 through MW-11, DW-1, TW-1 and TW-2 were sampled and analyzed for VOCs. No VOCs were detected in DW-1, MW-4, MW-6, TW-1 and TW-2. Detections in other wells include the following:

- TCA was detected in MW-5, MW-7, MW-8, and MW-10 at concentrations below the Type 1 RRS.
- DCA was detected in MW-8 and MW-10 at concentrations below the Type 1 RRS.
- DCE was detected in MW-5, MW-7, MW-8, and MW-10 at concentrations above the Type 1 RRS but below the Type 4 RRS.

- Freon-113 was detected in MW-1, MW-2, MW-3, MW-5, MW-7, MW-8, MW-9, MW-10, and MW-11 at concentrations below the Type 1 RRS.
- Freon-12 was detected in MW-8 and MW-10 at concentrations below the Type 1 RRS.
- PCE was detected in MW-3, MW-5, MW-7, MW-8, and MW-10. Each of these detections is below the Type 4 RRS with the exception of MW-10.
- IPB was detected in MW-10 at a concentration of below the Type 2 RRS.

There was a significant difference in the Freon-113 concentration in MW-11 from the October 2009 event to the August 2011 event. Thus, on November 15, 2011, MW-10 and MW-11 were re-sampled to confirm the presence or absence of Freon-113 in these wells. No VOCs (including Freon-113) were detected in the deeper of the two wells, MW-11, indicating the absence of a DNAPL. TCA, DCA, DCE, Freon-113, PCE and IPB were detected in MW-10 at concentrations similar to previous detections.

Groundwater sampling results are shown on Figure 6 and summarized in Table 1. In accordance with Comment #7 from the EPD's March 30, 2012 letter, monitoring well sampling logs from November 2011 are included in Appendix F.

2.2.9 March 2013 Monitoring Well Installation

On March 6, 2013, two monitoring wells, MW-12 and MW-13, were installed on the Site in accordance with Comment #1 of the EPD's letter dated March 30, 2012. The wells were installed using hollow stem auger methods. The locations of these wells were specified in the EPD letter and were intended to capture the center of the VOC plume migrating toward the property boundary in the two different groundwater flow directions.

2.2.10 Quarterly Groundwater Monitoring Events

Quarterly groundwater monitoring events were conducted in March 2013, June 2013, August 2013, and December 2013. During these events, monitoring wells MW-2, MW-5, MW-10, TW-1, and newly installed wells MW-12 and MW-13 were sampled.

- VOCs detected in source area well MW-10 included TCA, DCA, DCE, acetone, Freon-113, Freon-12, IPB, and PCE. DCE concentrations were above the Type 2 RRS of 103 µg/L but below the Type 4 of 520 µg/L. PCE was detected above the Type 4 RRS of 98 µg/L.
- VOCs detected in mid-plume well MW-5 included TCA, Freon-113, and PCE. TCA and Freon-113 concentrations were all below the Type 1 RRSs, and PCE was below the Type 2 RRS.
- For downgradient wells MW-2, MW-12, MW-13, and TW-1, no VOCs were detected in MW-2, MW-12, or TW-1 with the exception of some minor Freon-113 detections in

MW-2 and MW-12. TCA and Freon-113 were detected in MW-13 below the Type 1 RRSs. PCE was detected in MW-13 at concentrations below the Type 2 RRS.

VOC concentrations for all wells sampled during the quarterly sampling events remained relatively steady throughout the sampling period. This data is summarized on Table 1 and on Figures 7A, 7B, 7C, and 7D for each of the four events.

2.3 Recent Field Investigation

2.3.1 August 2014 Monitoring Well Installation and Sampling

2.3.1.1 Well Installation

During the 2013 quarterly groundwater sampling events, PCE was detected in well MW-13 at concentrations slightly above the delineation criteria (Type 1 RRS). On August 6, 2014, monitoring well MW-14 was installed downgradient of MW-13 on City of LaFayette property across the Chattooga and Chickamauga Railway Right-of-Way from the Site. Because the location was not accessible with a drill rig, the well was installed using hand auger methods. The proposed well location was due east of MW-13. During the well installation, this area was underwater and the well location was offset to the south. Four hand auger borings reached refusal at a gravel layer at or very near to the water table. After several offsets, the well was finally installed approximately 25 feet south of its proposed location.

The hand auger boring was advanced to 8 ft-bgs. Monitoring well MW-14 was constructed with 5 feet of 2-inch diameter, 0.010-inch slotted PVC screen and 2-inch PVC riser installed to a depth of 8 ft-bgs. Sand was placed in the well annulus from 8 ft-bgs up to 2.25 ft-bgs, and a bentonite seal was placed in the well annulus from 2.25 ft-bgs to 1.5 ft-bgs and hydrated. A stick-up well vault was set at 1.5 ft-bgs and grouted in place, and a concrete pad was constructed around the stick-up vault. A well cap was placed on the well, and a lock was placed on the vault. The well location and top-of-casing elevation were surveyed.

On August 15, 2014, MW-14 was developed by pumping the well until it was free of visible sediment and until pH, temperature, turbidity, and specific conductivity stabilized. A total of 8.25 gallons of water were purged from the well during development. A well development log is included in Appendix F.

2.3.1.2 Well Sampling

On August 22, 2014, MW-14 was purged and sampled. Prior to purging, the groundwater depth was measured in the well with a water level meter to determine the purge volume.

MW-14 was purged and sampled using a peristaltic pump. Well purging was considered complete when, for three consecutive readings, pH was constant within 0.1 Standard Units, specific conductance varied no more than 5 percent, and turbidity stabilized below 10 Nephelometric Turbidity Units. A well sampling form is included in Appendix F.

Once the parameters stabilized, the sample was collected using the “soda straw” method. The tubing in the well was filled with groundwater, and the pump was turned off. The tubing was then pulled out of the well and the groundwater in the tubing was drained into the sample bottles. The groundwater sample was collected for VOC analysis in two 40-milliliter glass vials preserved with hydrochloric acid. The sample was placed on ice in a cooler, logged under standard chain-of-custody procedures, and delivered to Analytical Environmental Services in Atlanta, Georgia for VOC analysis by method 8260B.

2.3.2 Well Sampling Results

No VOCs were detected in MW-14 in August 2014. Laboratory analytical results are summarized on Table 1. Figure 7D shows the August 2014 sampling results for MW-14 along with the most recent (December 2013) sampling results from the other wells. The laboratory analytical report is included in Appendix E.

3 CONCEPTUAL SITE MODEL

3.1 Geology and Hydrogeology

3.1.1 Overview

The geologic and hydrogeologic characteristics of the Site and surrounding area are described in this section. This section also includes a discussion of regional physiography and Site topography. The discussion of regional characteristics was derived from published sources. Site specific characteristics were determined based on a review of field data.

3.1.2 Regional Physiography and Topography

A review of the *Physiographic Map of Georgia* (Clark and Zisa, 1976) indicates that Walker County is located in the northwestern portion of the Valley and Ridge Physiographic Province (Figure 8). This physiographic province is generally characterized by a series of linear ridges with elevations in lowland areas about 200 - 800 ft above sea level, but the higher ridges may be above 1,600 ft. Plant species vary from area to area based on local soil type, elevation, moisture, and disturbances (Holder, 1986).

The Ridge and Valley Province is bounded on the south by the Piedmont Province, to the east by the Blue Ridge Province, and on the north and west by the Appalachian Plateau Province. The Valley and Ridge province consists of Paleozoic sedimentary rocks that have been folded and faulted to cause long northeast-southwest trending valleys and ridges that give the region its name.

3.1.3 Site Topography

The topography of the Site and surrounding areas was reviewed on a United States Geological Survey (USGS) Quadrangle Map for the LaFayette Quadrangle (Figure 3). The elevation of the Site ranges from 240 to 250 feet above mean sea level. The high point of the Site is located at the western property boundary adjacent to Probasco Street. The grade slopes gently down the parking lots to the eastern property boundary to the drainage ditch on the Chattooga and Chickamauga Railway property. The storm water drainage flows as sheet flow across the Site to the drainage ditch. Storm water from the roofs of the two buildings is controlled by gutters/downspouts where it’s directed towards the drainage ditch on the eastern portion of the

Site. The drainage ditch flows into a small stream which forms the headwaters of the Chattooga River.

The pond located in the northern portion of the Site discharges to a small stream, which forms the headwaters to the Chattooga River.

3.1.4 Regional and Site Geology

Regional Geology

The strata of the Valley and Ridge include numerous carbonate units, such as the Cambro-Ordovcian Knox Dolostone and the Ordovician Chickamauga Limestone, and thus caves and karst terrain exist across large parts of the region. The Chickamauga Valley District is characterized by a series of gently rolling, discontinuous, northeast-trending valleys interrupted by low, linear, parallel ridges. The valley floors are predominantly limestone and dolomite of Cambro-Ordovician age while the ridges are capped by the more resistant cherty units of the Knox Group, also of Cambro-Ordovician age. The ridge tops are approximately 1000 feet in elevation and stand 200-300 feet above the intervening valleys. Rectangular drainage patterns in this district are indicative of structural control.

Residual soils in the Ridge and Valley Province are composed predominantly of Udults with some Ochrepts. Paleudults dominate upland areas underlain by limestone. Hapludults are in valleys underlain by shale. Dystrochrepts are common on side slopes of ridges. Hapludolls and Eutrochrepts are on bottom lands. Soils have an udic moisture regime and thermic or mesic temperature regime. Almost all soils are well drained. Soils range from shallow on sandstone and shale formations to very deep on limestone formations (US Forest Service, 1993). Soils grade into a saprolite or partially weathered bedrock with depth.

A review of the *Geologic Map of Georgia (Georgia Geological Survey, 1976)* indicates that the bedrock underlying LaFayette and nearby areas consists of a Conasauga Group dolostone. Dolostone is a sedimentary carbonate rock that contains a high percentage of the mineral dolomite. It is usually referred to as dolomite rock. Most dolostone formed as a magnesium replacement of limestone or lime mud prior to lithification. It is resistant to erosion and can either contain bedded layers or unbedded layers. It is less soluble than limestone in weakly acidic groundwater, but it can still develop solution features over time.

Site Geology

The Site geology has been investigated through the advancement of soil borings and the installation of shallow and deep monitoring wells. The shallow monitoring wells were installed at depths ranging from 13 ft-bgs to 16 ft-bgs through soil and saprolite residuum. The deep well (DW-1) was installed to a depth of 44 ft-bgs. Boring logs are included in Appendix G. In accordance with CSR Comment # 13 in EPD's April 23, 2015 letter, Figure 9A is a Geologic Cross Section Location Map and Figures 9B, 9C, and 9D are Cross Sections.

A review of the boring logs and associated cross-sections indicate that the subsurface geology consists of multi-colored clays with some gravel grading to the bedrock. Bedrock was reached in DW-1 at approximately 20 ft-bgs. Based on the hardness of the soils in other borings at the Site, it appears that bedrock exists approximately 20 ft-bgs across the Site.

3.1.5 Regional and Site Hydrogeology

Regional Hydrogeology

The upper boundary of unconfined groundwater in the Ridge and Valley is formed by the water table or surficial water bearing zones. The water table can be loosely defined as the boundary between saturated and unsaturated soil zones. The depth to the water table may range from a few ft-bgs to up to 50 ft-bgs along mountainous terrain. In the Ridge and Valley province, the water table is usually situated within the soil-saprolite residuum and the upper portion of the fractured dolomite bedrock. In areas where saprolite thicknesses are minimal, the water table may reside almost entirely in fractured bedrock. The soil-saprolite residuum generally has a relatively large storage capacity with a moderate transmissivity. The bedrock fracture system generally has a relatively low storage capacity with a high transmissivity where fracture systems are interconnected. If bedrock fracturing is significant, a hydraulic connection between the surficial water bearing zone and deeper groundwater aquifers may occur at varying depths within the bedrock.

Groundwater flow in the soil-saprolite/fractured bedrock zone often mimics the ground surface topography except where controlled by subsurface geologic structures or preferential pathways. These pathways may be caused by heterogeneities in the soil, weathering patterns of the saprolite, foliated bedding planes, faults, fractures, or other relict bedrock features. Groundwater flow is usually unconfined with recharge occurring from rainfall penetrating upland areas and discharge occurring as baseflow to streams and creeks in low lying areas. These flow regimes are commonly referred to as slope aquifer systems. Depending on the interconnection of fracture zones, a downward gradient is commonly observed in upland areas while an upward gradient is generally present in low areas.

Productive groundwater wells in the Ridge and Valley may be located in the saprolite residuum, fractured crystalline bedrock, or a combination of both. Water in the bedrock is transmitted via connected fractures within the rock unit. The quantity, size, and degree of connection between these fractures or discontinuities are generally more significant than the lithology in determining the amount of water available for withdrawal. Rates of withdrawal are often higher along contact zones between rock units. Secondary permeability and fracture size generally decrease with depth due to overburden pressures except in areas where deep thrust fractures are present. The Ridge and Valley province in the northwestern corner of Georgia is underlain by layers of sandstone, limestone, dolostone, and shale. Wells tapping limestone and dolomite aquifers in this province can be very productive (Tyson, 1993).

Site Hydrogeology

The surficial water bearing zone or uppermost aquifer beneath the Site includes the soil-saprolite unit above the bedrock interface. It is likely that this aquifer is interconnected to the bedrock aquifer beneath it via fractures in the rock. The vertical extent of the bedrock aquifer below 50 ft-bgs has not been investigated.

The groundwater under the Site flows from the high elevation at the western property boundary towards the northeast and the southeast. Considering the surface topography of the Site, the depth the groundwater, and the groundwater flow direction, groundwater at the Site is expected to enter the small stream east of the Site.

3.1.6 Groundwater Flow Direction and Gradient

The depth to groundwater at the Site was measured by EPS personnel in August 2014 in monitoring wells existing at that time. Groundwater elevations were calculated by subtracting the measured depth to groundwater from the surveyed top-of-well casing elevations. The groundwater depths and calculated elevations for the August 2014 gauging event and all previous sampling events are shown in Table 3. A Potentiometric Surface Map for August 2014 is included as Figure 10. As shown on the figure, groundwater flows toward the southeast and northeast, which is consistent with historical data. Based on the August 2014 Potentiometric Surface Map, the average horizontal hydraulic gradient for the Site is 0.03 ft/ft.

Generally, in Ridge and Valley slope aquifer systems an upward vertical flow gradient occurs near creeks or in valley areas and a downward vertical flow gradient occurs on hill sides (Lohman, 1972). The groundwater elevation for MW-7 was 794.15 ft and the elevation for the deeper well DW-1 was 793.62 ft. The lower elevation in DW-1 suggests that a downward vertical gradient may be present between the surficial soil aquifer and deeper bedrock aquifer.

3.1.7 Hydraulic Conductivity Data

On June 28, 2007 EPS performed slug tests on wells MW-4, MW-6, and MW-9 to evaluate the hydraulic conductivity of the upper aquifer. Hydraulic conductivity was determined using the Bouwer and Rice Graphical Method (Bouwer and Rice, 1976, 1989) and the results are shown below.

Well No.	K value (cm/sec)	K value (ft/day)
MW-4	7.4×10^{-5}	0.21
MW-6	1.2×10^{-4}	0.33
MW-9	1.5×10^{-4}	0.42
Average	1.1×10^{-4}	0.32

The average hydraulic conductivity value was calculated to be of 1.1×10^{-4} centimeters per second (cm/sec) or 0.32 feet per day (ft/day). This is consistent with published values for clayey soils. The Bower and Rice graphs are included in Appendix H.

3.1.8 Groundwater Flow Velocity

The seepage velocity or groundwater flow velocity is the average speed of groundwater movement by advective processes in the water-bearing zone. The seepage velocity is calculated by multiplying the hydraulic conductivity by the hydraulic gradient and dividing by the effective porosity. The effective porosity is sometimes referred to as the "drainable porosity" and is considered roughly equivalent to specific yield for sandy soils in unconfined units. This parameter is generally estimated using published values.

The groundwater flow velocity was calculated using the following formula:

$$V = \left[\frac{K \frac{dh}{dl}}{n} \right]$$

Where: k = the average hydraulic conductivity (0.32 ft./day)
dh/dl = the hydraulic gradient (0.032 ft./ft.)
n = the estimated effective porosity (0.15 from Fetter, 1988)

Using this formula, a calculated groundwater flow velocity of 0.07 ft/day (26 ft/year) was determined. It should be noted that this calculated value was derived under the assumption that groundwater flow at the Site occurs through a homogeneous, isotropic, porous medium. Since groundwater flow beneath the Site likely occurs through a heterogeneous matrix that may contain secondary fracture pathways, this calculated flow value should be considered only an estimate of the actual groundwater flow velocity.

3.2 Risk Reduction Standards

3.2.1 Soil RRS

In a letter dated June 24, 2011, the EPD concurred that the Site was in compliance with Residential RRSs for soil based on CSI Realty's December 29, 2009 Revised Compliance Status Report.

3.2.2 Groundwater RRSs

Regulated substances detected in groundwater at the Site consist of TCA, DCA, DCE, acetone, Freon-113, Freon-12, IPB, PCE, and lead. Type 1 RRSs were calculated for these constituents. TCA, DCE, PCE, and IPB were detected at concentrations which exceed the Type 1 RRSs, and Type 2 RRSs were calculated for these constituents. DCE and PCE exceed the Type 2 RRSs, and Type 4 RRSs were calculated for DCE and PCE. PCE is the only constituent that exceeds the Type 4 RRS. Table 1 summarizes Types 1, 2, and 4 RRSs and compares them to the maximum detected concentrations. In the EPD's April 23, 2015 letter, the EPD stated that the calculated RRSs for the Site are correct for all constituents and approved the use of the RRSs for the Site.

3.3 Potential Receptors and Exposure Pathways

3.3.1 Potential Environmental Receptors

The Site and adjacent properties are located in a predominantly residential and industrial setting. Common environmental receptors in this type of setting may include protected species, wetland areas, public drinking water wells, and surface water bodies.

3.3.1.1 Protected Species

Information compiled by the Georgia Natural Heritage Program was reviewed for Walker County, Georgia to identify sensitive wildlife receptors or protected species near the Site. The protected species identified in the Walker County include the following:

Plants

- Ohio Buckeye
- Purple Foxglove
- Heath Aster
- Phlox-leaved Aster
- Willow-leaf Aster
- Wild Daisy
- Glade Blue Indigo
- Bluehearts
- Wild Hyacinth
- White Bear Lake Sedge
- Broadleaf Sedge
- Purple Sedge
- Tussock Sedge
- Shellbark Hickory
- Alabama Lipfern
- American Smoketree
- Three-flowered Hawthorn
- Pink Ladyslipper
- Tennessee Fragile Fern
- Gattinger Prairie Clover
- Mullein Foxglove
- Cream-flowered Tick-trefoil
- American Dropseed
- Log Fern
- Harbinger-of-spring
- Mountain Witch-alder
- Blue Ash
- Goldenseal
- Glade St. Johnswort
- Twinleaf
- Texas Plains Rush
- Naked-fruit Rush
- Least Gladecress
- Gladecress
- Wood Lily
- Broadleaf Gromwell
- Climbing Fern
- Fraser's Loosestrife
- Limerock Milkvine
- Virginia Bluebells
- Sprouting Muhly
- Alabama Snow-wreath
- Marble-seed
- Limestone Adder-tongue Fern
- American Ginseng
- Silverling
- Miami-mist
- Hairy Mockorange
- Broadleaf Phlox
- Tennessee Leafcup
- Shadow-witch Orchid
- Bigleaf Pondweed
- Granite Gooseberry
- Cumberland Rose Gentian
- Large-flowered Skullcap
- Roundleaf Catchfly
- Virginia Spirea
- Nuttall's Hedge-nettle
- Celandine Poppy
- Silky Aster
- Downy Bush-pea
- Appalachian Filmy Fern
- Dwarf Filmy Fern
- Bent Trillium
- Lanceleaf Trillium
- Barksdale Trillium
- September Elm
- Ozark Bunchflower
- Limerock Arrow-wood
- Glade Violet
- Appalachian Cliff Fern

Animals

- Bachman's Sparrow
- Green Salamander
- Chickamauga Crayfish
- Chattooga River Crayfish
- Blackbarred Crayfish
- Spotfin Shiner
- Coosa Darter
- Blueside Darter
- Greenbreast Darter
- Redline Darter
- Banded Darter
- Northern Studfish
- Tennessee Cave Salamander
- Finelined Pocketbook
- Four-toed Salamander
- Flame Chub
- Lined Chub
- Tennessee Heelsplitter
- Spotted Spreadwing
- Sweetflag Spreadwing
- Scarlet Shiner
- Mountain Shiner
- Alabama Moccasinshell
- Gray Myotis
- Eastern Small-footed Myotis
- Southern Appalachian Woodrat
- Popeye Shiner
- Burrhead Shiner
- Telescope Shiner
- Yellowfin Madtom
- Dusky Darter
- Red-cockaded Woodpecker
- Pigeon Mountain Salamander
- Southern Pigtoe
- Skirted Hornsnail
- Tapered Cave Beetle
- Georgian Cave Beetle
- Pygmy Shrew
- Mountain Creekshell

A letter from the Wildlife Resources Division of the Georgia Department of Natural Resources indicated that there are no records of species of concern within the project area. The letter is attached as Appendix I.

3.3.1.2 Wetlands and Surface Water Bodies

A review of a National Wetland Inventory Map prepared by the U.S. Fish and Wildlife Service, indicates that the Site and adjacent properties are not located in identified wetland areas. A small stream, which forms the headwaters of the Chattooga River enters the Site from the north. The stream is dammed and forms a small pond on the northern end of the Site. The pond discharge then flows off the Site to the east. It is likely that groundwater flows into the stream and pond. Based on groundwater flow from the source area, the stream is considered to be a potential receptor of the groundwater plume. In October 2005, a surface water sample was collected from the pond. VOCs were not detected in this sample.

3.3.2 Potential Human Receptors

The Site includes a manufacturing building (approximately 74,000 square feet), a paved parking lot, a gravel drive leading to a paved loading dock, and a small pond. The future use of the Site will likely remain industrial; however, future residential use of the Site is evaluated below. The adjoining properties are used for residential, commercial, and industrial purposes.

3.3.2.1 Water Well Usage

In November 2005, a water well survey was performed by EPS to identify potential nearby private or public water wells. The survey involved a records search of the EPD files, communications with the City of LaFayette Water Department, a drive-by survey of the properties within a mile of the Site, and a USGS database search. The records search of the EPD files did not identify any water wells in the vicinity of the Site. EPS also reviewed the USGS water well database. No wells were identified in the USGS database within a three mile radius of the Site.

On November 28, 2005, EPS performed a drive-by survey of the properties within a one-mile radius of the Site. No private drinking water wells were observed. EPS identified the City of LaFayette drinking water intake as being located approximately 0.4 miles north of the Site.

Mr. Jim Speir, the City of LaFayette Director of Water & Sewer Utilities, confirmed that the intake location for the City of LaFayette's public water supply is located on a spring approximately 0.4 miles north of the Site. Figure 3 shows the location of the City of LaFayette drinking water intake relative to the Site. Mr. Speir stated that he was not aware of any private drinking water wells present within one mile of the Site. No other public water wells or intake locations are present in the City of LaFayette.

The only drinking water source receptor identified during this survey was the City of LaFayette water intake located along a spring approximately 0.4 miles north of the Site. The intake is located topographically upgradient and upstream of the Site and therefore, human exposure to the VOCs in the groundwater appears unlikely.

3.3.2.2 Underground Utilities

Underground utilities can act as conveyances by intercepting migrating regulated substances through a vapor phase or dissolved phase in the groundwater. In both cases, accumulation may occur inside a hollow pipe or along a preferential pathway created from permeable backfill materials used during placement of the utilities. Human exposures may occur in large diameter utility pipes, manholes, culverts, storm grates, or related access points.

The location of underground utilities in the vicinity of the groundwater plume is shown on Figure 2. The utilities identified include electrical conduits and small diameter roof drain storm water pipes. These utilities are likely located at depths between 2 and 3 ft-bgs. Based on the measured depth to groundwater of 4-5 ft-bgs, these underground utilities could intercept the groundwater table during periods of high groundwater levels.

3.3.2.3 Potential On and Off-Site Receptors

Current/Future Site Worker: Facility workers are expected to work approximately 40 hours per week at the Site. Because the soil has been certified to Residential RRS, and a UEC has been recorded for the Site limiting groundwater use, the only exposure pathway for facility workers is vapor intrusion from the groundwater plume to the indoor air. As discussed in Section 4.4, a vapor intrusion health risk is not present at the site.

Current/Future Groundskeeper: The grounds are currently maintained by a landscaping contractor on an as-needed basis, and landscaping activity is likely to be required for any future use scenarios. Since the soil has been certified to Residential RRSs, groundskeeper exposure to the VOCs at concentrations greater than Residential RRSs is not likely.

Future Construction/Utility Worker: No construction or utility work activities are currently planned at the Site. However, it is possible that these activities could be conducted in the future. These workers could potentially have short-term (<1 year) exposure to chemicals in groundwater via ingestion, dermal contact, and inhalation of volatiles.

Future On-Site Resident: The Site is currently used for industrial purposes and will likely remain industrial in the future. In addition, the UEC for the Site prohibits residential use of the Site, until such time as the EPD has concurred that the vapor intrusion pathway has been addressed for residential use, and prohibits the extraction and use of groundwater for drinking water and other non-remedial purposes. The Site is in compliance with the soil Type 1 RRSs, and therefore, the soils are protective of residential use.

Potential Off-Site Receptors: There are no potential off-site human receptors. The property immediately downgradient of the Site is the Chattooga and Chickamauga Railway Right-of-Way and further downgradient is a stream and a lower lying area owned by the City of LaFayette. As discussed in Section 4.3.3, the groundwater plume will not impact the stream.

4 GROUNDWATER COMPLIANCE

4.1 Groundwater Delineation

Groundwater has been delineated to the Type 1 RRSs. Figures 7A through 7D show the data from the four quarterly groundwater monitoring events conducted in 2013. All four compounds (TCA, DCE, IPB, and PCE) detected above the Type 1 RRSs are shown to be delineated on these figures.

4.2 Compliance with Residential and Non-Residential RRSs

Each of the regulated constituents detected in groundwater are in compliance with the Residential RRSs with the exception of DCE and PCE. DCE is in compliance with Non-Residential RRSs while PCE is not. Although Freon-113 was not detected above its Type 1 RRS, the compound was investigated further due to elevated concentrations, and it was determined that a Freon-113 DNAPL was not present. Table 1 summarizes the constituents detected in groundwater and compares them to the RRSs.

- DCE was detected in two soil borings, located inside of the building footprint, in 2006 and more recently in MW-10, located inside the building, above the Type Residential RRS of 103 µg/L. The maximum concentration of DCE detected was 290 µg/L, which is below the Type 4 RRS of 520 µg/L.
- PCE was detected above the Residential RRSs in groundwater samples from three borings and above the Non-Residential RRSs in two of these borings in 2006. More recent sampling results indicate PCE is above the Non-Residential RRS in only one monitoring well, MW-10, with concentrations fluctuating around 150 µg/L.
- Freon-113 has not been detected above the Residential RRS in groundwater. However, in 2006, it was detected at 27,000 µg/L in groundwater samples from borings SB-22 and SB-23 located inside the building, and the EPD was concerned of the potential presence of Freon-113 DNAPL. Monitoring wells MW-10 and MW-11 were installed in the vicinity of SB-22 and SB-23 as a nested well pair, with MW-10 screened near the water table (10-12.5 ft-bgs) and MW-11 screened on top of bedrock (17.5-20 ft-bgs). Although initial sampling results from MW-11 indicated elevated concentrations (15,000 and 21,000 µg/L) of Freon-113, follow-up sampling results were much lower (27 µg/L and non-detect). It is therefore believed that the initial elevated concentrations were the result of poor well development (due to slow recharge). Because significantly higher concentrations of Freon-113 exist in the shallow well (MW-10) and because the Freon-

113 concentrations in the deeper well (MW-11) are minor, it does not appear that Freon-113 exists as a DNAPL.

4.3 Groundwater Modeling

4.3.1 Introduction

BIOCHLOR Natural Attenuation Decision Support System (version 2.2) was used to model biodegradation of PCE at the Site. BIOCHLOR is an analytical model approved by the U.S. Environmental Protection Agency that is used to simulate the degradation of chlorinated ethenes and ethanes. It is an Excel-based program based on the Domenico analytical solute transport model. BIOCHLOR simulates advection, 3-D dispersion, linear adsorption and biotransformation via reductive dechlorination.

Under the Georgia Voluntary Remediation Program Act, Code O.C.G.A. § 12-8-100, et seq., the point of exposure is defined as the nearest of the following:

1. The closest existing downgradient drinking water supply well;
2. The likely nearest future location of a downgradient drinking water supply well where public supply water is not currently available and is not likely to be made available within the foreseeable future; or
3. The hypothetical point of drinking water exposure located at a distance of 1,000 feet downgradient from the delineated site contamination under this part.

Under these drinking water scenarios, the groundwater concentrations are compared to Risk Reduction Standards. However, the EPD has requested that the model evaluate the nearby headwater stream of the Chattooga River. In this case, the target concentration for PCE is the Georgia In-Stream Water Quality Standard (ISWQS), which is 3.3 µg/L.

4.3.2 Model Development and Calibration

The groundwater at the Site flows in two different directions (see Figure A in Appendix B). Accordingly, two different model simulations were developed and calibrated to simulate each of these flow directions. The highest concentrations of PCE in groundwater monitoring wells have occurred at the MW-10 location (SB-23). Thus, the zero distance area (or “initial concentrations”, model variable C_o) was considered to be in the area of MW-10 flowing in two different directions. Flow Path A is to the southeast and includes wells MW-10, MW-3, MW-13 and MW-14. Following Flow Path A, the headwater of the Chattooga River is encountered approximately 250 ft from the zero distance. Flow Path B is to the north-east and includes wells MW-10, MW-7 and MW-12. Following Flow Path B, the headwaters of the Chattooga River is encountered approximately 154 ft from the zero distance.

The input parameters used in the model are presented in Tables A and B in Appendix B for Flow Path A and Flow Path B, respectively. The advection parameters (e.g., hydraulic conductivity) were based on site-specific values. The dispersion and adsorption parameters were primarily based on default values available in the model documentation. The biotransformation decay coefficients were not used as biodegradation does not appear to be a primary factor at this Site. The model assumes that there is a continuous source since 1980 when the facility converted to yarn twisting. The source thickness was based on the approximate thickness of the aquifer (15 ft). The source width was developed during model calibration.

The modeled C_o concentration and source width were developed during model calibration. Historical groundwater data (from 2006 through 2014) were used to adjust the C_o concentrations and source width to develop a model that best represented the conditions at the Site. The C_o concentrations were chosen primarily to model the data from 2006, when the highest concentration of PCE was observed in groundwater (0.35 mg/L). Although the source width (0.3 ft for Flow Path A and 0.2 ft for Flow Path B) may or may not accurately represent the actual size of the source, these are the values that result in models that best represent the groundwater data collected at the site.

4.3.3 PCE Results

The BIOCHLOR Model input screens and PCE output screens for years that data were collected from 2006 through 2014 and for year 2044 (30 years after the last groundwater sampling event) for the two different flow paths (Flow Path A and Flow Path B) are included in Appendix B. The squares on these charts represent analytical data collected from groundwater in that year. In year 2013 groundwater was collected quarterly, thus the high and low concentrations observed in 2013 are both shown on the chart to represent the range of concentrations observed.

These charts show that the model, although not perfect, is a good representation of conditions at the Site and can be used to predict future concentrations. The model actually over predicts concentrations especially the further downgradient from the source indicating that the model is conservative. Thus, the model will conservatively estimate the concentrations of PCE into the future.

The projected concentrations for year 2044 show that the modeled PCE concentrations at the Point of Demonstration wells (MW-12 and MW-14) will not exceed the Type 1 RRS (5 µg/L). In addition, the projected concentrations for year 2044 show that the modeled PCE concentrations at the headwaters for the Chattooga River do not exceed the ISWQS (3.3 µg/L). Therefore, in response to Comment #3 in the EPD's letter data March 30, 2014, the combination of the two flow paths does not cause PCE concentrations entering the stream at concentrations which exceed the ISWQS (3.3 µg/L).

4.3.4 Sensitivity Analysis

A sensitivity analysis was conducted to evaluate the influence or relative importance of key input variables and assumptions on the predicted concentrations. In the initial CSR submission, the parameters evaluated included the retardation factor, hydraulic conductivity and porosity. This analysis showed that the model was not sensitive to these parameters. A new sensitivity analysis has been conducted for source width and source concentration. This analysis was run for model year 2013. For Flow Path A, the sensitivity analysis was conducted at two distances: 74 feet (MW-13) and 154 feet (MW-14). For Flow Path B, the sensitivity was conducted at 139 feet (MW-12).

The predicted concentrations (shown in Table C of Appendix B) at each of these distances were determined for three different conditions for each parameter being considered: (1) baseline, (2) a value higher than baseline, and (3) a value lower than baseline. The Flow Paths A and B input and output screens from the BIOCHLOR model sensitivity analysis are included in Appendix B.

4.3.5 Conclusions

Comparison of the model predictions to actual groundwater results at the Site indicates that the model can be used to conservatively predict future concentrations. According to the model results for the most recent year sampled (2013) and thirty years from then (2044), the PCE concentrations at the Point of Demonstration wells (MW-12 and MW-14) do not exceed the Type 1 RRS, which infers that PCE concentrations do not exceed the Type 1 RRS at the hypothetical points of drinking water exposure located at distances of 1,000 feet along each flow path downgradient from the delineated site contamination. In addition, PCE concentrations at the stream do not exceed the ISWQS.

4.4 Vapor Intrusion Assessment

Eight VOCs have been detected in soil and/or groundwater at the Site. Potential vapor intrusion risks associated with these VOCs were assessed using the advanced version of the 2004 Johnson and Ettinger Model, specific to soil and groundwater sources, to comply with Comments 9 through 12 of EPD’s April 23, 2015 letter. This model, published by the U.S. EPA Office of Emergency and Remedial Response, is an enhanced implementation of the U.S. EPA Office of Solid Waste and Emergency Response’s Subsurface Vapor Intrusion Guidance (U.S. EPA, 2002).

Vapor intrusion was assessed using the highest soil and groundwater concentrations detected for each of the VOC constituents. Exposure parameters listed in Appendix J were derived from Table 3 of Appendix III of the Hazardous Site Response Rule (391-3-19). The default air exchange rate of 0.25 volumes per hour was used in the models.

4.4.1 Non-Residential Exposure Modeling

The cancer risk was modeled for DCA and PCE, and the non-cancer risk was modeled for all eight of the detected VOCs, with the exception of DCA, which does not have an associated Reference Concentration. Neither the non-residential target cancer risk value of $1.0x10^{-5}$ nor the non-residential target hazard quotient of 1.0 was exceeded for any of the compounds using the soil or the groundwater source-based models. Model results are summarized in Table 4. Model parameters and calculations can be found in Appendix J.

4.4.2 Residential Exposure Modeling

The cancer risk was modeled for DCA and PCE, and the non-cancer risk was modeled for all eight of the detected VOCs, with the exception of DCA, which does not have an associated Reference Concentration. Neither the residential target cancer risk value of $1.0x10^{-6}$ nor the residential target hazard quotient of 1.0 was exceeded for any of the compounds using the soil or the groundwater source-based models, with the exception of DCA. The cancer risk associated with groundwater for DCA was $1.2x10^{-6}$. The potential for a residential exposure exceeding the cancer risk has been mitigated through a property use restriction clause in the UEC. Model results are summarized in Table 4. Model parameters and calculations can be found in Appendix J.

4.5 Institutional Controls

Pursuant to Section 12-8-107(h) of the VRP Act, a UEC, dated July 13, 2015, was recorded in the deed records of the Walker County Superior Court on July 22, 2015, which:

1. prohibits the use of the property for residential purposes until such time as EPD has concurred that the vapor intrusion pathway has been addressed for residential use; and
2. prohibits the use or extraction of groundwater on the Site for drinking water or any other non-remedial purpose.

5 REFERENCES

Bouwer, H. and Rice, R.C., 1976, *A Slug Test Method for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells,* Water Resources Research, 12-3, pp. 423-428.

Bouwer, H.,1989, *The Bouwer and Rice Slug Test - An Update,* Groundwater, vol. 24, no. 3, pp. 304-309.

Clark & Zisa, *A Physiographic Map of Georgia*, Department of Natural Resources, Georgia Geologic Survey, 1987.

Fetter, C. W., 1988, Applied Hydrogeology, 2nd Edition, Macmillan Publishing Company, New York, 592 p.

Lohman, S. W., 1972, *Ground-Water Hydraulics*, Professional Paper 708, U.S. Department of the Interior, Geological Survey, 67 p.

Tyson, Anthony W., 1993 Georgia's Ground Water Resources, University of Georgia College of Agricultural and Environmental Sciences, Bulletin 1096 October 1993.

U.S. Environmental Protection Agency, Region 4, *Field Branches Quality System and Technical Procedures*, Athens, Georgia.

U.S. Environmental Protection Agency, 2002, *Office of Solid Waste and Emergency Response's Subsurface Vapor Intrusion Guidance*.

U.S. Forest Service, Ecological Subregions of the U.S., November 5, 1993 http://www.fs.fed.us/land/pubs/ecoregions/ch20.html#231D

APPENDIX A

Uniform Environmental Covenant

Deed Doc: COVE
Recorded 07/22/2015 09:58AM

Carter Brown
Clerk Superior Court, Walker County, Ga.
Bk 01854 Pg 0012-0022

After Recording Return to:

Andrea L. Rimer
Troutman Sanders LLP
600 Peachtree Street, Suite 5200
Atlanta, GA 30308

Environmental Covenant

This instrument is an Environmental Covenant executed pursuant to the Georgia Uniform Environmental Covenants Act, OCGA § 44-16-1, *et seq.* This Environmental Covenant subjects the Property identified below to the activity and/or use limitations specified in this document. The effective date of this Environmental Covenant shall be the date upon which the fully executed Environmental Covenant has been recorded in accordance with OCGA § 44-16-8(a).

Fee Owner of Property/Grantor:	Walker County Development Authority 101 South Duke Street LaFayette, GA 30728
Grantee/Holder:	CSI Realty, LLC 1906 South Hamilton Street Dalton, GA 30720
Grantee/Entity with express power to enforce:	State of Georgia Department of Natural Resources Environmental Protection Division 2 Martin Luther King Jr. Drive, SE Suite 1054 East Tower Atlanta, GA 30334

Property:

The property subject to this Environmental Covenant is the former Color Spectrum property, Hazardous Site Inventory site number 10831 (hereinafter "Property"), located on 29 Probasco Street in LaFayette, Walker County, Georgia. This tract of land was conveyed on December 27, 2012 from CSI Realty, LLC to Walker County Development Authority, recorded in Deed Book 1746, Pages 797-799, Walker County Records. The area is located in Land Lot 28 of the 7th District and 4th Section of Walker County, Georgia. The property consists of approximately 1.38 acres, developed with an 80,000 square foot building used for yarn twisting and heat setting. A complete legal description of the area is attached as Exhibit A and a map of the area is attached as Exhibit B.

Tax Parcel Number(s):

Tax Parcel 1023 087 of Walker County, Georgia

Name and Location of Administrative Records:

The corrective action at the Property that is the subject of this Environmental Covenant is described in the following document[s]:

- Voluntary Investigation and Remediation Plan and Application, December 2011.
- March 30, 2012 correspondence from EPD to CSI Realty approving and providing comment on VRP Application.
- VRP Semi-Annual Status Updates, dated September 2012, March 2013, September 2013 and March 2014.
- Voluntary Remediation Program Compliance Status Report, October 2014.

These documents are available at the following location in the files for HSI Number 10831:

Georgia Environmental Protection Division
Response and Remediation Program
2 MLK Jr. Drive, SE, Suite 1054 East Tower
Atlanta, GA 30334
M-F 8:00 AM to 4:30 PM excluding state holidays

Description of Contamination and Corrective Action:

This Property has been listed on the state's hazardous site inventory due to a release of a regulated substance and has been designated as needing corrective action in accordance with the Rules for Hazardous Site Response. Contact the property owner or the Georgia Environmental Protection Division for further information concerning this Property. This notice is provided in compliance with the Georgia Hazardous Site Response Act.

This Declaration of Covenant is made pursuant to the Georgia Uniform Environmental Covenants Act, O.C.G.A. § 44-16-1 *et seq.* by the Walker County Development Authority , CSI Realty, LLC ("CSI Realty") and the State of Georgia, Department of Natural Resources, Environmental Protection Division (hereinafter "EPD"), and their respective successors and assigns. This Environmental Covenant is required because a release of 1,1-dichlorothene, tetrachloroethene, 1,1,1-trichloroethane, 1,1-dichloroethane, acetone, Freon-113, Freon-12, isopropylbenzene and lead occurred on the Property. These constituents are "regulated substances" as defined under the Georgia Hazardous Site Response Act, O.C.G.A. § 12-8-90 *et seq.*, and the rules promulgated thereunder (hereinafter "HSRA" and "Rules", respectively). The Corrective Action consists of the installation and maintenance of institutional controls (restrictions on use of groundwater and limitation of use to non-residential) to protect human health and the environment.

Grantor, Walker County Development Authority (hereinafter the "Authority"), hereby binds Grantor, and its successors and assigns to the activity and use restriction(s) for the Property identified herein and grants such other rights under this Environmental Covenant in favor of CSI Realty and EPD. EPD shall have full right of enforcement of the rights conveyed under this Environmental Covenant pursuant to HSRA, O.C.G.A. § 12-8-90 *et seq.*, and the rules promulgated thereunder. Failure to timely enforce compliance with this Environmental Covenant or the use or activity limitations contained herein by any person shall not bar subsequent enforcement by such person and shall not be deemed a waiver of the person's right to take action to enforce any non-compliance. Nothing in this Environmental Covenant shall restrict EPD from exercising any authority under applicable law.

The Authority makes the following declaration as to limitations, restrictions, and uses to which the Property may be put and specifies that such declarations shall constitute covenants to run with the land, pursuant to O.C.G.A. § 44-16-5(a); is perpetual, unless modified or terminated pursuant to the terms of this Covenant pursuant to O.C.G.A. § 44-16-9 and 10; and shall be binding on all parties and all persons claiming under them, including all current and future owners of any portion of or interest in the Property (hereinafter "Owner"). Should a transfer or sale of the Property occur before such time as this Environmental Covenant has been amended or revoked then said Environmental Covenant shall be binding on the transferee(s) or purchaser(s).

The Environmental Covenant shall inure to the benefit of CSI Realty, EPD, the Authority and their respective successors and assigns and shall be enforceable by the Director or his agents or assigns, CSI Realty or its successors, agents and assigns, the Authority or its successors, agents and assigns, and other party(ies) as provided for in O.C.G.A. § 44-16-11 in a court of competent jurisdiction.

Activity and/or Use Limitation(s)

1. Registry. Pursuant to O.C.G.A. § 44-16-12, this Environmental Covenant and any amendment or termination thereof, may be contained in EPD's registry for environmental covenants.

2. Notice. The Owner of the Property must give thirty (30) day advance written notice to EPD of the Owner's intent to convey an ownership interest in the Property. No conveyance of title, easement, lease, or other interest in the Property shall be consummated by the Owner without adequate and complete provision for continued monitoring, operation, and maintenance of the Corrective Action. The Owner of the Property must also give thirty (30) days advance written notice to EPD of the Owner's intent to change the use of the Property, apply for building permit(s) or propose any site work that would materially affect the Property.

3. Notice of Limitation in Future Conveyances. Each instrument hereafter conveying an interest in the Property subject to this Environmental Covenant shall contain a notice of the activity and use limitations set forth in this Environmental Covenant and shall provide the recorded location of the Environmental Covenant.

4. Periodic Reporting. The Owner shall inspect the Property and applicable property instruments at least annually to ensure compliance with this document. Annually, by no later than December 31st, in the year following the effective date of this Environmental Covenant, the Owner shall complete and submit to EPD the VRP Annual Property Evaluation Form attached to this document as Exhibit C. This report will document whether or not the activity and use limitations in this Environmental Covenant are being abided by.

5. Activity and Use Limitation(s). The Property shall be used only for non-residential uses, as defined in Section 391-3-19-.02 of the Rules and defined in and allowed under the Walker County zoning regulations as of the date of this Environmental Covenant. Any residential use of the Property shall be prohibited until such time as EPD has concurred that the vapor intrusion pathway has been addressed for residential use. Any activity on the Property that may result in the release or exposure to the regulated substances that were contained as part of the Corrective Action, or create a new exposure pathway, is prohibited.

6. Groundwater Limitation. The use or extraction of groundwater beneath the Property for drinking water or for any other non-remedial purposes shall be prohibited.

7. Right of Access. In addition to any rights already possessed by EPD and/or CSI Realty, the Owner shall allow authorized representatives of EPD and/or CSI Realty the right to enter the Property at reasonable times for the purpose of evaluating the Corrective Action; to take samples, to inspect the

Corrective Action conducted at the Property, to determine compliance with this Environmental Covenant, and to inspect records that are related to the Corrective Action.

8. Recording of Environmental Covenant and Proof of Notification. Within thirty (30) days after the date of the Director's signature, the Owner shall file this Environmental Covenant with the Recorders of Deeds for each County in which the Property is located, and send a file stamped copy of this Environmental Covenant to EPD within thirty (30) days of recording. Within that time period, the Owner shall also send a file-stamped copy to each of the following: (1) CSI Realty as Holder, (2) each person holding a recorded interest in the Property subject to the covenant, (3) each person in possession of the real property subject to the covenant, (4) each municipality, county, consolidated government, or other unit of local government in which real property subject to the covenant is located, and (5) each owner in fee simple whose property abuts the property subject to the Environmental Covenant.

9. Termination or Modification. The Environmental Covenant shall remain in full force and effect in accordance with O.C.G.A. § 44-5-60, unless and until the Director determines that the Property is in compliance with the Type 1, 2, 3, or 4 Risk Reduction Standards, as defined in Georgia Rules for Hazardous Site Response (Rules) Section 391-3-19-.07 and removes the Property from the Hazardous Site Inventory, whereupon the Environmental Covenant may be amended or revoked in accordance with Section 391-3-19-08(7) of the Rules and O.C.G.A. § 44-16-1 *et seq*.

10. Severability. If any provision of this Environmental Covenant is found to be unenforceable in any respect, the validity, legality, and enforceability of the remaining provisions shall not in any way be affected or impaired.

11. No Property Interest Created in EPD. This Environmental Covenant does not in any way create any interest by EPD in the Property that is subject to the Environmental Covenant. Furthermore, the act of approving this Environmental Covenant does not in any way create any interest by EPD in the Property in accordance with O.C.G.A. § 44-16-3(b).

Representations and Warranties.

Grantor hereby represents and warrants to the other signatories hereto:

a) That the Grantor has the power and authority to enter into this Environmental Covenant, to grant the rights and interests herein provided and to carry out all obligations hereunder;
b) That the Grantor is the sole owner of the Property and holds fee simple title which is free, clear and unencumbered;
c) That the Grantor has identified all other parties that hold any interest (e.g., encumbrance) in the Property and notified such parties of the Grantor's intention to enter into this Environmental Covenant;
d) That this Environmental Covenant will not materially violate, contravene, or constitute a material default under any other agreement, document or instrument to which Grantor is a party, by which Grantor may be bound or affected;
e) That the Grantor has served each of the people or entities referenced in Activity 8 above with an identical copy of this Environmental Covenant in accordance with O.C.G.A. § 44-16-4(d).
f) That this Environmental Covenant will not materially violate or contravene any zoning law or other law regulating use of the Property; and
g) That this Environmental Covenant does not authorize a use of the Property that is otherwise prohibited by a recorded instrument that has priority over the Environmental Covenant.

Notices.

Any document or communication required to be sent pursuant to the terms of this Environmental Covenant shall be sent to the following persons:

Georgia Environmental Protection Division
Branch Chief
Land Protection Branch
2 Martin Luther King Jr. Drive SE
Suite 1054 East Tower
Atlanta, GA 30334

CSI Realty, LLC
1906 South Hamilton Street
Dalton, GA 30720

Grantor has caused this Environmental Covenant to be executed pursuant to The Georgia Uniform Environmental Covenants Act, on the 13th day of July, 2015.

[Signatures on next page]

Signed, sealed, and delivered in the presence of:

Briggitt Garrett
Unofficial Witness *(Signature)*

Briggitt Garrett
Unofficial Witness Name *(Print)*

Murlyne Miller
Unofficial Witness *(Signature)*

Murlyne Miller
Unofficial Witness Address *(Print)*

Pamela D Townsend
Notary Public *(Signature)*

My Commission Expires: 5-27-17

For the Grantor
Walker County Development Authority:

Name of Grantor *(Print)*

Larry Brooks (Seal)
Grantor's Authorized Representative *(Signature)*

Larry Brooks
Authorized Representative Name *(Print)*

Executive Director
Title of Authorized Representative *(Print)*

Dated: 6/5/15

PAMELA D TOWNSEND NOTARY PUBLIC MY COMM. EXPIRES MAY 27, 2017 WALKER COUNTY GEORGIA

(NOTARY SEAL)

Signed, sealed, and delivered in the presence of:

Doralyn S Kirkland
Unofficial Witness *(Signature)*

Doralyn S. Kirkland
Unofficial Witness Name *(Print)*

Unofficial Witness *(Signature)*

Unofficial Witness Address *(Print)*

Cristal Sailors
Notary Public *(Signature)*

My Commission Expires: 1/22/16

For the State of Georgia
Environmental Protection Division:

Judson H. Turner
(Signature) (Seal)

Judson H. Turner
Director

Dated: 7/13/15

CRISTAL SAILORS NOTARY PUBLIC Exp. Jan. 22, 2017 SPALDING COUNTY, GA

(NOTARY SEAL)

Signed, sealed, and delivered in the presence of:

Judy Spradley

Unofficial Witness (*Signature*)

Judy Spradley

Unofficial Witness Name (*Print*)

Connie S Folsom

Unofficial Witness (*Signature*)

Connie S Folsom

Unofficial Witness Name (*Print*)

Katherine S. Hicks

Notary Public (*Signature*)

My Commission Expires: 6/24/18

KATHERINE S HICKS NOTARY PUBLIC FLOYD COUNTY, GEORGIA

For the Grantee/Holder
CSI Realty, LLC:

CSI Realty, LLC

Name of Grantee/Holder (*Print*)

_____________________ (Seal)

Grantee's Authorized Representative (*Signature*)

J. Tom Withers Jr.

Authorized Representative Name (*Print*)

Authorized Representative

Title of Authorized Representative (*Print*)

Dated: 05/15/15

(NOTARY SEAL)

EXHIBIT A

LEGAL DESCRIPTION

Tract III, Parcel A:

All that tract or parcel of land lying and being in Land Lot 28 in the 7[st] District and 4[th] Section of Walker County, Georgia and being more particularly described by plat of survey prepared by Bakkum-DeLoach & Associates, Inc. dated December 12, 1986, as follows: BEGINNING at a point where the North right of way line of Black Road intersects the East right of way line of Probasco Street; thence North 01 degree 55 minutes 00 seconds East, along the East right of way line of Probasco Street, 170.00 feet to an iron pin; thence North 89 degrees 49 minutes 59 seconds East, 232.59 feet to an iron pipe located in the West right of way line of Black Road and the West right of way line of the Central of Georgia Railroad; thence along the West right of way line of said Railroad and Black Road, the following courses and distances: South 09 degrees 54 minutes 43 seconds West, 95.15 feet; South 05 degrees 41 minutes 38 seconds West, 122.48 feet; thence continuing along the right of way of Black Road, the following courses and distances: South 34 degrees 31 minutes 03 seconds West, 26.63 feet; South 80 degrees 20 minutes 50 seconds West, 24.41 feet; North 72 degrees 57 minutes 06 seconds West, 27.18 feet; North 61 degrees 13 minutes 20 seconds West, 55.96 feet; North 66 degrees 02 minutes 02 seconds West, 58.33 feet and North 73 degrees 33 minutes 44 seconds West, 44.06 feet to the point of beginning.

Tract III, Parcel B:

All that tract or parcel of land lying and being in Land Lot No. 28, of the 7[th] District and 4[th] Section of Walker County, Georgia, and being more particularly described by a plat of survey prepared by Bakkum-DeLosch & Associates, Inc., dated December 12, 1986, as follows: BEGINNING at the point where the southern right of way line of Black Road intersects the eastern right of way line of Probasco Street; thence along the southerly right of way line of said Black Road the following courses and distances: south 72 degrees 01 minute 42 seconds east, 36.08 feet; south 65 degrees 49 minutes 08 seconds east, 53.55 feet; south 61 degrees 17 minutes 29 seconds east, 57.10 feet; south 74 degrees 00 minutes 07 seconds east, 38.39 feet and north 87 degrees 19 minutes 29 seconds east, 37.68 feet to the westerly right of way line of the Central of Georgia Railroad Company; thence the following courses and distances along the western right of way line of said Central of Georgia Railway Company: south 02 degrees 56 minutes 33 seconds west, 33.98 feet; south 00 degrees 01 minute 06 seconds east, 104.34 feet; south 01 degree 13 minutes 42 seconds east, 101.49 feet; and south 01 degree 45 minutes 48 seconds east, 166.74 feet to an iron pin; thence north 85 degrees 29 minutes 46 seconds west, 221.79 feet to an iron pipe located on the eastern right of way line of said Probasco Street; thence north 00 degrees 58 minutes 46 seconds east, along the eastern right of way line of said Probasco Street, a distance of 461.80 feet to the southeastern corner of the intersection of said Probasco Street and Black Road, and the point of beginning.

Being the same property as conveyed in Deed Book 1370, Page 497, in the Office of the Clerk of the Superior Court of Walker County, Georgia.

Exhibit B

Property Map

Property Boundary

180 Feet Approximate Scale

EPS 1050 Crown Pointe Pkwy Suite: 550 Atlanta, GA 30338 404.315.9113	N	**Uniform Environmental Covenant** **Former Color Spectrum** **29 Probasco Street** **LaFayette, Georgia** **Property Vicinity Map**	**Exhibit** B

Exhibit C

VRP ANNUAL PROPERTY EVALUATION FORM
Former Color Spectrum Property, HSI Site No. 10831
29 Probasco Street, LaFayette, Walker County, Georgia
Tax Parcel 1023 087

TYPE	No.	CRITERIA RESPONSE	YES	NO
Land Use	1	Does this VRP property meet the definition of non-residential property as defined in Section 391-3-19.02(2) of the Rules? "Non-residential property means any property or portion of a property not currently being used for human habitation or for other purposes with a similar potential for human exposure, at which activities have been or are being conducted that can be categorized in one of the 1987 Standard Industrial Classification major group..."		
	la	If no to 1, provide an explanation including a residential vapor intrusion exposure pathway evaluation to the EPD.		
Exposure	2	Has groundwater beneath the property been used or extracted for drinking water or any other non-remedial purpose?		
	2a	If yes to 2, use should be immediately terminated and a revised corrective action plan (CAP) that describes the actions necessary to bring the site's groundwater into compliance with appropriate risk reduction standards provided to EPD within 30 days.		
Property Instruments	3	Do all leases or other property instruments for the site have the applicable deed notice language inserted into them?		
	3a	If no to 3, provide a written explanation (attached) to the EPD.		

Certification:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, 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.

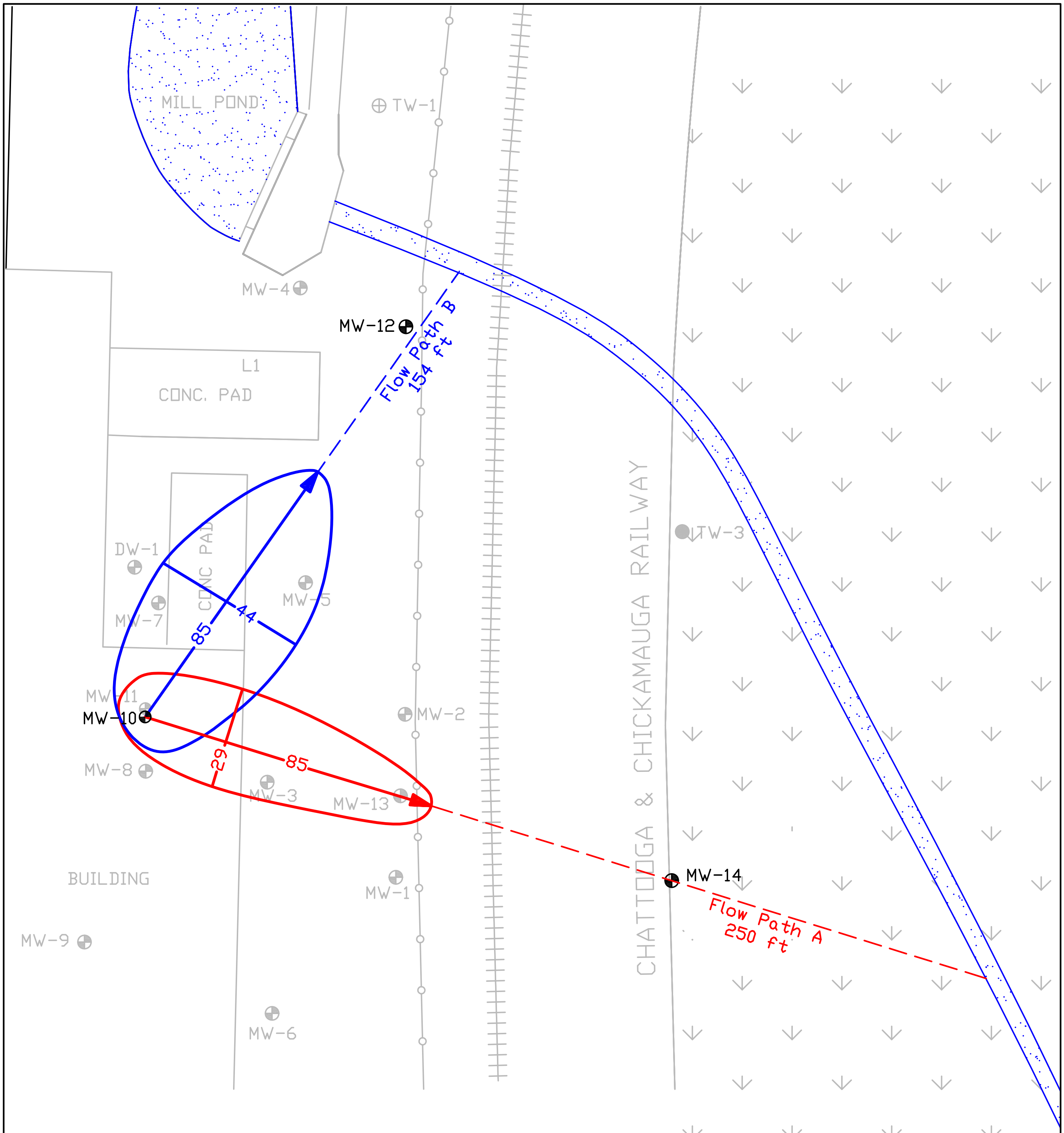
______________________________ ______________________
NAME (Please type or print) TITLE

______________________________ ______________________
SIGNATURE DATE

APPENDIX B

Groundwater Model

Figure



LEGEND

Monitoring Well Location

85 Plume Dimensions (ft)

0 20 40
Feet

1050 Crown Pointe Parkway
Suite 350
Atlanta, GA 30338
(404) 315-9113

DRN: JDV | DATE: June 2015

Color Spectrum
29 Probasco Street
LaFayette, GA 30728

Groundwater Plume Dimentions for BIOCHLOR Model

FIGURE A

Tables

Table A. Input Parameters for the BIOCHLOR Model - Flow Path A

Mechanism	Parameter	Value	Units	Basis
Advection	Hydraulic Conductivity	1.10E-04	cm/s	Average hydraulic conductivity presented in the 2009 Revised CSR (EPS, 2009)
	Hydraulic Gradient	0.015	ft/ft	Based on MW-10 to MW-13
	Effective Porosity	0.15	unitless	Typical value for lithological formation (EPA, 2000) and used historically for the Pro
Dispersion	Alpha X	6.2711	ft/ft	Modified Xu Eckstein (L approx 85 ft)
	Alpha Y/Alpha X	0.1	unitless	EPA model default
	Alpha Z/Alpha X	5.00E-02	unitless	EPA model default
Adsorption	Soil Bulk Density	1.7	kg/L	EPA model default
	Fraction Organic Carbon	0.001	unitless	EPA model default
	Organic Carbon Partitioning Coefficients			
	PCE	426	L/kg	EPA model default
	TCE	130	L/kg	EPA model default
	DCE	125	L/kg	EPA model default
	VC	30	L/kg	EPA model default
	Ethenes	302	L/kg	EPA model default
	Retardation Factor	2.47		Calcualted based on above values
Biotransformation	1st Order Decay Coefficients	0	1/yr	
General	Simulation Time	varies	yr	Assuming the source began in 1980
	Modeled Area Width	700	ft	Assumption
	Modeled Area Length	250	ft	Distance to stream
	Zone length	250	ft	Assuming one-zone
Source Contribution	Type	Continuous		Assumes continuous source concentrations throughout time
	Source Thickness in Saturated Zone	15	ft	Approximate thickness of aquifer
	Source Width	0.3	ft	Based on model calibration
	Source Concentrations			
	PCE	0.35	mg/L	Based on model calibration

Well Along Flow Path	Distance Downgradient of Source (ft)	Analytical Results (mg/L)					
		2006	2007	2009	2011	2013	2014
MW-10	0			0.054, 0.042	0.13, 0.12	0.12, 0.12, 0.16, 0.14, 0.15	
MW-3	39	0.0087	0.0076		0.0052		
MW-13	74					<0.005, 0.0073, 0.0086, 0.007	
MW-14	154						<0.00039

EPA,2000: BIOCHLOR Natural Attenuation Decision Support System. User's Manual Version 1.0 USEPA. January 2000
EPA,2002: BIOCHLOR Natural Attenuation Decision Support System. User's Manual Addendum. USEPA. March 2002.

Table B. Input Parameters for the BIOCHLOR Model - Flow Path B

Mechanism	Parameter	Value	Units	Basis
Advection	Hydraulic Conductivity	1.10E-04	cm/s	Average hydraulic conductivity presented in the 2009 Revised CSR (EPS, 2009)
	Hydraulic Gradient	0.02	ft/ft	Based on MW-7 to MW-12
	Effective Porosity	0.15	unitless	Typical value for lithological formation (EPA, 2000) and used historically for the Property
Dispersion	Alpha X	6.2711	ft/ft	Modified Xu Eckstein (L approx 85 ft)
	Alpha Y/Alpha X	0.1	unitless	EPA model default
	Alpha Z/Alpha X	5.00E-02	unitless	EPA model default
Adsorption	Soil Bulk Density	1.7	kg/L	EPA model default
	Fraction Organic Carbon	0.001	unitless	EPA model default
	Organic Carbon Partitioning Coefficients			
	PCE	426	L/kg	EPA model default
	TCE	130	L/kg	EPA model default
	DCE	125	L/kg	EPA model default
	VC	30	L/kg	EPA model default
	Ethenes	302	L/kg	EPA model default
	Retardation Factor	2.47		Calcualted based on above values
Biotransformation	1st Order Decay Coefficients	0	1/yr	
General	Simulation Time	varies	yr	Assuming the source began in 1980
	Modeled Area Width	700	ft	Assumption
	Modeled Area Length	154	ft	Distance to stream
	Zone length	154	ft	Assuming one-zone
Source Contribution	Type	Continuous		Assumes continuous source concentrations throughout time
	Source Thickness in Saturated Zone	15	ft	Approximate thickness of aquifer
	Source Width	0.2	ft	Based on model calibration
	Source Concentrations			
	PCE	0.35	mg/L	Based on model calibration

Well Along Flow Path	Distance Downgradient of Source (ft)	Analytical Results (mg/L)			
		2007	2009	2011	2013
MW-10	0		0.054, 0.042	0.13, 0.12	0.12, 0.12, 0.16, 0.14, 0.15
MW-7	32	<0.005		0.0086	
MW-12	139				<0.00047, <0.00047, <0.00047, <0.00047

EPA,2000: BIOCHLOR Natural Attenuation Decision Support System. User's Manual Version 1.0 USEPA. January 2000
EPA,2002: BIOCHLOR Natural Attenuation Decision Support System. User's Manual Addendum. USEPA. March 2002.

Table C. Sensitivity Analysis (Year 2013)

Source Width

	PCE Concentrations (mg/L)				
	Actual Concentration	w=0.01	w=0.3 (Baseline)	w=1	w=5
Flow Path A at MW-13 (74 ft)	<0.005, 0.007, 0.0073, 0.0086	0	0.004	0.014	0.068
Flow Path A at MW-14 (154 ft)	<0.00039	0	0.002	0.005	0.025
Flow Path B at MW-12 (139 ft)	<0.00047, <0.00047, <0.00047, <0.00047	0	0.002	0.0085	0.043

Source Concentration

	PCE Concentration (mg/L)			
	Actual Concentration	C=0.1	C=0.35 (Baseline)	C=0.75
Flow Path A at MW-13 (74 ft)	<0.005, 0.007, 0.0073, 0.0086	0.001	0.004	0.009
Flow Path A at MW-14 (154 ft)	<0.00039	0	0.002	0.0025
Flow Path B at MW-12 (139 ft)	<0.00047, <0.00047, <0.00047, <0.00047	0	0.002	0.004

EPS

BIOCHLOR Model

Input/Output Screens

Flow Path A

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path A - 2006

Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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 (selected) / Ethanes

1. ADVECTION

Seepage Velocity*	Vs	11.4	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.015	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	5.E-02	(-)

Calc.

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc		R	
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION -1st Order Decay Coefficient*

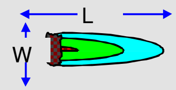
Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	26	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	250	(ft)
Zone 1 Length*	250	(ft)
Zone 2 Length*	0	(ft)



Zone 2=

6. SOURCE DATA TYPE: Continuous, Single Planar

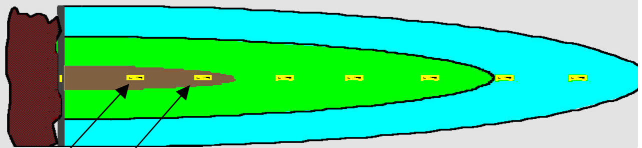
Source Options

Source Thickness in Sat. Zone* 15 (ft)

	Y1
Width* (ft)	0.3

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.35	0
TCE		0
DCE		0
VC		0
ETH		0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	.009	.008									
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	39	39									
Date Data Collected	2006										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore | RESET | *SEE OUTPUT* | Paste

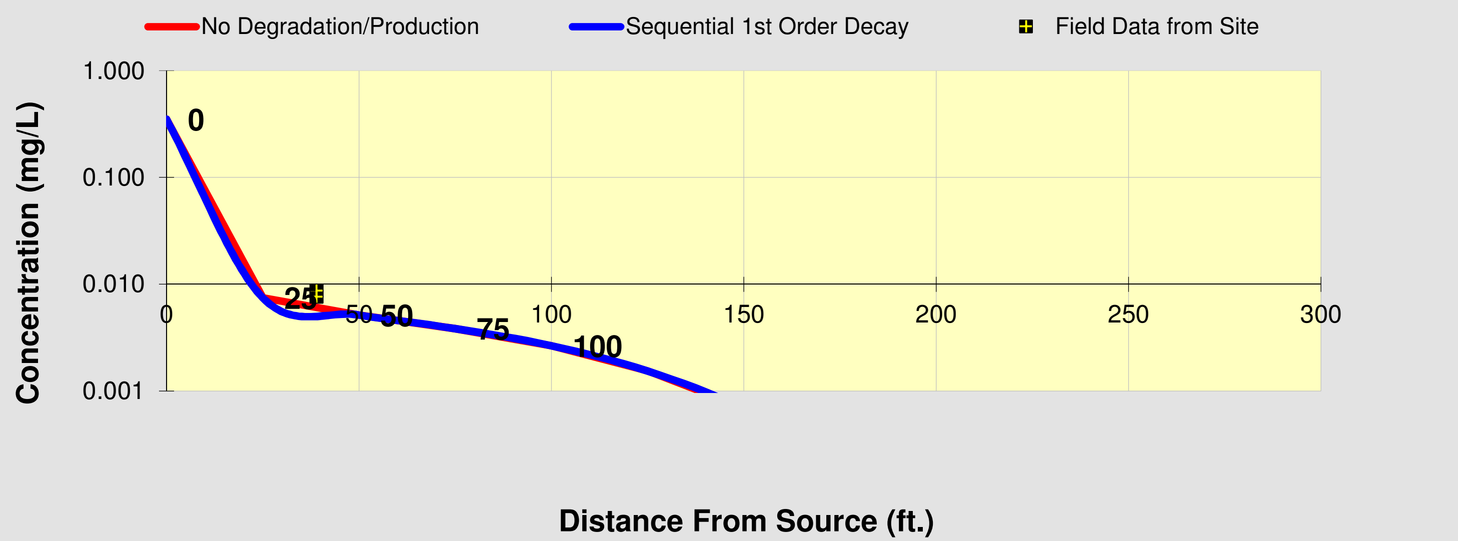
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

PCE	0	25	50	75	100	125	150	175	200	225	250
No Degradation	0.350	0.007	0.005	0.004	0.003	0.002	0.001	0.000	0.000	0.000	0.000
Biotransformation	0.3500	0.007	0.005	0.004	0.003	0.002	0.001	0.000	0.000	0.000	0.000

Monitoring Well Locations (ft)

	39	39									
Field Data from Site	0.009	0.008									



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

26.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path A - 2009
Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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	11.4	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.015	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	5.E-02	(-)

Calc.

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc		R	
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION **-1st Order Decay Coefficient***

Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	29	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	250	(ft)
Zone 1 Length*	250	(ft)
Zone 2 Length*	0	(ft)

L W Zone 2=

6. SOURCE DATA TYPE: Continuous Single Planar

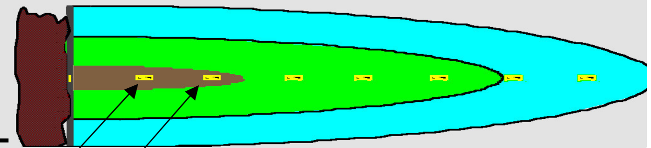
Source Options

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations

Source Thickness in Sat. Zone* 15 (ft)

	Y1
Width* (ft)	0.3

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.35	0
TCE		0
DCE		0
VC		0
ETH		0



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	.005	.004									
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	0	0									
Date Data Collected	2009										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE

RUN ARRAY

Help Restore RESET

SEE OUTPUT Paste

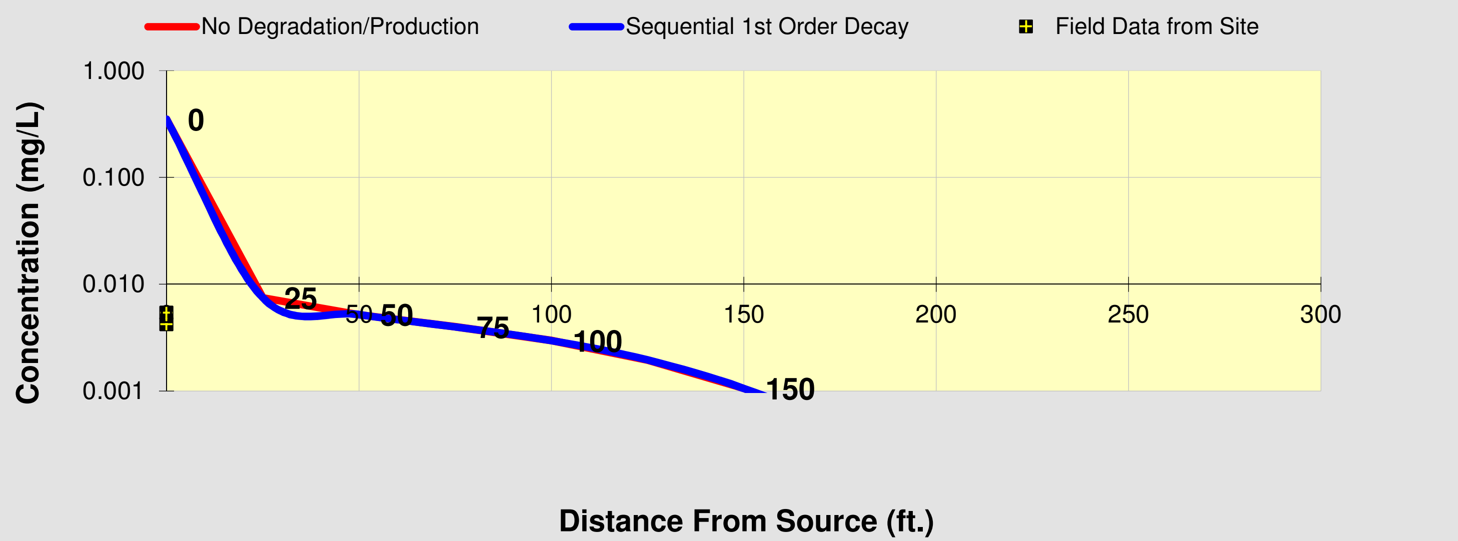
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

PCE	0	25	50	75	100	125	150	175	200	225	250
No Degradation	0.350	0.007	0.005	0.004	0.003	0.002	0.001	0.000	0.000	0.000	0.000
Biotransformation	0.3500	0.007	0.005	0.004	0.003	0.002	0.001	0.000	0.000	0.000	0.000

Monitoring Well Locations (ft)

	0	0									
Field Data from Site	0.005	0.004									



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

29.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path A - 2011

Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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 (selected) / Ethanes

1. ADVECTION

Seepage Velocity*	Vs	11.4	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.015	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	5.E-02	(-)

Calc.

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc		R	
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION **-1st Order Decay Coefficient***

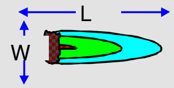
Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	31	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	250	(ft)
Zone 1 Length*	250	(ft)
Zone 2 Length*	0	(ft)



Zone 2=

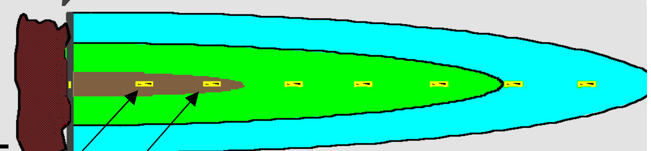
6. SOURCE DATA TYPE: Continuous Single Planar

Source Options

Source Thickness in Sat. Zone* 15 (ft)

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations

	Y1	
Width* (ft)	0.3	
Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.35	0
TCE		0
DCE		0
VC		0
ETH		0



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	.13	.12	.005								
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	0	0	39								
Date Data Collected	2011										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore | RESET | *SEE OUTPUT* | Paste

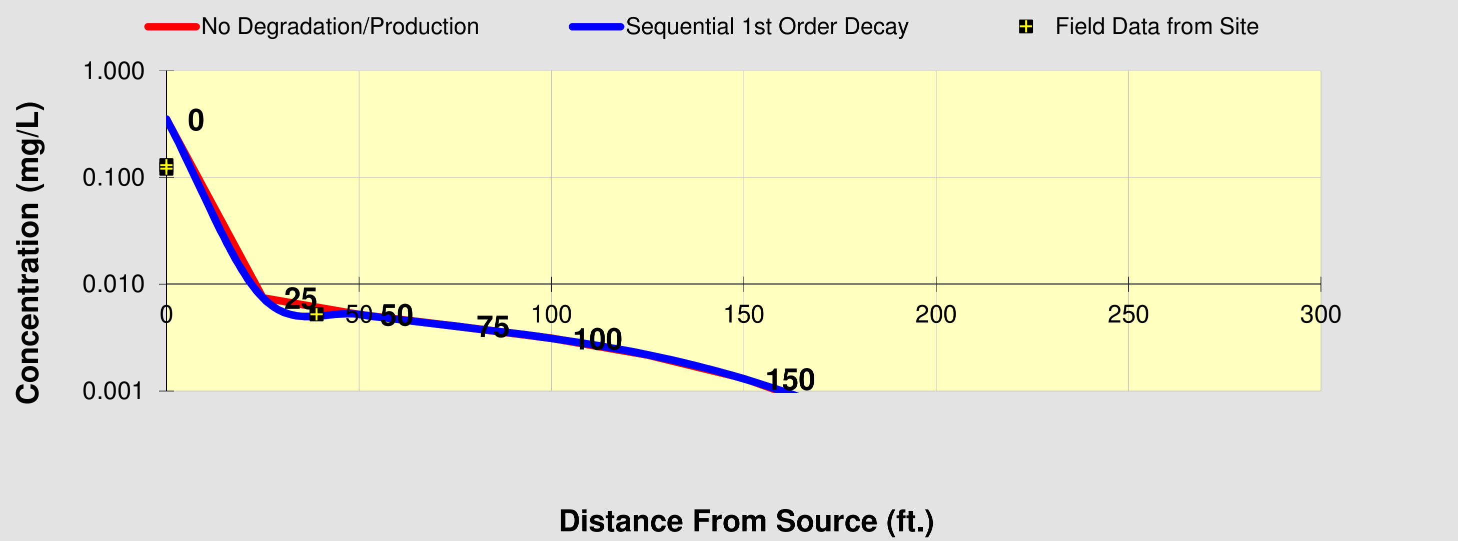
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

PCE	0	25	50	75	100	125	150	175	200	225	250
No Degradation	0.350	0.007	0.005	0.004	0.003	0.002	0.001	0.001	0.000	0.000	0.000
Biotransformation	0.3500	0.007	0.005	0.004	0.003	0.002	0.001	0.001	0.000	0.000	0.000

Monitoring Well Locations (ft)

	0	0	39								
Field Data from Site	0.130	0.120	0.005								



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

31.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path A - 2013
Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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	11.4	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.015	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)	Calc.
(Alpha y) / (Alpha x)*	0.1	(-)	
(Alpha z) / (Alpha x)*	5.E-02	(-)	

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc			
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)
Common R (used in model)* =			**2.47**	

4. BIOTRANSFORMATION **-1st Order Decay Coefficient***

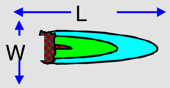
Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	33	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	250	(ft)
Zone 1 Length*	250	(ft)
Zone 2 Length*	0	(ft)



Zone 2=

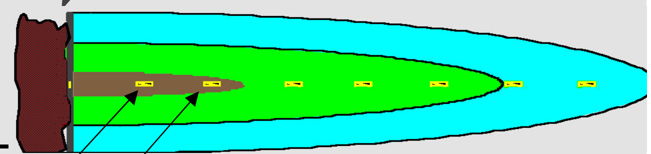
6. SOURCE DATA TYPE: Continuous Single Planar

Source Options

Source Thickness in Sat. Zone* 15 (ft)

	Y1	
Width* (ft)	0.3	
Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.35	0
TCE		0
DCE		0
VC		0
ETH		0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

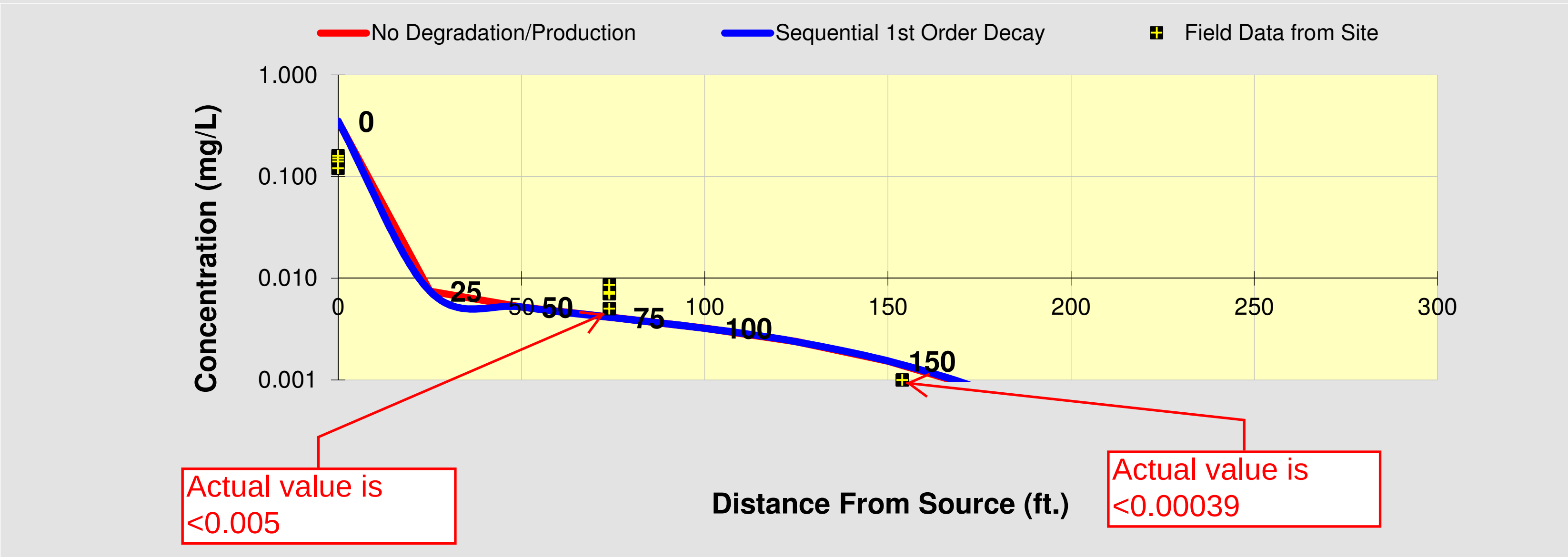
PCE Conc. (mg/L)	.12	.16	.14	.15	.005	.007	.009	.007	.001		
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	0	0	0	0	74	74	74	74	154		
Date Data Collected	2013										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore | RESET | *SEE OUTPUT* | Paste

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

PCE	Distance from Source (ft)										
	0	25	50	75	100	125	150	175	200	225	250
No Degradation	0.350	0.007	0.005	0.004	0.003	0.002	0.002	0.001	0.000	0.000	0.000
Biotransformation	0.3500	0.007	0.005	0.004	0.003	0.002	0.002	0.001	0.000	0.000	0.000
Monitoring Well Locations (ft)	0	0	0	0	74	74	74	74	154		
Field Data from Site	0.120	0.160	0.140	0.150	0.005	0.007	0.009	0.007	0.001		



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time: 33.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path A - 2044
Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or ↗ 2. Calculate by filling in gray
0.02 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	11.4	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.015	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	5.E-02	(-)

Calc.

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc			
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION

-1st Order Decay Coefficient*

Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	64	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	250	(ft)
Zone 1 Length*	250	(ft)
Zone 2 Length*	0	(ft)

L W Zone 2=

6. SOURCE DATA

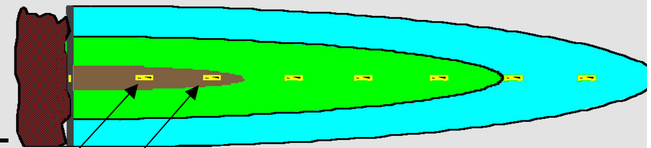
TYPE: Continuous Single Planar

Source Options

Source Thickness in Sat. Zone* 15 (ft)

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations

	Y1	
Width* (ft)	0.3	
Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.35	0
TCE		0
DCE		0
VC		0
ETH		0



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)											
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)											
Date Data Collected	2044										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore | RESET | ***SEE OUTPUT*** | Paste

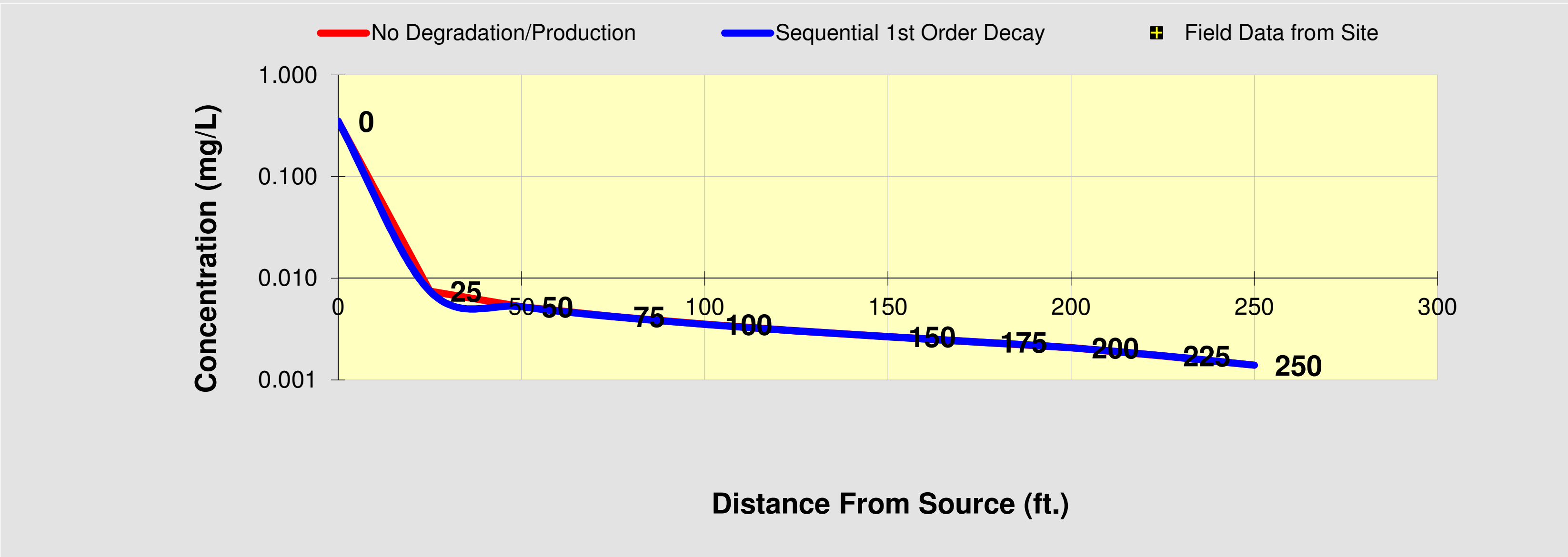
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

PCE	0	25	50	75	100	125	150	175	200	225	250
No Degradation	0.350	0.007	0.005	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.001
Biotransformation	0.3500	0.007	0.005	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.001

Monitoring Well Locations (ft)

Field Data from Site											



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

64.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

EPS

BIOCHLOR Model

Input/Output Screens

Flow Path B

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path B - 2007
Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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	15.2	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.02	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	5.E-02	(-)

Calc.

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc			
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION **-1st Order Decay Coefficient***

Zone 1

	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

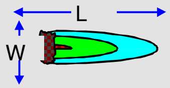
Zone 2

	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	29	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	154	(ft)
Zone 1 Length*	154	(ft)
Zone 2 Length*	0	(ft)



Zone 2=

6. SOURCE DATA TYPE: Continuous
Single Planar

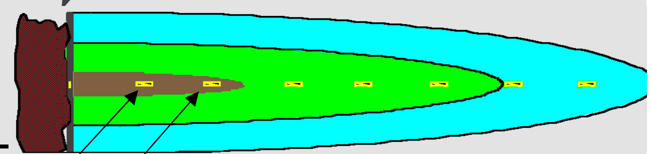
Source Options

Source Thickness in Sat. Zone* 15 (ft)

Y1
Width* (ft) 0.2

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.35	0
TCE		0
DCE		0
VC		0
ETH		0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	.005										
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	32										
Date Data Collected	2007										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore | RESET | *SEE OUTPUT* | Paste

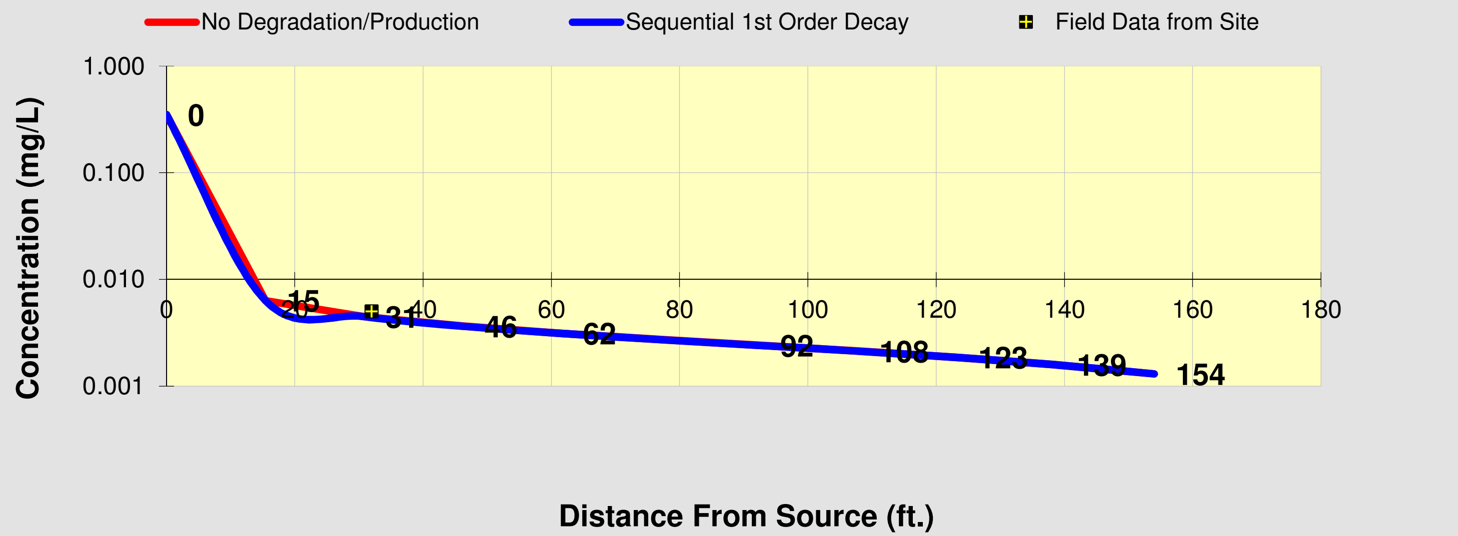
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

PCE	0	15	31	46	62	77	92	108	123	139	154
No Degradation	0.350	0.006	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.001
Biotransformation	0.3500	0.006	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.001

Monitoring Well Locations (ft)

	32										
Field Data from Site	0.005										



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

29.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path B - 2009

Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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	15.2	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.02	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	5.E-02	(-)

Calc.

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc			
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION **-1st Order Decay Coefficient***

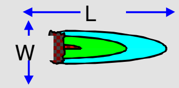
Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	29	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	154	(ft)
Zone 1 Length*	154	(ft)
Zone 2 Length*	0	(ft)



Zone 2=

6. SOURCE DATA TYPE: Continuous Single Planar

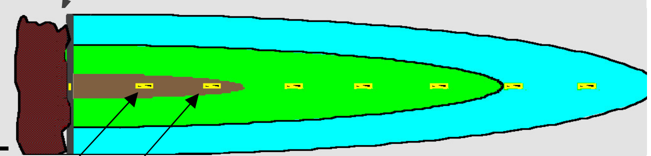
Source Options

Source Thickness in Sat. Zone* 15 (ft)

	Y1
Width* (ft)	0.2

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.35	0
TCE		0
DCE		0
VC		0
ETH		0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	.054	.042									
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	0	0									
Date Data Collected	2009										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore | RESET | *SEE OUTPUT* | Paste

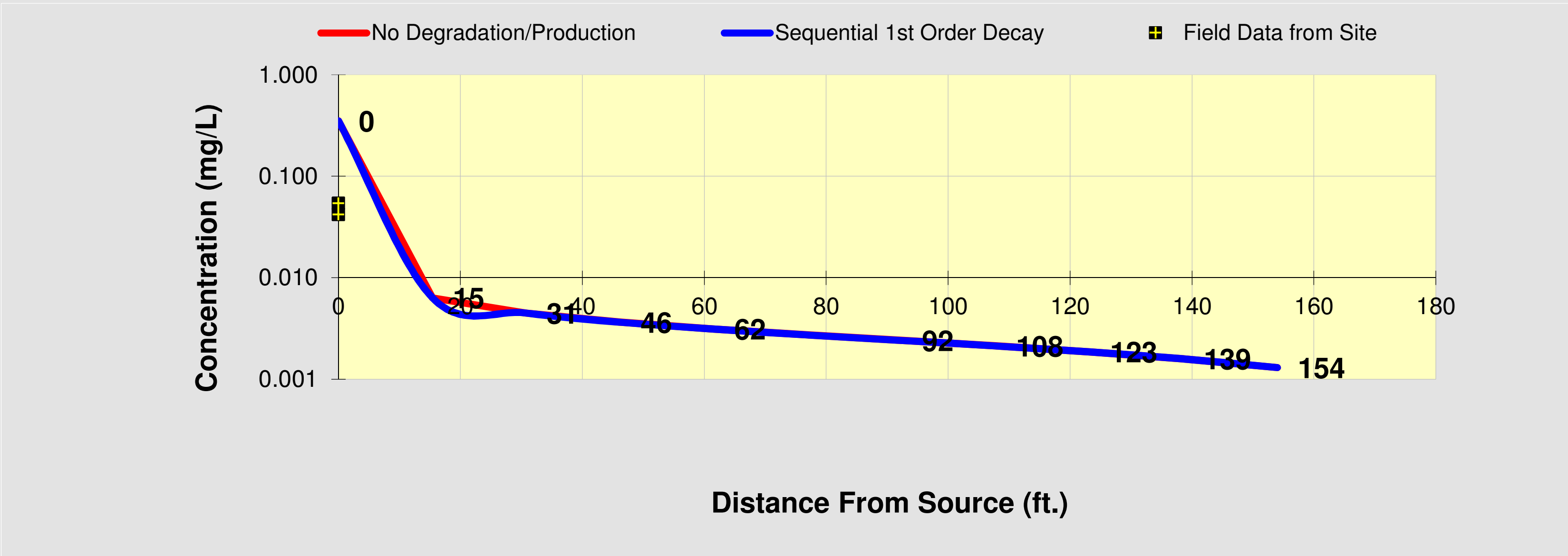
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

PCE	0	15	31	46	62	77	92	108	123	139	154
No Degradation	0.350	0.006	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.001
Biotransformation	0.3500	0.006	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.001

Monitoring Well Locations (ft)

	0	0									
Field Data from Site	0.054	0.042									



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

29.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path B - 2011

Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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 (selected) / Ethanes

1. ADVECTION

Seepage Velocity*	Vs	15.2	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.02	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	5.E-02	(-)

Calc.

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc		R	
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION **-1st Order Decay Coefficient***

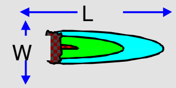
Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	31	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	154	(ft)
Zone 1 Length*	154	(ft)
Zone 2 Length*	0	(ft)



Zone 2=

6. SOURCE DATA TYPE: Continuous
Single Planar

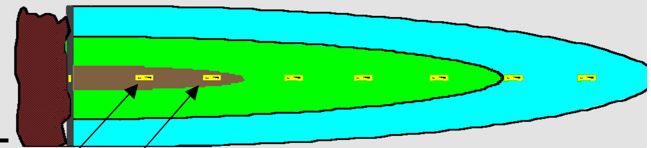
Source Options

Source Thickness in Sat. Zone* 15 (ft)

	Y1
Width* (ft)	0.2

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.35	0
TCE		0
DCE		0
VC		0
ETH		0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	.13	.12	.009								
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	0	0	32								
Date Data Collected	2011										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore | RESET | *SEE OUTPUT* | Paste

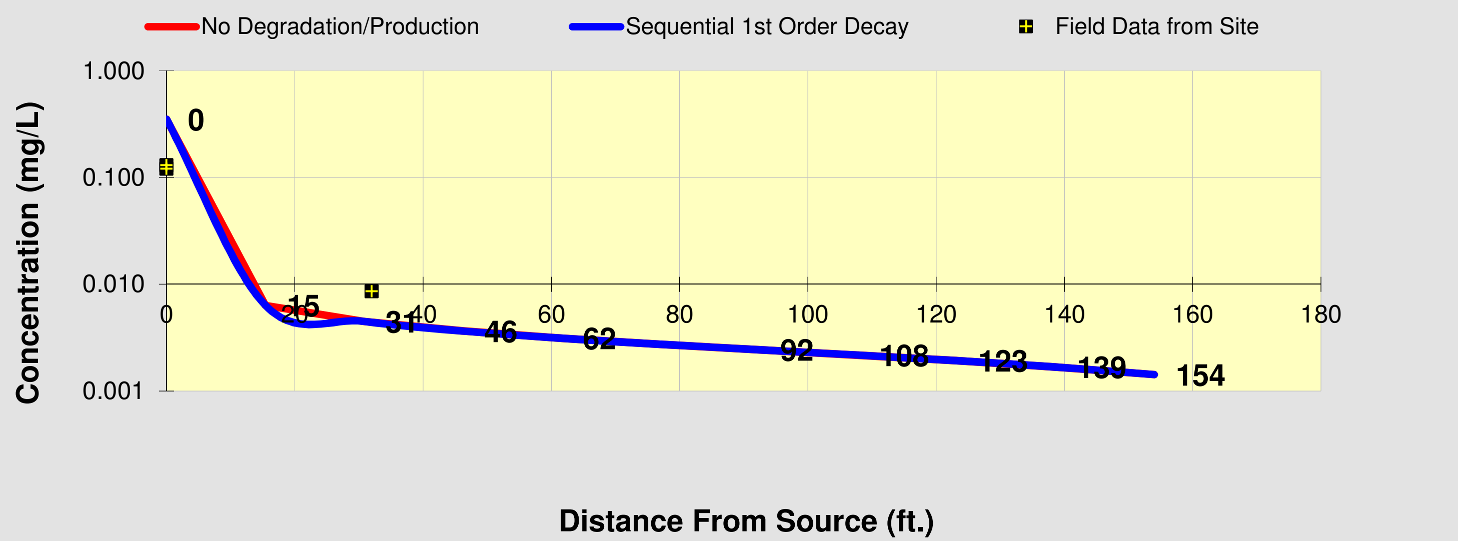
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

PCE	0	15	31	46	62	77	92	108	123	139	154
No Degradation	0.350	0.006	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.001
Biotransformation	0.3500	0.006	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.001

Monitoring Well Locations (ft)

	0	0	32								
Field Data from Site	0.130	0.120	0.009								



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

31.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path B - 2013

Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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	15.2	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.02	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	5.E-02	(-)

Calc.

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)
FractionOrganicCarbon, foc	1.0E-3	(-)

Partition Coefficient	Koc		R	
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION **-1st Order Decay Coefficient***

Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	33	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	154	(ft)
Zone 1 Length*	154	(ft)
Zone 2 Length*	0	(ft)

L W

Zone 2=

6. SOURCE DATA TYPE: Continuous Single Planar

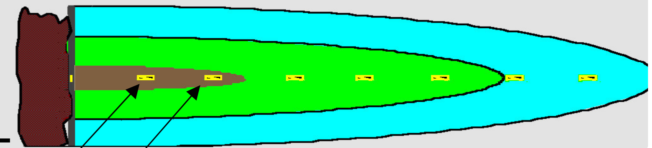
Source Options

Source Thickness in Sat. Zone* 15 (ft)

	Y1
Width* (ft)	0.2

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.35	0
TCE		0
DCE		0
VC		0
ETH		0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	.12	.16	.14	.15	.001	.001	.001				
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	0	0	0	0	139	139	139				
Date Data Collected	2013										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore | RESET | *SEE OUTPUT* | Paste

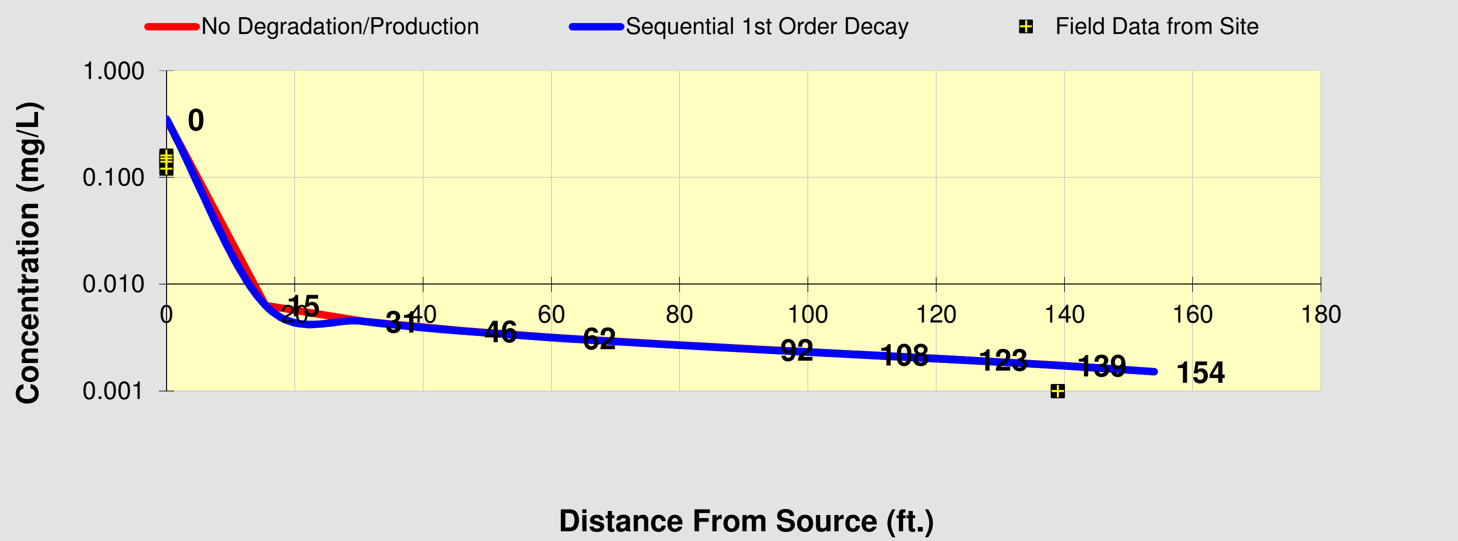
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

PCE	0	15	31	46	62	77	92	108	123	139	154
No Degradation	0.350	0.006	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.002
Biotransformation	0.3500	0.006	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.002

Monitoring Well Locations (ft)

	0	0	0	0	139	139	139				
Field Data from Site	0.120	0.160	0.140	0.150	0.001	0.001	0.001				



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

33.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path B - 2044

Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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	15.2	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.02	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)	Calc.
(Alpha y) / (Alpha x)*	0.1	(-)	
(Alpha z) / (Alpha x)*	5.E-02	(-)	

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc			
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION **-1st Order Decay Coefficient***

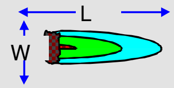
Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	64	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	154	(ft)
Zone 1 Length*	154	(ft)
Zone 2 Length*	0	(ft)



Zone 2=

6. SOURCE DATA TYPE: Continuous Single Planar

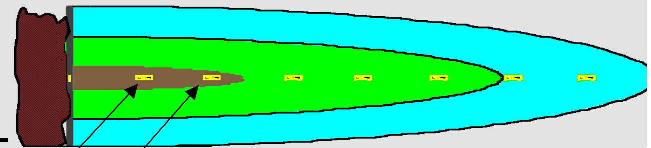
Source Options

Source Thickness in Sat. Zone* 15 (ft)

	Y1
Width* (ft)	0.2

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.35	0
TCE		0
DCE		0
VC		0
ETH		0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)											
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)											
Date Data Collected	2044										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore | RESET | *SEE OUTPUT* | Paste

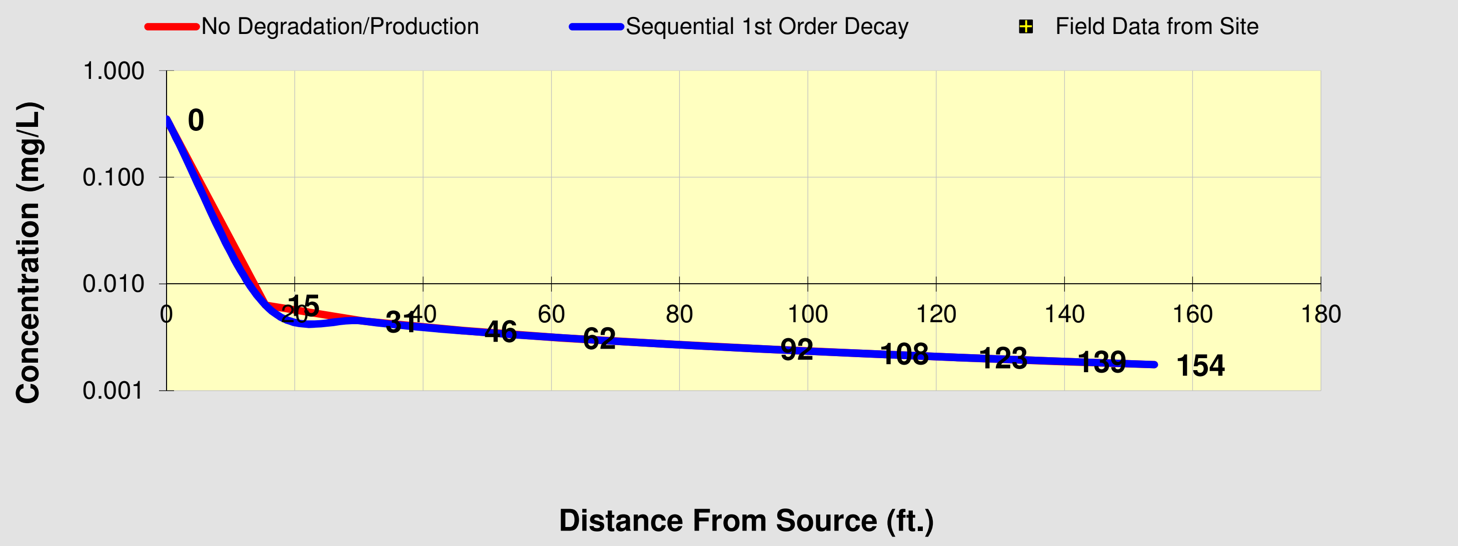
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

PCE	0	15	31	46	62	77	92	108	123	139	154
No Degradation	0.350	0.006	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.002
Biotransformation	0.3500	0.006	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.002

Monitoring Well Locations (ft)

Field Data from Site											



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

64.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

EPS

Sensitivity Analysis

Input/Output Screens

Flow Path A

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path A - 2013
Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
↑ *or* ↗ 2. Calculate by filling in gray
0.02 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	11.4	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.015	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	5.E-02	(-)

Calc.

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc			
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION -1st Order Decay Coefficient*

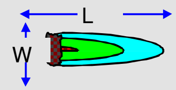
Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	33	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	250	(ft)
Zone 1 Length*	250	(ft)
Zone 2 Length*	0	(ft)



Zone 2=

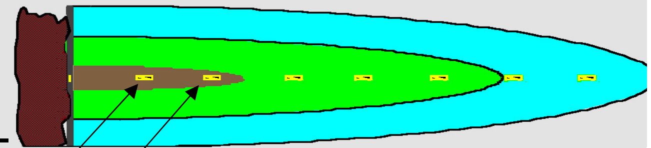
6. SOURCE DATA TYPE: Continuous Single Planar

Source Options

Source Thickness in Sat. Zone* 15 (ft)

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations

	Y1	
Width* (ft)	0.01	
Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.35	0
TCE		0
DCE		0
VC		0
ETH		0



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	.12	.16	.14	.15	.005	.007	.009	.007	.001		
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	0	0	0	0	74	74	74	74	154		
Date Data Collected	2013										

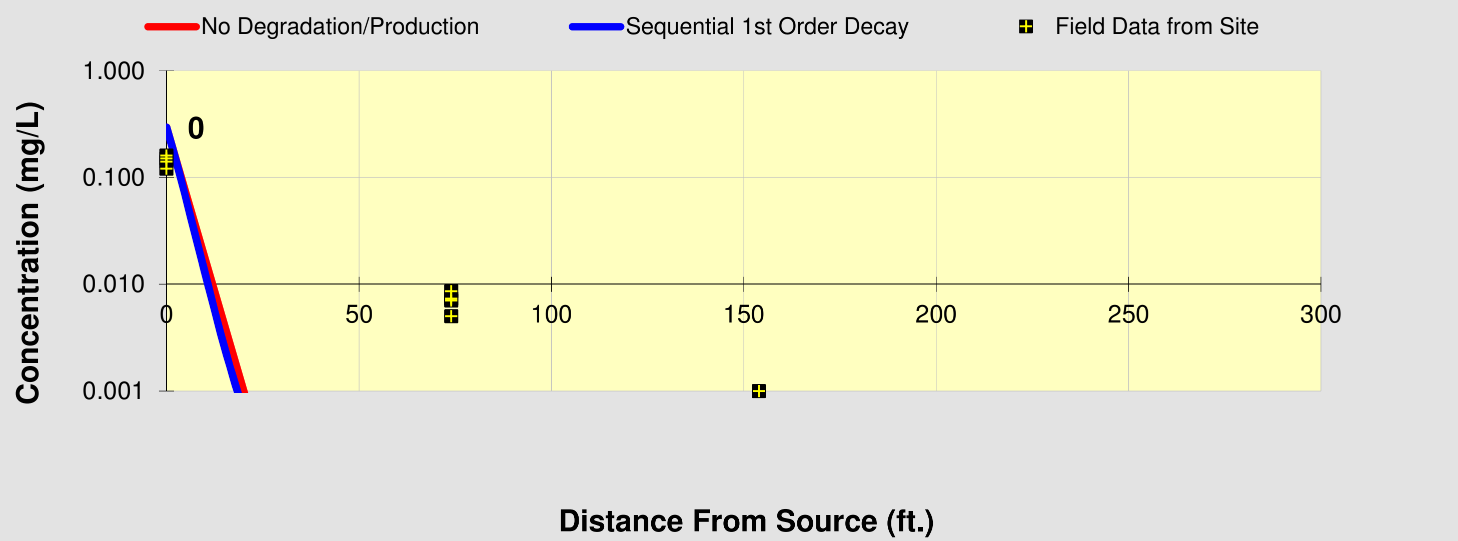
8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore | RESET | *SEE OUTPUT* | Paste

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

Distance from Source (ft)

PCE	0	25	50	75	100	125	150	175	200	225	250
No Degradation	0.295	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biotransformation	0.2947	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Monitoring Well Locations (ft)	0	0	0	0	74	74	74	74	154		
Field Data from Site	0.120	0.160	0.140	0.150	0.005	0.007	0.009	0.007	0.001		



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

33.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path A - 2013

Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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	11.4	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.015	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)	Calc.
(Alpha y) / (Alpha x)*	0.1	(-)	
(Alpha z) / (Alpha x)*	5.E-02	(-)	

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc			
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION **-1st Order Decay Coefficient***

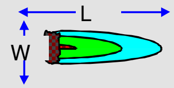
Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	33	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	250	(ft)
Zone 1 Length*	250	(ft)
Zone 2 Length*	0	(ft)



Zone 2=

6. SOURCE DATA TYPE: Continuous Single Planar

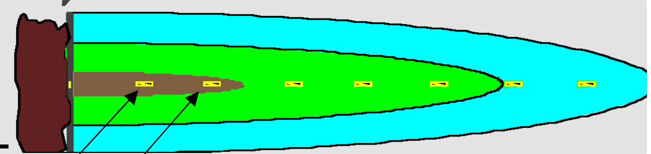
Source Options

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations

Source Thickness in Sat. Zone* 15 (ft)

	Y1
Width* (ft)	0.3

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.35	0
TCE		0
DCE		0
VC		0
ETH		0



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

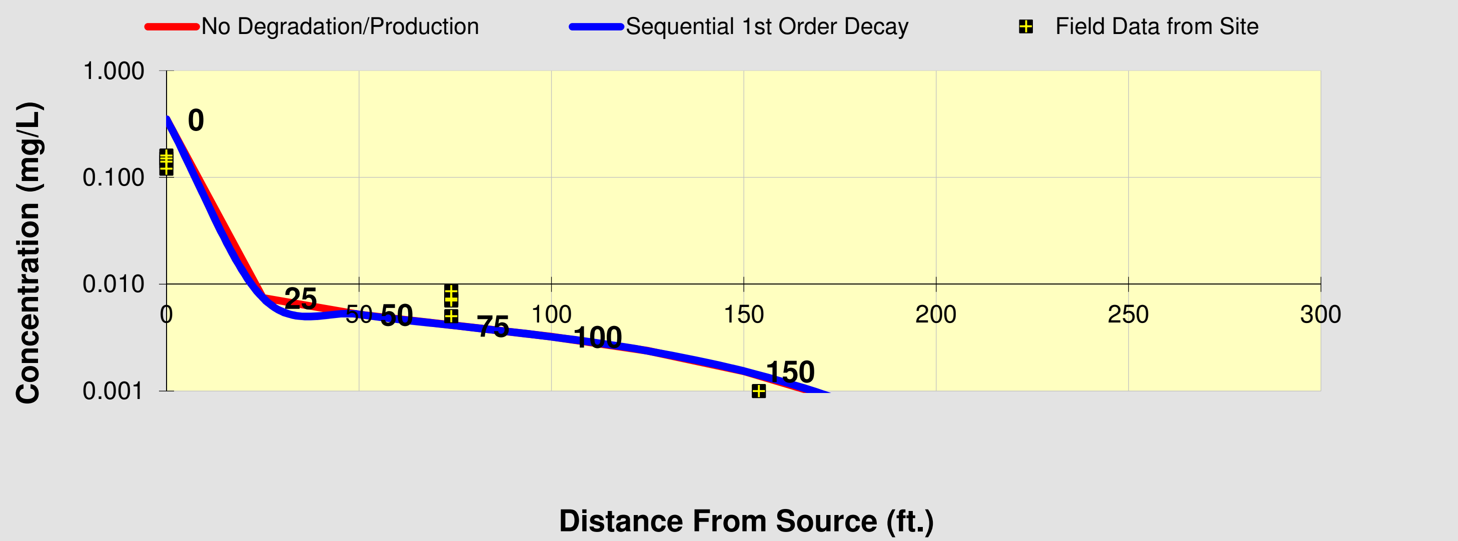
PCE Conc. (mg/L)	.12	.16	.14	.15	.005	.007	.009	.007	.001		
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	0	0	0	0	74	74	74	74	154		
Date Data Collected	2013										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore | RESET | *SEE OUTPUT* | Paste

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

PCE	Distance from Source (ft)										
	0	25	50	75	100	125	150	175	200	225	250
No Degradation	0.350	0.007	0.005	0.004	0.003	0.002	0.002	0.001	0.000	0.000	0.000
Biotransformation	0.3500	0.007	0.005	0.004	0.003	0.002	0.002	0.001	0.000	0.000	0.000
	Monitoring Well Locations (ft)										
	0	0	0	0	74	74	74	74	154		
Field Data from Site	0.120	0.160	0.140	0.150	0.005	0.007	0.009	0.007	0.001		



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

33.0 Years

Log ⇔ Linear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path A - 2013
Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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 11.4 (ft/yr)
or
Hydraulic Conductivity K 1.1E-04 (cm/sec)
Hydraulic Gradient i 0.015 (ft/ft)
Effective Porosity n 0.15 (-)

2. DISPERSION

Alpha x* 6.2711 (ft) Calc.
(Alpha y) / (Alpha x)* 0.1 (-)
(Alpha z) / (Alpha x)* 5.E-02 (-)

3. ADSORPTION

Retardation Factor* → R
or
Soil Bulk Density, rho 1.7 (kg/L)
FractionOrganicCarbon, foc 1.0E-3 (-)
Partition Coefficient Koc

	Koc		R	
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION -1st Order Decay Coefficient*

Zone 1

	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

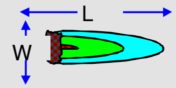
Zone 2

	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time* 33 (yr)
Modeled Area Width* 700 (ft)
Modeled Area Length* 250 (ft)
Zone 1 Length* 250 (ft)
Zone 2 Length* 0 (ft)



Zone 2=

6. SOURCE DATA TYPE: Continuous Single Planar

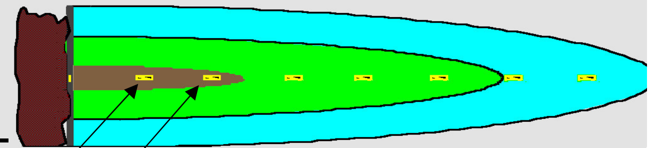
Source Options

Source Thickness in Sat. Zone* 15 (ft)

Y1
Width* (ft) 1

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.35	0
TCE		0
DCE		0
VC		0
ETH		0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	.12	.16	.14	.15	.005	.007	.009	.007	.001		
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	0	0	0	0	74	74	74	74	154		
Date Data Collected	2013										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore | RESET | *SEE OUTPUT* | Paste

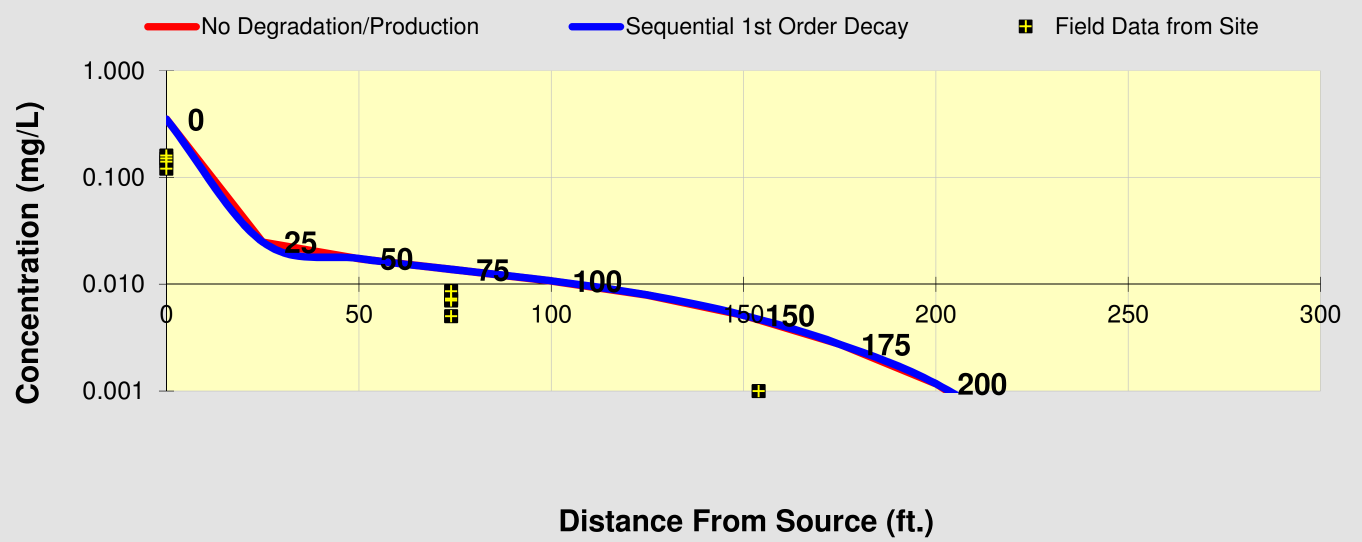
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

PCE	0	25	50	75	100	125	150	175	200	225	250
No Degradation	0.350	0.025	0.017	0.014	0.011	0.008	0.005	0.003	0.001	0.000	0.000
Biotransformation	0.3500	0.025	0.017	0.014	0.011	0.008	0.005	0.003	0.001	0.000	0.000

Monitoring Well Locations (ft)

	0	0	0	0	74	74	74	74	154		
Field Data from Site	0.120	0.160	0.140	0.150	0.005	0.007	0.009	0.007	0.001		



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

33.0 Years

Log ⇔ Linear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path A - 2013
Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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	11.4	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.015	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)	Calc.
(Alpha y) / (Alpha x)*	0.1	(-)	
(Alpha z) / (Alpha x)*	5.E-02	(-)	

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc			
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION

-1st Order Decay Coefficient*

Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	33	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	250	(ft)
Zone 1 Length*	250	(ft)
Zone 2 Length*	0	(ft)

L W Zone 2=

6. SOURCE DATA

TYPE: Continuous Single Planar

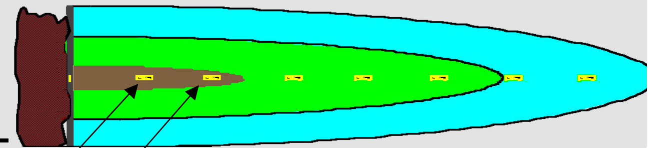
Source Options

Source Thickness in Sat. Zone* 15 (ft)

	Y1
Width* (ft)	5

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.35	0
TCE		0
DCE		0
VC		0
ETH		0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	.12	.16	.14	.15	.005	.007	.009	.007	.001		
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	0	0	0	0	74	74	74	74	154		
Date Data Collected	2013										

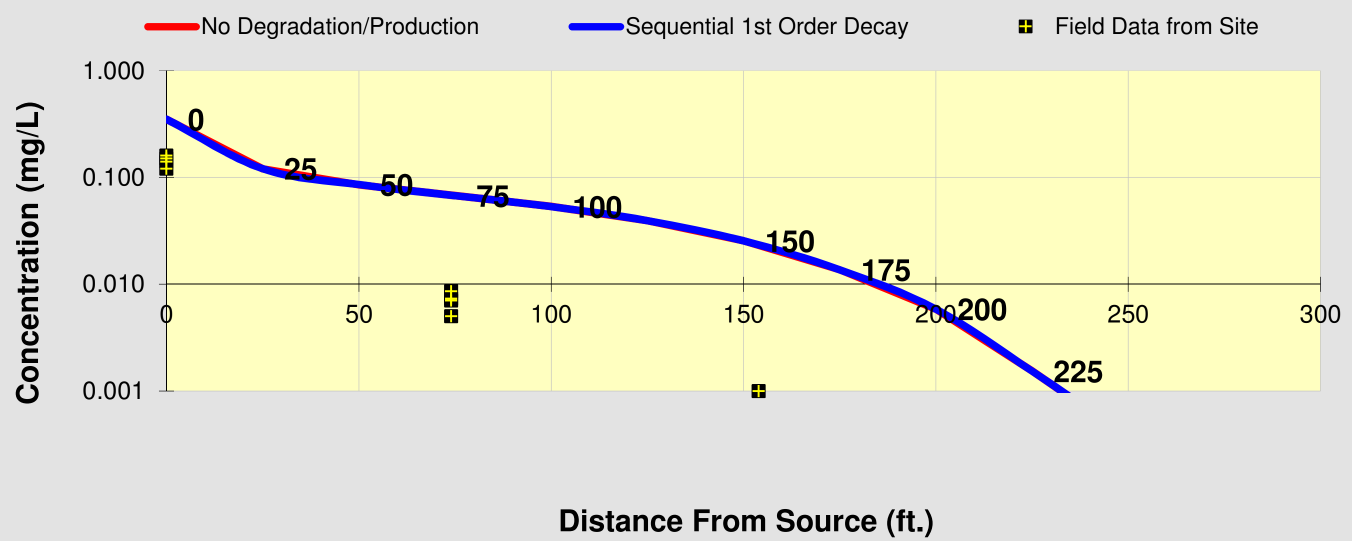
8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore | RESET | *SEE OUTPUT* | Paste

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

PCE	Distance from Source (ft)										
	0	25	50	75	100	125	150	175	200	225	250
No Degradation	0.350	0.121	0.086	0.068	0.053	0.039	0.025	0.014	0.006	0.002	0.000
Biotransformation	0.3500	0.121	0.086	0.068	0.053	0.039	0.025	0.014	0.006	0.002	0.000

	Monitoring Well Locations (ft)									
	0	0	0	0	74	74	74	74	154		
Field Data from Site	0.120	0.160	0.140	0.150	0.005	0.007	0.009	0.007	0.001		



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

33.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path A - 2013

Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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	11.4	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.015	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	5.E-02	(-)

Calc.

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc			
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION **-1st Order Decay Coefficient***

Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	33	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	250	(ft)
Zone 1 Length*	250	(ft)
Zone 2 Length*	0	(ft)

L W

Zone 2=

6. SOURCE DATA TYPE: Continuous Single Planar

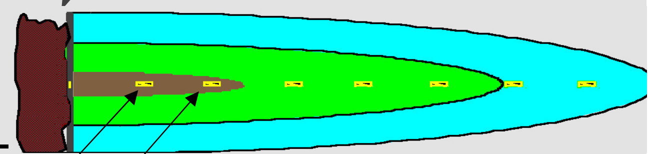
Source Options

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations

Source Thickness in Sat. Zone* 15 (ft)

	Y1
Width* (ft)	0.3

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.1	0
TCE		0
DCE		0
VC		0
ETH		0



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	.12	.16	.14	.15	.005	.007	.009	.007	.001		
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	0	0	0	0	74	74	74	74	154		
Date Data Collected	2013										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | Help | Restore | RESET | SEE OUTPUT | Paste

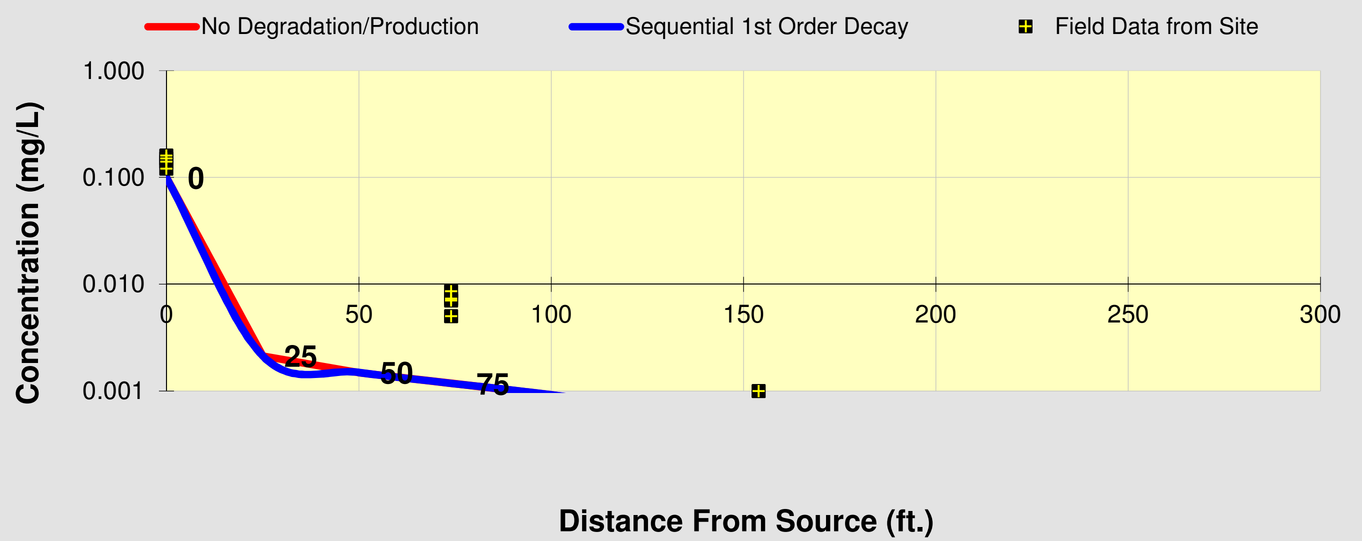
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

PCE	0	25	50	75	100	125	150	175	200	225	250
No Degradation	0.100	0.002	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000
Biotransformation	0.1000	0.002	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000

Monitoring Well Locations (ft)

	0	0	0	0	74	74	74	74	154		
Field Data from Site	0.120	0.160	0.140	0.150	0.005	0.007	0.009	0.007	0.001		



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

33.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path A - 2013

Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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	11.4	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.015	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	5.E-02	(-)

Calc.

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc			
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION **-1st Order Decay Coefficient***

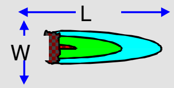
Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	33	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	250	(ft)
Zone 1 Length*	250	(ft)
Zone 2 Length*	0	(ft)



Zone 2=

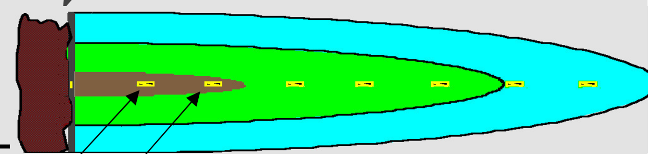
6. SOURCE DATA TYPE: Continuous Single Planar

Source Options

Source Thickness in Sat. Zone* 15 (ft)

	Y1	
Width* (ft)	0.3	
Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.35	0
TCE		0
DCE		0
VC		0
ETH		0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	.12	.16	.14	.15	.005	.007	.009	.007	.001		
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	0	0	0	0	74	74	74	74	154		
Date Data Collected	2013										

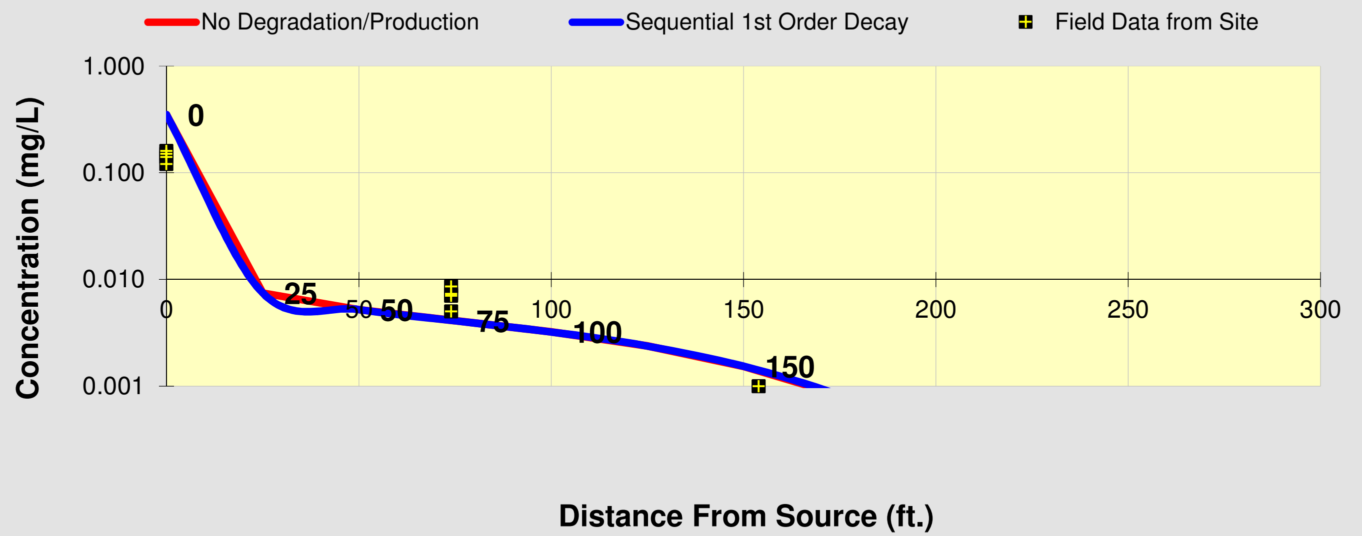
8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore | RESET | *SEE OUTPUT* | Paste

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

PCE

	Distance from Source (ft)										
	0	25	50	75	100	125	150	175	200	225	250
No Degradation	0.350	0.007	0.005	0.004	0.003	0.002	0.002	0.001	0.000	0.000	0.000
Biotransformation	0.3500	0.007	0.005	0.004	0.003	0.002	0.002	0.001	0.000	0.000	0.000
	Monitoring Well Locations (ft)										
	0	0	0	0	74	74	74	74	154		
Field Data from Site	0.120	0.160	0.140	0.150	0.005	0.007	0.009	0.007	0.001		



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

33.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path A - 2013
Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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	11.4	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.015	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	5.E-02	(-)

Calc.

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc			
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION **-1st Order Decay Coefficient***

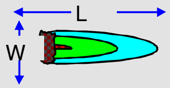
Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	33	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	250	(ft)
Zone 1 Length*	250	(ft)
Zone 2 Length*	0	(ft)



Zone 2=

6. SOURCE DATA TYPE: Continuous Single Planar

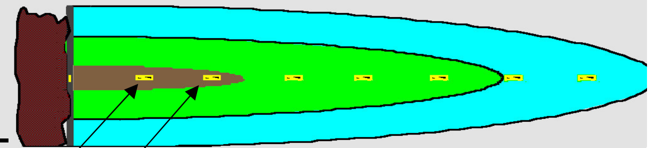
Source Options

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations

Source Thickness in Sat. Zone* 15 (ft)

	Y1
Width* (ft)	0.3

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.75	0
TCE		0
DCE		0
VC		0
ETH		0



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	.12	.16	.14	.15	.005	.007	.009	.007	.001		
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	0	0	0	0	74	74	74	74	154		
Date Data Collected	2013										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore | RESET | *SEE OUTPUT* | Paste

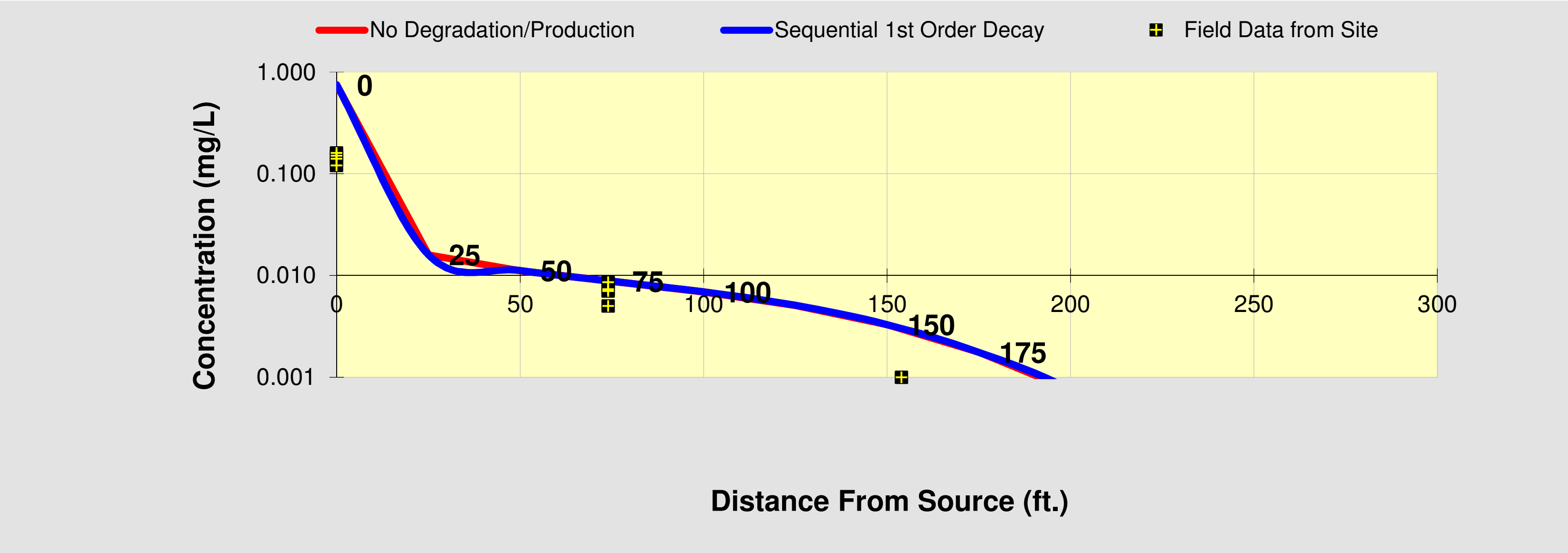
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

PCE	0	25	50	75	100	125	150	175	200	225	250
No Degradation	0.750	0.016	0.011	0.009	0.007	0.005	0.003	0.002	0.001	0.000	0.000
Biotransformation	0.7500	0.016	0.011	0.009	0.007	0.005	0.003	0.002	0.001	0.000	0.000

Monitoring Well Locations (ft)

	0	0	0	0	74	74	74	74	154		
Field Data from Site	0.120	0.160	0.140	0.150	0.005	0.007	0.009	0.007	0.001		



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

33.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

Sensitivity Analysis

Input/Output Screens

Flow Path B

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path B - 2013

Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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 (selected) / Ethanes

1. ADVECTION

Seepage Velocity*	Vs	15.2	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.02	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	5.E-02	(-)

Calc.

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc		R	
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION **-1st Order Decay Coefficient***

Zone 1

	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

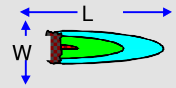
Zone 2

	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	33	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	154	(ft)
Zone 1 Length*	154	(ft)
Zone 2 Length*	0	(ft)



Zone 2=

6. SOURCE DATA TYPE: Continuous Single Planar

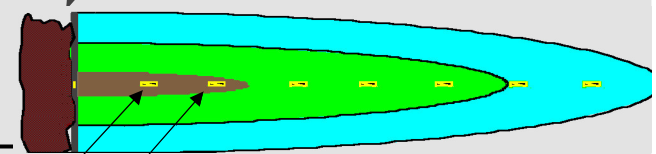
Source Options

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations

Source Thickness in Sat. Zone* 15 (ft)

	Y1
Width* (ft)	0.2

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.1	0
TCE		0
DCE		0
VC		0
ETH		0



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

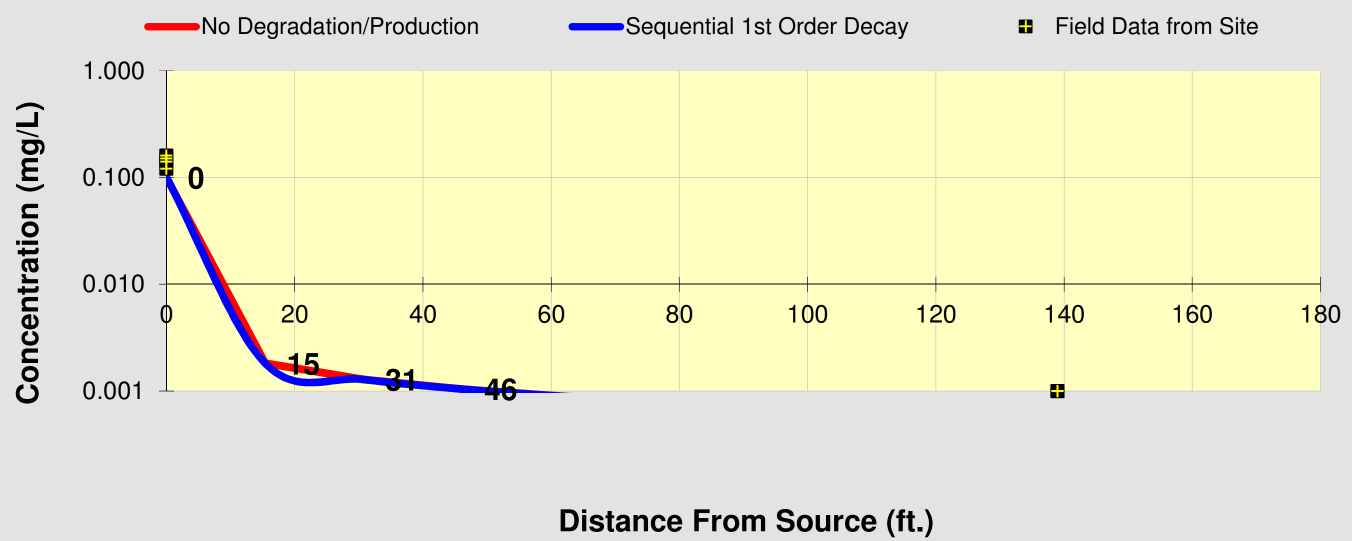
PCE Conc. (mg/L)	.12	.16	.14	.15	.001	.001	.001				
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	0	0	0	0	139	139	139				
Date Data Collected	2013										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | Help | Restore | RESET | SEE OUTPUT | Paste

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

PCE	Distance from Source (ft)										
	0	15	31	46	62	77	92	108	123	139	154
No Degradation	0.100	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000
Biotransformation	0.1000	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000
	Monitoring Well Locations (ft)										
	0	0	0	0	139	139	139				
Field Data from Site	0.120	0.160	0.140	0.150	0.001	0.001	0.001				



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

33.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path B - 2013

Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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	15.2	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.02	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	5.E-02	(-)

Calc.

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc			
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION **-1st Order Decay Coefficient***

Zone 1

	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

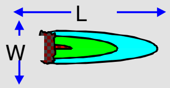
Zone 2

	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	33	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	154	(ft)
Zone 1 Length*	154	(ft)
Zone 2 Length*	0	(ft)



Zone 2=

6. SOURCE DATA TYPE: Continuous Single Planar

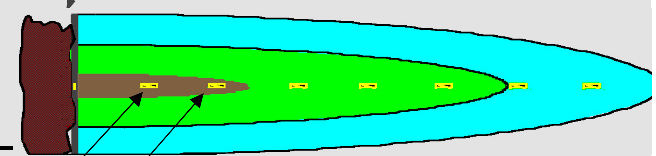
Source Options

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations

Source Thickness in Sat. Zone* 15 (ft)

	Y1
Width* (ft)	0.2

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.35	0
TCE		0
DCE		0
VC		0
ETH		0



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	.12	.16	.14	.15	.001	.001	.001				
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	0	0	0	0	139	139	139				
Date Data Collected	2013										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE RUN ARRAY *Help* Restore RESET *SEE OUTPUT* Paste

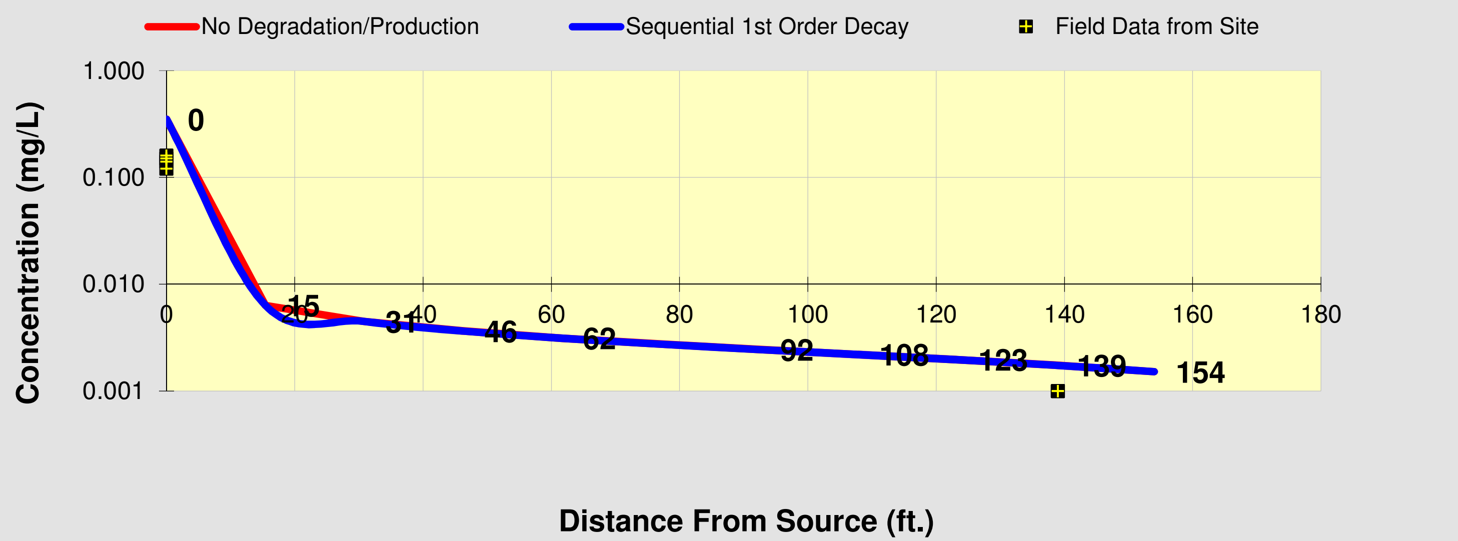
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

PCE	0	15	31	46	62	77	92	108	123	139	154
No Degradation	0.350	0.006	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.002
Biotransformation	0.3500	0.006	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.002

Monitoring Well Locations (ft)

	0	0	0	0	139	139	139				
Field Data from Site	0.120	0.160	0.140	0.150	0.001	0.001	0.001				



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

33.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path B - 2013

Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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	15.2	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.02	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	5.E-02	(-)

Calc.

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc			
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION **-1st Order Decay Coefficient***

Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	33	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	154	(ft)
Zone 1 Length*	154	(ft)
Zone 2 Length*	0	(ft)

L W

Zone 2=

6. SOURCE DATA TYPE: Continuous Single Planar

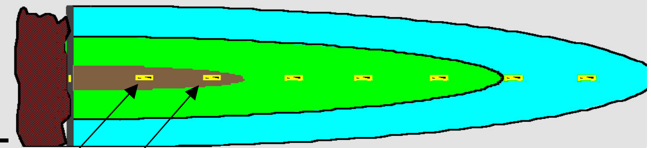
Source Options

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations

Source Thickness in Sat. Zone* 15 (ft)

	Y1
Width* (ft)	0.2

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.75	0
TCE		0
DCE		0
VC		0
ETH		0



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	.12	.16	.14	.15	.001	.001	.001				
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	0	0	0	0	139	139	139				
Date Data Collected	2013										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore | RESET | *SEE OUTPUT* | Paste

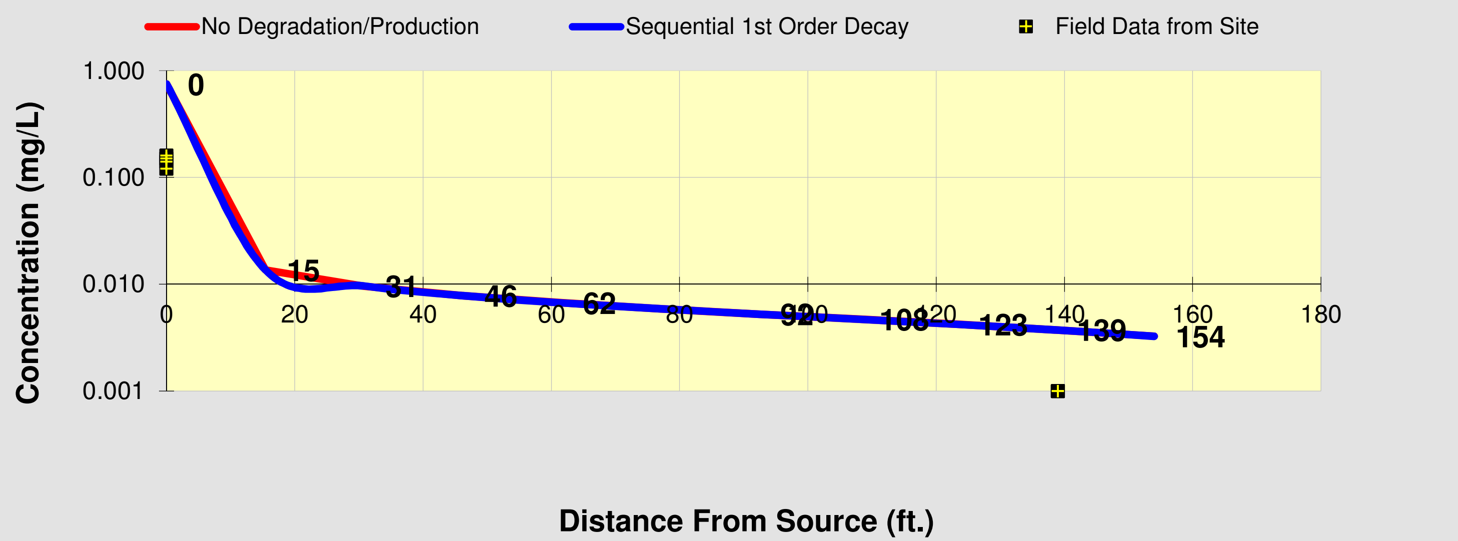
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

PCE	0	15	31	46	62	77	92	108	123	139	154
No Degradation	0.750	0.014	0.010	0.008	0.007	0.006	0.005	0.005	0.004	0.004	0.003
Biotransformation	0.7500	0.014	0.010	0.008	0.007	0.006	0.005	0.005	0.004	0.004	0.003

Monitoring Well Locations (ft)

	0	0	0	0	139	139	139				
Field Data from Site	0.120	0.160	0.140	0.150	0.001	0.001	0.001				



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

33.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path B - 2013
Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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	15.2	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.02	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	5.E-02	(-)

Calc.

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)
FractionOrganicCarbon, foc	1.0E-3	(-)

Partition Coefficient	Koc		R	
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION **-1st Order Decay Coefficient***

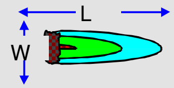
Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	33	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	154	(ft)
Zone 1 Length*	154	(ft)
Zone 2 Length*	0	(ft)



Zone 2=

6. SOURCE DATA TYPE: Continuous Single Planar

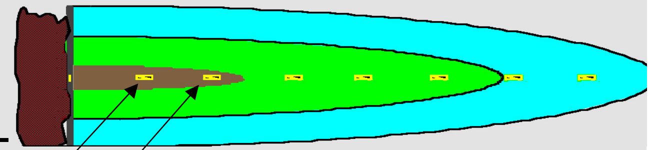
Source Options

Source Thickness in Sat. Zone* 15 (ft)

	Y1
Width* (ft)	0.01

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.35	0
TCE		0
DCE		0
VC		0
ETH		0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	.12	.16	.14	.15	.001	.001	.001				
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	0	0	0	0	139	139	139				
Date Data Collected	2013										

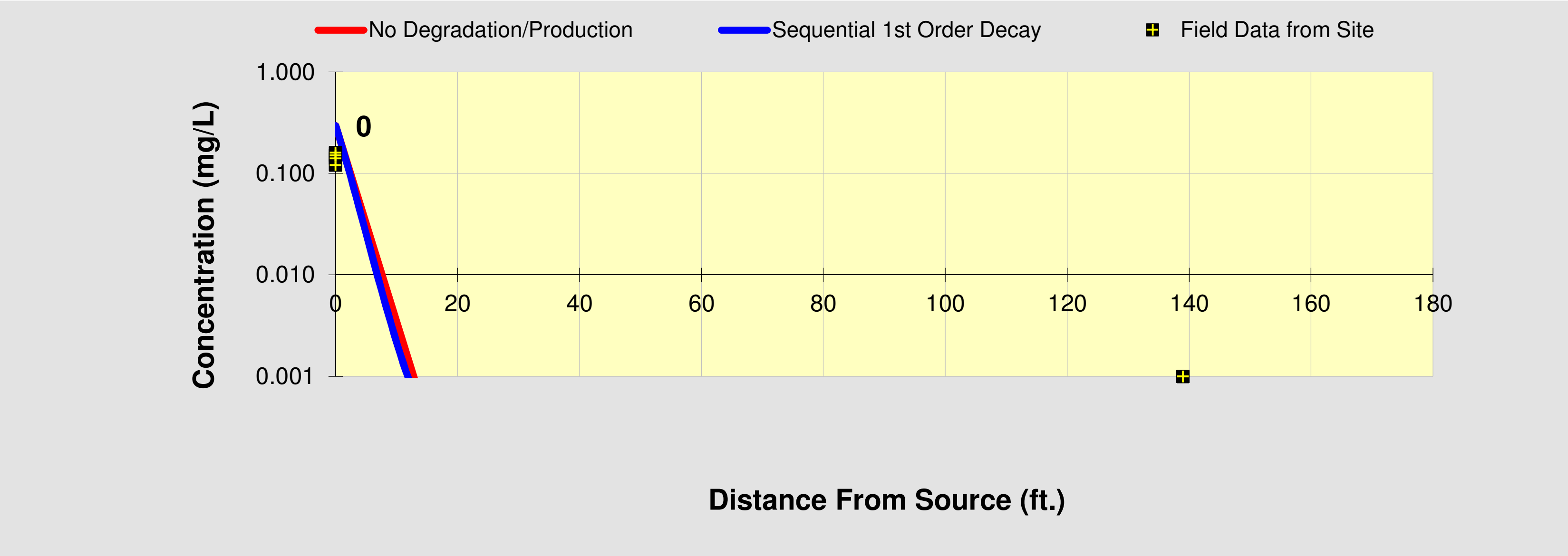
8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE RUN ARRAY *Help* Restore RESET *SEE OUTPUT* Paste

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

PCE	Distance from Source (ft)										
	0	15	31	46	62	77	92	108	123	139	154
No Degradation	0.295	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biotransformation	0.2947	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	Monitoring Well Locations (ft)										
	0	0	0	0	139	139	139				
Field Data from Site	0.120	0.160	0.140	0.150	0.001	0.001	0.001				



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

33.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path B - 2013
Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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	15.2	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.02	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	5.E-02	(-)

Calc.

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)
FractionOrganicCarbon, foc	1.0E-3	(-)

Partition Coefficient	Koc		R	
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION **-1st Order Decay Coefficient***

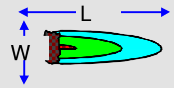
Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	33	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	154	(ft)
Zone 1 Length*	154	(ft)
Zone 2 Length*	0	(ft)



Zone 2=

6. SOURCE DATA TYPE: Continuous Single Planar

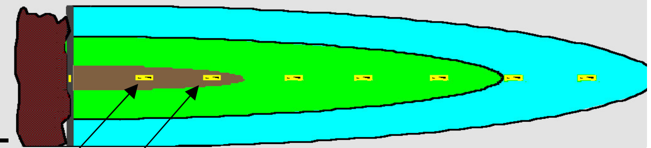
Source Options

Source Thickness in Sat. Zone* 15 (ft)

	Y1
Width* (ft)	0.2

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.35	0
TCE		0
DCE		0
VC		0
ETH		0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	.12	.16	.14	.15	.001	.001	.001				
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	0	0	0	0	139	139	139				
Date Data Collected	2013										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore | RESET | *SEE OUTPUT* | Paste

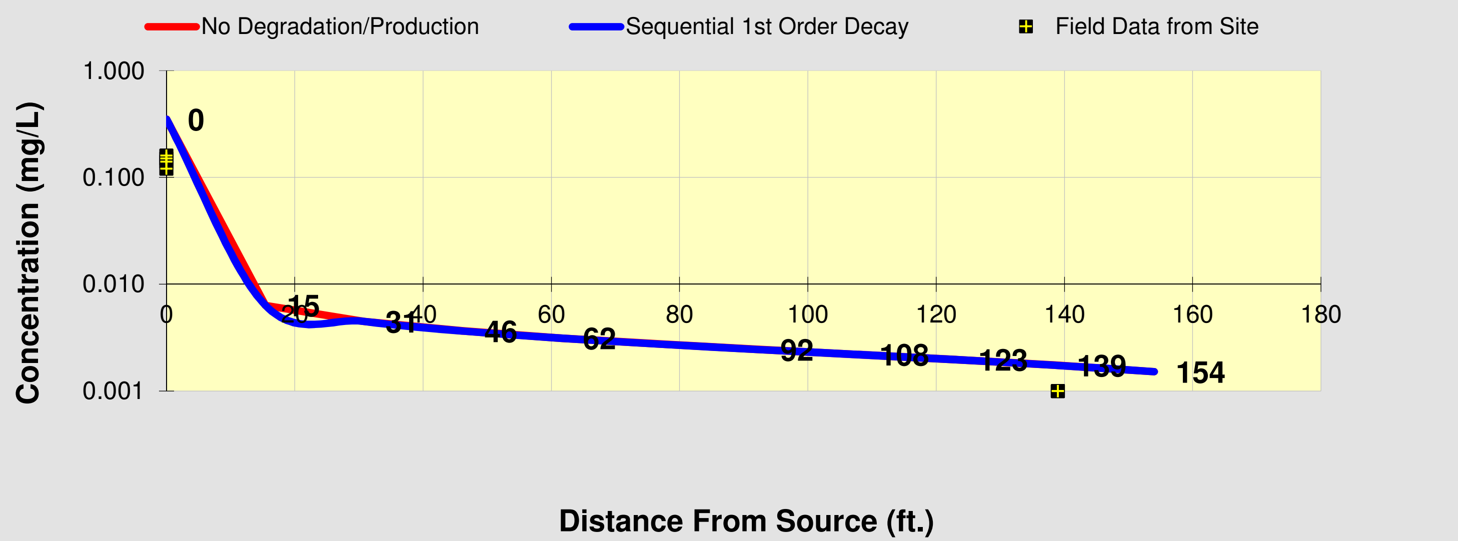
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

PCE	0	15	31	46	62	77	92	108	123	139	154
No Degradation	0.350	0.006	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.002
Biotransformation	0.3500	0.006	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.002

Monitoring Well Locations (ft)

	0	0	0	0	139	139	139				
Field Data from Site	0.120	0.160	0.140	0.150	0.001	0.001	0.001				



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

33.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path B - 2013

Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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	15.2	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.02	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	5.E-02	(-)

Calc.

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc			
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)
Common R (used in model)* =			**2.47**	

4. BIOTRANSFORMATION **-1st Order Decay Coefficient***

Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	33	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	154	(ft)
Zone 1 Length*	154	(ft)
Zone 2 Length*	0	(ft)

L W Zone 2=

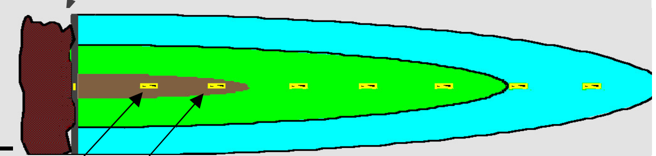
6. SOURCE DATA TYPE: Continuous Single Planar

Source Options

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations

Source Thickness in Sat. Zone* 15 (ft)

	Y1	
Width* (ft)	1	
Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.35	0
TCE		0
DCE		0
VC		0
ETH		0



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

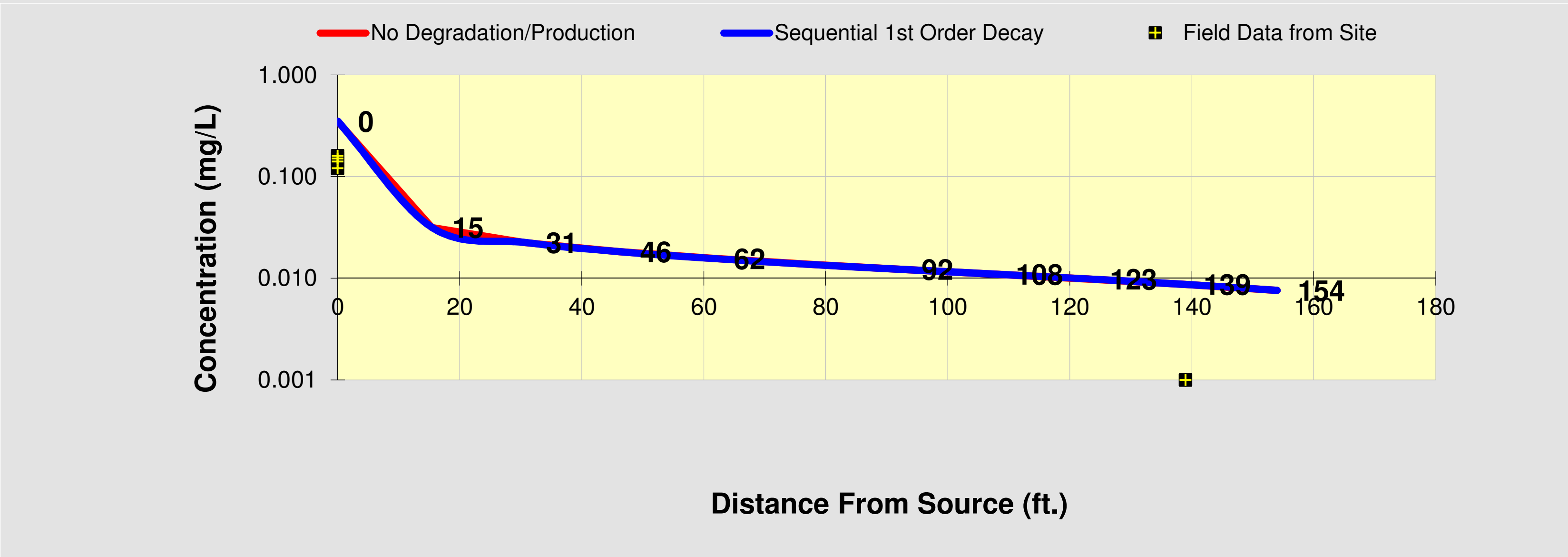
PCE Conc. (mg/L)	.12	.16	.14	.15	.001	.001	.001				
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	0	0	0	0	139	139	139				
Date Data Collected	2013										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE RUN ARRAY *Help* Restore RESET *SEE OUTPUT* Paste

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

PCE	Distance from Source (ft)										
	0	15	31	46	62	77	92	108	123	139	154
No Degradation	0.350	0.032	0.022	0.018	0.016	0.014	0.012	0.011	0.010	0.009	0.008
Biotransformation	0.3500	0.032	0.022	0.018	0.016	0.014	0.012	0.011	0.010	0.009	0.008
Monitoring Well Locations (ft)	0	0	0	0	139	139	139				
Field Data from Site	0.120	0.160	0.140	0.150	0.001	0.001	0.001				



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

33.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Color Spectrum
Flow Path B - 2013

Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 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 (selected) / Ethanes

1. ADVECTION

Seepage Velocity*	Vs	15.2	(ft/yr)
or			
Hydraulic Conductivity	K	1.1E-04	(cm/sec)
Hydraulic Gradient	i	0.02	(ft/ft)
Effective Porosity	n	0.15	(-)

2. DISPERSION

Alpha x*	6.2711	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	5.E-02	(-)

Calc.

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.7	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc		R	
PCE	426	(L/kg)	5.83	(-)
TCE	130	(L/kg)	2.47	(-)
DCE	125	(L/kg)	2.42	(-)
VC	30	(L/kg)	1.34	(-)
ETH	302	(L/kg)	4.42	(-)

Common R (used in model)* = 2.47

4. BIOTRANSFORMATION **-1st Order Decay Coefficient***

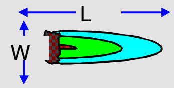
Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	0.000		0.79
TCE → DCE	0.000		0.74
DCE → VC	0.000		0.64
VC → ETH	0.000		0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	33	(yr)
Modeled Area Width*	700	(ft)
Modeled Area Length*	154	(ft)
Zone 1 Length*	154	(ft)
Zone 2 Length*	0	(ft)



Zone 2=

6. SOURCE DATA TYPE: Continuous Single Planar

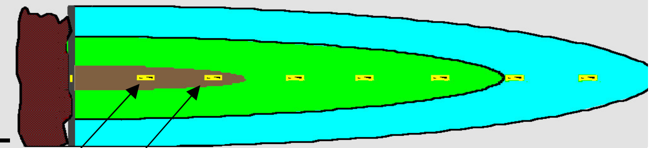
Source Options

Source Thickness in Sat. Zone* 15 (ft)

	Y1
Width* (ft)	5

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	.35	0
TCE		0
DCE		0
VC		0
ETH		0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	.12	.16	.14	.15	.001	.001	.001				
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)	0	0	0	0	139	139	139				
Date Data Collected	2013										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore | RESET | *SEE OUTPUT* | Paste

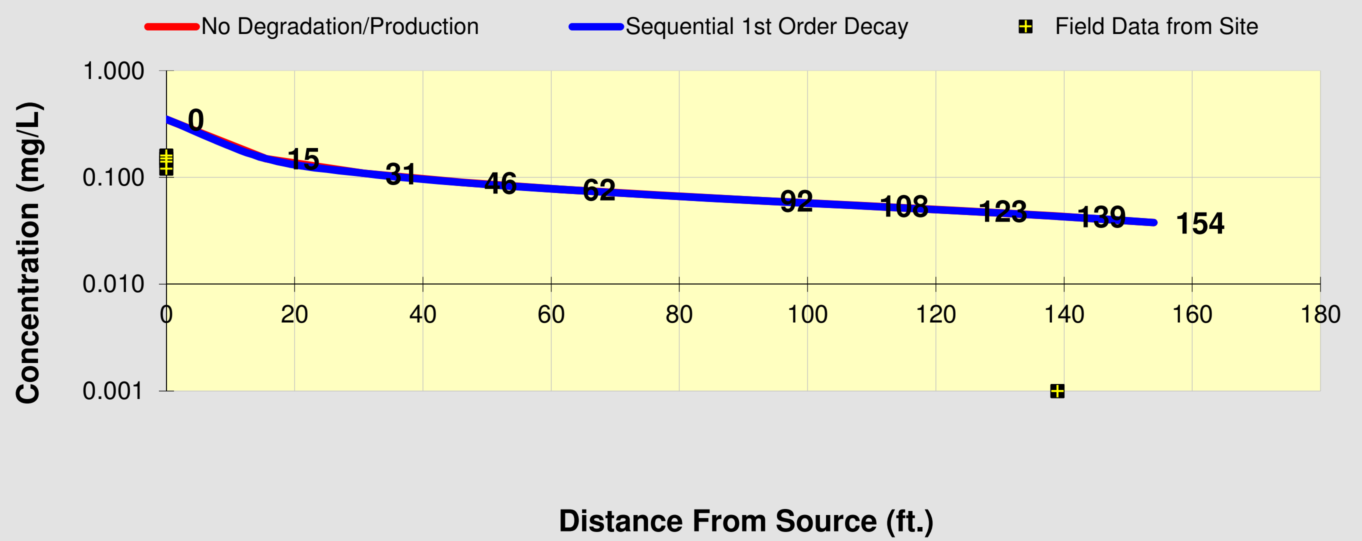
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

PCE	0	15	31	46	62	77	92	108	123	139	154
No Degradation	0.350	0.151	0.109	0.090	0.077	0.068	0.061	0.054	0.049	0.043	0.038
Biotransformation	0.3500	0.151	0.109	0.090	0.077	0.068	0.061	0.054	0.049	0.043	0.038

Monitoring Well Locations (ft)

	0	0	0	0	139	139	139				
Field Data from Site	0.120	0.160	0.140	0.150	0.001	0.001	0.001				



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

33.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

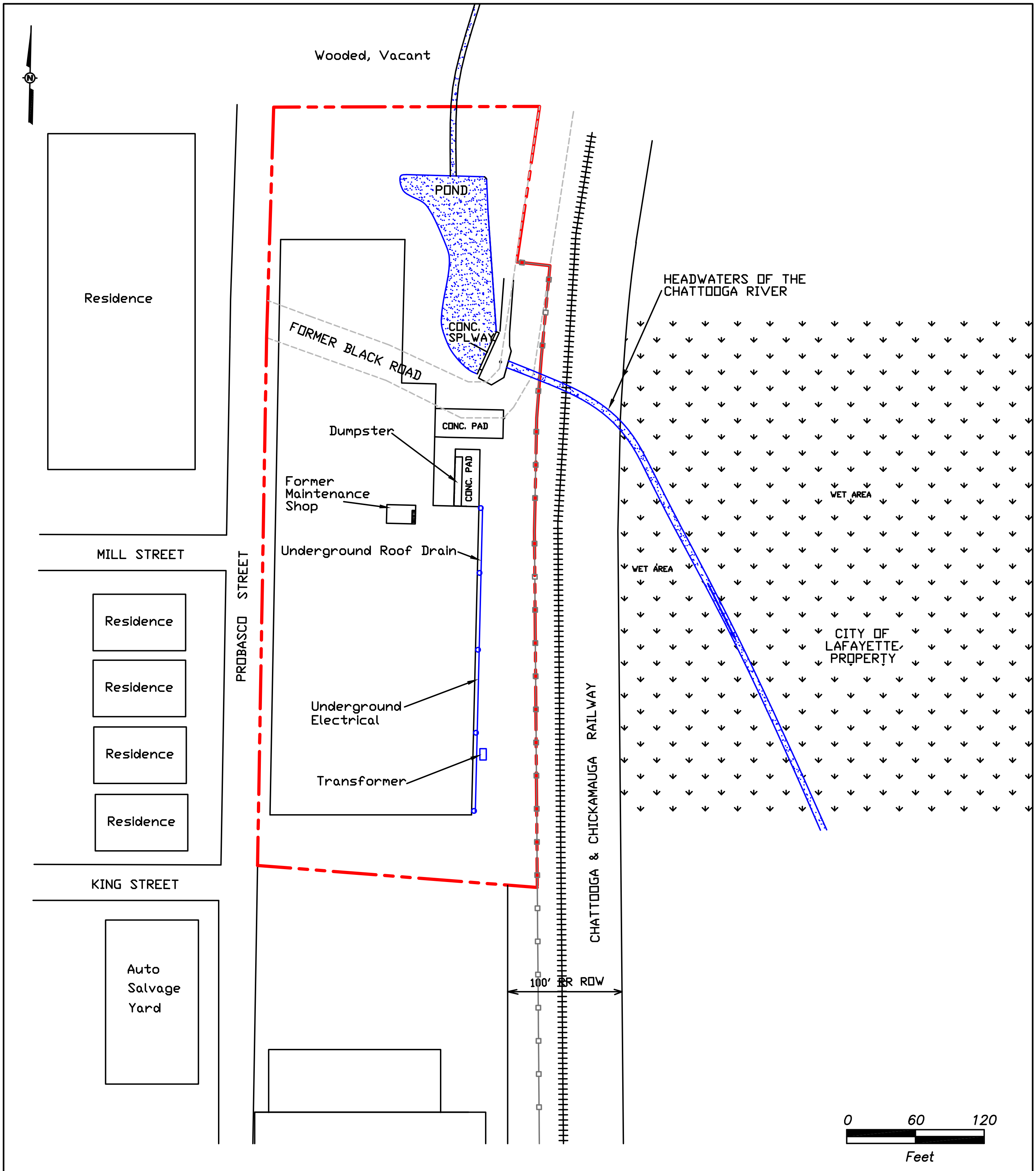
APPENDIX C

Figures

SOURCE: GOOGLE EARTH

Approximate Site Boundary

EPS 1050 Crown Pointe Pkwy Suite: 550 Atlanta, GA 30338 404.315.9113	N	Drawn by: JDD Date: July 2015 **Color Spectrum** **29 Probasco Street** **LaFayette, GA 30728** **SITE LOCATION MAP**	**FIGURE** **1**



LEGEND

Railroad Tracks
Fence Line
Site

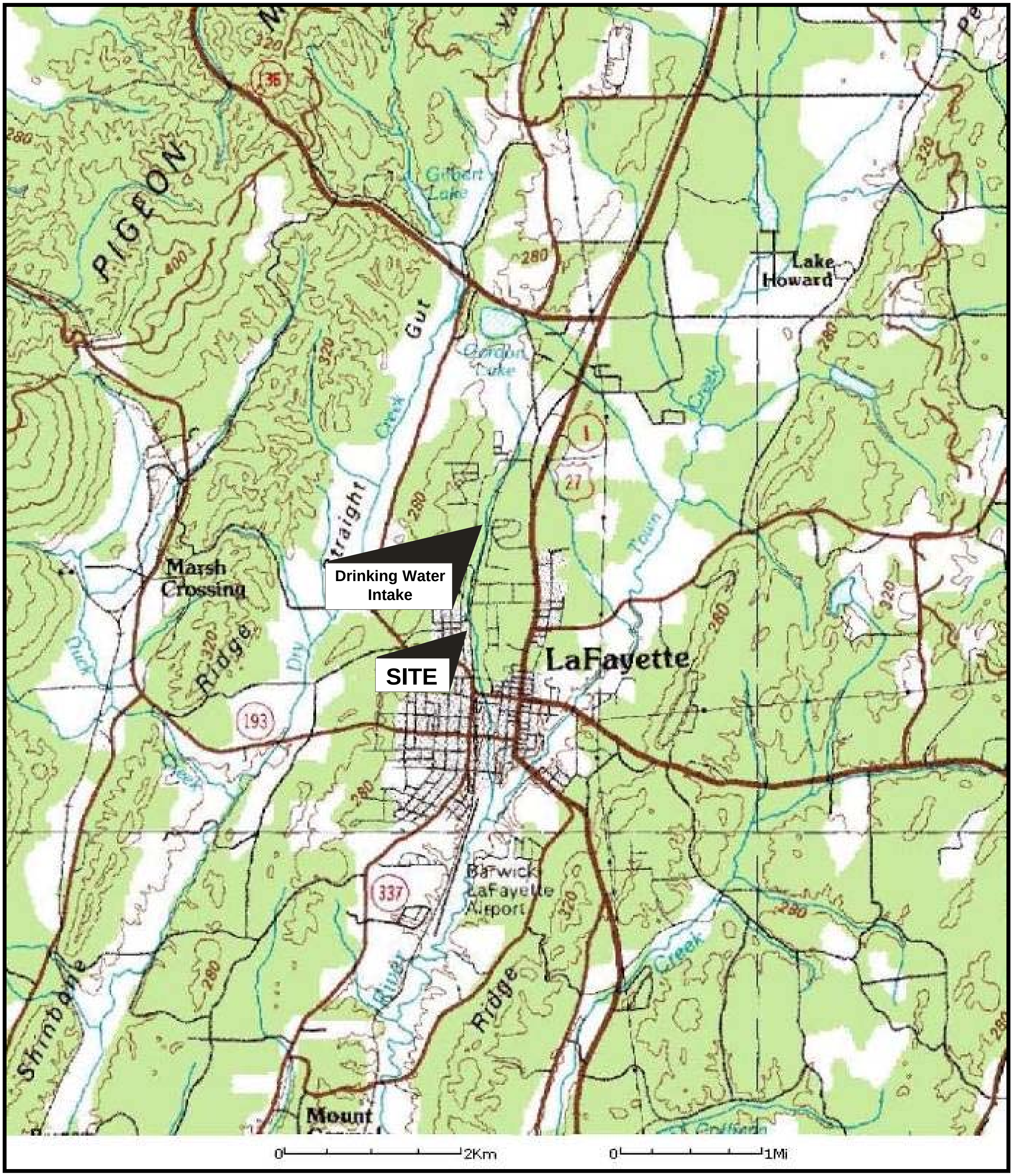
EPS
1050 Crown Pointe Parkway
Suite 350
Atlanta, GA 30338
(404) 315-9113

DRN: JDD | DATE: July 2015

Color Spectrum
29 Probasco Street
LaFayette, GA 30728

Site Plan and Site Vicinity Map

FIGURE
2



Scale shown above

Source: USGS Quadrangle Map Lafayette, Georgia

EPS

1050 Crown Pointe Pkwy
Suite: 550
Atlanta, GA 30338
404.315.9113

N

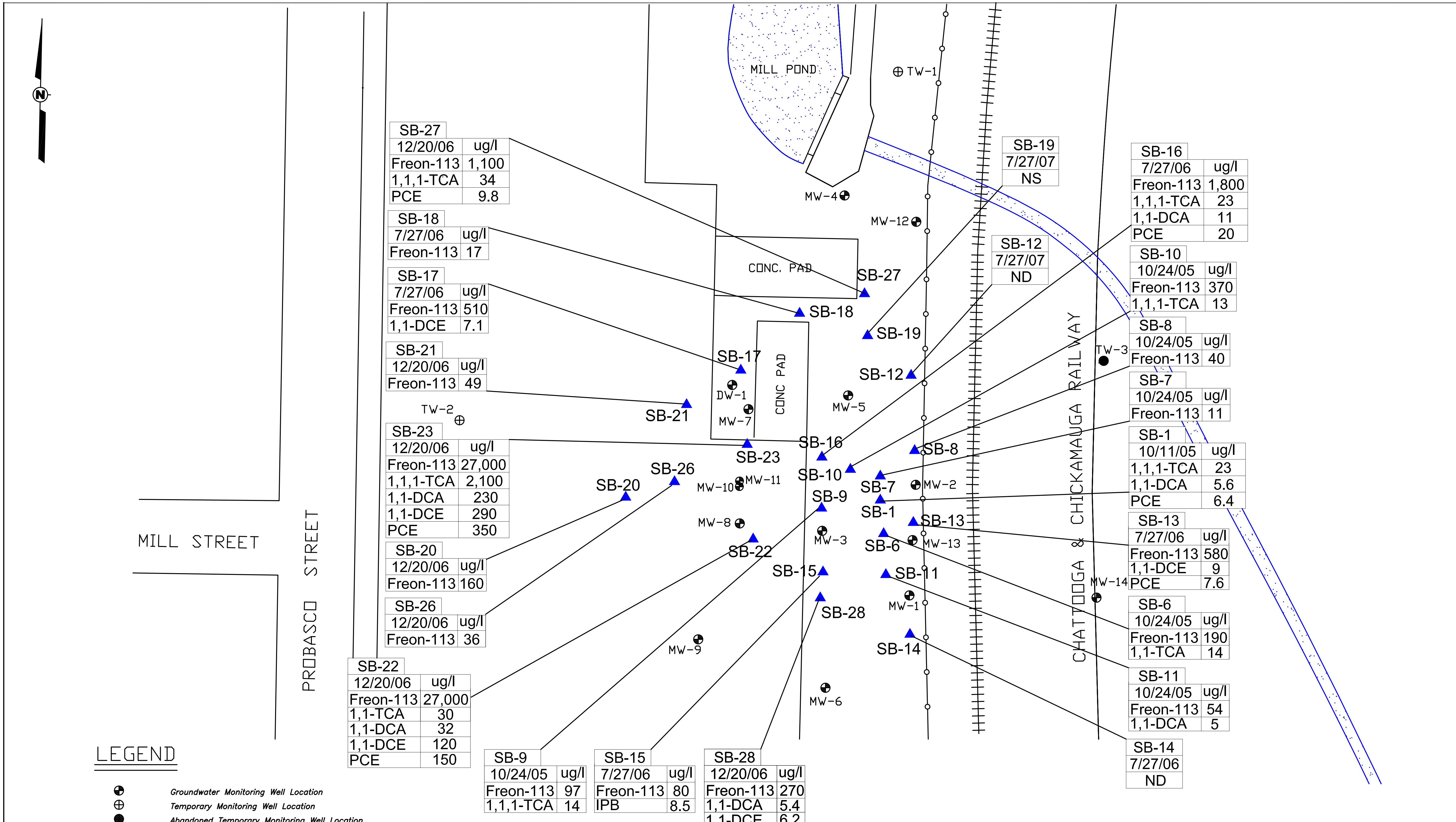
Drawn by: JDD | Date: October 2014

Color Spectrum
29 Probasco Street
LaFayette, GA 30728

USGS QUADRANGLE MAP

FIGURE

3



EPS

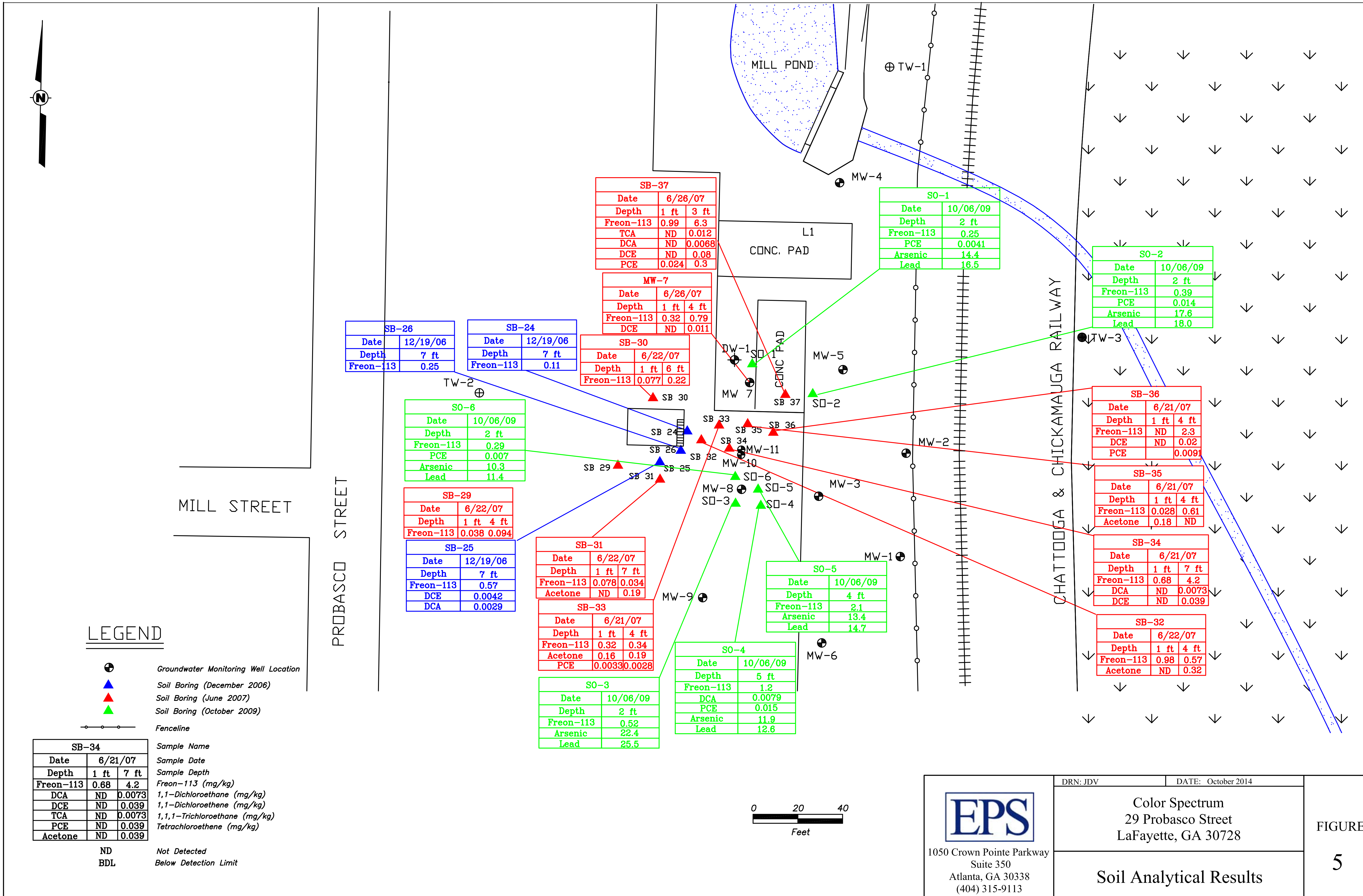
1050 Crown Pointe Parkway
Suite 350
Atlanta, GA 30338
(404) 315-9113

DRN: JDD DATE: July 2015

Color Spectrum
29 Probasco Street
LaFayette, GA 30728

Historical Soil Boring
Groundwater Results

FIGURE
4



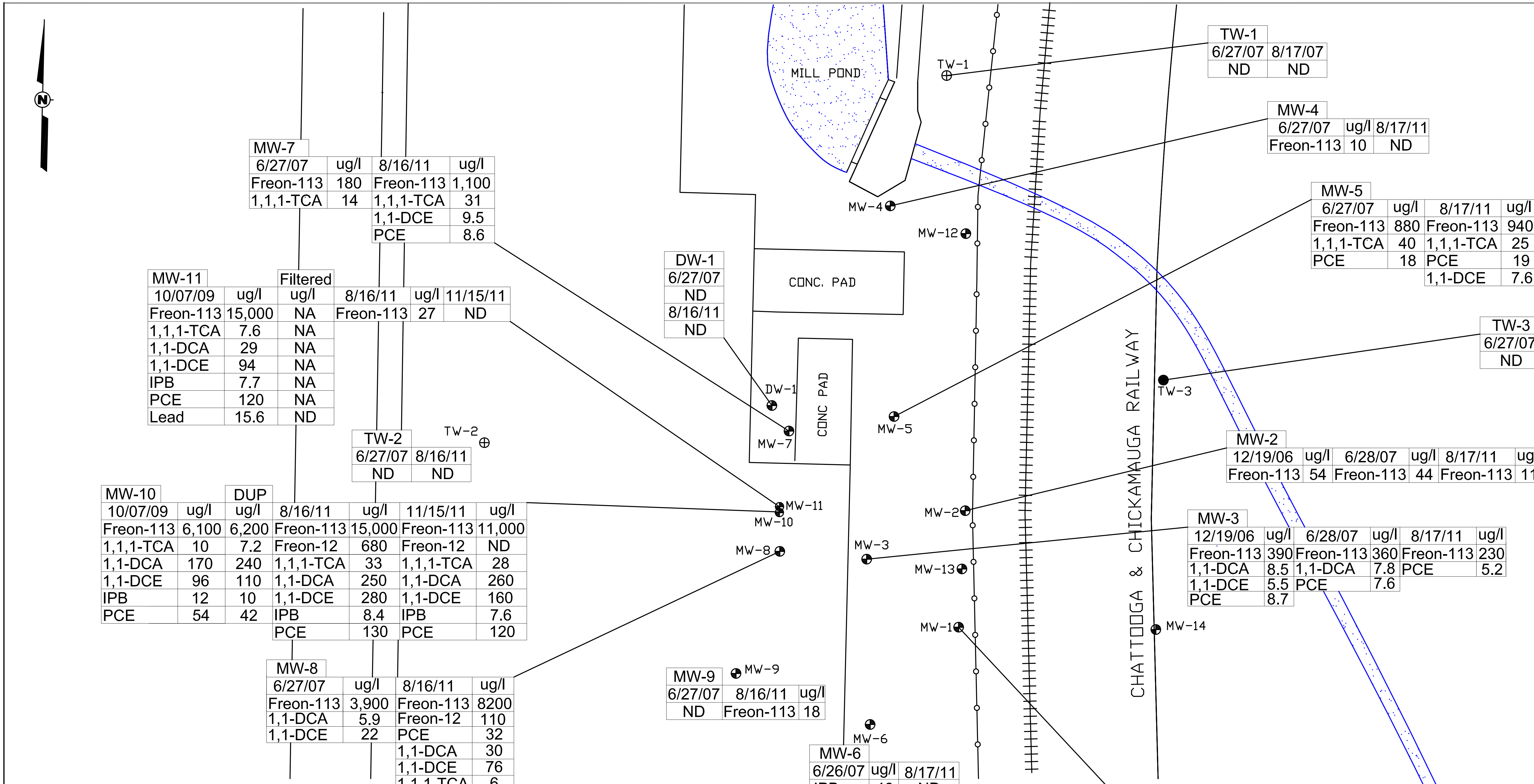
EPS
1050 Crown Pointe Parkway
Suite 350
Atlanta, GA 30338
(404) 315-9113

DRN: JDV | DATE: October 2014

Color Spectrum
29 Probasco Street
LaFayette, GA 30728

Soil Analytical Results

FIGURE 5



MW-7

6/27/07	ug/l	8/16/11	ug/l
Freon-113	180	Freon-113	1,100
1,1,1-TCA	14	1,1,1-TCA	31
		1,1-DCE	9.5
		PCE	8.6

MW-11

10/07/09	ug/l	Filtered ug/l	8/16/11	ug/l	11/15/11
Freon-113	15,000	NA	Freon-113	27	ND
1,1,1-TCA	7.6	NA			
1,1-DCA	29	NA			
1,1-DCE	94	NA			
IPB	7.7	NA			
PCE	120	NA			
Lead	15.6	ND			

TW-2

6/27/07	8/16/11
ND	ND

MW-10

10/07/09	ug/l	DUP ug/l	8/16/11	ug/l	11/15/11	ug/l
Freon-113	6,100	6,200	Freon-113	15,000	Freon-113	11,000
1,1,1-TCA	10	7.2	Freon-12	680	Freon-12	ND
1,1-DCA	170	240	1,1,1-TCA	33	1,1,1-TCA	28
1,1-DCE	96	110	1,1-DCA	250	1,1-DCA	260
IPB	12	10	1,1-DCE	280	1,1-DCE	160
PCE	54	42	IPB	8.4	IPB	7.6
			PCE	130	PCE	120

MW-8

6/27/07	ug/l	8/16/11	ug/l
Freon-113	3,900	Freon-113	8200
1,1-DCA	5.9	Freon-12	110
1,1-DCE	22	PCE	32
		1,1-DCA	30
		1,1-DCE	76
		1,1,1-TCA	6

DW-1

DW-1
6/27/07
ND
8/16/11
ND

MW-9

6/27/07	8/16/11	ug/l
ND	Freon-113	18

MW-6

6/26/07	ug/l	8/17/11
IPB	46	ND

TW-1

6/27/07	8/17/07
ND	ND

MW-4

6/27/07	ug/l	8/17/11
Freon-113	10	ND

MW-5

6/27/07	ug/l	8/17/11	ug/l
Freon-113	880	Freon-113	940
1,1,1-TCA	40	1,1,1-TCA	25
PCE	18	PCE	19
		1,1-DCE	7.6

TW-3

6/27/07
ND

MW-2

12/19/06	ug/l	6/28/07	ug/l	8/17/11	ug/l
Freon-113	54	Freon-113	44	Freon-113	11

MW-3

12/19/06	ug/l	6/28/07	ug/l	8/17/11	ug/l
Freon-113	390	Freon-113	360	Freon-113	230
1,1-DCA	8.5	1,1-DCA	7.8	PCE	5.2
1,1-DCE	5.5	PCE	7.6		
PCE	8.7				

MW-1

12/19/06	ug/l	6/28/07	ug/l	8/17/11	ug/l
Freon-113	60	Freon-113	63	Freon-113	28

LEGEND

- Groundwater Monitoring Well Location
- Temporary Monitoring Well Location
- Abandoned Temporary Monitoring Well Location
- Fenceline

1,1,1-TCA	1,1,1–Trichloroethane
1,1-DCA	1,1–Dicloroethane
1,1-DCE	1,1–Dicloroethene
PCE	Tetrachloroethene
VOC	Volatile Organic Compound
ND	Non–Detect
ug/L	micrograms per liter

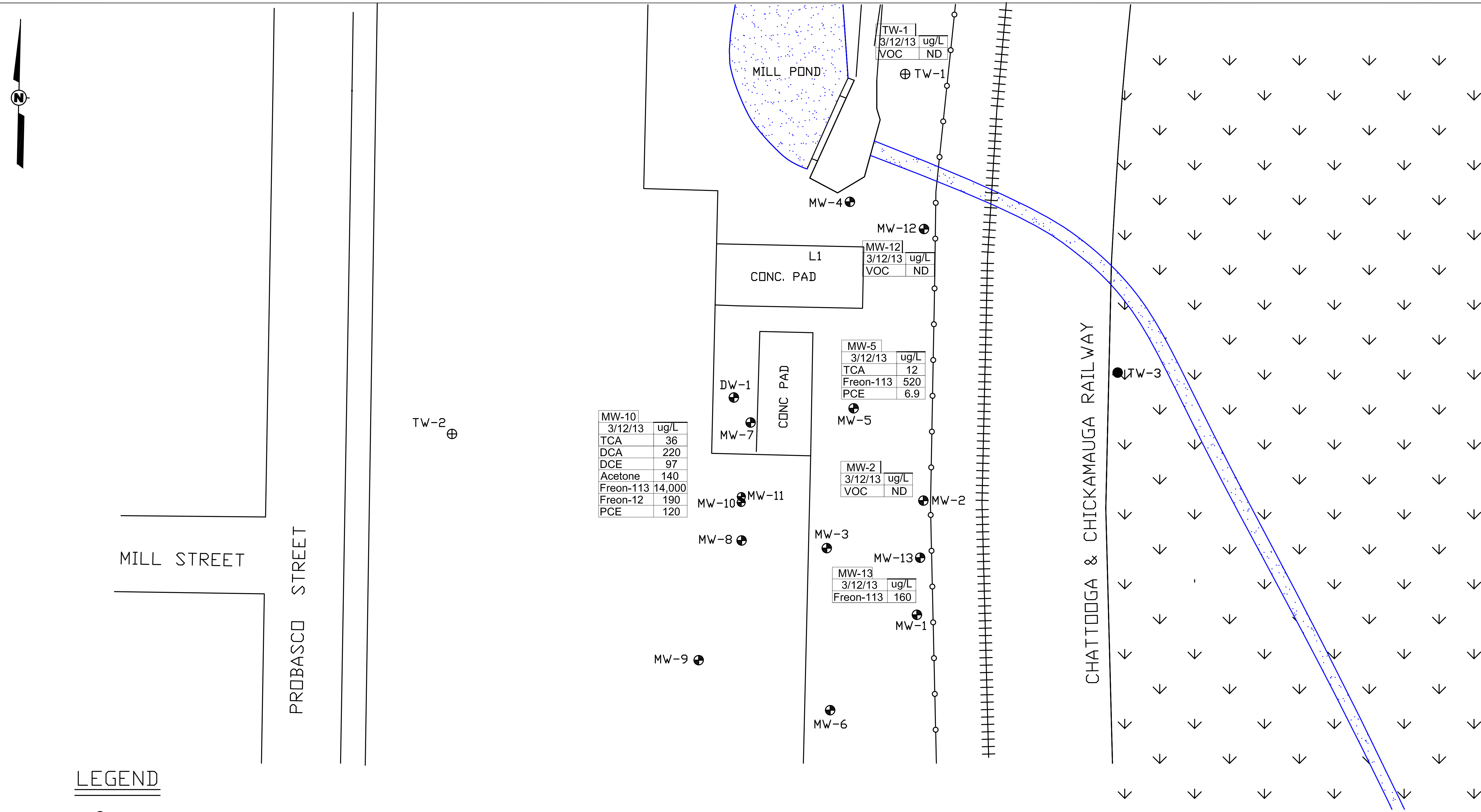
EPS
1050 Crown Pointe Parkway
Suite 350
Atlanta, GA 30338
(404) 315-9113

DRN: JDV DATE: July 2015

Color Spectrum
29 Probasco Street
LaFayette, GA 30728

Historical Monitoring Well Results

FIGURE 6



LEGEND

- Groundwater Monitoring Well Location
- Temporary Monitoring Well Location
- Abandoned Temporary Monitoring Well Location
- Fenceline

TCA	1,1,1–Trichloroethane
DCA	1,1–Dicloroethane
DCE	1,1–Dicloroethene
PCE	Tetrachloroethene
VOC	Volatile Organic Compound
ND	Non–Detect
ug/L	micrograms per liter

0 20 40
Feet

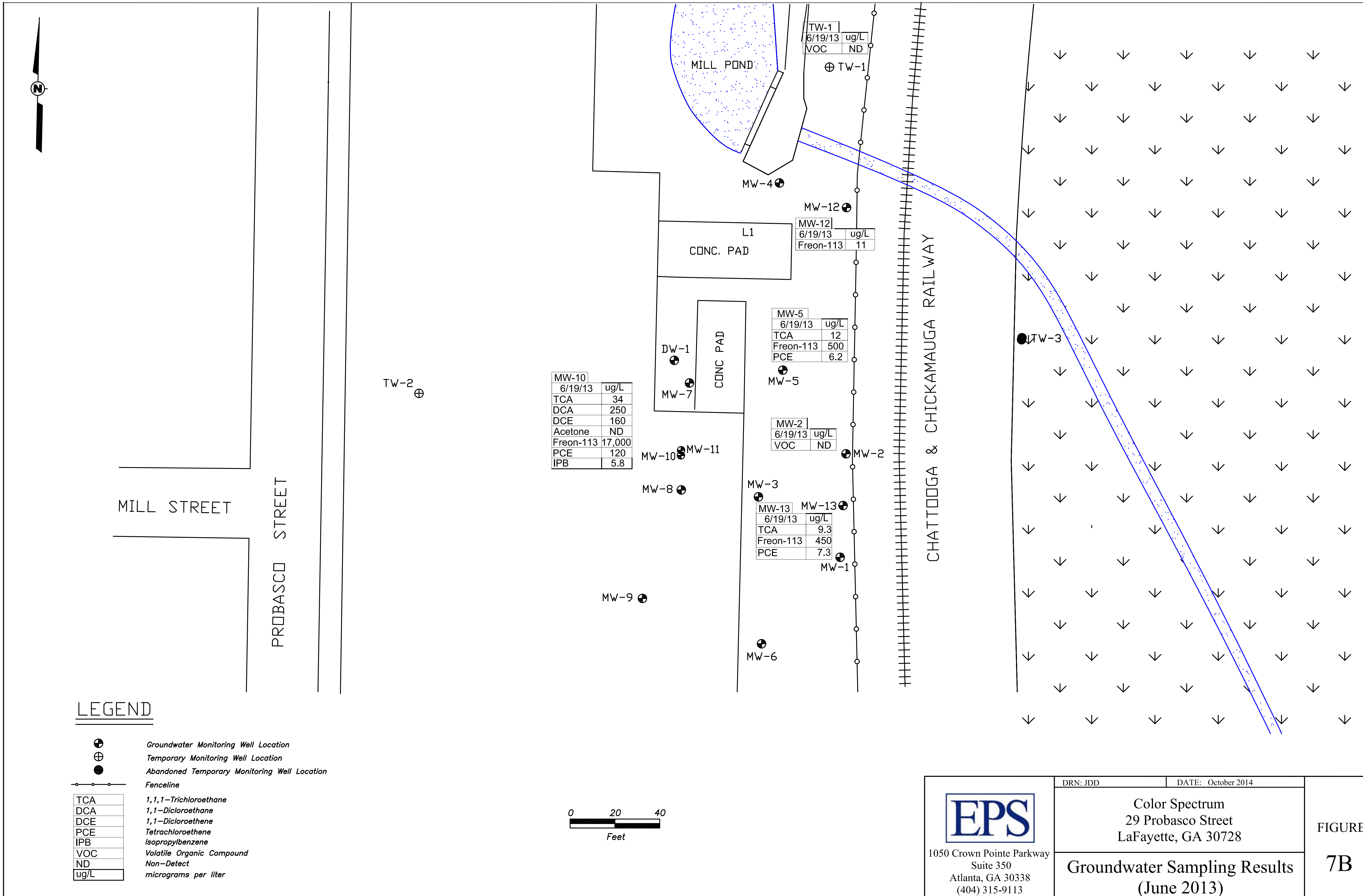
EPS
1050 Crown Pointe Parkway
Suite 350
Atlanta, GA 30338
(404) 315-9113

DRN: JDD DATE: October 2014

Color Spectrum
29 Probasco Street
LaFayette, GA 30728

Groundwater Sampling Results
(March 2013)

FIGURE
7A



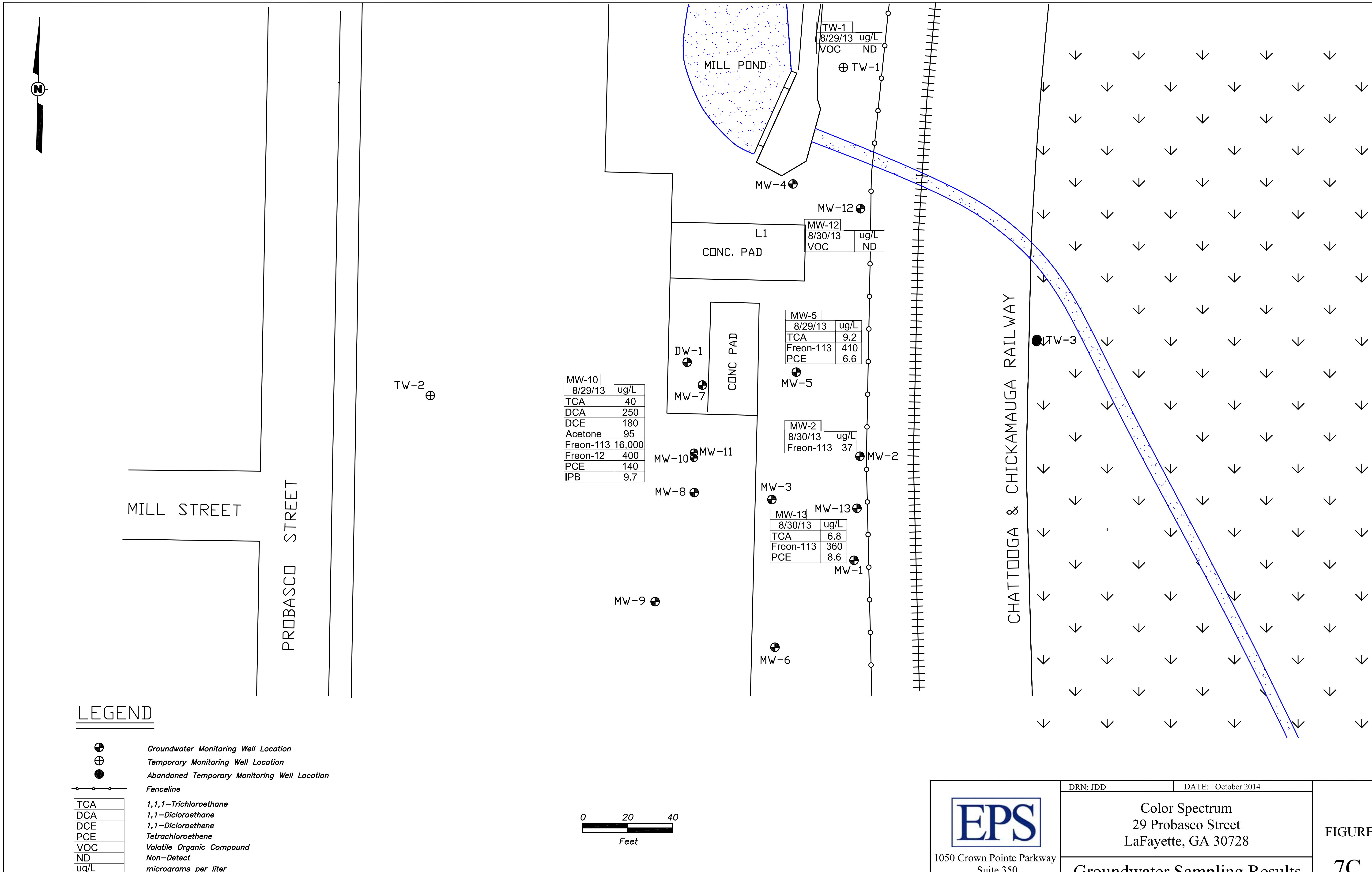
EPS
1050 Crown Pointe Parkway
Suite 350
Atlanta, GA 30338
(404) 315-9113

DRN: JDD DATE: October 2014

Color Spectrum
29 Probasco Street
LaFayette, GA 30728

Groundwater Sampling Results
(June 2013)

FIGURE
7B



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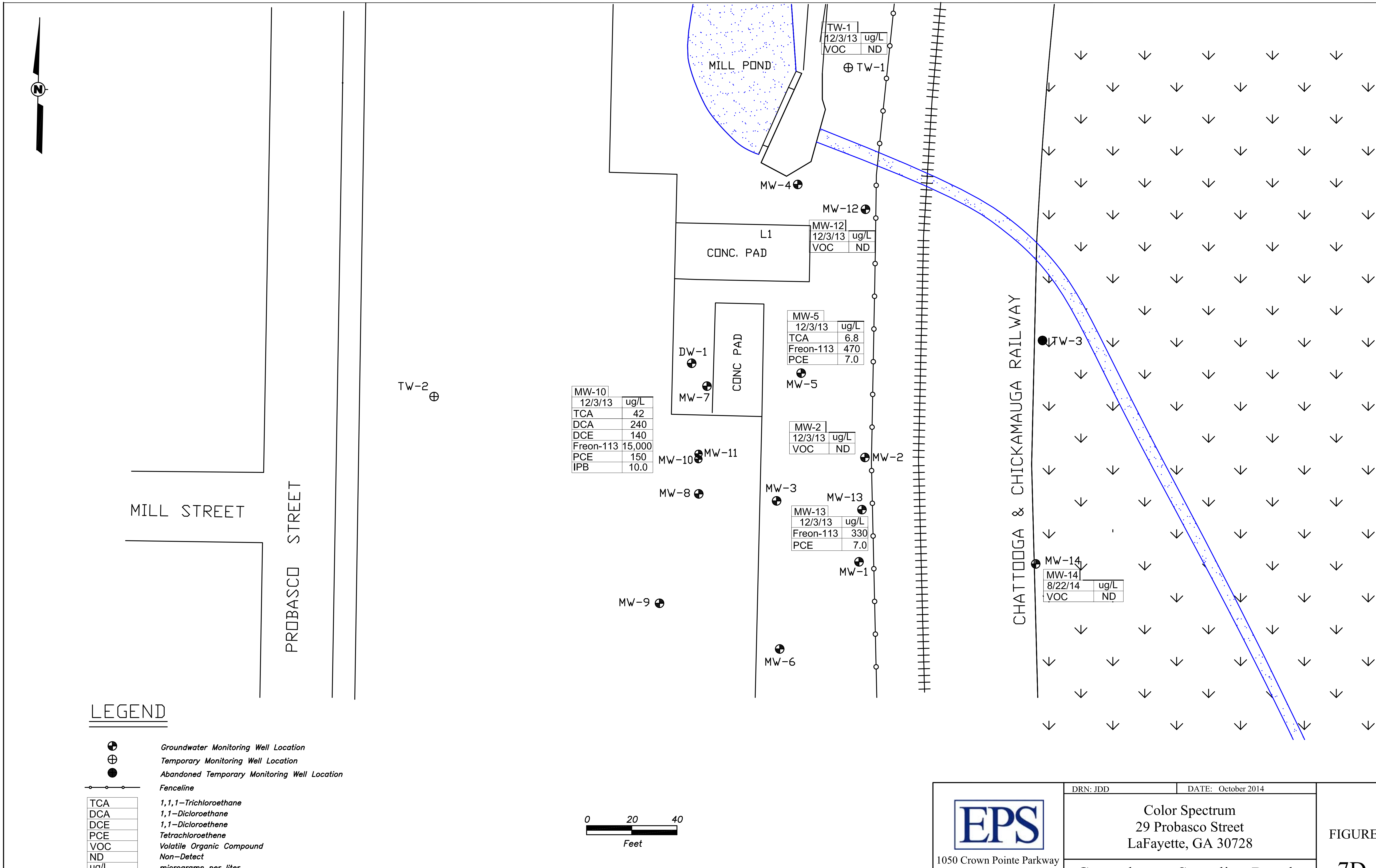
Atlanta, GA 30338
(404) 315-9113

DRN: JDD DATE: October 2014

Color Spectrum
29 Probasco Street
LaFayette, GA 30728

Groundwater Sampling Results
(August 2013)

FIGURE
7C



EPS
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Atlanta, GA 30338
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DRN: JDD DATE: October 2014

Color Spectrum
29 Probasco Street
LaFayette, GA 30728

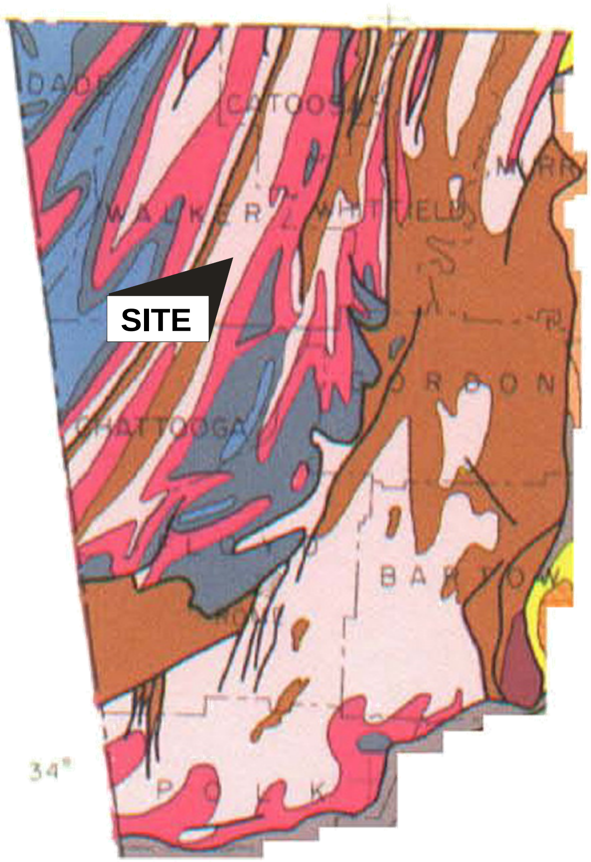
Groundwater Sampling Results
(Dec 2013 & Aug 2014)

FIGURE
7D

Geologic Map of Georgia -- Ridge and Valley

Georgia Geologic Survey
1977

David E. Lawton



PENNSYLVANIAN ROCKS	CAMBRIAN AND ORDOVICIAN ROCKS
MISSISSIPPIAN ROCKS	CAMBRIAN ROCKS
DEVONIAN ROCKS	CAMBRIAN-preCAMBRIAN ROCKS

0 7.5 15
Miles

EPS
1050 Crown Pointe Pkwy
Suite: 550
Atlanta, GA 30338
404.315.9113

N

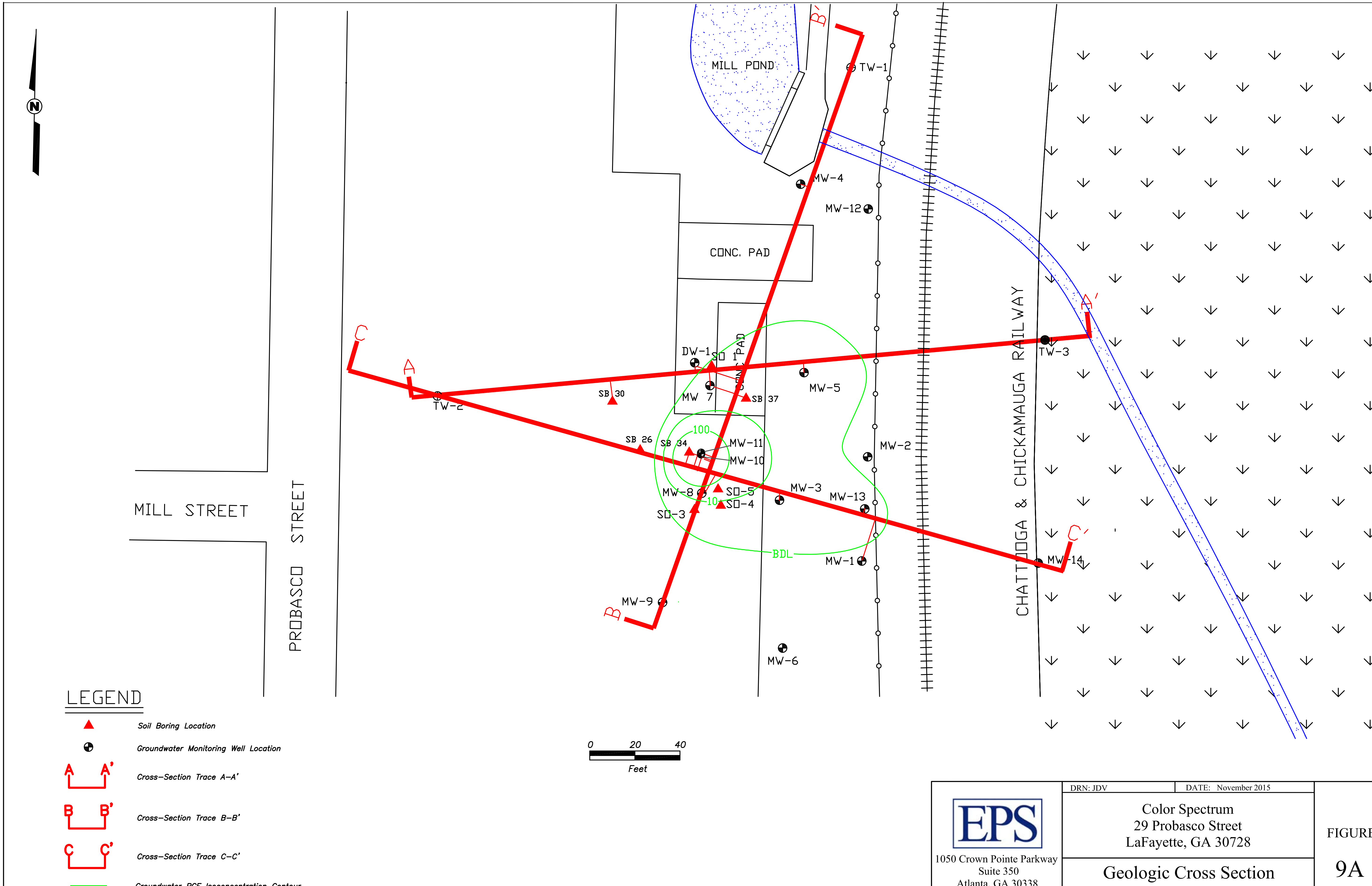
Drawn by: JDD | Date: October 2014

Color Spectrum
29 Probasco Street
LaFayette, GA 30728

GEOLOGIC MAP OF THE GEORGIA RIDGE AND VALLEY

FIGURE

8



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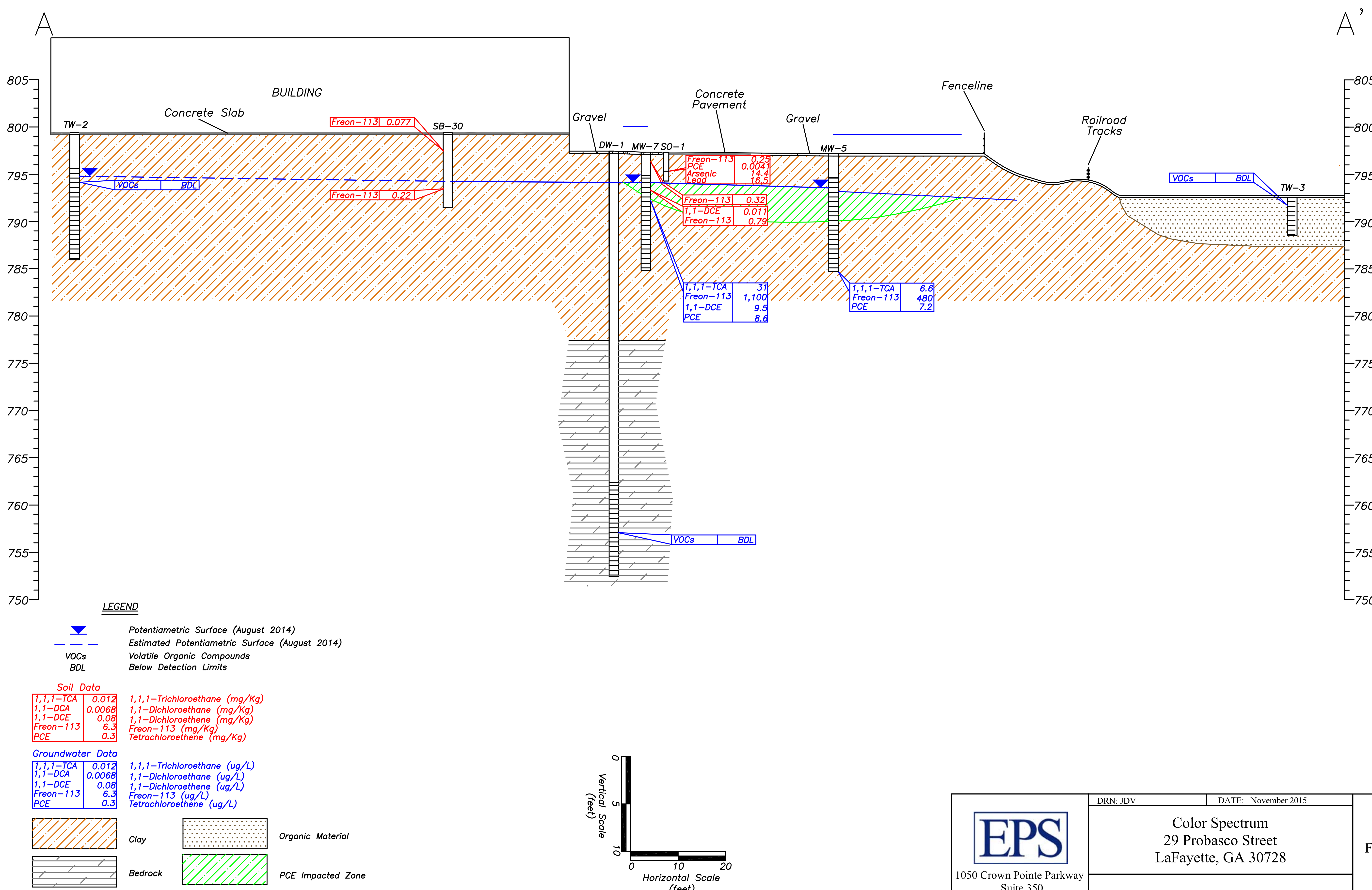
Color Spectrum
29 Probasco Street
LaFayette, GA 30728

Geologic Cross Section Location Map

FIGURE 9A



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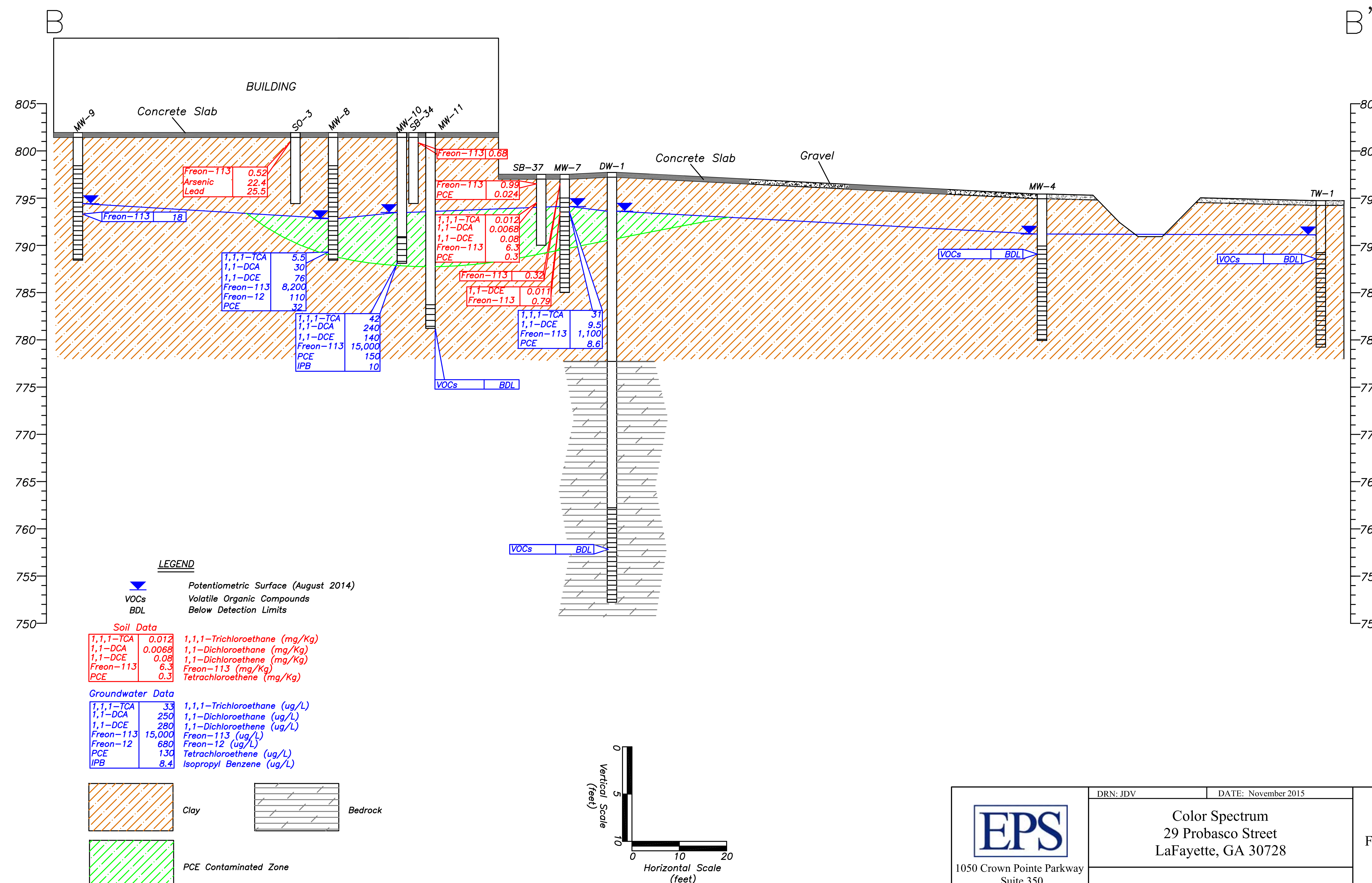
Color Spectrum
29 Probasco Street
LaFayette, GA 30728

Cross Section A-A'

FIGURE
9B



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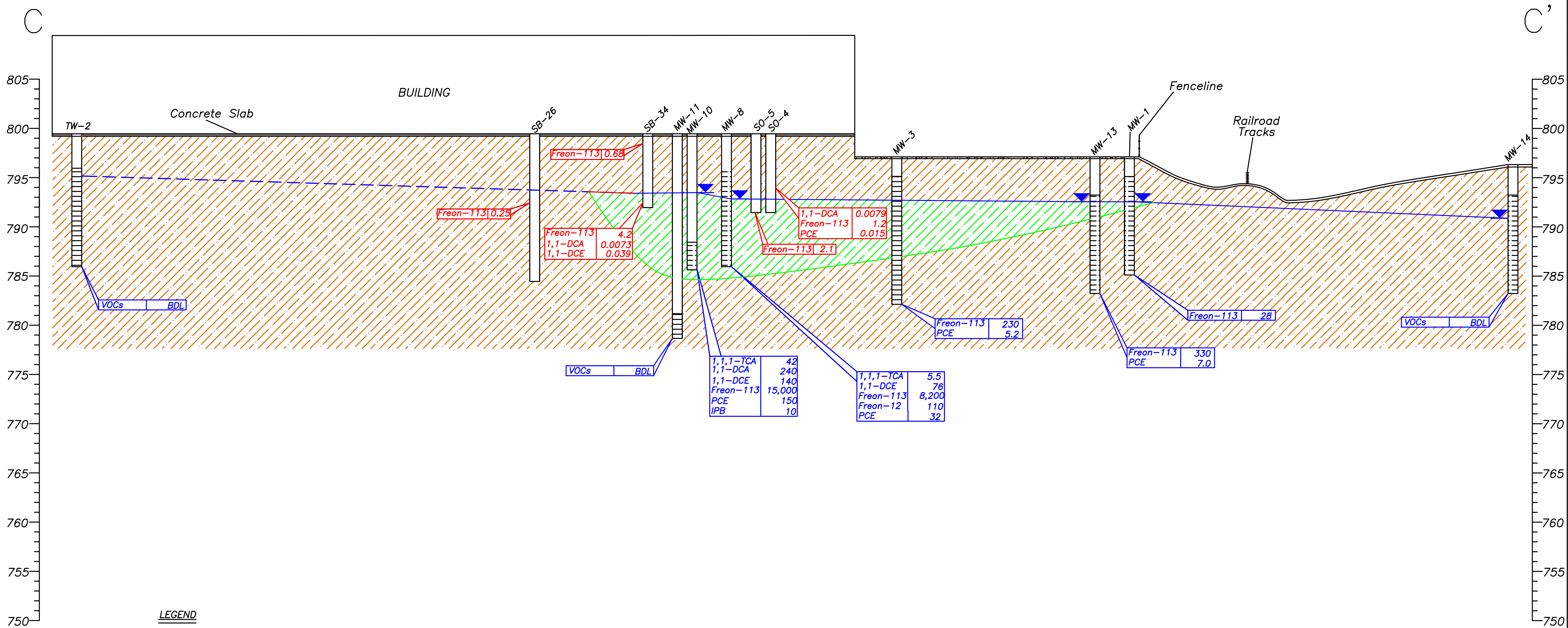
Color Spectrum
29 Probasco Street
LaFayette, GA 30728

Cross Section B-B'

FIGURE
9C



LEGEND

(symbol)	Potentiometric Surface (August 2014)
— — —	Estimated Potentiametric Surface (August 2014)
VOCs	Volatile Organic Compounds
BDL	Below Detection Limits

Soil Data

1,1,1-TCA	0.012	1,1,1-Trichloroethane (mg/Kg)
1,1-DCA	0.0068	1,1-Dichloroethane (mg/Kg)
1,1-DCE	0.08	1,1-Dichloroethene (mg/Kg)
Freon-113	6.3	Freon-113 (mg/Kg)
PCE	0.3	Tetrachloroethene (mg/Kg)

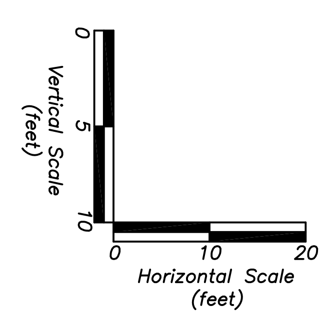
Groundwater Data

1,1,1-TCA	0.012	1,1,1-Trichloroethane (ug/L)
1,1-DCA	0.0068	1,1-Dichloroethane (ug/L)
1,1-DCE	0.08	1,1-Dichloroethene (ug/L)
Freon-113	6.3	Freon-113 (ug/L)
PCE	0.3	Tetrachloroethene (ug/L)

Clay

PCE Impacted Zone

Note: Groundwater data for MW-14 is from August 2014
Groundwater data for MW-10 & MW-13 December 2013.
All other groundwater data from 2011.



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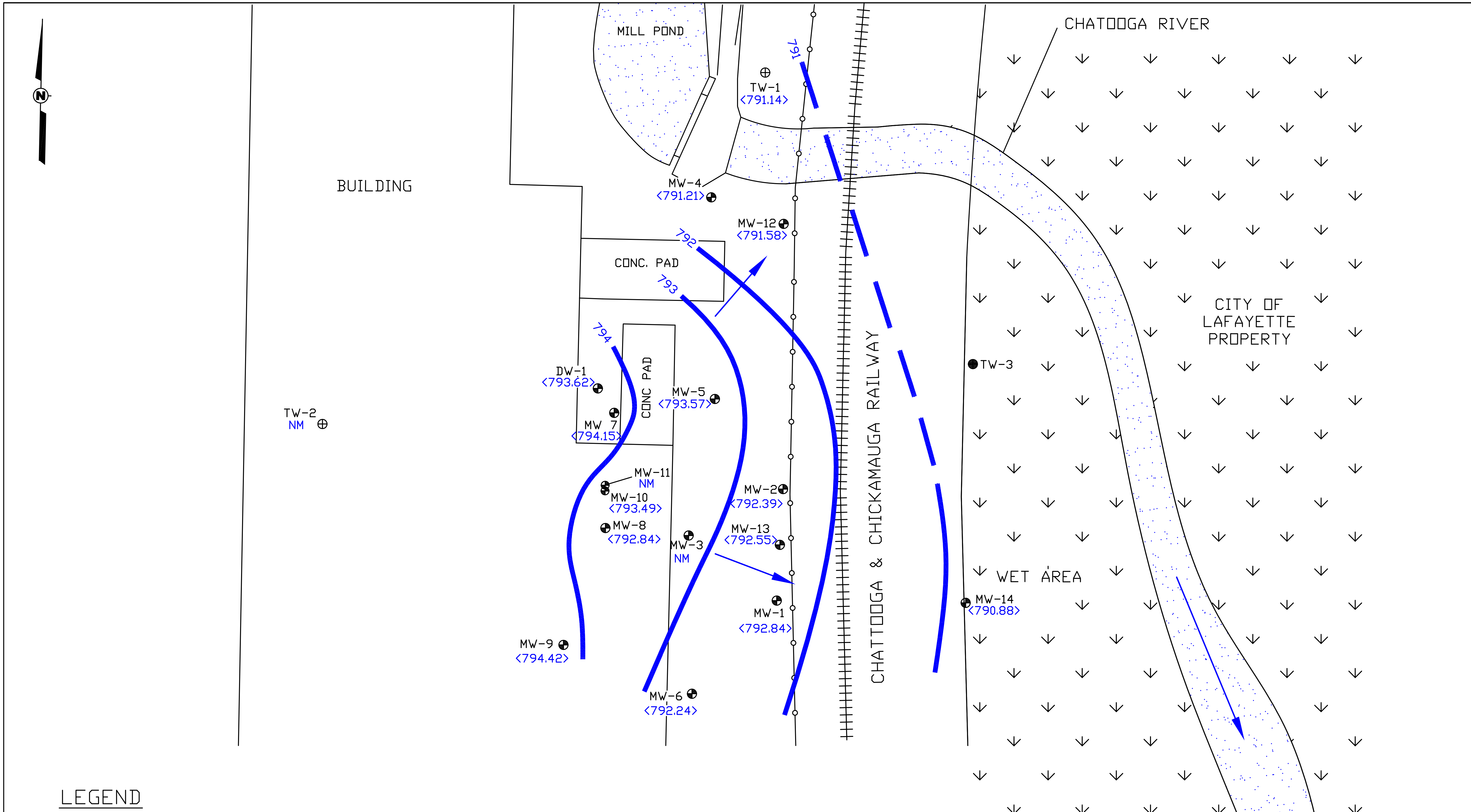
DRN: JDV DATE: November 2015

Color Spectrum
29 Probasco Street
LaFayette, GA 30728

Cross Section C-C'

FIGURE 9D



LEGEND

- Groundwater Monitoring Well Location
- Temporary Monitoring Well Location
- Abandoned Temporary Monitoring Well Location
- 794 Groundwater Elevation Contour (Ft. Above NGVD)
- 792.72 Groundwater Elevation at Well (Ft. Above NGVD)
- Groundwater and Stream Flow Direction
- Fenceline

Note: Well DW-1 is a bedrock well and is not used for this map.
Wells MW-8, MW-10, and MW-11 are considered anomalies are were not used for this map.

0 20 40
Graphic Scale
(feet)

EPS
1050 Crown Pointe Parkway
Suite 350
Atlanta, GA 30338
(404) 315-9113

DATE: May 2015 DRN: JDD

Color Spectrum
29 Probasco Street
LaFayette, GA 30728

Potentiometric Surface Map
(August 2014)

FIGURE
10

APPENDIX D

Tables

Table 1
Summary of Groundwater Analytical Results
Color Spectrum
LaFayette, Georgia

Sample Location	Sample Date	TCA (µg/L)	DCA (µg/L)	DCE (µg/L)	Acetone (µg/L)	Freon-113 (µg/L)	Freon-12 (µg/L)	IPB (µg/L)	PCE (µg/L)	Arsenic (µg/L)	Lead (µg/L)
	Type 1 RRS	200	4,000	7	4,000	1,000,000	1,000	5*	5	10	15
	Type 2 RRS	2,720	NC	103	NC	NC	NC	207	19	NC	NC
	Type 4 RRS	13,600	NC	520	NC	NC	NC	1,050	98	NC	NC***
Minimum Detected Value		5.5	5.0	5.5	95	10	110	6	5	ND	15.6
Maximum Detected Value		2,100	280	290	140	27,000	680	46	350	ND	15.6
MW-1	12/19/06	<5.0	<5.0	<5.0	--	**60**	<10	<5.0	<5.0	--	--
	06/28/07	<5.0	<5.0	<5.0	--	**63**	<10	<5.0	<5.0	--	--
	08/17/11	<5.0	<5.0	<5.0	<50	**28**	<10	<5.0	<5.0	--	--
MW-2	12/19/06	<5.0	<5.0	<5.0	--	**54**	<10	<5.0	<5.0	--	--
	06/28/07	<5.0	<5.0	<5.0	--	**44**	<10	<5.0	<5.0	--	--
	08/17/11	<5.0	<5.0	<5.0	<50	**11**	<10	<5.0	<5.0	--	--
	03/12/13	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
Duplicate	03/12/13	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
	06/19/13	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
	08/30/13	<5.0	<5.0	<5.0	<50	**37**	<10	<5.0	<5.0	--	--
Duplicate	08/30/13	<5.0	<5.0	<5.0	<50	**36**	<10	<5.0	<5.0	--	--
	12/03/13	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
MW-3	12/19/06	<5.0	**8.5**	**5.5**	--	**390**	<10	<5.0	**8.7**	--	--
	06/28/07	<5.0	**7.8**	<5.0	--	**360**	<10	<5.0	**7.6**	--	--
	08/17/11	<5.0	<5.0	<5.0	<50	**230**	<10	<5.0	**5.2**	--	--
MW-4	06/27/07	<5.0	<5.0	<5.0	--	**10**	<10	<5.0	<5.0	--	--
	08/17/11	<5.0	<5.0	<5.0	<50	<5.0	<10	<5.0	<5.0	--	--
MW-5	06/27/07	**40**	<5.0	<5.0	--	**880**	<10	<5.0	**18**	--	--
	08/17/11	**25**	<5.0	**7.6**	<50	**940**	<10	<5.0	**19**	--	--
	03/12/13	**12**	<5.0	<5.0	<50	**520**	<10	<5.0	**6.9**	--	--
	06/19/13	**12**	<5.0	<5.0	<50	**500**	<10	<5.0	**6.2**	--	--
	08/29/13	**9.2**	<5.0	<5.0	<50	**410**	<10	<5.0	**6.6**	--	--
	12/03/13	**6.8**	<5.0	<5.0	<50	**470**	<10	<5.0	**7.0**	--	--
Duplicate	12/03/13	**6.6**	<5.0	<5.0	<50	**480**	<10	<5.0	**7.2**	--	--
MW-6	06/27/07	<5.0	<5.0	<5.0	--	<10	<10	**46**	<5.0	--	--
	08/17/11	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
Duplicate	08/17/11	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
MW-7	06/27/07	**14**	<5.0	<5.0	--	**180**	<10	<5.0	<5.0	--	--
	08/16/11	**31**	<5.0	**9.5**	<50	**1,100**	<10	<5.0	**8.6**	--	--
MW-8	06/27/07	<5.0	**5.9**	**22**	--	**3,900**	<10	<5.0	<5.0	--	--
	08/16/11	**5.5**	**30**	**76**	<50	**8,200**	**110**	<5.0	**32**	--	--
MW-9	06/27/07	<5.0	<5.0	<5.0	--	<10	<10	<5.0	<5.0	--	--
	08/16/11	<5.0	<5.0	<5.0	<50	**18**	<10	<5.0	<5.0	--	--
MW-10	10/07/09	**10**	**170**	**96**	<50	**6,100**	<10	**12**	**54**	<4.4**	<10
Duplicate	10/07/09	**7.2**	**240**	**110**	<50	**6,200**	<10	**10**	**42**	<4.4**	<10
	08/16/11	**33**	**250**	**280**	<50	**15,000**	**680**	**8.4**	**130**	--	--
	11/15/11	**28**	**260**	**160**	<50	**11,000**	<10	**7.6**	**120**	--	--
	03/12/13	**36**	**220**	**97**	**140**	**14,000**	**190**	<5.0	**120**	--	--
	06/19/13	**34**	**250**	**160**	<50	**17,000**	<10	**5.8**	**120**	--	--
Duplicate	06/19/13	**48**	**280**	**280**	<50	**12,000**	<10	**8.2**	**160**	--	--
	08/29/13	**40**	**250**	**180**	**95**	**16,000**	**400**	**9.7**	**140**	--	--
	12/03/13	**42**	**240**	**140**	<50	**15,000**	<10	**10**	**150**	--	--
MW-11	10/07/09	**7.6**	**29**	**94**	<50	**15,000**	<10	**7.7**	**120**	<4.4**	**15.6*** **
MW-11(F)	10/07/09	**11**	**33**	**100**	<50	**21,000**	<10	**7.5**	**64**	<4.4**	<10
	08/16/11	<5.0	<5.0	<5.0	<50	**27**	<10	<5.0	<5.0	--	--
	11/15/11	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
	08/30/13	--	--	--	--	--	--	--	--	--	<10
Duplicate	08/30/13	--	--	--	--	--	--	--	--	--	<10

EPS

Table 1
Summary of Groundwater Analytical Results
Color Spectrum
LaFayette, Georgia

Sample Location	Sample Date	TCA (µg/L)	DCA (µg/L)	DCE (µg/L)	Acetone (µg/L)	Freon-113 (µg/L)	Freon-12 (µg/L)	IPB (µg/L)	PCE (µg/L)	Arsenic (µg/L)	Lead (µg/L)
	Type 1 RRS	**200**	**4,000**	**7**	**4,000**	**1,000,000**	**1,000**	**5***	**5**	**10**	**15**
	Type 2 RRS	**2,720**	**NC**	**103**	**NC**	**NC**	**NC**	**207**	**19**	**NC**	**NC**
	Type 4 RRS	**13,600**	**NC**	**520**	**NC**	**NC**	**NC**	**1,050**	**98**	**NC**	**NC*** **
MW-12	03/12/13	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
	06/19/13	<5.0	<5.0	<5.0	<50	**11**	<10	<5.0	<5.0	--	--
	08/30/13	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
	12/03/13	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
MW-13	03/12/13	<5.0	<5.0	<5.0	<50	**160**	<10	<5.0	<5.0	--	--
	06/19/13	**9.3**	<5.0	<5.0	<50	**450**	<10	<5.0	**7.3**	--	--
	08/30/13	**6.8**	<5.0	<5.0	<50	**360**	<10	<5.0	**8.6**	--	--
	12/03/13	<5.0	<5.0	<5.0	<50	**330**	<10	<5.0	**7.0**	--	--
MW-14	08/22/14	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
DW-1	06/27/07	<5.0	<5.0	<5.0	--	<10	<10	<5.0	<5.0	--	--
	08/16/11	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
TW-1	06/27/07	<5.0	<5.0	<5.0	--	<10	<10	<5.0	<5.0	--	--
	08/17/11	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
	03/12/13	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
	06/19/13	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
	08/29/13	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
	12/03/13	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
TW-2	06/27/07	<5.0	<5.0	<5.0	--	<10	<10	<5.0	<5.0	--	--
	08/16/11	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
TW-3	06/27/07	<5.0	<5.0	<5.0	--	<10	<10	<5.0	<5.0	--	--
SB-1	10/11/05	**23**	**5.6**	<5.0	<50	<10	<10	<5.0	**6.4**	--	--
SB-2	10/11/05	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
SB-3	10/11/05	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
SB-4	10/11/05	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
SB-5	10/11/05	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
SB-6	10/24/05	**14**	<5.0	<5.0	<50	**190**	<10	<5.0	<5.0	--	--
SB-7	10/24/05	<5.0	<5.0	<5.0	<50	**11**	<10	<5.0	<5.0	--	--
SB-8	10/24/05	<5.0	<5.0	<5.0	<50	**40**	<10	<5.0	<5.0	--	--
SB-9	10/24/05	**14**	<5.0	<5.0	<50	**97**	<10	<5.0	<5.0	--	--
SB-10	10/24/05	**13**	<5.0	<5.0	<50	**370**	<10	<5.0	<5.0	--	--
SB-11	10/24/05	<5.0	**5.0**	<5.0	<50	**54**	<10	<5.0	<5.0	--	--
SB-12	07/27/06	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
SB-13	07/27/06	<5.0	<5.0	**9.0**	<50	**580**	<10	<5.0	**7.6**	--	--
SB-14	07/27/06	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
SB-15	07/27/06	<5.0	<5.0	<5.0	<50	**80**	<10	**8.5**	<5.0	--	--
SB-16	07/27/06	**23**	**11**	<5.0	<50	**1,800**	<10	<5.0	**20**	--	--
SB-17	07/27/06	<5.0	<5.0	**7.1**	<50	**510**	<10	<5.0	<5.0	--	--
SB-18	07/27/06	<5.0	<5.0	<5.0	<50	**17**	<10	<5.0	<5.0	--	--
SB-19	07/27/06	NS	NS	NS	NS	NS	NS	NS	NS	--	--
SB-20	12/20/06	<5.0	<5.0	<5.0	--	**160**	<10	<5.0	<5.0	--	--
SB-21	12/20/06	<5.0	<5.0	<5.0	--	**49**	<10	<5.0	<5.0	--	--
SB-22	12/20/06	**30**	**32**	**120**	--	**27,000**	<10	<5.0	**150**	--	--
SB-23	12/20/06	**2,100**	**230**	**290**	--	**27,000**	<10	<5.0	**350**	--	--
SB-26	12/20/06	<5.0	<5.0	<5.0	--	**36**	<10	<5.0	<5.0	--	--
Duplicate	12/20/06	<5.0	<5.0	<5.0	--	**22**	<10	<5.0	<5.0	--	--
SB-27	12/20/06	**34**	<5.0	<5.0	--	**1,100**	<10	<5.0	**9.8**	--	--
SB-28	12/20/06	<5.0	**5.4**	**6.2**	--	**270**	<10	**8.3**	<5.0	--	--
POND	10/11/05	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
Field Blank	12/20/06	<5.0	<5.0	<5.0	--	<10	<10	<5.0	<5.0	--	--

EPS

Table 1
Summary of Groundwater Analytical Results
Color Spectrum
LaFayette, Georgia

Sample Location	Sample Date	TCA (µg/L)	DCA (µg/L)	DCE (µg/L)	Acetone (µg/L)	Freon-113 (µg/L)	Freon-12 (µg/L)	IPB (µg/L)	PCE (µg/L)	Arsenic (µg/L)	Lead (µg/L)
	Type 1 RRS	**200**	**4,000**	**7**	**4,000**	**1,000,000**	**1,000**	**5***	**5**	**10**	**15**
	Type 2 RRS	**2,720**	**NC**	**103**	**NC**	**NC**	**NC**	**207**	**19**	**NC**	**NC**
	Type 4 RRS	**13,600**	**NC**	**520**	**NC**	**NC**	**NC**	**1,050**	**98**	**NC**	**NC*** **
Trip Blank	10/24/05	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
	12/20/06	<5.0	<5.0	<5.0	--	<10	<10	<5.0	<5.0	--	--
	06/29/07	<5.0	<5.0	<5.0	--	<10	<10	<5.0	<5.0	--	--
	10/07/09	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
	08/18/11	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
	03/11/13	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
	08/29/13	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
	12/03/13	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
Rinsate	10/07/09	<5.0	<5.0	<5.0	<50	<10	<10	<5.0	<5.0	--	--
	08/17/11	<5.0	<5.0	<5.0	<50	<11	<10	<5.0	<5.0	--	--

Notes:

ug/L = micrograms per liter
<5.0 = constituent was not detected above the detection limit.
NS = not sampled
* A value does not exist on Table 1 of Appendix III for this compound.
The Reporting Limit was used for the Type 1 RRS.
** This result is reported down to the Method Detection Limit because
the Reporting Limit was greater than the Type 1 RRS.
*** The well could not be fully developed due to slow recharge.
The result represents a highly turbid sample and is not considered
valid. Lead was not detected in a filtered sample
collected from the same well.

NC = Not Calculated
TCA = 1,1,1-Trichloroethane
DCA = 1,1-Dichloroethane
DCE = 1,1-Dichloroethene
PCE = Tetrachloroethene
IPB = Isopropylbenzene
-- = Constituent Not Analyzed
NR = Not Regulated
(F) = Filtered
Above Residential RRS (Type 1/2 RRS)
Above Non-Residential RRS (Type 4 RRS)

EPS

Table 2
Summary of Soil Analytical Results
Color Spectrum
LaFayette, Georgia

Sample Location	Depth (feet)	Sample Date	TCA (mg/Kg)	DCA (mg/Kg)	DCE (mg/Kg)	Acetone (mg/Kg)	Freon-113 (mg/Kg)	PCE (mg/Kg)	Arsenic (mg/Kg)	Lead (mg/Kg)
SB-24	7	12/19/06	<0.0035	<0.0035	<0.0035	NS	**0.11**	<0.0035	--	--
SB-25	7	12/19/06	<0.0024	**0.0029**	**0.0042**	NS	**0.57**	<0.0024	--	--
SB-26	7	12/19/06	<0.0033	<0.0033	<0.0033	NS	**0.25**	<0.0033	--	--
SB-29	1	06/22/07	<0.0046	<0.0046	<0.0046	<0.092	**0.038**	<0.0046	--	--
SB-29	4	06/22/07	<0.0038	<0.0038	<0.0038	<0.076	**0.094**	<0.0038	--	--
SB-30	1	06/22/07	<0.0030	<0.0030	<0.0030	<0.061	**0.077**	<0.0030	--	--
SB-30	6	06/22/07	<0.0035	<0.0035	<0.0035	<0.070	**0.22**	<0.0035	--	--
SB-31	1	06/22/07	<0.0044	<0.0044	<0.0044	<0.087	**0.078**	<0.0044	--	--
SB-31	7	06/22/07	<0.0036	<0.0036	<0.0036	**0.19**	**0.034**	<0.0036	--	--
SB-32	1	06/22/07	<0.0035	<0.0035	<0.0035	<0.069	**0.98**	<0.0035	--	--
SB-32	4	06/22/07	<0.0031	<0.0031	<0.0031	**0.32**	**0.57**	<0.0031	--	--
SB-33	1	06/21/07	<0.0028	<0.0028	<0.0028	**0.16**	**0.32**	**0.0033**	--	--
SB-33	4	06/21/07	<0.0027	<0.0027	<0.0027	**0.19**	**0.34**	**0.0028**	--	--
SB-34	1	06/21/07	<0.0033	<0.0033	<0.0033	<0.066	**0.68**	<0.0033	--	--
SB-34	7	06/21/07	<0.0027	**0.0073**	**0.039**	<0.054	**4.2**	<0.0027	--	--
SB-35	1	06/21/07	<0.0034	<0.0034	<0.0034	**0.18**	**0.028**	<0.0034	--	--
SB-35	4	06/21/07	<0.0041	<0.0041	<0.0041	<0.082	**0.61**	<0.0041	--	--
SB-36	1	06/21/07	<0.0046	<0.0046	<0.0046	<0.092	<0.0092	<0.0046	--	--
SB-36	4	06/21/07	<0.0038	<0.0038	**0.020**	<0.077	**2.3**	**0.0091**	--	--
SB-37	1	06/26/07	<0.0039	<0.0039	<0.0039	<0.077	**0.99**	**0.024**	--	--
SB-37	3	06/26/07	**0.012**	**0.0068**	**0.08**	<0.059	**6.3**	**0.30**	--	--
MW-7	1	06/26/07	<0.0032	<0.0032	<0.0032	<0.064	**0.32**	<0.0032	--	--
MW-7	4	06/26/07	<0.0031	<0.0031	**0.011**	<0.061	**0.79**	<0.0031	--	--
SO-1	2	10/06/09	<0.0031	<0.0031	<0.0031	<0.063	**0.25**	**0.0041**	**14.4**	**16.5**
SO-2	2	10/06/09	<0.0030	<0.0030	<0.0030	<0.061	**0.39**	**0.014**	**17.6**	**18**
SO-3	2	10/06/09	<0.0032	<0.0032	<0.0032	<0.064	**0.52**	<0.0032	**22.4**	**25.5**
SO-4	5	10/06/09	<0.0042	**0.0079**	<0.0042	<0.084	**1.2**	**0.015**	**11.9**	**12.6**
SO-5	4	10/06/09	<0.0044	<0.0044	<0.0044	<0.087	**2.1**	<0.0044	**13.4**	**14.7**
Duplicate	4	10/06/09	<0.0037	<0.0037	<0.0037	<0.074	**1.6**	<0.0037	**12.7**	**10.8**
SO-6	4	10/06/09	<0.0066	<0.0066	<0.0066	<0.13	**0.29**	**0.007**	**10.3**	**11.4**

Notes:

mg/Kg = milligrams per kilogram
<0.0035 = constituent was not detected above the detection limit.
NS = Not Sampled
TCA = 1,1,1-Trichloroethane
DCA = 1,1-Dichloroethane
DCE = 1,1-Dichloroethene
PCE = Tetrachloroethene
NC = Not Calculated
-- = Constituent Not Analyzed

Table 3
Groundwater Elevations
Color Spectrum
LaFayette, Georgia

Well Location	Date	Ground Surface Elevation (ft above NGVD)	TOC Elevation (ft above NGVD)	Screened Interval (ft below TOC)	Depth to Groundwater (ft below TOC)	Depth to Product (ft below TOC)	Groundwater Elevation (ft above NGVD)
MW-1	6/28/2007	796.96	796.64	2-12	5.06	ND	791.58
	8/16/2011				5.58	ND	791.06
	3/12/2013		796.34		3.56	ND	792.78
	8/29/2013				4.51	ND	791.83
	12/3/2013				3.65	ND	792.69
	8/22/2014				3.50	ND	792.84
MW-2*	6/28/2007	796.43	796.06	2-12	5.48	NM	790.58
	8/16/2011				5.20	5.15	791.27
	3/12/2013				3.70	3.65	792.77
	6/19/2013				4.10	3.00	793.27
	8/29/2013				5.36	4.36	791.92
	12/3/2013				4.65	4.64	791.79
	8/22/2014				3.67	ND	792.39
MW-3	6/28/2007	797.46	797.14	2-15	5.45	ND	791.69
	8/16/2011				5.59	ND	791.55
	3/12/2013				NM	NM	NM
	8/29/2013				NM	NM	NM
	12/3/2013				NM	NM	NM
	8/22/2014				NM	NM	NM
MW-4	6/28/2007	795.58	795.43	6-16	4.48	ND	790.95
	8/16/2011				4.82	ND	790.61
	3/12/2013				4.26	ND	791.17
	8/29/2013				4.39	ND	791.04
	12/3/2013				4.33	ND	791.10
	8/22/2014				4.22	ND	791.21
MW-5	6/28/2007	797.46	797.19	3-13	5.10	ND	792.09
	8/16/2011				4.65	ND	792.54
	3/12/2013				3.82	ND	793.37
	6/19/2013				3.84	ND	793.35
	8/29/2013				4.01	ND	793.18
	12/3/2013				3.99	ND	793.20
	8/22/2014				3.62	ND	793.57
MW-6	6/28/2007	796.92	796.62	3-13	4.45	ND	792.17
	8/16/2011				4.83	ND	791.79
	3/12/2013				3.90	ND	792.72
	8/29/2013				3.81	ND	792.81
	12/3/2013				4.33	ND	792.29
	8/22/2014				4.38	ND	792.24
MW-7	6/28/2007	797.89	797.52	3.5-13.5	3.69	ND	793.83
	8/16/2011				3.63	ND	793.89
	3/12/2013				3.28	ND	794.24
	8/29/2013				3.30	ND	794.22
	12/3/2013				3.40	ND	794.12
	8/22/2014				3.37	ND	794.15

Table 3
Groundwater Elevations
Color Spectrum
LaFayette, Georgia

Well Location	Date	Ground Surface Elevation (ft above NGVD)	TOC Elevation (ft above NGVD)	Screened Interval (ft below TOC)	Depth to Groundwater (ft below TOC)	Depth to Product (ft below TOC)	Groundwater Elevation (ft above NGVD)
MW-8	6/28/2007	801.96	801.74	4-14	12.17	ND	789.57
	8/16/2011				9.27	ND	792.47
	3/12/2013				8.47	ND	793.27
	8/29/2013				8.45	ND	793.29
	12/3/2013				8.91	ND	792.83
	8/22/2014				8.90	ND	792.84
MW-9	6/28/2007	801.97	801.53	4-14	7.45	ND	794.08
	8/16/2011				7.41	ND	794.12
	3/12/2013				7.02	ND	794.51
	8/29/2013				6.98	ND	794.55
	12/3/2013				7.15	ND	794.38
	8/22/2014				7.11	ND	794.42
MW-10	10/6/2009	801.96	801.62	10-12.5	9.24	ND	792.38
	8/16/2011				8.78	ND	792.84
	3/12/2013				8.06	ND	793.56
	6/19/2013				8.04	ND	793.58
	8/29/2013				7.81	ND	793.81
	12/3/2013				8.31	ND	793.31
	8/22/2014				8.13	ND	793.49
MW-11	10/6/2009	801.96	801.75	17.5-20	14.21	ND	787.54
	8/16/2011				9.35	ND	792.40
	3/12/2013				8.65	ND	793.10
	6/19/2013				8.65	ND	793.10
	8/29/2013				7.96	ND	793.79
	12/3/2013				9.00	ND	792.75
	8/22/2014				NM	NM	NM
MW-12	3/12/2013	NM	795.29	3-13	3.78	ND	791.51
	6/19/2013				3.65	ND	791.64
	8/29/2013				3.76	ND	791.53
	12/3/2013				3.78	ND	791.51
	8/22/2014				3.71	ND	791.58
MW-13	3/12/2013	NM	796.24		3.57	ND	792.67
	6/19/2013				3.63	ND	792.61
	8/29/2013				4.41	ND	791.83
	12/3/2013				4.12	ND	792.12
	8/22/2014				3.69	ND	792.55
MW-14	8/22/2014	NM	796.34		5.46	ND	790.88
TW-1	6/28/2007	795.01	794.73	6-16	3.81	ND	790.92
	8/16/2011				4.10	ND	790.63
	3/12/2013				3.05	ND	791.68
	6/19/2013				3.49	ND	791.24
	8/29/2013				3.65	ND	791.08
	12/3/2013				3.61	ND	791.12
	8/22/2014				3.59	ND	791.14

Table 3
Groundwater Elevations
Color Spectrum
LaFayette, Georgia

Well Location	Date	Ground Surface Elevation (ft above NGVD)	TOC Elevation (ft above NGVD)	Screened Interval (ft below TOC)	Depth to Groundwater (ft below TOC)	Depth to Product (ft below TOC)	Groundwater Elevation (ft above NGVD)
TW-2	6/28/2007	801.94	801.74	4-14	7.36	ND	794.38
	8/16/2011				6.89	ND	794.85
	3/12/2013				NM	NM	NM
	8/29/2013				NM	NM	NM
	12/3/2013				5.92	ND	795.82
	8/22/2014				NM	NM	NM
DW-1	6/28/2007	798.10	797.72	35.6-45.6	4.70	ND	793.02
	8/16/2011				4.45	ND	793.27
	3/12/2013				3.45	ND	794.27
	8/29/2013				3.77	ND	793.95
	12/3/2013				4.10	ND	793.62
	8/22/2014				4.10	ND	793.62

Notes
ft = feet
NGVD = National Geodetic Vertical Datum
*'= corrected for free product, measurements are approximate
TOC = top of casing
NM = not measured
A specific gravity correction factor of 0.85 was used to adjust potentiometric surface elevations for MW-2.

Table 4
Summary of Vapor Intrusion Modeling Results
Color Spectrum
LaFayette, Georgia

Compound	Property Use Scenario	Matrix	Estimated Area Volume ft^3	Modeled Air Exchange (AE) Volume (1/h)	Sample Location	Concentration µg/L (GW) mg/kg (soil)	Cancer Risk*	Hazard Quotient
TCA	Non-Residential	GW	1,628,000	0.25	SB-23	2,100	--	**7.1E-04**
	Residential	GW	1,000	0.25	SB-23	2,100	--	**3.4E-03**
	Non-Residential	Soil	1,628,000	0.25	SB-37	0.012	--	**6.7E-06**
	Residential	Soil	1,000	0.25	SB-37	0.012	--	**2.3.E-05**
DCA	Non-Residential	GW	1,628,000	0.25	MW-10	280	**1.7E-07**	--
	Residential	GW	1,000	0.25	MW-10	280	**1.2E-06**	--
	Non-Residential	Soil	1,628,000	0.25	SO-4	0.0079	**1.3E-08**	--
	Residential	Soil	1,000	0.25	SO-4	0.0079	**5.1E-08**	--
DCE	Non-Residential	GW	1,628,000	0.25	SB-23	290	--	**4.0E-03**
	Residential	GW	1,000	0.25	SB-23	290	--	**2.0E-02**
	Non-Residential	Soil	1,628,000	0.25	SB-37	0.08	--	**1.1E-03**
	Residential	Soil	1,000	0.25	SB-37	0.08	--	**3.8E-03**
Acetone	Non-Residential	GW	1,628,000	0.25	MW-10	140	--	**8.7E-08**
	Residential	GW	1,000	0.25	MW-10	140	--	**3.9E-06**
	Non-Residential	Soil	1,628,000	0.25	SB-34	0.32	--	**1.7E-06**
	Residential	Soil	1,000	0.25	SB-34	0.32	--	**9.8E-05**
Freon-113	Non-Residential	GW	1,628,000	0.25	SB-23	27,000	--	**1.7E-02**
	Residential	GW	1,000	0.25	SB-23	27,000	--	**7.3E-02**
	Non-Residential	Soil	1,628,000	0.25	SB-34	6.3	--	**1.2E-03**
	Residential	Soil	1,000	0.25	SB-34	6.3	--	**4.0E-03**
Freon-12	Non-Residential	GW	1,628,000	0.25	MW-10	680	--	**1.5E-01**
	Residential	GW	1,000	0.25	MW-10	680	--	**7.0E-01**
IPB	Non-Residential	GW	1,628,000	0.25	MW-6	46	--	**1.3E-04**
	Residential	GW	1,000	0.25	MW-6	46	--	**6.3E-04**
PCE	Non-Residential	GW	1,628,000	0.25	SB-23	350	**4.9E-08**	**1.3E-02**
	Residential	GW	1,000	0.25	SB-23	350	**2.8E-07**	**6.2E-02**
	Non-Residential	Soil	1,628,000	0.25	SB-37	0.3	**7.8E-08**	**2.1E-02**
	Residential	Soil	1,000	0.25	SB-37	0.3	**3.2E-07**	**7.1E-02**

Notes:
µg/L = micrograms per liter
TCA = 1,1,1-Trichloroethane
DCA = 1,1-Dichloroethane
DCE = 1,1-Dichloroethene
PCE = Tetrachloroethene
IPB = Isopropylbenzene
1/hr = 1 building volume per hour
* = Estimated Risk is calculated based on measured groundwater and soil PCE concentrations

EPS

APPENDIX E

Laboratory Analytical Reports

Analytical Environmental Services, Inc.

Date: *21-Oct-14*

CLIENT: Environmental Planning Specialists, Inc.
Client Sample ID: 09280-MW-10
Lab Order: 0910778
Collection Date: 10/7/2009 11:40:00 AM
Project: Color Spectrum
Lab ID: 0910778-011
Matrix: GROUNDWATER

Analyses	Result	Qual	MDL	Rpt. Limit	Units	BatchID	DF	Date Analyzed
METALS, TOTAL SW6010C				**(SW3010A)**				Analyst: **JY**
Arsenic	BRL		0.0044	0.0500	mg/L	119718	1	10/12/2009 2:32:15 PM
Lead	BRL		0.0022	0.0100	mg/L	119718	1	10/12/2009 2:32:15 PM
TCL VOLATILE ORGANICS SW8260B				**(SW5030B)**				Analyst: **JCT**
1,1,1-Trichloroethane	10		0.14	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
1,1,2,2-Tetrachloroethane	BRL		0.16	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
1,1,2-Trichloroethane	BRL		0.15	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
1,1-Dichloroethane	170		0.13	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
1,1-Dichloroethene	96		0.27	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
1,2,4-Trichlorobenzene	BRL		0.21	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
1,2-Dibromo-3-chloropropane	BRL		0.28	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
1,2-Dibromoethane	BRL		0.24	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
1,2-Dichlorobenzene	BRL		0.16	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
1,2-Dichloroethane	BRL		0.12	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
1,2-Dichloropropane	BRL		0.17	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
1,3-Dichlorobenzene	BRL		0.13	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
1,4-Dichlorobenzene	BRL		0.11	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
2-Butanone	BRL		5.4	50	ug/L	119752	1	10/11/2009 3:02:00 AM
2-Hexanone	BRL		0.21	10	ug/L	119752	1	10/11/2009 3:02:00 AM
4-Methyl-2-pentanone	BRL		0.41	10	ug/L	119752	1	10/11/2009 3:02:00 AM
Acetone	BRL		5.5	50	ug/L	119752	1	10/11/2009 3:02:00 AM
Benzene	0.91	J	0.13	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
Bromodichloromethane	BRL		0.13	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
Bromoform	BRL		0.30	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
Bromomethane	BRL		1.9	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
Carbon disulfide	BRL		0.19	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
Carbon tetrachloride	BRL		0.18	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
Chlorobenzene	BRL		0.088	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
Chloroethane	BRL		0.20	10	ug/L	119752	1	10/11/2009 3:02:00 AM
Chloroform	1.3	J	0.15	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
Chloromethane	BRL		0.15	10	ug/L	119752	1	10/11/2009 3:02:00 AM
cis-1,2-Dichloroethene	BRL		0.070	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
cis-1,3-Dichloropropene	BRL		0.17	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
Cyclohexane	BRL		0.80	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
Dibromochloromethane	BRL		0.12	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
Dichlorodifluoromethane	BRL		0.21	10	ug/L	119752	1	10/11/2009 3:02:00 AM
Ethylbenzene	BRL		0.085	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
Freon-113	6100		16	1000	ug/L	119752	100	10/12/2009 7:13:00 PM
Isopropylbenzene	12		0.069	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
m,p-Xylene	BRL		0.092	10	ug/L	119752	1	10/11/2009 3:02:00 AM
Methyl acetate	BRL		0.31	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM

Qualifiers:

*	Value exceeds Maximum Contaminant Level	<	Less than Result value
>	Greater than Result value	B	Analyte detected in the associated Method Blank
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

Analytical Environmental Services, Inc.

Date: *21-Oct-14*

CLIENT: Environmental Planning Specialists, Inc.
Lab Order: 0910778
Project: Color Spectrum
Lab ID: 0910778-011

Client Sample ID: 09280-MW-10
Collection Date: 10/7/2009 11:40:00 AM
Matrix: GROUNDWATER

Analyses	Result	Qual	MDL	Rpt. Limit	Units	BatchID	DF	Date Analyzed
TCL VOLATILE ORGANICS SW8260B				**(SW5030B)**				Analyst: **JCT**
Methyl tert-butyl ether	2.7	J	0.073	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
Methylcyclohexane	BRL		0.13	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
Methylene chloride	BRL		0.96	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
o-Xylene	BRL		0.053	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
Styrene	BRL		0.12	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
Tetrachloroethene	54		0.17	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
Toluene	BRL		0.15	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
trans-1,2-Dichloroethene	BRL		0.20	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
trans-1,3-Dichloropropene	BRL		0.098	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
Trichloroethene	BRL		0.12	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
Trichlorofluoromethane	BRL		0.17	5.0	ug/L	119752	1	10/11/2009 3:02:00 AM
Vinyl chloride	BRL		0.19	2.0	ug/L	119752	1	10/11/2009 3:02:00 AM
Surr: 4-Bromofluorobenzene	84.3		0	61.3-128	%REC	119752	100	10/12/2009 7:13:00 PM
Surr: 4-Bromofluorobenzene	92.9		0	61.3-128	%REC	119752	1	10/11/2009 3:02:00 AM
Surr: Dibromofluoromethane	105		0	67.8-130	%REC	119752	1	10/11/2009 3:02:00 AM
Surr: Dibromofluoromethane	95.5		0	67.8-130	%REC	119752	100	10/12/2009 7:13:00 PM
Surr: Toluene-d8	89.2		0	70.6-121	%REC	119752	1	10/11/2009 3:02:00 AM
Surr: Toluene-d8	83.9		0	70.6-121	%REC	119752	100	10/12/2009 7:13:00 PM

Qualifiers:

*	Value exceeds Maximum Contaminant Level	<	Less than Result value
>	Greater than Result value	B	Analyte detected in the associated Method Blank
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

Analytical Environmental Services, Inc.

Date: *21-Oct-14*

CLIENT:	Environmental Planning Specialists, Inc.	**Client Sample ID:**	09280-MW-11
Lab Order:	0910778	**Collection Date:**	10/7/2009 2:35:00 PM
Project:	Color Spectrum		
Lab ID:	0910778-012	**Matrix:**	GROUNDWATER

Analyses	Result	Qual	MDL	Rpt. Limit	Units	BatchID	DF	Date Analyzed
METALS, TOTAL SW6010C				**(SW3010A)**				Analyst: **JY**
Arsenic	BRL		0.0044	0.0500	mg/L	119718	1	10/12/2009 2:35:58 PM
Lead	0.0156		0.0022	0.0100	mg/L	119718	1	10/12/2009 2:35:58 PM
TCL VOLATILE ORGANICS SW8260B				**(SW5030B)**				Analyst: **JCT**
1,1,1-Trichloroethane	7.6		0.14	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
1,1,2,2-Tetrachloroethane	BRL		0.16	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
1,1,2-Trichloroethane	BRL		0.15	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
1,1-Dichloroethane	29		0.13	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
1,1-Dichloroethene	94		0.27	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
1,2,4-Trichlorobenzene	BRL		0.21	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
1,2-Dibromo-3-chloropropane	BRL		0.28	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
1,2-Dibromoethane	BRL		0.24	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
1,2-Dichlorobenzene	BRL		0.16	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
1,2-Dichloroethane	BRL		0.12	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
1,2-Dichloropropane	BRL		0.17	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
1,3-Dichlorobenzene	BRL		0.13	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
1,4-Dichlorobenzene	BRL		0.11	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
2-Butanone	BRL		5.4	50	ug/L	119752	1	10/11/2009 3:30:00 AM
2-Hexanone	BRL		0.21	10	ug/L	119752	1	10/11/2009 3:30:00 AM
4-Methyl-2-pentanone	BRL		0.41	10	ug/L	119752	1	10/11/2009 3:30:00 AM
Acetone	BRL		5.5	50	ug/L	119752	1	10/11/2009 3:30:00 AM
Benzene	BRL		0.13	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
Bromodichloromethane	BRL		0.13	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
Bromoform	BRL		0.30	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
Bromomethane	BRL		1.9	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
Carbon disulfide	BRL		0.19	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
Carbon tetrachloride	BRL		0.18	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
Chlorobenzene	BRL		0.088	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
Chloroethane	BRL		0.20	10	ug/L	119752	1	10/11/2009 3:30:00 AM
Chloroform	BRL		0.15	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
Chloromethane	BRL		0.15	10	ug/L	119752	1	10/11/2009 3:30:00 AM
cis-1,2-Dichloroethene	BRL		0.070	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
cis-1,3-Dichloropropene	BRL		0.17	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
Cyclohexane	BRL		0.80	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
Dibromochloromethane	BRL		0.12	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
Dichlorodifluoromethane	BRL		0.21	10	ug/L	119752	1	10/11/2009 3:30:00 AM
Ethylbenzene	BRL		0.085	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
Freon-113	15000		16	1000	ug/L	119752	100	10/12/2009 7:41:00 PM
Isopropylbenzene	7.7		0.069	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
m,p-Xylene	BRL		0.092	10	ug/L	119752	1	10/11/2009 3:30:00 AM
Methyl acetate	BRL		0.31	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM

Qualifiers:				
	*	Value exceeds Maximum Contaminant Level	<	Less than Result value
	>	Greater than Result value	B	Analyte detected in the associated Method Blank
	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

Analytical Environmental Services, Inc.

Date: *21-Oct-14*

CLIENT:	Environmental Planning Specialists, Inc.	**Client Sample ID:**	09280-MW-11
Lab Order:	0910778	**Collection Date:**	10/7/2009 2:35:00 PM
Project:	Color Spectrum		
Lab ID:	0910778-012	**Matrix:**	GROUNDWATER

Analyses	Result	Qual	MDL	Rpt. Limit	Units	BatchID	DF	Date Analyzed
TCL VOLATILE ORGANICS SW8260B				**(SW5030B)**			Analyst: **JCT**	
Methyl tert-butyl ether	1.4	J	0.073	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
Methylcyclohexane	BRL		0.13	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
Methylene chloride	BRL		0.96	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
o-Xylene	BRL		0.053	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
Styrene	BRL		0.12	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
Tetrachloroethene	120		0.17	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
Toluene	BRL		0.15	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
trans-1,2-Dichloroethene	BRL		0.20	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
trans-1,3-Dichloropropene	BRL		0.098	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
Trichloroethene	BRL		0.12	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
Trichlorofluoromethane	BRL		0.17	5.0	ug/L	119752	1	10/11/2009 3:30:00 AM
Vinyl chloride	BRL		0.19	2.0	ug/L	119752	1	10/11/2009 3:30:00 AM
Surr: 4-Bromofluorobenzene	83.7		0	61.3-128	%REC	119752	100	10/12/2009 7:41:00 PM
Surr: 4-Bromofluorobenzene	85.6		0	61.3-128	%REC	119752	1	10/11/2009 3:30:00 AM
Surr: Dibromofluoromethane	106		0	67.8-130	%REC	119752	1	10/11/2009 3:30:00 AM
Surr: Dibromofluoromethane	96.2		0	67.8-130	%REC	119752	100	10/12/2009 7:41:00 PM
Surr: Toluene-d8	87.5		0	70.6-121	%REC	119752	1	10/11/2009 3:30:00 AM
Surr: Toluene-d8	86.3		0	70.6-121	%REC	119752	100	10/12/2009 7:41:00 PM

Qualifiers:				
	*	Value exceeds Maximum Contaminant Level	<	Less than Result value
	>	Greater than Result value	B	Analyte detected in the associated Method Blank
	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

Analytical Environmental Services, Inc.

Date: *21-Oct-14*

CLIENT:	Environmental Planning Specialists, Inc.	**Client Sample ID:**	09280-MW-11 F
Lab Order:	0910778	**Collection Date:**	10/7/2009 2:30:00 PM
Project:	Color Spectrum		
Lab ID:	0910778-013	**Matrix:**	GROUNDWATER

Analyses	Result	Qual	MDL	Rpt. Limit	Units	BatchID	DF	Date Analyzed
METALS, TOTAL SW6010C				**(SW3010A)**				Analyst: **JY**
Arsenic	BRL		0.0044	0.0500	mg/L	119718	1	10/12/2009 2:39:34 PM
Lead	0.0039	J	0.0022	0.0100	mg/L	119718	1	10/12/2009 2:39:34 PM
TCL VOLATILE ORGANICS SW8260B				**(SW5030B)**				Analyst: **JCT**
1,1,1-Trichloroethane	11		0.14	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
1,1,2,2-Tetrachloroethane	BRL		0.16	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
1,1,2-Trichloroethane	BRL		0.15	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
1,1-Dichloroethane	33		0.13	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
1,1-Dichloroethene	100		0.27	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
1,2,4-Trichlorobenzene	BRL		0.21	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
1,2-Dibromo-3-chloropropane	BRL		0.28	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
1,2-Dibromoethane	BRL		0.24	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
1,2-Dichlorobenzene	BRL		0.16	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
1,2-Dichloroethane	BRL		0.12	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
1,2-Dichloropropane	BRL		0.17	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
1,3-Dichlorobenzene	BRL		0.13	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
1,4-Dichlorobenzene	BRL		0.11	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
2-Butanone	BRL		5.4	50	ug/L	119752	1	10/11/2009 4:27:00 AM
2-Hexanone	BRL		0.21	10	ug/L	119752	1	10/11/2009 4:27:00 AM
4-Methyl-2-pentanone	BRL		0.41	10	ug/L	119752	1	10/11/2009 4:27:00 AM
Acetone	BRL		5.5	50	ug/L	119752	1	10/11/2009 4:27:00 AM
Benzene	BRL		0.13	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
Bromodichloromethane	BRL		0.13	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
Bromoform	BRL		0.30	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
Bromomethane	BRL		1.9	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
Carbon disulfide	BRL		0.19	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
Carbon tetrachloride	BRL		0.18	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
Chlorobenzene	BRL		0.088	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
Chloroethane	BRL		0.20	10	ug/L	119752	1	10/11/2009 4:27:00 AM
Chloroform	BRL		0.15	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
Chloromethane	BRL		0.15	10	ug/L	119752	1	10/11/2009 4:27:00 AM
cis-1,2-Dichloroethene	BRL		0.070	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
cis-1,3-Dichloropropene	BRL		0.17	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
Cyclohexane	BRL		0.80	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
Dibromochloromethane	BRL		0.12	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
Dichlorodifluoromethane	BRL		0.21	10	ug/L	119752	1	10/11/2009 4:27:00 AM
Ethylbenzene	2.7	J	0.085	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
Freon-113	21000	E	0.16	10	ug/L	119752	1	10/11/2009 4:27:00 AM
Isopropylbenzene	7.5		0.069	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
m,p-Xylene	1.5	J	0.092	10	ug/L	119752	1	10/11/2009 4:27:00 AM
Methyl acetate	BRL		0.31	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM

Qualifiers:				
	*	Value exceeds Maximum Contaminant Level	<	Less than Result value
	>	Greater than Result value	B	Analyte detected in the associated Method Blank
	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

Analytical Environmental Services, Inc.

Date: *21-Oct-14*

CLIENT:	Environmental Planning Specialists, Inc.	**Client Sample ID:**	09280-MW-11 F
Lab Order:	0910778	**Collection Date:**	10/7/2009 2:30:00 PM
Project:	Color Spectrum		
Lab ID:	0910778-013	**Matrix:**	GROUNDWATER

Analyses	Result	Qual	MDL	Rpt. Limit	Units	BatchID	DF	Date Analyzed
TCL VOLATILE ORGANICS SW8260B				**(SW5030B)**				Analyst: **JCT**
Methyl tert-butyl ether	1.6	J	0.073	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
Methylcyclohexane	BRL		0.13	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
Methylene chloride	BRL		0.96	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
o-Xylene	3.0	J	0.053	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
Styrene	BRL		0.12	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
Tetrachloroethene	64		0.17	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
Toluene	5.2		0.15	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
trans-1,2-Dichloroethene	BRL		0.20	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
trans-1,3-Dichloropropene	BRL		0.098	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
Trichloroethene	BRL		0.12	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
Trichlorofluoromethane	BRL		0.17	5.0	ug/L	119752	1	10/11/2009 4:27:00 AM
Vinyl chloride	BRL		0.19	2.0	ug/L	119752	1	10/11/2009 4:27:00 AM
Surr: 4-Bromofluorobenzene	92.4		0	61.3-128	%REC	119752	1	10/11/2009 4:27:00 AM
Surr: Dibromofluoromethane	100		0	67.8-130	%REC	119752	1	10/11/2009 4:27:00 AM
Surr: Toluene-d8	86.8		0	70.6-121	%REC	119752	1	10/11/2009 4:27:00 AM

Qualifiers:

*	Value exceeds Maximum Contaminant Level	<	Less than Result value
>	Greater than Result value	B	Analyte detected in the associated Method Blank
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

Analytical Environmental Services, Inc.

Date: *21-Oct-14*

CLIENT: Environmental Planning Specialists, Inc.
Client Sample ID: 09280-DUP
Lab Order: 0910778
Collection Date: 10/7/2009
Project: Color Spectrum
Lab ID: 0910778-014
Matrix: GROUNDWATER

Analyses	Result	Qual	MDL	Rpt. Limit	Units	BatchID	DF	Date Analyzed
METALS, TOTAL SW6010C				**(SW3010A)**				Analyst: **JY**
Arsenic	BRL		0.0044	0.0500	mg/L	119718	1	10/12/2009 2:43:06 PM
Lead	BRL		0.0022	0.0100	mg/L	119718	1	10/12/2009 2:43:06 PM
TCL VOLATILE ORGANICS SW8260B				**(SW5030B)**				Analyst: **JCT**
1,1,1-Trichloroethane	7.2		0.14	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
1,1,2,2-Tetrachloroethane	BRL		0.16	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
1,1,2-Trichloroethane	BRL		0.15	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
1,1-Dichloroethane	240		1.3	50	ug/L	119752	10	10/13/2009 1:47:00 AM
1,1-Dichloroethene	110		0.27	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
1,2,4-Trichlorobenzene	BRL		0.21	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
1,2-Dibromo-3-chloropropane	BRL		0.28	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
1,2-Dibromoethane	BRL		0.24	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
1,2-Dichlorobenzene	BRL		0.16	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
1,2-Dichloroethane	1.0	J	0.12	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
1,2-Dichloropropane	BRL		0.17	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
1,3-Dichlorobenzene	BRL		0.13	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
1,4-Dichlorobenzene	BRL		0.11	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
2-Butanone	BRL		5.4	50	ug/L	119752	1	10/11/2009 5:52:00 AM
2-Hexanone	BRL		0.21	10	ug/L	119752	1	10/11/2009 5:52:00 AM
4-Methyl-2-pentanone	BRL		0.41	10	ug/L	119752	1	10/11/2009 5:52:00 AM
Acetone	BRL		5.5	50	ug/L	119752	1	10/11/2009 5:52:00 AM
Benzene	1.1	J	0.13	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
Bromodichloromethane	BRL		0.13	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
Bromoform	BRL		0.30	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
Bromomethane	BRL		1.9	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
Carbon disulfide	BRL		0.19	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
Carbon tetrachloride	BRL		0.18	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
Chlorobenzene	BRL		0.088	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
Chloroethane	BRL		0.20	10	ug/L	119752	1	10/11/2009 5:52:00 AM
Chloroform	BRL		0.15	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
Chloromethane	BRL		0.15	10	ug/L	119752	1	10/11/2009 5:52:00 AM
cis-1,2-Dichloroethene	BRL		0.070	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
cis-1,3-Dichloropropene	BRL		0.17	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
Cyclohexane	BRL		0.80	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
Dibromochloromethane	BRL		0.12	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
Dichlorodifluoromethane	BRL		0.21	10	ug/L	119752	1	10/11/2009 5:52:00 AM
Ethylbenzene	BRL		0.085	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
Freon-113	6200		16	1000	ug/L	119752	100	10/12/2009 8:37:00 PM
Isopropylbenzene	10		0.069	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
m,p-Xylene	0.46	J	0.092	10	ug/L	119752	1	10/11/2009 5:52:00 AM
Methyl acetate	BRL		0.31	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM

Qualifiers:

*	Value exceeds Maximum Contaminant Level	<	Less than Result value
>	Greater than Result value	B	Analyte detected in the associated Method Blank
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

Analytical Environmental Services, Inc.

Date: *21-Oct-14*

CLIENT: Environmental Planning Specialists, Inc.
Client Sample ID: 09280-DUP
Lab Order: 0910778
Collection Date: 10/7/2009
Project: Color Spectrum
Lab ID: 0910778-014
Matrix: GROUNDWATER

Analyses	Result	Qual	MDL	Rpt. Limit	Units	BatchID	DF	Date Analyzed
TCL VOLATILE ORGANICS SW8260B				**(SW5030B)**				Analyst: **JCT**
Methyl tert-butyl ether	4.6	J	0.073	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
Methylcyclohexane	BRL		0.13	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
Methylene chloride	BRL		0.96	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
o-Xylene	BRL		0.053	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
Styrene	BRL		0.12	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
Tetrachloroethene	42		0.17	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
Toluene	0.73	J	0.15	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
trans-1,2-Dichloroethene	BRL		0.20	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
trans-1,3-Dichloropropene	BRL		0.098	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
Trichloroethene	BRL		0.12	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
Trichlorofluoromethane	BRL		0.17	5.0	ug/L	119752	1	10/11/2009 5:52:00 AM
Vinyl chloride	BRL		0.19	2.0	ug/L	119752	1	10/11/2009 5:52:00 AM
Surr: 4-Bromofluorobenzene	81.3		0	61.3-128	%REC	119752	10	10/13/2009 1:47:00 AM
Surr: 4-Bromofluorobenzene	83.7		0	61.3-128	%REC	119752	100	10/12/2009 8:37:00 PM
Surr: 4-Bromofluorobenzene	89.6		0	61.3-128	%REC	119752	1	10/11/2009 5:52:00 AM
Surr: Dibromofluoromethane	101		0	67.8-130	%REC	119752	10	10/13/2009 1:47:00 AM
Surr: Dibromofluoromethane	99.8		0	67.8-130	%REC	119752	100	10/12/2009 8:37:00 PM
Surr: Dibromofluoromethane	100		0	67.8-130	%REC	119752	1	10/11/2009 5:52:00 AM
Surr: Toluene-d8	86.5		0	70.6-121	%REC	119752	10	10/13/2009 1:47:00 AM
Surr: Toluene-d8	83.5		0	70.6-121	%REC	119752	1	10/11/2009 5:52:00 AM
Surr: Toluene-d8	84.4		0	70.6-121	%REC	119752	100	10/12/2009 8:37:00 PM

Qualifiers:

*	Value exceeds Maximum Contaminant Level	<	Less than Result value
>	Greater than Result value	B	Analyte detected in the associated Method Blank
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

August 29, 2014

Justin Vickery
Environmental Planning Specialists, Inc.
1050 Crown Pointe Parkway
Atlanta GA 30338

TEL: (404) 315-9113
FAX: (404) 315-8509

RE: Color Spectrum

Dear Justin Vickery: Order No: 1408K76

Analytical Environmental Services, Inc. received 2 samples on 8/22/2014 3:55:00 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.

James Forrest
Project Manager

ANALYTICAL ENVIRONMENTAL SERVICES, INC
3080 Presidential Drive, Atlanta GA 30340-3704
AES TEL.: (770) 457-8177 / TOLL-FREE (800) 972-4889 / FAX: (770) 457-8188

CHAIN OF CUSTODY

Work Order: 1408K76

Date: 8-22-14 Page 1 of 1

COMPANY: EPS Inc.

ADDRESS: 1050 Crown Pointe Pkwy Suite 550 Atlanta, GA 30338

PHONE: 404-315-9113

FAX:

SAMPLED BY: Alex Testoff

SIGNATURE: Alex Testoff

Visit our website **www.aesatlanta.com** to check on the status of your results, place bottle orders, etc.

#	SAMPLE ID	SAMPLED DATE	SAMPLED TIME	Grab	Composite	Matrix (See codes)	VOCs (Preservation: H+I)	REMARKS	No # of Containers
1	14234-MW-14	8-22-14	1100	X		GW	X		2
2	Trip Blank					W			2
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									

RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
1: Alex Testoff	8-22-14 3:55	1: Latoya Reeves	8/22/14 3:55pm
2:		2:	
3:		3:	

PROJECT INFORMATION

PROJECT NAME: Color Spectrum

PROJECT #: ~~[illegible]~~

SITE ADDRESS: LaFayette, GA

SEND REPORT TO: jvickery@envplanning.com, atestoff@envplanning.com

INVOICE TO: (IF DIFFERENT FROM ABOVE)

QUOTE #: PO#:

RECEIPT

Total # of Containers: 4

Turnaround Time Request
- [x] Standard 5 Business Days
- [ ] 2 Business Day Rush
- [ ] Next Business Day Rush
- [ ] Same Day Rush (auth req.)
- [ ] Other

STATE PROGRAM (if any):

E-mail? Y / N; Fax? Y / N

DATA PACKAGE: I II III IV

SPECIAL INSTRUCTIONS/COMMENTS:

SHIPMENT METHOD
OUT / / VIA:
IN / / VIA:
CLIENT FedEx UPS MAIL COURIER
GREYHOUND OTHER

SAMPLES RECEIVED AFTER 3PM OR ON SATURDAY ARE CONSIDERED RECEIVED THE NEXT BUSINESS DAY. IF TURNAROUND TIME IS NOT INDICATED, AES WILL PROCEED WITH STANDARD TAT OF SAMPLES. SAMPLES ARE DISPOSED 30 DAYS AFTER REPORT COMPLETION UNLESS OTHER ARRANGEMENTS ARE MADE.

MATRIX CODES: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water (Blanks) DW = Drinking Water (Blanks) O = Other (specify) WW = Waste Water

PRESERVATIVE CODES: H+I = Hydrochloric acid + ice I = Ice only N = Nitric acid S+I = Sulfuric acid + ice S/M+I = Sodium Bisulfate/Methanol + ice O = Other (specify) NA = None

White Copy - Original; Yellow Copy - Client

Analytical Environmental Services, Inc

Date: 29-Aug-14

Client:	Environmental Planning Specialists, Inc.	**Client Sample ID:**	14234-MW-14
Project Name:	Color Spectrum	**Collection Date:**	8/22/2014 11:06:00 AM
Lab ID:	1408K76-001	**Matrix:**	Groundwater

Analyses	Result	Reporting Limit	Qual	Units	BatchID	Dilution Factor	Date Analyzed	Analyst
Volatile Organic Compounds by GC/MS SW8260B				**(SW5030B)**				
1,1,1-Trichloroethane	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
1,1,2,2-Tetrachloroethane	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
1,1,2-Trichloroethane	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
1,1-Dichloroethane	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
1,1-Dichloroethene	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
1,2,4-Trichlorobenzene	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
1,2-Dibromo-3-chloropropane	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
1,2-Dibromoethane	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
1,2-Dichlorobenzene	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
1,2-Dichloroethane	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
1,2-Dichloropropane	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
1,3-Dichlorobenzene	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
1,4-Dichlorobenzene	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
1,4-Dioxane	BRL	150		ug/L	195485	1	08/28/2014 15:09	NP
2-Butanone	BRL	50		ug/L	195485	1	08/28/2014 15:09	NP
2-Hexanone	BRL	10		ug/L	195485	1	08/28/2014 15:09	NP
4-Methyl-2-pentanone	BRL	10		ug/L	195485	1	08/28/2014 15:09	NP
Acetone	BRL	50		ug/L	195485	1	08/28/2014 15:09	NP
Benzene	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Bromodichloromethane	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Bromoform	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Bromomethane	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Carbon disulfide	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Carbon tetrachloride	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Chlorobenzene	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Chloroethane	BRL	10		ug/L	195485	1	08/28/2014 15:09	NP
Chloroform	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Chloromethane	BRL	10		ug/L	195485	1	08/28/2014 15:09	NP
cis-1,2-Dichloroethene	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
cis-1,3-Dichloropropene	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Cyclohexane	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Dibromochloromethane	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Dichlorodifluoromethane	BRL	10		ug/L	195485	1	08/28/2014 15:09	NP
Ethylbenzene	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Freon-113	BRL	10		ug/L	195485	1	08/28/2014 15:09	NP
Isopropylbenzene	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Methyl acetate	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Methyl tert-butyl ether	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Methylcyclohexane	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Methylene chloride	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Styrene	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated (value above quantitation range)
BRL	Below reporting limit	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	Narr	See case narrative
N	Analyte not NELAC certified	NC	Not confirmed
B	Analyte detected in the associated method blank	<	Less than Result value
>	Greater than Result value	J	Estimated value detected below Reporting Limit

Analytical Environmental Services, Inc

Date: 29-Aug-14

Client:	Environmental Planning Specialists, Inc.	**Client Sample ID:**	14234-MW-14
Project Name:	Color Spectrum	**Collection Date:**	8/22/2014 11:06:00 AM
Lab ID:	1408K76-001	**Matrix:**	Groundwater

Analyses	Result	Reporting Limit	Qual	Units	BatchID	Dilution Factor	Date Analyzed	Analyst
Volatile Organic Compounds by GC/MS SW8260B				**(SW5030B)**				
Tetrachloroethene	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Toluene	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
trans-1,2-Dichloroethene	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
trans-1,3-Dichloropropene	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Trichloroethene	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Trichlorofluoromethane	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Vinyl chloride	BRL	2.0		ug/L	195485	1	08/28/2014 15:09	NP
Xylenes, Total	BRL	5.0		ug/L	195485	1	08/28/2014 15:09	NP
Surr: 4-Bromofluorobenzene	81.9	66.2-120		%REC	195485	1	08/28/2014 15:09	NP
Surr: Dibromofluoromethane	105	79.5-121		%REC	195485	1	08/28/2014 15:09	NP
Surr: Toluene-d8	103	77-117		%REC	195485	1	08/28/2014 15:09	NP

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated (value above quantitation range)
BRL	Below reporting limit	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	Narr	See case narrative
N	Analyte not NELAC certified	NC	Not confirmed
B	Analyte detected in the associated method blank	<	Less than Result value
>	Greater than Result value	J	Estimated value detected below Reporting Limit

Analytical Environmental Services, Inc

Date: 29-Aug-14

Client:	Environmental Planning Specialists, Inc.	**Client Sample ID:**	TRIP BLANK
Project Name:	Color Spectrum	**Collection Date:**	8/22/2014
Lab ID:	1408K76-002	**Matrix:**	Aqueous

Analyses	Result	Reporting Limit	Qual	Units	BatchID	Dilution Factor	Date Analyzed	Analyst
Volatile Organic Compounds by GC/MS SW8260B				**(SW5030B)**				
1,1,1-Trichloroethane	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
1,1,2,2-Tetrachloroethane	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
1,1,2-Trichloroethane	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
1,1-Dichloroethane	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
1,1-Dichloroethene	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
1,2,4-Trichlorobenzene	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
1,2-Dibromo-3-chloropropane	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
1,2-Dibromoethane	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
1,2-Dichlorobenzene	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
1,2-Dichloroethane	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
1,2-Dichloropropane	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
1,3-Dichlorobenzene	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
1,4-Dichlorobenzene	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
1,4-Dioxane	BRL	150		ug/L	195485	1	08/28/2014 14:45	NP
2-Butanone	BRL	50		ug/L	195485	1	08/28/2014 14:45	NP
2-Hexanone	BRL	10		ug/L	195485	1	08/28/2014 14:45	NP
4-Methyl-2-pentanone	BRL	10		ug/L	195485	1	08/28/2014 14:45	NP
Acetone	BRL	50		ug/L	195485	1	08/28/2014 14:45	NP
Benzene	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Bromodichloromethane	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Bromoform	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Bromomethane	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Carbon disulfide	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Carbon tetrachloride	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Chlorobenzene	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Chloroethane	BRL	10		ug/L	195485	1	08/28/2014 14:45	NP
Chloroform	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Chloromethane	BRL	10		ug/L	195485	1	08/28/2014 14:45	NP
cis-1,2-Dichloroethene	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
cis-1,3-Dichloropropene	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Cyclohexane	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Dibromochloromethane	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Dichlorodifluoromethane	BRL	10		ug/L	195485	1	08/28/2014 14:45	NP
Ethylbenzene	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Freon-113	BRL	10		ug/L	195485	1	08/28/2014 14:45	NP
Isopropylbenzene	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Methyl acetate	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Methyl tert-butyl ether	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Methylcyclohexane	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Methylene chloride	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Styrene	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated (value above quantitation range)
BRL	Below reporting limit	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	Narr	See case narrative
N	Analyte not NELAC certified	NC	Not confirmed
B	Analyte detected in the associated method blank	<	Less than Result value
>	Greater than Result value	J	Estimated value detected below Reporting Limit

Analytical Environmental Services, Inc **Date:** 29-Aug-14

Client:	Environmental Planning Specialists, Inc.	**Client Sample ID:**	TRIP BLANK
Project Name:	Color Spectrum	**Collection Date:**	8/22/2014
Lab ID:	1408K76-002	**Matrix:**	Aqueous

Analyses	Result	Reporting Limit	Qual	Units	BatchID	Dilution Factor	Date Analyzed	Analyst
Volatile Organic Compounds by GC/MS SW8260B				**(SW5030B)**				
Tetrachloroethene	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Toluene	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
trans-1,2-Dichloroethene	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
trans-1,3-Dichloropropene	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Trichloroethene	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Trichlorofluoromethane	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Vinyl chloride	BRL	2.0		ug/L	195485	1	08/28/2014 14:45	NP
Xylenes, Total	BRL	5.0		ug/L	195485	1	08/28/2014 14:45	NP
Surr: 4-Bromofluorobenzene	82.6	66.2-120		%REC	195485	1	08/28/2014 14:45	NP
Surr: Dibromofluoromethane	107	79.5-121		%REC	195485	1	08/28/2014 14:45	NP
Surr: Toluene-d8	105	77-117		%REC	195485	1	08/28/2014 14:45	NP

Qualifiers:

*	Value exceeds maximum contaminant level	E	Estimated (value above quantitation range)
BRL	Below reporting limit	S	Spike Recovery outside limits due to matrix
H	Holding times for preparation or analysis exceeded	Narr	See case narrative
N	Analyte not NELAC certified	NC	Not confirmed
B	Analyte detected in the associated method blank	<	Less than Result value
>	Greater than Result value	J	Estimated value detected below Reporting Limit

Analytical Environmental Services, Inc.

Sample/Cooler Receipt Checklist

Client Env. Planning Specialists Work Order Number 1408K76

Checklist completed by Ioana Pacurar 8/22/14
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 3.4°C 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.

\\Aes_server\l\Sample Receipt\My Documents\COCs and pH Adjustment Sheet\Sample_Cooler_Recipt_Checklist_Rev1.rtf

Analytical Environmental Services, Inc

Date: 29-Aug-14

Client: Environmental Planning Specialists, Inc.
Project Name: Color Spectrum
Workorder: 1408K76

ANALYTICAL QC SUMMARY REPORT

BatchID: **195485**

Sample ID: **MB-195485** Client ID: Units: **ug/L** Prep Date: **08/27/2014** Run No: **274624**
SampleType: **MBLK** TestCode: **Volatile Organic Compounds by GC/MS SW8260B** BatchID: **195485** Analysis Date: **08/27/2014** Seq No: **5795611**

Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual
1,1,1-Trichloroethane	BRL	5.0									
1,1,2,2-Tetrachloroethane	BRL	5.0									
1,1,2-Trichloroethane	BRL	5.0									
1,1-Dichloroethane	BRL	5.0									
1,1-Dichloroethene	BRL	5.0									
1,2,4-Trichlorobenzene	BRL	5.0									
1,2-Dibromo-3-chloropropane	BRL	5.0									
1,2-Dibromoethane	BRL	5.0									
1,2-Dichlorobenzene	BRL	5.0									
1,2-Dichloroethane	BRL	5.0									
1,2-Dichloropropane	BRL	5.0									
1,3-Dichlorobenzene	BRL	5.0									
1,4-Dichlorobenzene	BRL	5.0									
2-Butanone	BRL	50									
2-Hexanone	BRL	10									
4-Methyl-2-pentanone	BRL	10									
Acetone	BRL	50									
Benzene	BRL	5.0									
Bromodichloromethane	BRL	5.0									
Bromoform	BRL	5.0									
Bromomethane	BRL	5.0									
Carbon disulfide	BRL	5.0									
Carbon tetrachloride	BRL	5.0									
Chlorobenzene	BRL	5.0									
Chloroethane	BRL	10									
Chloroform	BRL	5.0									
Chloromethane	BRL	10									

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: Environmental Planning Specialists, Inc.
Project Name: Color Spectrum
Workorder: 1408K76

ANALYTICAL QC SUMMARY REPORT

BatchID: 195485

Sample ID: **MB-195485** Client ID: Units: **ug/L** Prep Date: **08/27/2014** Run No: **274624**
SampleType: **MBLK** TestCode: **Volatile Organic Compounds by GC/MS SW8260B** BatchID: **195485** Analysis Date: **08/27/2014** Seq No: **5795611**

Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual
cis-1,2-Dichloroethene	BRL	5.0									
cis-1,3-Dichloropropene	BRL	5.0									
Cyclohexane	BRL	5.0									
Dibromochloromethane	BRL	5.0									
Dichlorodifluoromethane	BRL	10									
Ethylbenzene	BRL	5.0									
Freon-113	BRL	10									
Isopropylbenzene	BRL	5.0									
Methyl acetate	BRL	5.0									
Methyl tert-butyl ether	BRL	5.0									
Methylcyclohexane	BRL	5.0									
Methylene chloride	BRL	5.0									
Styrene	BRL	5.0									
Tetrachloroethene	BRL	5.0									
Toluene	BRL	5.0									
trans-1,2-Dichloroethene	BRL	5.0									
trans-1,3-Dichloropropene	BRL	5.0									
Trichloroethene	BRL	5.0									
Trichlorofluoromethane	BRL	5.0									
Vinyl chloride	BRL	2.0									
Xylenes, Total	BRL	5.0									
Surr: 4-Bromofluorobenzene	42.71	0	50.00		85.4	66.2	120				
Surr: Dibromofluoromethane	50.65	0	50.00		101	79.5	121				
Surr: Toluene-d8	50.65	0	50.00		101	77	117				

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: Environmental Planning Specialists, Inc.
Project Name: Color Spectrum
Workorder: 1408K76

ANALYTICAL QC SUMMARY REPORT

BatchID: **195485**

Sample ID: **LCS-195485** | Client ID: | Units: **ug/L** | Prep Date: **08/27/2014** | Run No: **274624**
SampleType: **LCS** | TestCode: **Volatile Organic Compounds by GC/MS SW8260B** | BatchID: **195485** | Analysis Date: **08/27/2014** | Seq No: **5795610**

Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual
1,1-Dichloroethene	52.29	5.0	50.00		105	63.1	140				
Benzene	51.45	5.0	50.00		103	74.2	129				
Chlorobenzene	45.89	5.0	50.00		91.8	70	129				
Toluene	52.63	5.0	50.00		105	74.2	129				
Trichloroethene	51.22	5.0	50.00		102	71.2	135				
Surr: 4-Bromofluorobenzene	43.23	0	50.00		86.5	66.2	120				
Surr: Dibromofluoromethane	48.48	0	50.00		97.0	79.5	121				
Surr: Toluene-d8	50.83	0	50.00		102	77	117				

Sample ID: **1408K90-022AMS** | Client ID: | Units: **ug/L** | Prep Date: **08/27/2014** | Run No: **274624**
SampleType: **MS** | TestCode: **Volatile Organic Compounds by GC/MS SW8260B** | BatchID: **195485** | Analysis Date: **08/27/2014** | Seq No: **5795623**

Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual
1,1-Dichloroethene	635500	50000	500000		127	60.2	159				
Benzene	560300	50000	500000		112	70.2	138				
Chlorobenzene	491400	50000	500000		98.3	70.1	133				
Toluene	586400	50000	500000		117	70	139				
Trichloroethene	552100	50000	500000		110	70.1	144				
Surr: 4-Bromofluorobenzene	421200	0	500000		84.2	66.2	120				
Surr: Dibromofluoromethane	506400	0	500000		101	79.5	121				
Surr: Toluene-d8	505900	0	500000		101	77	117				

Sample ID: **1408K90-022AMSD** | Client ID: | Units: **ug/L** | Prep Date: **08/27/2014** | Run No: **274624**
SampleType: **MSD** | TestCode: **Volatile Organic Compounds by GC/MS SW8260B** | BatchID: **195485** | Analysis Date: **08/27/2014** | Seq No: **5795624**

Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual
1,1-Dichloroethene	630900	50000	500000		126	60.2	159	635500	0.726	19.2	
Benzene	550700	50000	500000		110	70.2	138	560300	1.73	20	

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		

Analytical Environmental Services, Inc

Date: 29-Aug-14

Client: Environmental Planning Specialists, Inc.
Project Name: Color Spectrum
Workorder: 1408K76

ANALYTICAL QC SUMMARY REPORT

BatchID: **195485**

Sample ID: **1408K90-022AMSD** Client ID: Units: **ug/L** Prep Date: **08/27/2014** Run No: **274624**
SampleType: **MSD** TestCode: **Volatile Organic Compounds by GC/MS SW8260B** BatchID: **195485** Analysis Date: **08/27/2014** Seq No: **5795624**

Analyte	Result	RPT Limit	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Val	%RPD	RPD Limit	Qual
Chlorobenzene	489600	50000	500000		97.9	70.1	133	491400	0.367	20	
Toluene	578000	50000	500000		116	70	139	586400	1.44	20	
Trichloroethene	542400	50000	500000		108	70.1	144	552100	1.77	20	
Surr: 4-Bromofluorobenzene	419900	0	500000		84.0	66.2	120	421200	0	0	
Surr: Dibromofluoromethane	508400	0	500000		102	79.5	121	506400	0	0	
Surr: Toluene-d8	514500	0	500000		103	77	117	505900	0	0	

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		

APPENDIX F

Well Development and Well Sampling Forms

EPS

Monitoring Well Sampling Form

EPS Project: Color Spectrum **Date:** 11.15.11

Well ID: MW-10
Field Conditions: Rain - 60°
Sampling Performed By: G. Henry
Well Construction: 2" Flush Mount
General Condition of Well: Fair
Well Labeled: No Well Cap: Yes Well Locked: No
Condition of surrounding area: Concrete-Interior
Well depth from TOC: 12.37
Depth to Water from TOC: 8.77
Well Diameter (in): 2"
Method of measure: WLM
Height (Ht) of water in well (Well depth from TOC - Static level from TOC): 3.6
Volume of water in well (Ht. x(.16 for 2")(.653 for 4")(1.469 for 6"): 0.58
Three Well Volumes (gal): 1.73
Purging Method: Peristaltic - Low flow / stress
Time @ Start of Purge: 1055
Sample Method: Thumb
Sample Parameters: VOC 8260B

Time	Volume (gal)	Temp (oC)	pH	Cond. (mS/cm)	DO (mg/L)	Turbidity (NTU)	ORP (mV)	DTW Comments
1120	.5	21.03	6.81	0.827	6.20	17.2	-70	9.75
1135	.75	21.12	6.83	0.825	5.12	7.42	-77	9.77
1150	1.0	21.18	6.94	0.816	4.06	5.57	-86	10.02
1202	1.25	21.17	6.95	0.816	3.94	3.45	-87	10.05
1215	1.50	21.16	6.93	0.819	3.31	2.74	-82	10.04
1225	1.75	21.11	6.93	0.816	3.28	2.45	-80	10.09

Sample ID: 11319-MW-10 Time Collected: 1225 Technician Signature: [signature]

EPS

Monitoring Well Sampling Form

EPS Project: Color Spectrum **Date:** 11-15-11

Well ID: MW-11
Field Conditions: Rain - 60°
Sampling Performed By: C. Henry
Well Construction: 2" Flush Mount
General Condition of Well: Fair
Well Labeled: No Well Cap: Yes Well Locked: No
Condition of surrounding area: Concrete - interior
Well depth from TOC: 19.89 (some sediment)
Depth to Water from TOC: 9.43
Well Diameter (in): 2"
Method of measure: WLM
Height (Ht) of water in well (Well depth from TOC - Static level from TOC): 10.46
Volume of water in well (Ht. x(.16 for 2")(.653 for 4")(1.469 for 6"): 1.67
Three Well Volumes (gal): 5.02
Purging Method: Peristaltic - Low Flow/Low Stress
Time @ Start of Purge: 920
Sample Method: Thumb
Sample Parameters: VOC 8260B

Time	Volume (gal)	Temp (oC)	pH	Cond. (mS/cm)	DO (mg/L)	Turbidity (NTU)	ORP (mV)	DTW Comments
950	0.5	20.06	6.71	0.342	~~[illegible]~~ 1.88	79.6	249	11.95
1005	1.0	20.51	7.35	0.336	1.07	73.2	217	14.31
10.24	1.5	20.60	7.46	0.332	1.01	128	202	16.35
10.40	2.0	20.61	7.53	0.328	0.96	172	194	18.95
10:50	Purged	Dry @	2.25 gallons	- will	wait to	recharge &	Collect Sample	
1355		20.97	6.87	0.171	6.56	28.7	25	

Sample ID: 1319-MW-11 Time Collected: 1355 Technician Signature [signature]

Well Development

Monitoring Well Sampling Form

EPS

EPS Project: Color Spectrum **Date:** 08/15/2014

Well ID: MW-14 **Field Conditions:** Clear, ~73°F
Sampling Performed By: William Crowe
Well Construction: Stick up **General Condition of Well:** good
Well Labeled: N **Well Cap:** Y **Well Locked:** Y **Condition of surrounding area:** good
Well depth from TOC: 10.94 **Depth to Water from TOC:** 4.43
Well Diameter (in): 2" **Method of measure:** WLM
Height (Ht) of water in well (Well depth from TOC - Static level from TOC): 6.51
Volume of water in well (Ht. x(.16 for 2")(.653 for 4")(1.469 for 6"): 1.04 **Three Well Volumes (gal):** 3.12
Purging Method: bailer / Peri Pump **Time @ Start of Purge:** 1001
Sample Method: **Sample Parameters:**

Time	Volume (gal)	Down hole Temp (°C)	Flow Cell Temp (°C)	pH	ORP (mV)	Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Depth to Water (ft)	Comments
1047	6.0		20.48	6.17	143	0.400	47.9	1.86		use bailer to purge
1052	6.25		20.55	6.08	-37	0.398	31.2	0.64		well until turbidity
1057	6.75		20.49	6.13	-62	0.400	15.7	0.00		is low then use
1102	7.25		20.55	6.16	-76	0.400	6.24	0.00		peri-pump to
1107	7.75		20.55	6.18	-79	0.399	4.72	0.00		complete
1112	~~6.17~~ 8.25		20.56	6.17	-82	0.399	4.29	0.00		development
										purged dry several
										times (see notes
										for details)

Temp probe ID: **Ferrous Iron (Fe^{2+})=** mg/L

Sample ID: —

Time Collected: —

Technician Signature

EPS

Monitoring Well Sampling Form

EPS Project: Color Spectrum Date: 8-22-14

Well ID: MW-14 Field Conditions: 77°F, clear
Sampling Performed By: Alex Testoff
Well Construction: General Condition of Well: good
Well Labeled: no Well Cap: yes Well Locked: yes Condition of surrounding area: forested
Well depth from TOC: 8.0 Depth to Water from TOC: 5.46
Well Diameter (in): 2" Method of measure: WLM
Height (Ht) of water in well (Well depth from TOC - Static level from TOC): 2.54
Volume of water in well (Ht. x(.16 for 2")(.653 for 4")(1.469 for 6"): 0.40 Three Well Volumes (gal): 1.23
Purging Method: peristaltic pump Time @ Start of Purge: 1038
Sample Method: direct Sample Parameters: VOC

Time	Volume (gal)	Down hole Temp (°C)	Flow Cell Temp (°C)	pH	ORP (mV)	Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Depth to Water (ft)	Comments
1044	0.5		24.26	6.51	-74	0.212	0.65	19.61	5.63	
~~1100~~ 1050	1.0		22.82	6.55	-83	0.209	0.75	5.24	5.64	
1057	1.50		22.60	6.55	-86	0.210	0.62	3.99	5.65	
1103	2.0		22.48	6.56	-91	0.209	0.56	3.21	5.66	

Temp probe ID: Ferrous Iron (Fe^{2+})= mg/L

Sample ID: 14234-MW-14 Time Collected: 1106 Technician Signature: [signature]

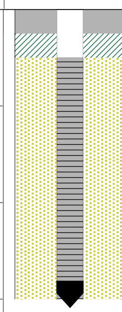
APPENDIX G

Boring Logs and Well Diagrams

PROJECT: Syntec Industries, Inc.	Log of Boring No. MW-1	
SITE LOCATION: La Fayette, GA	TOP OF CASING ELEVATION (ft): N/A	
DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE STARTED: 6/20/06	DATE FINISHED: 6/20/06
DRILLING METHOD: Direct Push	TOTAL DEPTH (ft.): 12	SCREEN INTERVAL (ft.): 2-12
DRILLING EQUIPMENT: AMS Power Probe	DEPTH TO WATER AT TIME OF BORING (ft.):	CASING (ft.): 0-2
SAMPLING METHOD: Macrocore w/ Acetate Liner	BOREHOLE DIAMETER (In.): 7.25	WELL DIAMETER (In.): 2
LOGGED BY: K. Moore		

Top of Casing Elevation (ft): N/A

DEPTH (feet)	SAMPLES: Sample No. Location	SAMPLES: Blows/ Foot	PID Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0–4			0.2	Tan orange sandy clay crumbles easily (fill)	
4–8			6.2	Tan orange sandy clay (fill) some petroleum odor at 7 ft at transition	
8–12			2	Gray brown clayey course grain sand - saprolite	Terminated at 12 ft-bls.



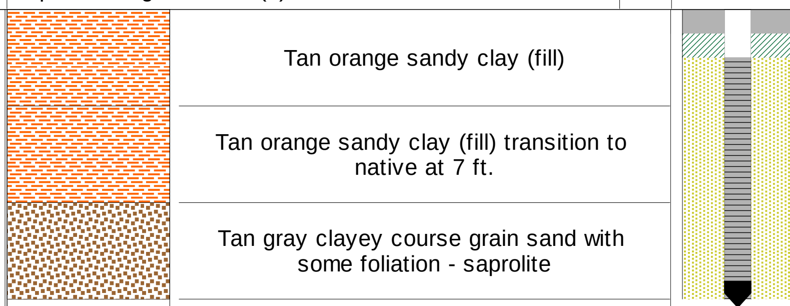
EPS

PROJECT: **Syntec Industries, Inc.**

Log of Boring No. MW-2

SITE LOCATION: La Fayette, GA		TOP OF CASING ELEVATION (ft): N/A	
DRILLING CONTRACTOR: Atlas Geo-Sampling		DATE STARTED: 6/20/06	DATE FINISHED: 6/20/06
DRILLING METHOD: Direct Push		TOTAL DEPTH (ft.): 12	SCREEN INTERVAL (ft.): 2-12
DRILLING EQUIPMENT: AMS Power Probe		DEPTH TO WATER AT TIME OF BORING (ft.):	CASING (ft.): 0-2
SAMPLING METHOD: Macrocore w/ Acetate Liner		BOREHOLE DIAMETER (In.): 7.25	WELL DIAMETER (In.): 2
LOGGED BY: K. Moore			

DEPTH (feet)	SAMPLES: Sample No. Location	SAMPLES: Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): N/A)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0–4				Tan orange sandy clay (fill)	
4–8			0	Tan orange sandy clay (fill) transition to native at 7 ft.	
8–12			0.5	Tan gray clayey course grain sand with some foliation - saprolite	Terminated at 12 ft-bls.
12			5.5		

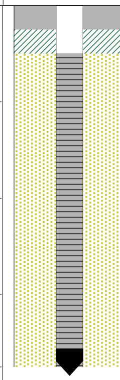


Depth scale: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

EPS

PROJECT: Syntec Industries, Inc.	Log of Boring No. MW-3	
SITE LOCATION: La Fayette, GA	TOP OF CASING ELEVATION (ft): N/A	
DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE STARTED: 6/20/06	DATE FINISHED: 6/20/06
DRILLING METHOD: Direct Push	TOTAL DEPTH (ft.): 15	SCREEN INTERVAL (ft.): 2-15
DRILLING EQUIPMENT: AMS Power Probe	DEPTH TO WATER AT TIME OF BORING (ft.):	CASING (ft.): 0-2
SAMPLING METHOD: Macrocore w/ Acetate Liner	BOREHOLE DIAMETER (In.): 7.25	WELL DIAMETER (In.): 2
LOGGED BY: K. Moore		

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Location	Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): N/A)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0					Gray brown clayey medium grain sand	
5				0.5	Gray brown clayey medium grain sand (moist)	
10				0.2	Tan gray clayey course grain quartz sands - saprolite	
				0.1	Gray brown clayey course grain sand - saprolite	
15				0		Terminated at 15 ft-bls.
20						
25						
30						
35						
40						
45						
50						



EPS

PROJECT: **Syntec Industries, Inc.**	**Log of Boring No. MW-4**
SITE LOCATION: La Fayette, GA	TOP OF CASING ELEVATION (ft): 795.43
DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE STARTED: 6/21/07 — DATE FINISHED: 6/21/07
DRILLING METHOD: Direct Push and HSA	TOTAL DEPTH (ft.): 16 — SCREEN INTERVAL (ft.): 6-16
DRILLING EQUIPMENT: GeoProbe	DEPTH TO WATER AT TIME OF BORING (ft.): 4.48 — CASING (ft.): 0-6
SAMPLING METHOD: Macrocore Acetate Liner	BOREHOLE DIAMETER (In.): 7.25 — WELL DIAMETER (In.): 2
LOGGED BY: N/A G. Henry	

DEPTH (feet)	SAMPLES: Sample No. Location	SAMPLES: Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): 795.43)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0				Dark brown clayey sand with gravel	
				Black weathered rock	
5				Tan clay with some gravel (wet)	
10				Tan weathered rock with come clay (wet)	
				Tan clay with rock	
15					Terminated at 16 ft-bls.
20					
25					
30					
35					
40					
45					
50					

EPS

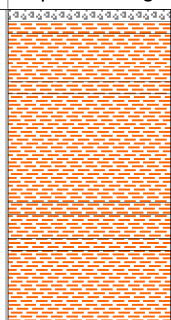
PROJECT: Syntec Industries, Inc.	Log of Boring No. MW-5	
SITE LOCATION: La Fayette, GA	TOP OF CASING ELEVATION (ft): 797.19	
DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE STARTED: 6/21/07	DATE FINISHED: 6/21/07
DRILLING METHOD: Hollow Stem Auger	TOTAL DEPTH (ft.): 13	SCREEN INTERVAL (ft.): 3-13
DRILLING EQUIPMENT: Deitrich	DEPTH TO WATER AT TIME OF BORING (ft.): 5.1	CASING (ft.): 0-3
SAMPLING METHOD: Split Spoon	BOREHOLE DIAMETER (In.): 7.25	WELL DIAMETER (In.): 2
LOGGED BY: N/A G. Henry		

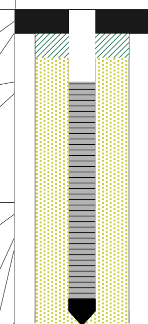
DEPTH (feet)	SAMPLES: Sample No. Location	SAMPLES: Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): 797.19)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0				Gravel	
				Red clay with gravel	
				Dark brown clay with come rock gravel and black deposits	
				Black clay with some weathered rock	
5				Red clay with interbedded grey clay and some gravel	
				Dark red clay with some black clay deposits	
10				Orange-red clay with rock gravel and sands	
13					Terminated at 13ft-bls.
15					
20					
25					
30					
35					
40					
45					
50					

EPS

PROJECT: **Syntec Industries, Inc.**	**Log of Boring No. MW-6**
SITE LOCATION: La Fayette, GA	TOP OF CASING ELEVATION (ft): 796.62
DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE STARTED: 6/21/07 — DATE FINISHED: 6/21/07
DRILLING METHOD: Hollow Stem Auger	TOTAL DEPTH (ft.): 13 — SCREEN INTERVAL (ft.): 3-13
DRILLING EQUIPMENT: Deitrich	DEPTH TO WATER AT TIME OF BORING (ft.): 4.45 — CASING (ft.): 0-3
SAMPLING METHOD: Split Spoon	BOREHOLE DIAMETER (In.): 7.25 — WELL DIAMETER (In.): 2
LOGGED BY: N/A G. Henry	

DEPTH (feet)	SAMPLES: Sample No. Location	SAMPLES: Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): 796.62)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0				Gravel	
				Red-orange clay with some rock and silts	
				Brown-black clay with some rock and silts	
				Black clay and silt with some rock gravel	
5				Brown-tan clay with some grey clay and gravel	
				Tan clay with some black sands and gravel	
10				Tan-gray clay with some gravel and black striations	
				Orange clay with some gray clay deposits and gravel	Terminated at 13ft-bls.
				Green-gray clay	
15					
20					
25					
30					
35					
40					
45					
50					

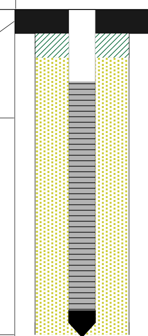




EPS

PROJECT: Syntec Industries, Inc.		Log of Boring No. MW-7	
SITE LOCATION:	La Fayette, GA	TOP OF CASING ELEVATION (ft): 797.52	
DRILLING CONTRACTOR:	Atlas Geo-Sampling	DATE STARTED: 6/26/07	DATE FINISHED: 6/26/07
DRILLING METHOD:	Direct Push and HSA	TOTAL DEPTH (ft.): 13.5	SCREEN INTERVAL (ft.): 3.5-13.5
DRILLING EQUIPMENT:	GeoProbe	DEPTH TO WATER AT TIME OF BORING (ft.): 3.69	CASING (ft.): 0-3.5
SAMPLING METHOD:	Macrocore Acetate Liner	BOREHOLE DIAMETER (In.): 7.25	WELL DIAMETER (In.): 2
LOGGED BY:	N/A G. Henry		

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Location	Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): 797.52)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0					Rock gravel	
0–4.5					Red clay with gravel	
4.5–13.5					Red clay with rock layers (wet)	Terminated at 13.5ft-bls.
15						
20						
25						
30						
35						
40						
45						
50						

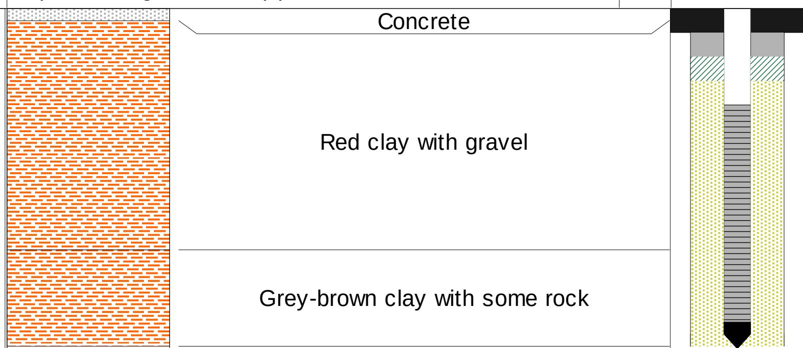


EPS

PROJECT: Syntec Industries, Inc.	Log of Boring No. MW-8	
SITE LOCATION: La Fayette, GA	TOP OF CASING ELEVATION (ft): 801.96	
DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE STARTED: 6/22/07	DATE FINISHED: 6/22/07
DRILLING METHOD: Direct Push and HSA	TOTAL DEPTH (ft.): 14	SCREEN INTERVAL (ft.): 4-14
DRILLING EQUIPMENT: GeoProbe	DEPTH TO WATER AT TIME OF BORING (ft.): 12.17	CASING (ft.): 0-4
SAMPLING METHOD: Macrocore Acetate Liner	BOREHOLE DIAMETER (In.): 7.25	WELL DIAMETER (In.): 2
LOGGED BY: N/A G. Henry		

DEPTH (feet)	SAMPLES: Sample No. Location	Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): 801.96)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0				Concrete	
0–10				Red clay with gravel	
10–14				Grey-brown clay with some rock	Terminated at 14ft-bls.

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50



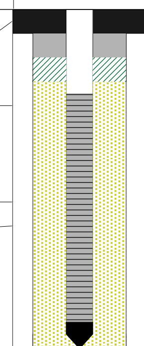
EPS

PROJECT: **Syntec Industries, Inc.**	**Log of Boring No. MW-9**
SITE LOCATION: La Fayette, GA	TOP OF CASING ELEVATION (ft): 801.93

DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE STARTED: 6/22/07	DATE FINISHED: 6/22/07
DRILLING METHOD: Direct Push and HSA	TOTAL DEPTH (ft.): 14	SCREEN INTERVAL (ft.): 4-14
DRILLING EQUIPMENT: GeoProbe	DEPTH TO WATER AT TIME OF BORING (ft.): 7.45	CASING (ft.): 0-4
SAMPLING METHOD: Macrocore Acetate Liner	BOREHOLE DIAMETER (In.): 7.25	WELL DIAMETER (In.): 2

LOGGED BY: N/A G. Henry

DEPTH (feet)	SAMPLES: Sample No. Location	SAMPLES: Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): 801.93)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0				Concrete	
				Red clay with gravel	
5				Red-brown clay with gravel	
				Rock layer	
10				Gray-brown clay with some rock	
15					Terminated at 14ft-bls.
20					
25					
30					
35					
40					
45					
50					

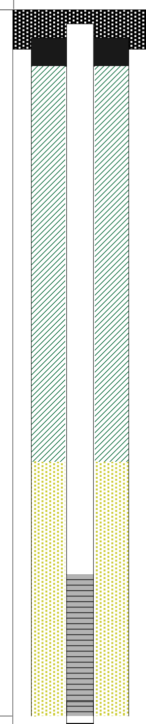


EPS

PROJECT: **Color Spectrum**		**Log of Boring No. MW-10**	
SITE LOCATION: LaFayette, GA		TOP OF CASING ELEVATION (ft): N/A	
DRILLING CONTRACTOR: Atlas Geo-Sampling		DATE STARTED: 10/6/09	DATE FINISHED: 10/6/09
DRILLING METHOD: Hollow Stem Auger		TOTAL DEPTH (ft.): 12.5	SCREEN INTERVAL (ft.): 10-12.5
DRILLING EQUIPMENT: AMS Power Probe		DEPTH TO WATER AT TIME OF BORING (ft.): 9.24	CASING (ft.): 10
SAMPLING METHOD: None		BOREHOLE DIAMETER (In.): 7.25	WELL DIAMETER (In.): 2
LOGGED BY: R. Jones			

DEPTH (feet)	SAMPLES: Sample No. Location	SAMPLES: Blows/ Foot	PID Reading	DESCRIPTION Ground Surface Elevation (ft): N/A	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0–12.5				No soils collected	Boring terminated at 12.5-ft below land surface. Installed well using 2-inch screen. Gauged and collected groundwater sample on 10/7/09.

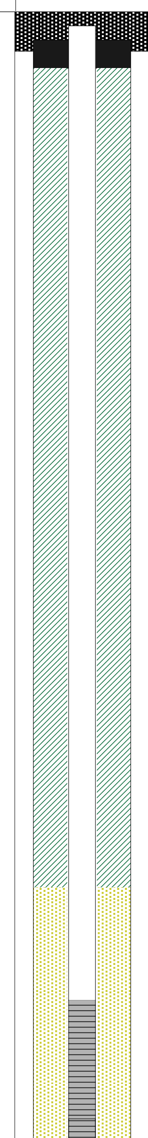
Depth scale: 0, 5, 10, 15, 20



EPS

PROJECT: **Color Spectrum**		**Log of Boring No.**	**MW-11**
SITE LOCATION:	LaFayette, GA	TOP OF CASING ELEVATION (ft):	N/A
DRILLING CONTRACTOR:	Atlas Geo-Sampling	DATE STARTED: 10/6/09	DATE FINISHED: 10/6/09
DRILLING METHOD:	Hollow Stem Auger	TOTAL DEPTH (ft.): 20	SCREEN INTERVAL (ft.): 17.5-20
DRILLING EQUIPMENT:	AMS Power Probe	DEPTH TO WATER AT TIME OF BORING (ft.): 14.21	CASING (ft.): 17.5
SAMPLING METHOD:	None	BOREHOLE DIAMETER (In.): 7.25	WELL DIAMETER (In.): 2
LOGGED BY:	R. Jones		

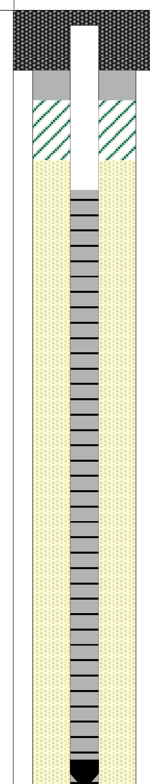
DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Location	Blows/ Foot	PID Reading	DESCRIPTION (Ground Surface Elevation (ft): N/A)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0						
5						
10					No soils collected	
15						
20						Boring terminated at 20-ft below land surface. Installed well using 2-inch screen. Gauged and collected groundwater sample on 10/7/09.



EPS

PROJECT: **Color Spectrum**	**Log of Boring No. MW-12**
SITE LOCATION: LaFayette, GA	TOP OF CASING ELEVATION (ft): 795.29
DRILLING CONTRACTOR: Geo Lab	DATE STARTED: 3/6/2013 / DATE FINISHED: 3/6/2013
DRILLING METHOD: Hollow Stem Auger	TOTAL DEPTH (ft.): 13 / SCREEN INTERVAL (ft.): 3-13
DRILLING EQUIPMENT: Geoprobe	DEPTH TO WATER AT TIME OF BORING (ft.): N/A / CASING (ft.): 0-3
SAMPLING METHOD: N/A	BOREHOLE DIAMETER (In.): 7.25 / WELL DIAMETER (In.): 2
LOGGED BY: B. Crowe	

DEPTH (feet)	SAMPLES: Sample No. Location	SAMPLES: Blows/ Foot	PID Reading	DESCRIPTION Ground Surface Elevation (ft): N/A	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0					Flush mounted vault set in concrete Grout 1-1.5 Bentonite 1.5-2.5 ft-bls
5					
					Filter Sand 2.5-13 ft-bls.
10					
					Boring terminated at 13 ft-bls.
15					
20					



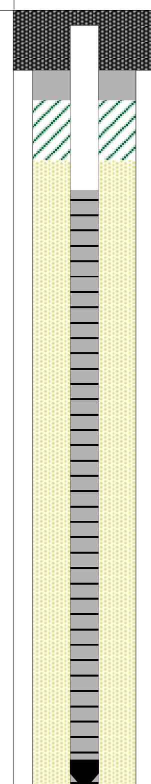
EPS

PROJECT: **Color Spectrum**

Log of Boring No. MW-13

SITE LOCATION:	LaFayette, GA	TOP OF CASING ELEVATION (ft):	796.24
DRILLING CONTRACTOR:	Geo Lab	DATE STARTED: 3/6/2013	DATE FINISHED: 3/6/2013
DRILLING METHOD:	Hollow Stem Auger	TOTAL DEPTH (ft.): 13	SCREEN INTERVAL (ft.): 3-13
DRILLING EQUIPMENT:	Geoprobe	DEPTH TO WATER AT TIME OF BORING (ft.): N/A	CASING (ft.): 0-3
SAMPLING METHOD:	N/A	BOREHOLE DIAMETER (In.): 7.25	WELL DIAMETER (In.): 2
LOGGED BY:	B. Crowe		

DEPTH (feet)	SAMPLES: Sample No. Location	SAMPLES: Blows/ Foot	PID Reading	DESCRIPTION — Ground Surface Elevation (ft): N/A	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0					Flush mounted vault set in concrete
					Grout 1-1.5
					Bentonite 1.5-2.5 ft-bls
5					
					Filter Sand 2.5-13 ft-bls.
10					
					Boring terminated at 13 ft-bls.
15					
20					

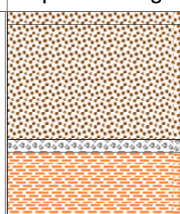


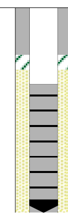
EPS

PROJECT: **Syntec Industries, Inc.**	**Log of Boring No. MW-14**
SITE LOCATION: La Fayette, GA	TOP OF CASING ELEVATION (ft): N/A
DRILLING CONTRACTOR: N/A	DATE STARTED: 8/6/2014 / DATE FINISHED: 8/6/2014
DRILLING METHOD: Hand Auger	TOTAL DEPTH (ft.): 8 / SCREEN INTERVAL (ft.): 3-8
DRILLING EQUIPMENT: Hand Auger	DEPTH TO WATER AT TIME OF BORING (ft.): 2.5 / CASING (ft.): 0-3
SAMPLING METHOD: N/A	BOREHOLE DIAMETER (In.): 4 / WELL DIAMETER (In.): 2

LOGGED BY: Ben Crowe / Alex Testoff

DEPTH (feet)	SAMPLES: Sample No. Location	SAMPLES: Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): N/A)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0				sand and roots	Grout
				clayey sand	Bentonite
5				sandy gravel	Filter Sand
				clay	Terminated at 8 ft-bls.
10					
15					
20					
25					
30					
35					
40					
45					
50					

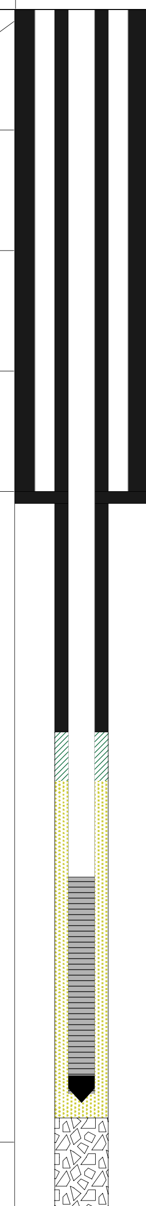




EPS

PROJECT: **Syntec Industries, Inc.**	**Log of Boring No. DW-1**
SITE LOCATION: La Fayette, GA	TOP OF CASING ELEVATION (ft): N/A
DRILLING CONTRACTOR: ESN Southeast	DATE STARTED: 6/21/07 — DATE FINISHED: 6/22/07
DRILLING METHOD: Hollow Stem Auger	TOTAL DEPTH (ft.): 46 — SCREEN INTERVAL (ft.): 36-46
DRILLING EQUIPMENT: Deitrich	DEPTH TO WATER AT TIME OF BORING (ft.): — CASING (ft.): 0-36
SAMPLING METHOD: N/A	BOREHOLE DIAMETER (In.): — WELL DIAMETER (In.):
LOGGED BY: N/A G. Henry	

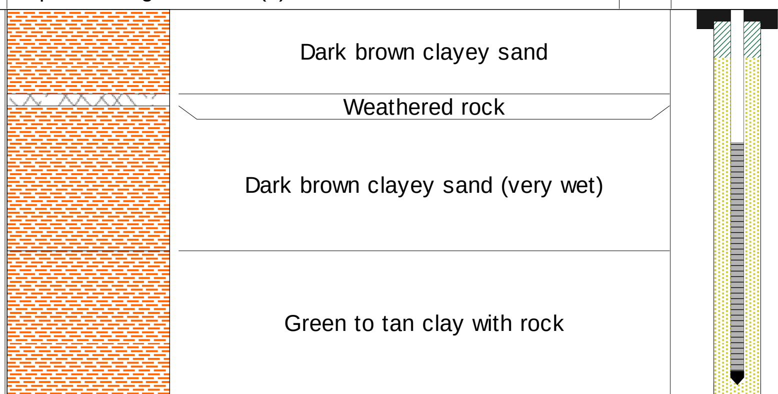
DEPTH (feet)	SAMPLES: Sample No. Location	SAMPLES: Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): N/A)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0				Gravel	
0-5				Red clay and gravel	Bore hole dia: 10.25 in Well dia: 4 in
5-10				Brown to dark grey clay with silt	
10-15				Brown-tan clay with silt	
15-20				Brown clay	
20-47				Bedrock with some fractures and unconsolidated materials	Outer Casing installed from 0 to 20ft-bls. Bore hole dia: 4 in Well dia: 2 in
47-50					Refusal encountered at 50ft-bls. Cave in occurred from 45.5 to 50ft-bls.



EPS

PROJECT: **Color Spectrum**	**Log of Boring No. TW-1**
SITE LOCATION: 15 Probasco Street, LaFayette, GA	TOP OF CASING ELEVATION (ft): 794.73
DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE STARTED: 6/21/2007 — DATE FINISHED: 6/21/2007
DRILLING METHOD: Direct Push and HSA	TOTAL DEPTH (ft.): 16 — SCREEN INTERVAL (ft.): 5.5-15.5
DRILLING EQUIPMENT: AMS Power Probe	DEPTH TO WATER AT TIME OF BORING (ft.): 3.81 — CASING (ft.): 0-5.5
SAMPLING METHOD: Macrocore with Acetate Liner	BOREHOLE DIAMETER (In.): 3.5 — WELL DIAMETER (In.): 1
LOGGED BY: G.Henry	

DEPTH (feet)	SAMPLES: Sample No. Location	SAMPLES: Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): 794.73)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0				Dark brown clayey sand	
				Weathered rock	
5				Dark brown clayey sand (very wet)	
10				Green to tan clay with rock	
15					Terminated at 16 ft-bls.
20					
25					
30					
35					
40					
45					
50					

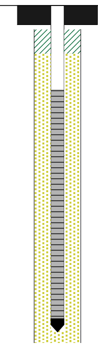


EPS

PROJECT: **Color Spectrum**	**Log of Boring No. TW-2**
SITE LOCATION: 15 Probasco Street, LaFayette, GA	TOP OF CASING ELEVATION (ft): 801.74
DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE STARTED: 6/22/2007 — DATE FINISHED: 6/22/2007
DRILLING METHOD: Direct Push and HSA	TOTAL DEPTH (ft.): 14 — SCREEN INTERVAL (ft.): 3.5-13.5
DRILLING EQUIPMENT: AMS Power Probe	DEPTH TO WATER AT TIME OF BORING (ft.): 5.48 — CASING (ft.): 0-3.5
SAMPLING METHOD: Macrocore with Acetate Liner	BOREHOLE DIAMETER (In.): 3.5 — WELL DIAMETER (In.): 1
LOGGED BY: G.Henry	

DEPTH (feet)	SAMPLES: Sample No. Location	Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): 801.74)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0				Concrete	
0–4				Red clay with gravel	
4–14				Red-brown clay with some rock	Refusal encountered at 14ft-bls.

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50



EPS

PROJECT: Syntec Industries, Inc.	Log of Boring No. TW-3	
SITE LOCATION: La Fayette, GA	TOP OF CASING ELEVATION (ft): N/A	
DRILLING CONTRACTOR: N/A	DATE STARTED: 6/27/09	DATE FINISHED: 6/27/09
DRILLING METHOD: Direct Push	TOTAL DEPTH (ft.): 4	SCREEN INTERVAL (ft.): 0-4
DRILLING EQUIPMENT: Hand Auger	DEPTH TO WATER AT TIME OF BORING (ft.):	CASING (ft.): N/A
SAMPLING METHOD: N/A	BOREHOLE DIAMETER (In.): 4	WELL DIAMETER (In.): 1
LOGGED BY: G. Henry		

DEPTH (feet)	SAMPLES: Sample No.	Location	Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): N/A)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0					Organic material	Terminated at 4 ft-bls. Well abandoned immediately after sampling.
5						
10						
15						
20						
25						
30						
35						
40						
45						
50						

EPS

PROJECT: **Color Spectrum Inc.**	**Log of Boring No. SB-1 to SB-19**
PROJECT LOCATION: La Fayette, GA	GROUND SURFACE ELEVATION AND DATUM: N/M
DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE INSTALLED: 12/19/06
DRILLING METHOD: Direct Push	TOTAL DEPTH (ft.): 15 (average); SCREEN INTERVAL (ft.): N/A
DRILLING EQUIPMENT: AMS Powerprobe	DEPTH TO WATER: FIRST: ~5; COMPL. N/M; CASING: N/A
SAMPLING METHOD: N/S	LOGGED BY: K. Moore / G. Henry

DEPTH (feet)	SAMPLES: Sample No.	Sample	Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation: N/M)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0–16					No Soil Samples Collected	No soils collected, groundwater collected with screen point sampler. Borings were abandoned after sampling.

PROJECT: Color Spectrum Inc.	Log of Boring No. SB-20			
PROJECT LOCATION: La Fayette, GA	GROUND SURFACE ELEVATION AND DATUM: N/M			
DRILLING CONTRACTOR: ESN Southeast	DATE INSTALLED: 12/19/06			
DRILLING METHOD: Direct Push	TOTAL DEPTH (ft.): 14			SCREEN INTERVAL (ft.): 9-14
DRILLING EQUIPMENT: GeoProbe	DEPTH TO WATER:	FIRST: ~10	COMPL. 8.51	CASING: 0-9
SAMPLING METHOD: N/S	LOGGED BY: K. Moore			

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	PID Reading	DESCRIPTION — Top of Casing Elevation: N/M	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0						
1						
2						
3						
4						
5						
6						
7					No Soil Samples Collected	
8						
9						
10						
11						
12						
13						
14						Boring terminated at 14 ft-bls. Temporary well abandoned after collection of groundwater sample.
15						
16						

EPS

PROJECT: Color Spectrum Inc.	Log of Boring No. SB-21			
PROJECT LOCATION: La Fayette, GA	GROUND SURFACE ELEVATION AND DATUM: N/M			
DRILLING CONTRACTOR: ESN Southeast	DATE INSTALLED: 12/19/06			
DRILLING METHOD: Direct Push	TOTAL DEPTH (ft.): 15			SCREEN INTERVAL (ft.): 10-15
DRILLING EQUIPMENT: GeoProbe	DEPTH TO WATER:	FIRST: ~14.5	COMPL. 14.45	CASING: 0-10
SAMPLING METHOD: N/S	LOGGED BY: K. Moore			

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	Blows/ Foot	PID Reading	DESCRIPTION Top of Casing Elevation: N/M	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0						
1						
2						
3						
4						
5						
6						
7						
8					No Soil Samples Collected	
9						
10						
11						
12						
13						
14						Direct push refusal at 15 ft-bls. Temporary well abandoned after collection of groundwater sample.
15						
16						

PROJECT: **Color Spectrum Inc.**		**Log of Boring No. SB-22**	
PROJECT LOCATION: La Fayette, GA		GROUND SURFACE ELEVATION AND DATUM: N/M	
DRILLING CONTRACTOR: ESN Southeast		DATE INSTALLED: 12/19/06	
DRILLING METHOD: Direct Push		TOTAL DEPTH (ft.): 15	SCREEN INTERVAL (ft.): 10-15
DRILLING EQUIPMENT: GeoProbe		DEPTH TO WATER: FIRST: ~13 COMPL. 11.39	CASING: 0-10
SAMPLING METHOD: N/S		LOGGED BY: K. Moore	

DEPTH (feet)	SAMPLES: Sample No.	Sample	Blows/ Foot	PID Reading	DESCRIPTION Top of Casing Elevation: N/M	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0						
1						
2						
3						
4						
5						
6						
7					No Soil Samples Collected	
8						
9						
10						
11						
12						
13						
14						Direct push refusal at 15 ft-bls. Temporary well abandoned after collection of groundwater sample.
15						
16						

PROJECT: Color Spectrum Inc.	Log of Boring No. SB-24			
PROJECT LOCATION: La Fayette, GA	GROUND SURFACE ELEVATION AND DATUM: N/A			
DRILLING CONTRACTOR: ESN Southeast	DATE STARTED: 12/19/06			DATE FINISHED: 12/19/06
DRILLING METHOD: Direct Push	TOTAL DEPTH (ft.): 15			SCREEN INTERVAL (ft.): 5-15
DRILLING EQUIPMENT: GeoProbe	DEPTH TO WATER:	FIRST: 8	COMPL. 8.07	CASING: 0-5
SAMPLING METHOD: Macrocore Acetate Liner	LOGGED BY: K. Moore			

Top of Casing Elevation: 106.64

DEPTH (feet)	SAMPLES: Sample No.	Sample	Blows/ Foot	PID Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0–2					Concrete/concrete base-no recovery	
2–4					Red orange fine grain sandy clay with gravel inclusions (fill)	
4–6				0	Red orange medium grain sandy clay with gravel size dolomite inclusions	
6–8	SB-24	7–7.5		1	Red orange coarse grain sandy clay with gravel size dolomite	
8–10				1.1	Orange red clay with yellow mottling-satured-tight trace dolomite gravel	
10–15					No recovery-saturated	Terminate boring at 15 ft-bls

PROJECT: Color Spectrum Inc.	Log of Boring No. SB-26
PROJECT LOCATION: La Fayette, GA	GROUND SURFACE ELEVATION AND DATUM: N/A
DRILLING CONTRACTOR: ESN Southeast	DATE STARTED: 12/19/06 — DATE FINISHED: 12/19/06
DRILLING METHOD: Direct Push	TOTAL DEPTH (ft.): 15 — SCREEN INTERVAL (ft.): 5-15
DRILLING EQUIPMENT: GeoProbe	DEPTH TO WATER: FIRST: 8 — COMPL. 7.87 — CASING: 0-5
SAMPLING METHOD: Macrocore Acetate Liner	LOGGED BY: K. Moore

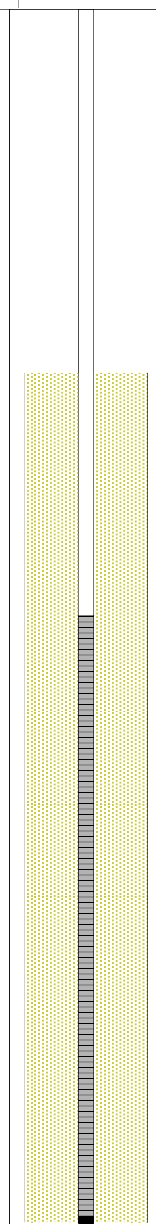
Top of Casing Elevation: 106.41

DEPTH (feet)	Sample No.	Sample	Blows/Foot	PID Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0–2					Concrete with large concrete aggregate	
2–4					Orange brown fine grain sandy clay-tight	Bore hole dia: 3.5 in Well dia: 1 in
4–6				0 (4)	Red orange coarse grain sandy clay with medium dolomite inclusions 1-2 cm-tight	
6–8	SB-26	7–7.5		0 (6)	Red orange medium grain sandy clay with yellow mottling - dry-tight	
8–10				1.5 (8)	Yellow orange red fine grain sandy clay with large dolomite inclusions > 2 cm - saturated and loose	
10–15					No recovery	Terminate boring at 15 ft-bls

EPS

PROJECT: **Color Spectrum Inc.**	**Log of Boring No. SB-27**
PROJECT LOCATION: La Fayette, GA	GROUND SURFACE ELEVATION AND DATUM: N/A
DRILLING CONTRACTOR: ESN Southeast	DATE STARTED: 12/20/06 · DATE FINISHED: 12/20/06
DRILLING METHOD: Direct Push	TOTAL DEPTH (ft.): 10 · SCREEN INTERVAL (ft.): 5-10
DRILLING EQUIPMENT: GeoProbe	DEPTH TO WATER: FIRST: 5 · COMPL. 4.63 · CASING: 0-5
SAMPLING METHOD: Macrocore Acetate Liner	LOGGED BY: K. Moore

DEPTH (feet)	SAMPLES: Sample No.	Sample	Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation: 102.35)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0–1					Gravel/road bed	
1–2					Yellow orange silty clay-loose and dry	Bore hole dia: 3.5 in Well dia: 1 in
2–5					Terra cotta with soot (from burning)	
5–10					No recovery	Terminate boring at 10 ft-bls



PROJECT: **Color Spectrum Inc.**	**Log of Boring No. SB-28**
PROJECT LOCATION: La Fayette, GA	GROUND SURFACE ELEVATION AND DATUM: N/A
DRILLING CONTRACTOR: ESN Southeast	DATE STARTED: 12/19/06 — DATE FINISHED: 12/19/06
DRILLING METHOD: Direct Push	TOTAL DEPTH (ft.): 10 — SCREEN INTERVAL (ft.): 5-10
DRILLING EQUIPMENT: GeoProbe	DEPTH TO WATER: FIRST: 6 — COMPL. 7.75 — CASING: 0-5
SAMPLING METHOD: Macrocore Acetate Liner	LOGGED BY: K. Moore

Top of Casing Elevation: 99.84

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	Blows/ Foot	PID Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0–2					Yellow orange silty clay with gravel size dolomite inclusions <2 cm	
2–2.5					Black chared/organics from burning	Bore hole dia: 3.5 in Well dia: 1 in
2.5–3					Terra cotta fragments	
3–5					Brown black organic rich silty clay - tight	
5–7.5					Brown black organic rich silty clay - tight	
7.5–10					Yellow orange tan mottled medium grain sandy clay	Terminate boring at 10 ft-bls

PROJECT: **Color Spectrum**

Log of Boring No. SB-29

SITE LOCATION: 15 Probasco Street, LaFayette, GA	TOP OF CASING ELEVATION (ft): N/A
DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE STARTED: 6/22/2007 — DATE FINISHED: 6/22/2007
DRILLING METHOD: Direct Push and HSA	TOTAL DEPTH (ft.): 8 — SCREEN INTERVAL (ft.): N/A
DRILLING EQUIPMENT: AMS Power Probe	DEPTH TO WATER AT TIME OF BORING (ft.): N/A — CASING (ft.): N/A
SAMPLING METHOD: Macrocore with Acetate Liner	BOREHOLE DIAMETER (In.): 3.5 — WELL DIAMETER (In.): N/A
LOGGED BY: G.Henry	

DEPTH (feet)	Sample No.	Location	Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): N/A)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0	SB-29 (1)	■		17.5	Concrete	
					Red clay with gravel	
5	SB-29 (4)	■		13.9		
				12.6		Terminated at 8ft-bls.
10						
15						
20						
25						
30						
35						
40						
45						
50						

EPS

PROJECT: **Color Spectrum**

Log of Boring No. SB-30

SITE LOCATION: 15 Probasco Street, LaFayette, GA	TOP OF CASING ELEVATION (ft): N/A
DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE STARTED: 6/22/2007 — DATE FINISHED: 6/22/2007
DRILLING METHOD: Direct Push and HSA	TOTAL DEPTH (ft.): 8 — SCREEN INTERVAL (ft.): N/A
DRILLING EQUIPMENT: AMS Power Probe	DEPTH TO WATER AT TIME OF BORING (ft.): N/A — CASING (ft.): N/A
SAMPLING METHOD: Macrocore with Acetate Liner	BOREHOLE DIAMETER (In.): 3.5 — WELL DIAMETER (In.): N/A
LOGGED BY: G.Henry	

DEPTH (feet)	SAMPLES: Sample No.	Location	Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): N/A)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0	SB-30 (1)			1.1	Concrete	
	SB-30 (4)			1.6	Red clay with gravel	
5				1.5		
8						Terminated at 8ft-bls.

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

EPS

PROJECT: Color Spectrum	Log of Boring No. SB-31	
SITE LOCATION: 15 Probasco Street, LaFayette, GA	TOP OF CASING ELEVATION (ft): N/A	
DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE STARTED: 6/22/2007	DATE FINISHED: 6/22/2007
DRILLING METHOD: Direct Push and HSA	TOTAL DEPTH (ft.): 8	SCREEN INTERVAL (ft.): N/A
DRILLING EQUIPMENT: AMS Power Probe	DEPTH TO WATER AT TIME OF BORING (ft.): N/A	CASING (ft.): N/A
SAMPLING METHOD: Macrocore with Acetate Liner	BOREHOLE DIAMETER (In.): 3.5	WELL DIAMETER (In.): N/A
LOGGED BY: G.Henry		

DEPTH (feet)	SAMPLES: Sample No. Location	Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): N/A)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0				Concrete	
	SB-31 (1)		2.3		
			1.8	Red clay with gravel	
5					
	SB-31 (7)		2.8		Terminated at 8ft-bls.
10					
15					
20					
25					
30					
35					
40					
45					
50					

EPS

PROJECT: Color Spectrum	Log of Boring No. SB-32	
SITE LOCATION: 15 Probasco Street, LaFayette, GA	TOP OF CASING ELEVATION (ft): N/A	
DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE STARTED: 6/22/2007	DATE FINISHED: 6/22/2007
DRILLING METHOD: Direct Push and HSA	TOTAL DEPTH (ft.): 8	SCREEN INTERVAL (ft.): N/A
DRILLING EQUIPMENT: AMS Power Probe	DEPTH TO WATER AT TIME OF BORING (ft.): N/A	CASING (ft.): N/A
SAMPLING METHOD: Macrocore with Acetate Liner	BOREHOLE DIAMETER (In.): 3.5	WELL DIAMETER (In.): N/A
LOGGED BY: G.Henry		

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Location	Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): N/A)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0	SB-32 (1)			8.8	Concrete	
	SB-32 (4)			3	Red clay with gravel	
5						
8						Terminated at 8ft-bls.
10						
15						
20						
25						
30						
35						
40						
45						
50						

EPS

PROJECT: **Color Spectrum**		**Log of Boring No. SB-33**	
SITE LOCATION:	15 Probasco Street, LaFayette, GA	TOP OF CASING ELEVATION (ft): N/A	
DRILLING CONTRACTOR:	Atlas Geo-Sampling	DATE STARTED: 6/21/2007	DATE FINISHED: 6/21/2007
DRILLING METHOD:	Direct Push and HSA	TOTAL DEPTH (ft.): 12	SCREEN INTERVAL (ft.): N/A
DRILLING EQUIPMENT:	AMS Power Probe	DEPTH TO WATER AT TIME OF BORING (ft.): N/A	CASING (ft.): N/A
SAMPLING METHOD:	Macrocore with Acetate Liner	BOREHOLE DIAMETER (In.): 3.5	WELL DIAMETER (In.): N/A
LOGGED BY:	G.Henry		

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Location	Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): N/A)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0					Concrete	
1	SB-33 (1)	■		0.8	Red clay with gravel	
4	SB-33 (4)	■		0.4		
7				0.3		
12						Terminated at 12ft-bls.

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

EPS

PROJECT: **Color Spectrum**	**Log of Boring No. SB-34**
SITE LOCATION: 15 Probasco Street, LaFayette, GA	TOP OF CASING ELEVATION (ft): N/A
DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE STARTED: 6/21/2007 — DATE FINISHED: 6/21/2007
DRILLING METHOD: Direct Push and HSA	TOTAL DEPTH (ft.): 8 — SCREEN INTERVAL (ft.): N/A
DRILLING EQUIPMENT: AMS Power Probe	DEPTH TO WATER AT TIME OF BORING (ft.): N/A — CASING (ft.): N/A
SAMPLING METHOD: Macrocore with Acetate Liner	BOREHOLE DIAMETER (In.): 3.5 — WELL DIAMETER (In.): N/A
LOGGED BY: G.Henry	

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Location	Blows/Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): N/A)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0					Concrete	
1	SB-34 (1)	■		2	Red clay with gravel	
4				3		
7	SB-34 (7)	■		3.4		
8						Terminated at 8ft-bls.

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

EPS

PROJECT: Color Spectrum	Log of Boring No. SB-35

SITE LOCATION:	15 Probasco Street, LaFayette, GA	TOP OF CASING ELEVATION (ft):	N/A
DRILLING CONTRACTOR:	Atlas Geo-Sampling	DATE STARTED: 6/21/2007	DATE FINISHED: 6/21/2007
DRILLING METHOD:	Direct Push and HSA	TOTAL DEPTH (ft.): 12	SCREEN INTERVAL (ft.): N/A
DRILLING EQUIPMENT:	AMS Power Probe	DEPTH TO WATER AT TIME OF BORING (ft.): 4.5	CASING (ft.): N/A
SAMPLING METHOD:	Macrocore with Acetate Liner	BOREHOLE DIAMETER (In.): 3.5	WELL DIAMETER (In.): N/A
LOGGED BY:	G.Henry		

DEPTH (feet)	SAMPLES: Sample No.	Location	Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): N/A)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0	SB-35 (1)			0	Concrete	
					Red clay with gravel	
5	SB-35 (4.5)			0.2		
				0	Red clay with gravel (wet)	
10						
12						Terminated at 12ft-bls.

EPS

PROJECT: Color Spectrum	Log of Boring No. SB-36	
SITE LOCATION: 15 Probasco Street, LaFayette, GA	TOP OF CASING ELEVATION (ft): N/A	
DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE STARTED: 6/21/2007	DATE FINISHED: 6/21/2007
DRILLING METHOD: Direct Push and HSA	TOTAL DEPTH (ft.): 12	SCREEN INTERVAL (ft.): N/A
DRILLING EQUIPMENT: AMS Power Probe	DEPTH TO WATER AT TIME OF BORING (ft.): N/A	CASING (ft.): N/A
SAMPLING METHOD: Macrocore with Acetate Liner	BOREHOLE DIAMETER (In.): 3.5	WELL DIAMETER (In.): N/A
LOGGED BY: G.Henry		

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Location	Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): N/A)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0	SB-36 (1)			0.6	Concrete	
					Red clay with gravel	
5	SB-36 (4)			0.6		
				0		
10						
						Terminated at 12ft-bls.
15						
20						
25						
30						
35						
40						
45						
50						

EPS

PROJECT: **Color Spectrum**		**Log of Boring No.**	**SB-37**
SITE LOCATION:	15 Probasco Street, LaFayette, GA	TOP OF CASING ELEVATION (ft): N/A	
DRILLING CONTRACTOR:	Atlas Geo-Sampling	DATE STARTED: 6/26/2007	DATE FINISHED: 6/26/2007
DRILLING METHOD:	Direct Push and HSA	TOTAL DEPTH (ft.): 8	SCREEN INTERVAL (ft.): N/A
DRILLING EQUIPMENT:	AMS Power Probe	DEPTH TO WATER AT TIME OF BORING (ft.): 4	CASING (ft.): N/A
SAMPLING METHOD:	Macrocore with Acetate Liner	BOREHOLE DIAMETER (In.): 7	WELL DIAMETER (In.): 2
LOGGED BY:	G.Henry		

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Location	Blows/ Foot	PID Reading	DESCRIPTION (Top of Casing Elevation (ft): N/A)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0	SB-37 (1)	🟥		2.3	Concrete and rock	
					Red-orange clay with some rock	
	SB-37 (3)	🟥				
5					Red-brown clay with some rock (wet)	
						Terminated at 8ft-bls.
10						
15						
20						
25						
30						
35						
40						
45						
50						

EPS

PROJECT: Color Spectrum	Log of Boring No. SO-1	
SITE LOCATION: LaFayette, GA	TOP OF CASING ELEVATION (ft): N/A	
DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE STARTED: 10/6/09	DATE FINISHED: 10/6/09
DRILLING METHOD: Direct Push	TOTAL DEPTH (ft.): 3	SCREEN INTERVAL (ft.): N/A
DRILLING EQUIPMENT: AMS Power Probe	DEPTH TO WATER AT TIME OF BORING (ft.): N/A	CASING (ft.): N/A
SAMPLING METHOD: Macrocore w/ Acetate Liner	BOREHOLE DIAMETER (In.): 3	WELL DIAMETER (In.): N/A
LOGGED BY: R. Jones		

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Location	Blows/ Foot	PID Reading	DESCRIPTION (Ground Surface Elevation (ft): N/A)	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0					Gravel, gray sand	
1	09279-SO-1-2	■		0	Red clay with rock (quartz)	
2				0	Red clay with sand and weathered rock	Boring terminated at 3-ft below land surface.
3				0		
5						
10						
15						
20						

EPS

PROJECT: Color Spectrum	Log of Boring No. SO-2	
SITE LOCATION: LaFayette, GA	TOP OF CASING ELEVATION (ft): N/A	
DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE STARTED: 10/6/09	DATE FINISHED: 10/6/09
DRILLING METHOD: Direct Push	TOTAL DEPTH (ft.): 3	SCREEN INTERVAL (ft.): N/A
DRILLING EQUIPMENT: AMS Power Probe	DEPTH TO WATER AT TIME OF BORING (ft.): N/A	CASING (ft.): N/A
SAMPLING METHOD: Macrocore w/ Acetate Liner	BOREHOLE DIAMETER (In.): 3	WELL DIAMETER (In.): N/A
LOGGED BY: R. Jones		

Ground Surface Elevation (ft): N/A

DEPTH (feet)	SAMPLES Sample No.	Location	Blows/Foot	PID Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0					Gravel, gray sand	
1	09279-SO-2-2	■		0	Red clay with rock (quartz)	
2				0	Red clay with sand and weathered rock	Boring terminated at 3-ft below land surface.
3				0		
5						
10						
15						
20						

EPS

PROJECT: Color Spectrum	Log of Boring No. SO-3	
SITE LOCATION: LaFayette, GA	TOP OF CASING ELEVATION (ft): N/A	
DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE STARTED: 10/6/09	DATE FINISHED: 10/6/09
DRILLING METHOD: Direct Push	TOTAL DEPTH (ft.): 8	SCREEN INTERVAL (ft.): N/A
DRILLING EQUIPMENT: AMS Power Probe	DEPTH TO WATER AT TIME OF BORING (ft.): 7	CASING (ft.): N/A
SAMPLING METHOD: Macrocore w/ Acetate Liner	BOREHOLE DIAMETER (In.): 3	WELL DIAMETER (In.): N/A
LOGGED BY: R. Jones		

Ground Surface Elevation (ft): N/A

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Location	SAMPLES: Blows/ Foot	PID Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0					Concrete, gravel and gray sand	
				6.2	Sand with clay and weathered rock	
	09279-SO-3-2	■		6.1		
				4.3	Red clay with sand and weathered rock	
				4.5		
5				4.4	Red clay with weathered rock	
				5.2		
				7.3		Boring terminated at 8-ft below land surface.
10						
15						
20						

EPS

PROJECT: **Color Spectrum**	**Log of Boring No. SO-4**
SITE LOCATION: LaFayette, GA	TOP OF CASING ELEVATION (ft): N/A
DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE STARTED: 10/6/09 — DATE FINISHED: 10/6/09
DRILLING METHOD: Direct Push	TOTAL DEPTH (ft.): 8 — SCREEN INTERVAL (ft.): N/A
DRILLING EQUIPMENT: AMS Power Probe	DEPTH TO WATER AT TIME OF BORING (ft.): 7 — CASING (ft.): N/A
SAMPLING METHOD: Macrocore w/ Acetate Liner	BOREHOLE DIAMETER (In.): 3 — WELL DIAMETER (In.): N/A
LOGGED BY: R. Jones	

Ground Surface Elevation (ft): N/A

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Location	Blows/ Foot	PID Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0					Concrete, gravel and gray sand	
1				2.9	Sand with clay and weathered rock	
2				3		
3				2.7	Red clay with sand and weathered rock	
4	09279-SO-4-5	4–5		2.7		
5				6.4	Red clay with weathered rock	
6				6.7		
7				1.7		Boring terminated at 8-ft below land surface.
10						
15						
20						

EPS

PROJECT: Color Spectrum	Log of Boring No. SO-5	
SITE LOCATION: LaFayette, GA	TOP OF CASING ELEVATION (ft): N/A	
DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE STARTED: 10/6/09	DATE FINISHED: 10/6/09
DRILLING METHOD: Direct Push	TOTAL DEPTH (ft.): 8	SCREEN INTERVAL (ft.): N/A
DRILLING EQUIPMENT: AMS Power Probe	DEPTH TO WATER AT TIME OF BORING (ft.): 7	CASING (ft.): N/A
SAMPLING METHOD: Macrocore w/ Acetate Liner	BOREHOLE DIAMETER (In.): 3	WELL DIAMETER (In.): N/A
LOGGED BY: R. Jones		

Ground Surface Elevation (ft): N/A

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Location	SAMPLES: Blows/ Foot	PID Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0					Concrete, gravel and gray sand	
1				4.7	Sand with clay and weathered rock	
2				4.7		
3	09279-SO-5-4	■		4.4	Red clay with sand and weathered rock	
4				4.8		
5				4.2	Red clay with weathered rock	
6				6.3		
7				6.3		Boring terminated at 8-ft below land surface.
10						
15						
20						

EPS

PROJECT: **Color Spectrum**

Log of Boring No. SO-6

SITE LOCATION: LaFayette, GA	TOP OF CASING ELEVATION (ft): N/A
DRILLING CONTRACTOR: Atlas Geo-Sampling	DATE STARTED: 10/6/09 — DATE FINISHED: 10/6/09
DRILLING METHOD: Direct Push	TOTAL DEPTH (ft.): 8 — SCREEN INTERVAL (ft.): N/A
DRILLING EQUIPMENT: AMS Power Probe	DEPTH TO WATER AT TIME OF BORING (ft.): 7 — CASING (ft.): N/A
SAMPLING METHOD: Macrocore w/ Acetate Liner	BOREHOLE DIAMETER (In.): 3 — WELL DIAMETER (In.): N/A
LOGGED BY: R. Jones	

Ground Surface Elevation (ft): N/A

DEPTH (feet)	SAMPLES: Sample No. / Location	Blows/Foot	PID Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0–0.5				Concrete, gravel and gray sand	
0.5–3			4.1 (1), 4.2 (2)	Sand with clay and weathered rock	
3–5	09279-SO-6-4 (3–4 ft)		5.1 (3), 5.2 (4)	Red clay with sand and weathered rock	
5–8			4.1 (5), 4.5 (6)	Red clay with weathered rock	Boring terminated at 8-ft below land surface.

Depth scale: 0, 5, 10, 15, 20

EPS

EPS

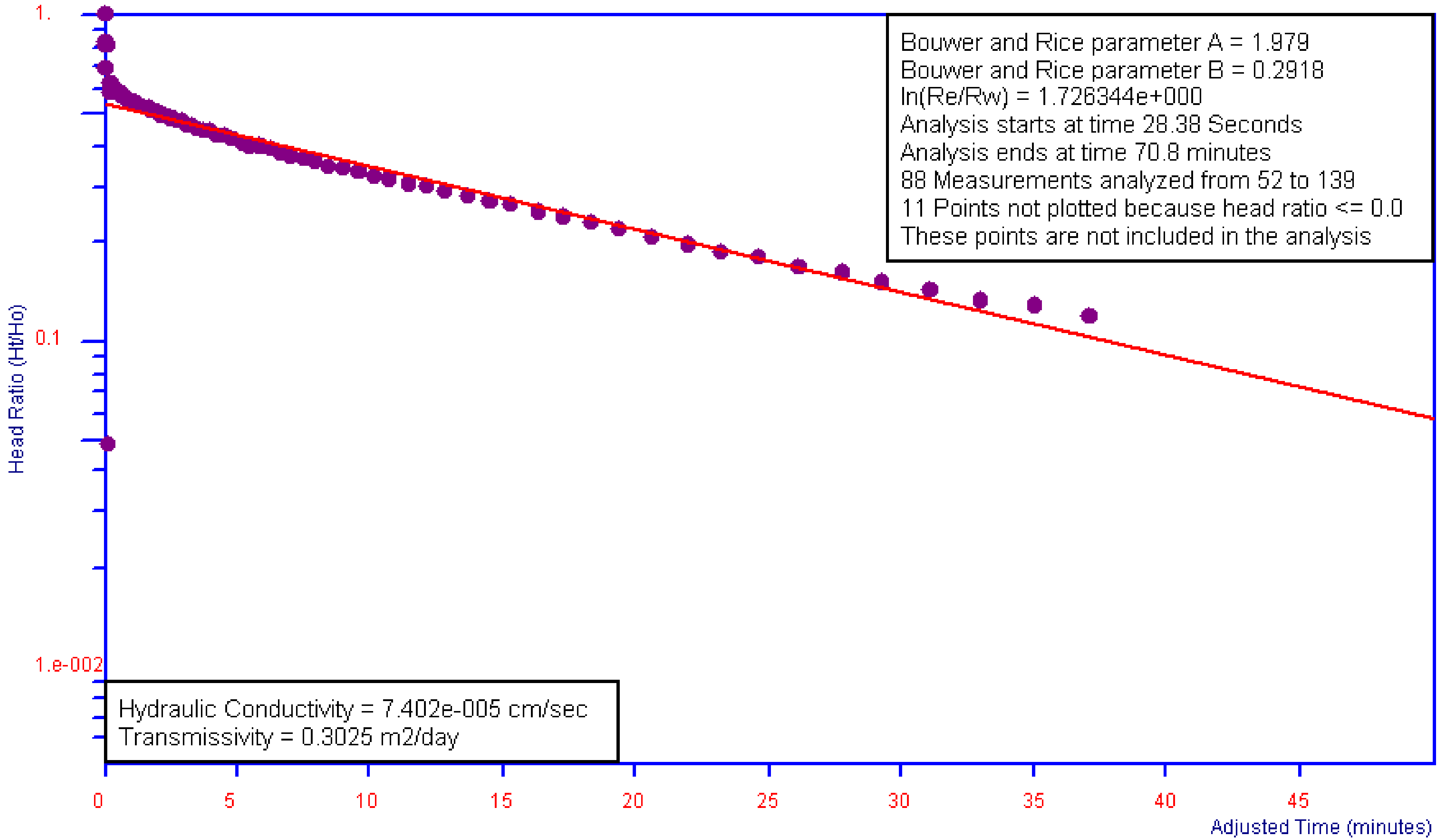
APPENDIX H

Slug Test Data

Color Spectrum

Bouwer and Rice Graph

MW-4



Analysis by Starpoint Software

Ho is 0.846 feet at 28.38 Seconds

Report Date:	7/2/2007 11:51
Report User Name:	amodi
Report Computer Name:	EPS-DIM-2400

Log File Properties

File Name	MW4 2007-06-28 09.57.08.wsl
Create Date	6/28/2007 12:56

Device Properties

Device	LevelTroll 700
Site	color spectrum mw-4
Device Name	MW4
Serial Number	114123
Firmware Version	2.04

Log Configuration

Log Name	MW4
Created By	Unknown
Computer Name	Pocket PC
Application	WinSituMobile.exe
Application Version	5.1.0.11
Create Date	6/28/2007 11:45
Notes Size(bytes)	4096
Type	True Logarithmic
Overwrite when full	Disabled
Scheduled Start	Manual Start
Scheduled Stop	No Stop Time
Max Interval	Days: 0 Hours: 00 Mins: 20 Secs: 00

Level Reference Settings At Log Creation

Level Measurement Mode	Depth
Specific Gravity	0.999

Log Notes:

Date and Time	Note
6/28/2007 11:45	Manual Start Command
6/28/2007 12:56	Suspend Command
6/28/2007 12:56	Manual Stop Command

Log Data:

Record Count 139

Date and Time	Elapsed Time Seconds	Sensor: Pres 15G SN#: 114123 Pressure (PSI)	Sensor: Pres 15G SN#: 114123 Depth (ft)	Sensor: Pres 15G SN#: 114123 Temperature (F)
6/28/2007 11:45	0	3.498	8.077	68.414
6/28/2007 11:45	0.251	3.499	8.08	68.442
6/28/2007 11:45	0.502	3.5	8.082	68.464
6/28/2007 11:45	0.751	3.499	8.079	68.478
6/28/2007 11:45	1.001	3.499	8.079	68.485

6/28/2007 11:45	1.251	3.499	8.078	68.491
6/28/2007 11:45	1.501	3.499	8.078	68.501
6/28/2007 11:45	1.751	3.498	8.076	68.505
6/28/2007 11:45	2.001	3.499	8.078	68.509
6/28/2007 11:45	2.251	3.498	8.077	68.509
6/28/2007 11:45	2.501	3.498	8.078	68.513
6/28/2007 11:45	2.751	3.499	8.078	68.513
6/28/2007 11:45	3.001	3.498	8.078	68.511
6/28/2007 11:45	3.251	3.498	8.076	68.508
6/28/2007 11:45	3.501	3.498	8.077	68.508
6/28/2007 11:45	3.751	3.499	8.079	68.512
6/28/2007 11:45	4.001	3.498	8.077	68.505
6/28/2007 11:45	4.251	3.498	8.077	68.506
6/28/2007 11:45	4.501	3.498	8.077	68.51
6/28/2007 11:45	4.751	3.498	8.076	68.502
6/28/2007 11:45	5.001	3.498	8.077	68.505
6/28/2007 11:45	5.251	3.498	8.077	68.495
6/28/2007 11:45	5.501	3.499	8.079	68.494
6/28/2007 11:45	5.751	3.497	8.075	68.491
6/28/2007 11:45	6.001	3.498	8.077	68.492
6/28/2007 11:45	6.361	3.498	8.078	68.471
6/28/2007 11:45	6.721	3.498	8.077	68.457
6/28/2007 11:45	7.141	3.499	8.078	68.437
6/28/2007 11:45	7.561	3.498	8.077	68.423
6/28/2007 11:45	7.981	3.499	8.08	68.42
6/28/2007 11:45	8.461	3.498	8.078	68.403
6/28/2007 11:45	9.001	3.498	8.077	68.386
6/28/2007 11:45	9.481	3.499	8.079	68.376
6/28/2007 11:45	10.081	3.498	8.078	68.359
6/28/2007 11:45	10.681	3.499	8.078	68.348
6/28/2007 11:45	11.281	3.498	8.077	68.335
6/28/2007 11:45	12.074	3.499	8.078	68.308
6/28/2007 11:45	12.66	3.498	8.077	68.336
6/28/2007 11:45	13.441	3.499	8.079	68.301
6/28/2007 11:45	14.221	3.499	8.079	68.283
6/28/2007 11:45	15.061	3.5	8.08	68.259
6/28/2007 11:45	15.961	3.499	8.078	68.242
6/28/2007 11:45	16.92	3.499	8.08	68.228
6/28/2007 11:45	17.88	3.5	8.081	68.206
6/28/2007 11:45	18.961	3.501	8.083	68.184
6/28/2007 11:45	20.101	3.503	8.088	68.164
6/28/2007 11:45	21.301	3.504	8.09	68.147
6/28/2007 11:45	22.561	3.381	7.807	68.124
6/28/2007 11:45	23.88	3.612	8.34	68.131
6/28/2007 11:45	25.321	3.859	8.91	68.084
6/28/2007 11:45	26.821	3.726	8.603	68.063
6/28/2007 11:45	28.38	3.864	8.923	68.041
6/28/2007 11:45	30.061	3.801	8.776	68.008
6/28/2007 11:45	31.86	3.751	8.66	67.975
6/28/2007 11:45	33.721	3.795	8.763	67.974
6/28/2007 11:46	35.761	3.795	8.762	67.93
6/28/2007 11:46	37.86	3.516	8.118	67.891
6/28/2007 11:46	40.081	3.709	8.563	67.869
6/28/2007 11:46	42.481	3.725	8.602	67.826
6/28/2007 11:46	45	3.721	8.592	67.805

6/28/2007 11:46	47.64	3.719	8.588	67.763
6/28/2007 11:46	50.461	3.718	8.584	67.722
6/28/2007 11:46	53.473	3.716	8.58	67.715
6/28/2007 11:46	56.64	3.714	8.576	67.646
6/28/2007 11:46	60.001	3.711	8.569	67.599
6/28/2007 11:46	63.6	3.71	8.565	67.58
6/28/2007 11:46	67.2	3.708	8.561	67.515
6/28/2007 11:46	71.401	3.706	8.556	67.455
6/28/2007 11:46	75.6	3.703	8.551	67.417
6/28/2007 11:46	79.8	3.703	8.549	67.359
6/28/2007 11:46	84.6	3.7	8.544	67.311
6/28/2007 11:46	90	3.699	8.54	67.247
6/28/2007 11:46	94.8	3.697	8.536	67.204
6/28/2007 11:47	100.801	3.695	8.532	67.137
6/28/2007 11:47	106.8	3.693	8.527	67.081
6/28/2007 11:47	112.801	3.692	8.526	67.016
6/28/2007 11:47	119.4	3.69	8.521	66.956
6/28/2007 11:47	126.6	3.688	8.516	66.891
6/28/2007 11:47	134.4	3.686	8.511	66.835
6/28/2007 11:47	142.201	3.684	8.507	66.761
6/28/2007 11:47	150.601	3.683	8.504	66.694
6/28/2007 11:48	159.6	3.68	8.497	66.635
6/28/2007 11:48	169.201	3.678	8.492	66.559
6/28/2007 11:48	178.801	3.677	8.489	66.498
6/28/2007 11:48	189.6	3.674	8.483	66.43
6/28/2007 11:48	201.001	3.672	8.478	66.359
6/28/2007 11:48	213.049	3.668	8.468	66.292
6/28/2007 11:49	225.6	3.666	8.465	66.226
6/28/2007 11:49	238.801	3.664	8.459	66.158
6/28/2007 11:49	253.237	3.661	8.454	66.144
6/28/2007 11:49	268.2	3.659	8.449	66.029
6/28/2007 11:50	283.8	3.656	8.441	65.98
6/28/2007 11:50	300.6	3.653	8.436	65.899
6/28/2007 11:50	318.6	3.651	8.43	65.842
6/28/2007 11:51	337.2	3.648	8.422	65.779
6/28/2007 11:51	357.6	3.645	8.416	65.72
6/28/2007 11:51	378.6	3.643	8.412	65.666
6/28/2007 11:52	400.8	3.641	8.407	65.609
6/28/2007 11:52	424.8	3.636	8.396	65.561
6/28/2007 11:52	450	3.634	8.391	65.503
6/28/2007 11:53	476.4	3.632	8.386	65.46
6/28/2007 11:53	504.6	3.629	8.379	65.422
6/28/2007 11:54	534.6	3.624	8.369	65.375
6/28/2007 11:54	566.4	3.623	8.366	65.322
6/28/2007 11:55	600	3.619	8.356	65.281
6/28/2007 11:56	636	3.616	8.35	65.252
6/28/2007 11:56	672	3.613	8.342	65.21
6/28/2007 11:57	714.179	3.609	8.334	65.209
6/28/2007 11:58	756	3.607	8.328	65.147
6/28/2007 11:58	798	3.604	8.321	65.114
6/28/2007 11:59	846	3.6	8.313	65.087
6/28/2007 12:00	900	3.596	8.303	65.056
6/28/2007 12:01	948	3.594	8.298	65.037
6/28/2007 12:02	1008	3.59	8.29	65.007
6/28/2007 12:03	1068	3.587	8.281	64.988

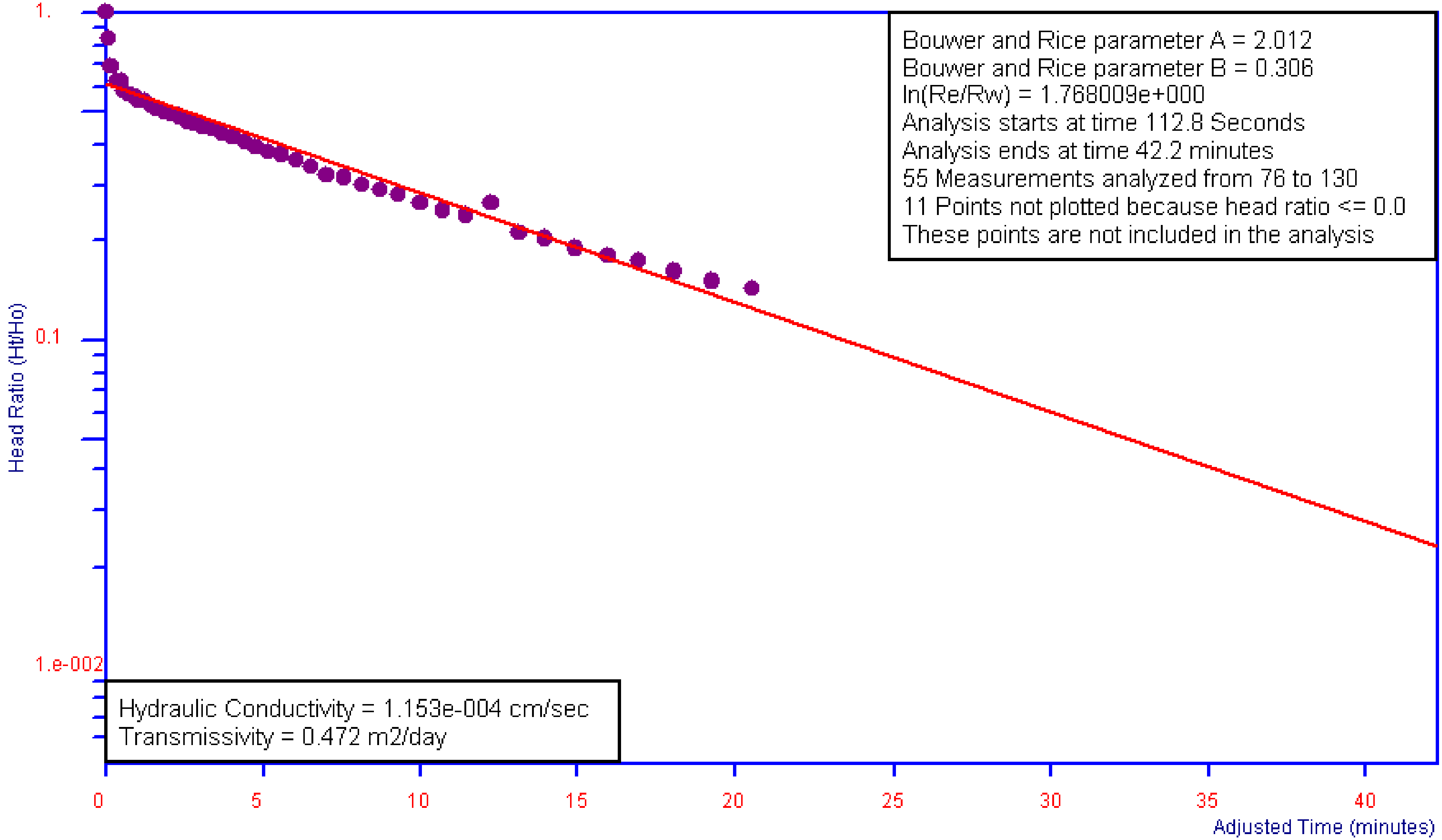
6/28/2007 12:04	1128	3.583	8.272	64.97
6/28/2007 12:05	1194.057	3.579	8.264	64.984
6/28/2007 12:06	1266	3.575	8.254	64.934
6/28/2007 12:07	1344.115	3.571	8.245	64.943
6/28/2007 12:09	1422	3.568	8.237	64.894
6/28/2007 12:10	1506	3.564	8.229	64.888
6/28/2007 12:12	1596	3.56	8.22	64.875
6/28/2007 12:13	1692	3.557	8.214	64.85
6/28/2007 12:15	1788	3.554	8.206	64.84
6/28/2007 12:17	1896	3.551	8.199	64.83
6/28/2007 12:18	2010	3.547	8.19	64.816
6/28/2007 12:20	2130	3.545	8.186	64.797
6/28/2007 12:23	2256	3.542	8.179	64.788
6/28/2007 12:25	2388	3.335	7.701	64.772
6/28/2007 12:27	2532	3.376	7.796	64.745
6/28/2007 12:30	2682	3.4	7.85	64.744
6/28/2007 12:32	2838	3.42	7.896	64.788
6/28/2007 12:35	3006	3.436	7.934	64.934
6/28/2007 12:38	3186	3.451	7.968	65.066
6/28/2007 12:41	3372	3.461	7.992	65.069
6/28/2007 12:45	3576	3.472	8.016	65.061
6/28/2007 12:48	3786	3.479	8.033	64.985
6/28/2007 12:52	4008	3.488	8.053	64.928
6/28/2007 12:56	4248	3.493	8.066	64.884

Color Spectrum

LaFayette, GA June 28, 2007

Bouwer and Rice Graph

MW-6



Analysis by Starpoint Software

Ho is 0.583 feet at 112.8 Seconds

Report Date:	7/2/2007 11:52			
Report User Name:	amodi			
Report Computer Name:	EPS-DIM-2400			

Log File Properties

File Name	MW6 2007-06-28 11.22.20.wsl
Create Date	6/28/2007 14:22

Device Properties

Device	LevelTroll 700
Site	color spectrum mw-4
Device Name	MW4
Serial Number	114123
Firmware Version	2.04

Log Configuration

Log Name	MW6
Created By	Unknown
Computer Name	Pocket PC
Application	WinSituMobile.exe
Application Version	5.1.0.11
Create Date	6/28/2007 13:38
Notes Size(bytes)	4096
Type	True Logarithmic
Overwrite when full	Disabled
Scheduled Start	Manual Start
Scheduled Stop	No Stop Time
Max Interval	Days: 0 Hours: 00 Mins: 20 Secs: 00

Level Reference Settings At Log Creation

Level Measurement Mode	Depth
Specific Gravity	0.999

Log Notes:

Date and Time	Note
6/28/2007 13:38	Manual Start Command
6/28/2007 14:22	Manual Stop Command

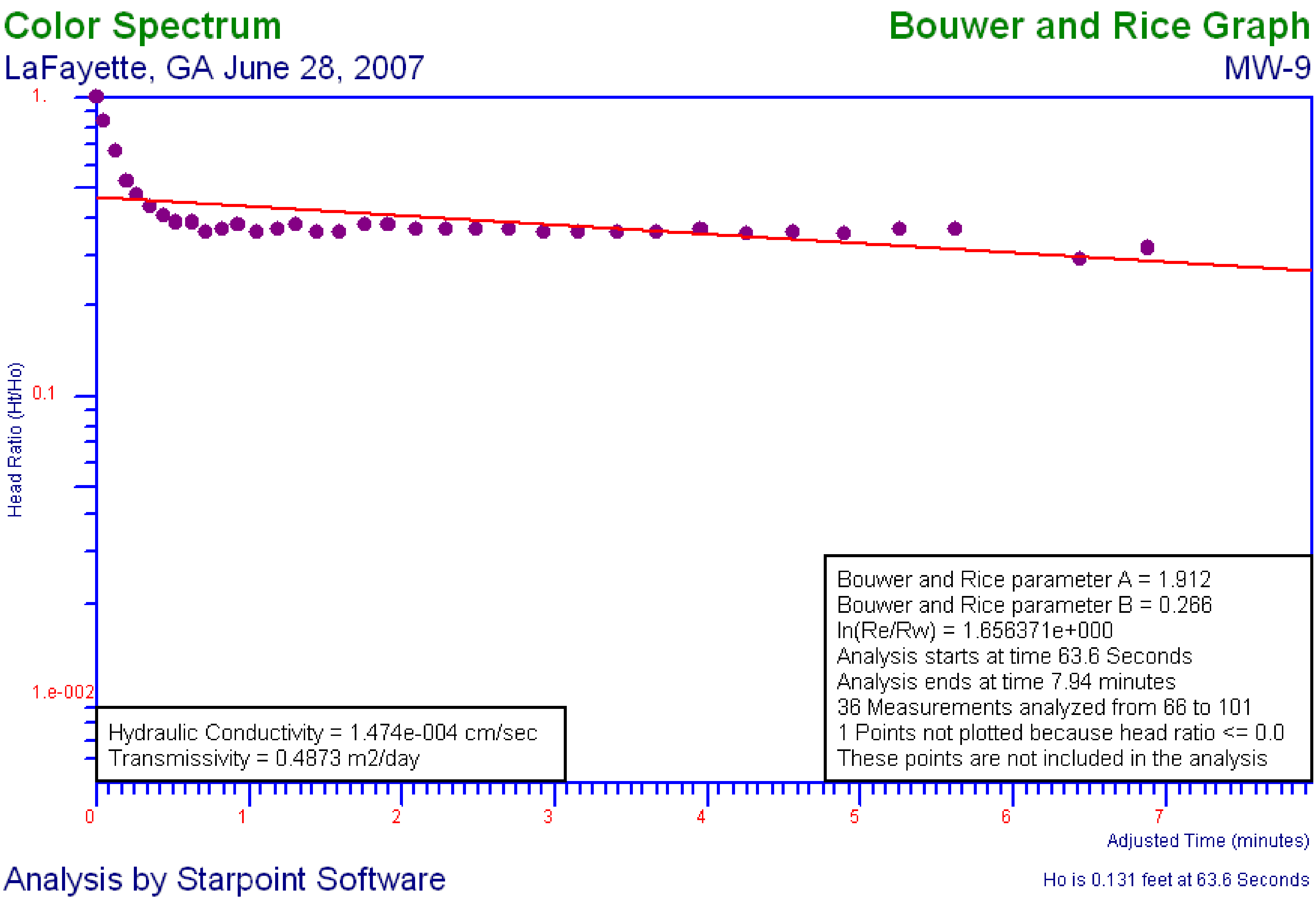
Log Data:
Record Count 130

Date and Time	Elapsed Time Seconds	Sensor: Pres 15G SN#: 114123 Pressure (PSI)	Sensor: Pres 15G SN#: 114123 Depth (ft)	Sensor: Pres 15G SN#: 114123 Temperature (F)
6/28/2007 13:38	0	3.869	8.933	71.412
6/28/2007 13:38	0.25	3.869	8.933	71.442
6/28/2007 13:38	0.501	3.869	8.934	71.46
6/28/2007 13:38	0.794	3.881	8.961	71.464
6/28/2007 13:38	1.002	3.868	8.931	71.485
6/28/2007 13:38	1.25	3.869	8.933	71.485
6/28/2007 13:38	1.5	3.869	8.934	71.488

6/28/2007 13:38	1.75	3.869	8.933	71.489
6/28/2007 13:38	2	3.868	8.931	71.486
6/28/2007 13:38	2.25	3.868	8.93	71.486
6/28/2007 13:38	2.5	3.869	8.932	71.485
6/28/2007 13:38	2.75	3.869	8.933	71.484
6/28/2007 13:38	3	3.868	8.932	71.481
6/28/2007 13:38	3.25	3.869	8.933	71.476
6/28/2007 13:38	3.5	3.867	8.93	71.472
6/28/2007 13:38	3.75	3.868	8.931	71.471
6/28/2007 13:38	4	3.868	8.931	71.468
6/28/2007 13:38	4.25	3.867	8.929	71.463
6/28/2007 13:38	4.5	3.868	8.931	71.461
6/28/2007 13:38	4.75	3.869	8.933	71.457
6/28/2007 13:38	5.176	3.868	8.931	71.425
6/28/2007 13:38	5.379	3.869	8.934	71.468
6/28/2007 13:38	5.712	3.867	8.93	71.424
6/28/2007 13:38	6.103	3.867	8.93	71.441
6/28/2007 13:38	6.306	3.867	8.93	71.438
6/28/2007 13:38	6.511	3.867	8.93	71.441
6/28/2007 13:38	6.716	3.868	8.931	71.441
6/28/2007 13:38	7.14	3.868	8.93	71.395
6/28/2007 13:38	7.56	3.867	8.928	71.379
6/28/2007 13:38	7.98	3.868	8.931	71.354
6/28/2007 13:38	8.46	3.867	8.93	71.329
6/28/2007 13:38	9	3.868	8.932	71.306
6/28/2007 13:38	9.48	3.867	8.928	71.292
6/28/2007 13:38	10.08	3.867	8.93	71.268
6/28/2007 13:38	10.68	3.868	8.931	71.24
6/28/2007 13:38	11.28	3.868	8.931	71.224
6/28/2007 13:38	11.94	3.868	8.931	71.208
6/28/2007 13:38	12.66	3.868	8.932	71.187
6/28/2007 13:38	13.44	3.867	8.93	71.164
6/28/2007 13:38	14.22	3.868	8.931	71.14
6/28/2007 13:38	15.06	3.868	8.931	71.112
6/28/2007 13:38	15.96	3.867	8.929	71.09
6/28/2007 13:38	16.92	3.868	8.931	71.093
6/28/2007 13:38	17.88	3.868	8.931	71.048
6/28/2007 13:38	18.96	3.869	8.933	71.014
6/28/2007 13:38	20.1	3.869	8.934	70.981
6/28/2007 13:38	21.3	3.868	8.931	70.949
6/28/2007 13:38	22.56	3.869	8.933	70.919
6/28/2007 13:38	23.88	3.869	8.932	70.879
6/28/2007 13:38	25.32	3.868	8.932	70.844
6/28/2007 13:38	26.82	3.868	8.931	70.837
6/28/2007 13:38	28.38	3.868	8.931	70.78
6/28/2007 13:38	30.06	3.868	8.931	70.738
6/28/2007 13:38	31.86	3.868	8.932	70.688
6/28/2007 13:38	33.72	3.868	8.931	70.644
6/28/2007 13:39	35.76	3.868	8.932	70.597
6/28/2007 13:39	37.86	3.868	8.931	70.564
6/28/2007 13:39	40.08	3.869	8.934	70.5
6/28/2007 13:39	42.48	3.869	8.933	70.454
6/28/2007 13:39	45	3.869	8.933	70.405
6/28/2007 13:39	47.64	3.868	8.932	70.355
6/28/2007 13:39	50.46	3.869	8.933	70.281
6/28/2007 13:39	53.46	3.868	8.93	70.217

6/28/2007 13:39	56.649	3.868	8.93	70.189
6/28/2007 13:39	60	3.868	8.931	70.115
6/28/2007 13:39	63.6	3.868	8.932	70.024
6/28/2007 13:39	67.199	3.868	8.931	69.952
6/28/2007 13:39	71.4	3.867	8.929	69.886
6/28/2007 13:39	75.6	3.867	8.929	69.794
6/28/2007 13:39	79.8	3.868	8.931	69.723
6/28/2007 13:39	84.6	3.867	8.929	69.641
6/28/2007 13:39	90.023	3.867	8.93	69.548
6/28/2007 13:40	94.8	3.868	8.932	69.481
6/28/2007 13:40	100.8	3.866	8.927	69.401
6/28/2007 13:40	106.8	3.872	8.94	69.288
6/28/2007 13:40	112.8	4.121	9.516	69.2
6/28/2007 13:40	119.4	4.081	9.423	69.106
6/28/2007 13:40	126.6	4.045	9.339	69.007
6/28/2007 13:40	134.399	4.026	9.296	68.896
6/28/2007 13:40	142.199	4.025	9.294	68.8
6/28/2007 13:40	150.6	4.016	9.273	68.714
6/28/2007 13:41	159.6	4.012	9.263	68.581
6/28/2007 13:41	169.2	4.009	9.257	68.473
6/28/2007 13:41	178.8	4.006	9.25	68.377
6/28/2007 13:41	189.599	4.004	9.245	68.264
6/28/2007 13:41	201	4	9.235	68.174
6/28/2007 13:41	213	3.997	9.229	68.07
6/28/2007 13:42	225.599	3.995	9.224	67.965
6/28/2007 13:42	238.8	3.992	9.218	67.871
6/28/2007 13:42	253.199	3.991	9.214	67.777
6/28/2007 13:42	268.2	3.987	9.205	67.676
6/28/2007 13:43	283.799	3.985	9.201	67.589
6/28/2007 13:43	300.599	3.982	9.195	67.522
6/28/2007 13:43	318.599	3.981	9.193	67.399
6/28/2007 13:44	337.2	3.977	9.182	67.309
6/28/2007 13:44	357.599	3.974	9.176	67.221
6/28/2007 13:44	378.599	3.971	9.168	67.149
6/28/2007 13:45	400.799	3.968	9.161	67.104
6/28/2007 13:45	424.799	3.964	9.153	67.006
6/28/2007 13:45	450.041	3.961	9.147	66.945
6/28/2007 13:46	476.399	3.958	9.14	66.885
6/28/2007 13:46	504.599	3.955	9.131	66.835
6/28/2007 13:47	534.599	3.95	9.121	66.78
6/28/2007 13:47	566.4	3.949	9.117	66.73
6/28/2007 13:48	600.1	3.944	9.107	66.685
6/28/2007 13:49	636	3.941	9.101	66.638
6/28/2007 13:49	672	3.939	9.095	66.603
6/28/2007 13:50	713.999	3.935	9.086	66.567
6/28/2007 13:51	756	3.932	9.078	66.533
6/28/2007 13:51	797.999	3.929	9.073	66.501
6/28/2007 13:52	845.999	3.936	9.087	66.462
6/28/2007 13:53	900.114	3.923	9.058	66.444
6/28/2007 13:54	948	3.921	9.053	66.421
6/28/2007 13:55	1008	3.918	9.045	66.391
6/28/2007 13:56	1068	3.915	9.039	66.36
6/28/2007 13:57	1128	3.913	9.035	66.328
6/28/2007 13:58	1193.999	3.91	9.028	66.311
6/28/2007 13:59	1265.999	3.907	9.021	66.287
6/28/2007 14:00	1343.999	3.905	9.016	66.259

6/28/2007 14:02	1421.999	3.734	8.621	66.241
6/28/2007 14:03	1505.999	3.755	8.669	66.177
6/28/2007 14:05	1596	3.767	8.699	66.116
6/28/2007 14:06	1691.999	3.778	8.723	66.095
6/28/2007 14:08	1788	3.787	8.743	66.057
6/28/2007 14:10	1896	3.795	8.762	66.038
6/28/2007 14:11	2010.024	3.803	8.78	66.022
6/28/2007 14:13	2130.032	3.808	8.793	66.003
6/28/2007 14:16	2256	3.814	8.808	65.987
6/28/2007 14:18	2388	3.82	8.821	65.96
6/28/2007 14:20	2531.999	3.825	8.833	65.944



Color Spectrum
Bouwer and Rice Graph
LaFayette, GA June 28, 2007
MW-9
Head Ratio (Ht/Ho)
1.
0.1
1.e-002
0
1
2
3
4
5
6
7
Adjusted Time (minutes)
Hydraulic Conductivity = 1.474e-004 cm/sec
Transmissivity = 0.4873 m2/day
Bouwer and Rice parameter A = 1.912
Bouwer and Rice parameter B = 0.266
ln(Re/Rw) = 1.656371e+000
Analysis starts at time 63.6 Seconds
Analysis ends at time 7.94 minutes
36 Measurements analyzed from 66 to 101
1 Points not plotted because head ratio <= 0.0
These points are not included in the analysis
Analysis by Starpoint Software
Ho is 0.131 feet at 63.6 Seconds

Report Date:	7/2/2007 11:52	
Report User Name:	amodi	
Report Computer Name:	EPS-DIM-2400	

Log File Properties

File Name	MW 9-[2] 2007-06-28 11.50.41.wsl
Create Date	6/28/2007 14:50

Device Properties

Device	LevelTroll 700
Site	color spectrum mw-4
Device Name	MW4
Serial Number	114123
Firmware Version	2.04

Log Configuration

Log Name	MW 9-[2]
Created By	Unknown
Computer Name	Pocket PC
Application	WinSituMobile.exe
Application Version	5.1.0.11
Create Date	6/28/2007 14:41
Notes Size(bytes)	4096
Type	True Logarithmic
Overwrite when full	Disabled
Scheduled Start	Manual Start
Scheduled Stop	No Stop Time
Max Interval	Days: 0 Hours: 00 Mins: 20 Secs: 00

Level Reference Settings At Log Creation

Level Measurement Mode	Depth
Specific Gravity	0.999

Log Notes:

Date and Time	Note
6/28/2007 14:42	Manual Start Command
6/28/2007 14:50	Suspend Command
6/28/2007 14:50	Manual Stop Command

Log Data:

Record Count 101

Date and Time	Elapsed Time Seconds	Sensor: Pres 15G SN#: 114123 Pressure (PSI)	Sensor: Pres 15G SN#: 114123 Depth (ft)	Sensor: Pres 15G SN#: 114123 Temperature (F)
6/28/2007 14:42	0	2.829	6.533	73.21
6/28/2007 14:42	0.25	2.829	6.533	73.245
6/28/2007 14:42	0.501	2.831	6.538	73.274
6/28/2007 14:42	0.966	2.841	6.56	73.269
6/28/2007 14:42	1.17	2.841	6.56	73.296
6/28/2007 14:42	1.374	2.829	6.531	73.31
6/28/2007 14:42	1.581	2.829	6.532	73.328

6/28/2007 14:42	1.785	2.829	6.532	73.342
6/28/2007 14:42	2	2.829	6.533	73.35
6/28/2007 14:42	2.25	2.829	6.532	73.346
6/28/2007 14:42	2.5	2.829	6.532	73.353
6/28/2007 14:42	2.75	2.829	6.532	73.35
6/28/2007 14:42	3	2.829	6.532	73.36
6/28/2007 14:42	3.25	2.829	6.532	73.363
6/28/2007 14:42	3.5	2.829	6.533	73.366
6/28/2007 14:42	3.75	2.83	6.533	73.372
6/28/2007 14:42	4	2.828	6.531	73.366
6/28/2007 14:42	4.25	2.829	6.531	73.377
6/28/2007 14:42	4.5	2.829	6.531	73.37
6/28/2007 14:42	4.75	2.828	6.53	73.378
6/28/2007 14:42	5	2.828	6.53	73.382
6/28/2007 14:42	5.389	2.829	6.532	73.366
6/28/2007 14:42	5.592	2.829	6.531	73.41
6/28/2007 14:42	5.925	2.829	6.531	73.38
6/28/2007 14:42	6.316	2.83	6.535	73.396
6/28/2007 14:42	6.521	2.829	6.532	73.403
6/28/2007 14:42	6.726	2.829	6.532	73.413
6/28/2007 14:42	7.14	2.828	6.529	73.375
6/28/2007 14:42	7.56	2.829	6.533	73.361
6/28/2007 14:42	7.98	2.829	6.531	73.356
6/28/2007 14:42	8.46	2.829	6.531	73.349
6/28/2007 14:42	9	2.828	6.53	73.331
6/28/2007 14:42	9.48	2.828	6.531	73.333
6/28/2007 14:42	10.08	2.829	6.532	73.325
6/28/2007 14:42	10.68	2.829	6.532	73.348
6/28/2007 14:42	11.28	2.828	6.531	73.324
6/28/2007 14:42	11.94	2.829	6.532	73.317
6/28/2007 14:42	12.66	2.83	6.535	73.306
6/28/2007 14:42	13.44	2.829	6.532	73.3
6/28/2007 14:42	14.22	2.829	6.531	73.295
6/28/2007 14:42	15.06	2.829	6.532	73.294
6/28/2007 14:42	15.96	2.829	6.531	73.288
6/28/2007 14:42	16.92	2.829	6.532	73.283
6/28/2007 14:42	17.88	2.828	6.531	73.285
6/28/2007 14:42	18.96	2.829	6.532	73.281
6/28/2007 14:42	20.1	2.83	6.533	73.275
6/28/2007 14:42	21.467	2.829	6.533	73.297
6/28/2007 14:42	22.56	2.829	6.533	73.279
6/28/2007 14:42	23.88	2.829	6.532	73.267
6/28/2007 14:42	25.32	2.829	6.532	73.264
6/28/2007 14:42	26.82	2.829	6.532	73.261
6/28/2007 14:42	28.38	2.83	6.534	73.257
6/28/2007 14:42	30.06	2.83	6.535	73.257
6/28/2007 14:42	31.86	2.829	6.533	73.279
6/28/2007 14:42	33.72	2.83	6.535	73.25
6/28/2007 14:42	35.76	2.83	6.535	73.247
6/28/2007 14:42	37.86	2.829	6.533	73.245
6/28/2007 14:42	40.08	2.83	6.535	73.243
6/28/2007 14:42	42.48	2.83	6.534	73.246
6/28/2007 14:42	45	2.83	6.535	73.241
6/28/2007 14:43	47.64	2.831	6.537	73.231
6/28/2007 14:43	50.46	2.835	6.545	73.235
6/28/2007 14:43	53.46	3.15	7.274	73.237
6/28/2007 14:43	56.64	2.908	6.715	73.227

6/28/2007 14:43	60	2.939	6.785	73.222
6/28/2007 14:43	63.6	2.886	6.664	73.228
6/28/2007 14:43	67.199	2.877	6.644	73.223
6/28/2007 14:43	71.472	2.867	6.62	73.249
6/28/2007 14:43	75.6	2.86	6.603	73.217
6/28/2007 14:43	79.8	2.856	6.595	73.212
6/28/2007 14:43	84.6	2.854	6.59	73.212
6/28/2007 14:43	90	2.852	6.586	73.21
6/28/2007 14:43	94.8	2.851	6.583	73.21
6/28/2007 14:43	100.99	2.851	6.583	73.204
6/28/2007 14:43	106.8	2.85	6.58	73.206
6/28/2007 14:44	112.8	2.85	6.581	73.217
6/28/2007 14:44	119.4	2.851	6.582	73.208
6/28/2007 14:44	126.6	2.85	6.58	73.209
6/28/2007 14:44	134.399	2.85	6.581	73.208
6/28/2007 14:44	142.199	2.851	6.582	73.218
6/28/2007 14:44	150.6	2.85	6.58	73.202
6/28/2007 14:44	159.6	2.85	6.58	73.198
6/28/2007 14:45	169.2	2.85	6.582	73.197
6/28/2007 14:45	178.8	2.851	6.582	73.189
6/28/2007 14:45	189.6	2.85	6.581	73.183
6/28/2007 14:45	201.045	2.85	6.581	73.185
6/28/2007 14:45	213	2.85	6.581	73.188
6/28/2007 14:45	225.599	2.85	6.581	73.174
6/28/2007 14:46	238.8	2.85	6.58	73.178
6/28/2007 14:46	253.199	2.85	6.58	73.186
6/28/2007 14:46	268.199	2.85	6.58	73.181
6/28/2007 14:46	283.799	2.85	6.58	73.196
6/28/2007 14:47	300.6	2.85	6.581	73.199
6/28/2007 14:47	318.599	2.849	6.579	73.206
6/28/2007 14:47	337.2	2.85	6.58	73.216
6/28/2007 14:48	357.6	2.85	6.579	73.217
6/28/2007 14:48	378.599	2.85	6.581	73.22
6/28/2007 14:48	400.98	2.85	6.581	73.26
6/28/2007 14:49	424.799	2.79	6.441	73.231
6/28/2007 14:49	450	2.846	6.571	73.225
6/28/2007 14:50	476.399	2.847	6.574	73.229

APPENDIX I

Wildlife Resources Division Letter

Noel Holcomb, Commissioner
Dan Forster, Director

Georgia Department of Natural Resources
Wildlife Resources Division

Nongame Conservation Section
2065 U.S. Highway 278, S.E., Social Circle, Georgia 30025-4743
(770) 918 6411

December 6, 2007

Justin Vickery, Senior Geologist
EPS
900 Ashwood Parkway
Atlanta, GA 30338

Subject: **Known Occurrences of Conservation Areas and Special Concern Animals and Plants On or Near EPD Hazardour Site Compliance Status Report, T&E Species Review, Walker County, Georgia**

Dear Mr. Vickery:

This is in response to your request of November 27, 2007. According to our records, within a three-mile radius of the project site there are the following Natural Heritage Database occurrences:

Aesculus glabra (Ohio Buckeye) approx. 2.5 mi. W of site
GA *Aneides aeneus* (Green Salamander) approx. 3.0 mi. W of site
Carya laciniosa (Shellbark Hickory) approx. 3.0 mi. W of site
GA *Crataegus triflora* (Three-flowered Hawthorn) approx. 3.0 mi. W of site
Etheostoma coosae (Coosa Darter) approx. 1.0 mi. SE of site in Town Creek
Etheostoma coosae (Coosa Darter) approx. 2.5 mi. N of site in Dry Creek
Etheostoma coosae (Coosa Darter) approx. 2.5 mi. W of site in Duck Creek
Fraxinus quadrangulata (Blue Ash) approx. 3.0 mi. W of site
GA *Jeffersonia diphylla* (Twinleaf) approx. 3.0 mi. W of site
GA *Neviusia alabamensis* (Alabama Snow-wreath) approx. 3.0 mi. W of site
Phacelia purshii (Miami-mist) approx. 2.5 mi. W of site
Ponthieva racemosa (Shadow-witch Orchid) approx. 3.0 mi. W of site
Potamogeton amplifolius (Bigleaf Pondweed) approx. 1.0 mi. N of site
Blue Hole [Cave] approx. 3.0 mi. W of site
Chattooga River [High Priority Stream] approx. 1.0 mi. SE of site
Crockford-Pigeon Mountain WMA [GA DNR] approx. 2.5 mi. W of site
Duck Creek [High Priority Stream] approx. 2.0 mi. SW of site
Wayne's Dudhole [Cave] approx. 3.0 mi. W of site

* Entries above proceeded by "US" indicates species with federal status in Georgia (Protected or Candidate). Species that are federally protected in Georgia are also state protected; "GA" indicates Georgia protected species.

Recommendations:

We have no records of species of concern within the project area. Please encourage strict measures to protect the important aquatic resources near this site. This site occurs near Duck

Creek and the Chattooga River, both high priority streams. As part of an effort to develop a comprehensive wildlife conservation strategy for the state of Georgia, the Wildlife Resources division has developed and mapped a list of streams that are important to the protection or restoration of rare aquatic species and aquatic communities. High priority waters and their surrounding watersheds are a high priority for a broad array of conservation activities, but do not receive any additional legal protections. We now have GIS ESRI shapefiles of GA high priority waters available on our website (http://www.georgiawildlife.com/content/displaycontent.asp?txtDocument=89&txtPage=13). Please contact the Georgia Natural Heritage Program if you would like additional information on high priority waters.

New Data Available on the Nongame Conservation Section Website

We have recently updated the Nongame Conservation Section Website!!! You can view the updated rare species and natural community information by Quarter Quad, County and HUC8 Watershed. To access this information, please visit our GA Rare Species and Natural Community Information page at:
http://georgiawildlife.dnr.state.ga.us/content/displaycontent.asp?txtDocument=89
An updated ESRI shape file of our rare species and natural community data by quarter quad and county is also available. It can be downloaded from:
http://georgiawildlife.dnr.state.ga.us/assets/documents/gnhp/gnhpds.zip

Disclaimer:

Please keep in mind the limitations of our database. The data collected by the Nongame Conservation Section comes from a variety of sources, including museum and herbarium records, literature, and reports from individuals and organizations, as well as field surveys by our staff biologists. In most cases the information is not the result of a recent on-site survey by our staff. Many areas of Georgia have never been surveyed thoroughly. Therefore, the Nongame Conservation Section can only occasionally provide definitive information on the presence or absence of rare species on a given site. Our files are updated constantly as new information is received. **Thus, information provided by our program represents the existing data in our files at the time of the request and should not be considered a final statement on the species or area under consideration.**

If you know of populations of special concern species that are not in our database, please fill out the appropriate data collection form and send it to our office. Forms can be obtained through our web site (http://www.georgiawildlife.com) or by contacting our office. If I can be of further assistance, please let me know.

Sincerely,

Trina Morris

Katrina Morris
Environmental Review Coordinator

APPENDIX J

Vapor Intrusion Model

Non-Residential

Freon-113

Groundwater

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
76131	2.70E+04	1,1,2-Trichloro-1,2,2-trifluoroethane

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
20	15	213.36	213.36	0	0	A	SC	SC		

Totals must add up to value of L_{WT} (cell G28) (applies to thickness of soil strata A, B, C)

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SC	1.63	0.385	0.197	SC	1.63	0.385	0.197	SC	1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	15036.8	4572	670.56	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based groundwater concentration.

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
3.76E-02	8.59E-06	5.26E-01	25	6,463	320.70	487.30	1.11E+04	1.70E+02	0.0E+00	3.0E+01

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
7.88E+08	198.36	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	30.00	0.385	0.030	0.355	39,218

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, $D^{eff}{}_A$ (cm^2/s)	Stratum B effective diffusion coefficient, $D^{eff}{}_B$ (cm^2/s)	Stratum C effective diffusion coefficient, $D^{eff}{}_C$ (cm^2/s)	Capillary zone effective diffusion coefficient, $D^{eff}{}_{cz}$ (cm^2/s)	Total overall effective diffusion coefficient, $D^{eff}{}_T$ (cm^2/s)	Diffusion path length, L_d (cm)
3.20E+06	6.93E+07	5.66E-05	15	6,840	4.32E-01	1.80E+01	1.78E-04	9.70E-04	0.00E+00	0.00E+00	2.29E-06	1.49E-05	198.36

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	4.85E+08	0.10	8.33E+01	9.70E-04	3.92E+03	1.34E+95	1.54E-06	7.45E+02	NA	3.0E+01

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	1.70E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	1.7E-02

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Residential

Freon-113

Groundwater

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
76131	2.70E+04	1,1,2-Trichloro-1,2,2-trifluoroethane

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
20	15	213.36	213.36	0	0	A	SC	SC		

Thickness columns: Totals must add up to value of L_{WT} (cell G28)

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SC	1.63	0.385	0.197	SC	1.63	0.385	0.197	SC	1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1

Used to calculate risk-based groundwater concentration.

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
3.76E-02	8.59E-06	5.26E-01	25	6,463	320.70	487.30	1.11E+04	1.70E+02	0.0E+00	3.0E+01

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	198.36	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	30.00	0.385	0.030	0.355	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, $D^{eff}{}_A$ (cm^2/s)	Stratum B effective diffusion coefficient, $D^{eff}{}_B$ (cm^2/s)	Stratum C effective diffusion coefficient, $D^{eff}{}_C$ (cm^2/s)	Capillary zone effective diffusion coefficient, $D^{eff}{}_{cz}$ (cm^2/s)	Total overall effective diffusion coefficient, $D^{eff}{}_T$ (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	6,840	4.32E-01	1.80E+01	1.78E-04	9.70E-04	0.00E+00	0.00E+00	2.29E-06	1.49E-05	198.36

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	4.85E+08	0.10	8.33E+01	9.70E-04	4.00E+02	#NUM!	4.71E-06	2.28E+03	NA	3.0E+01

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	1.70E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	7.3E-02

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Non-Residential
Freon-113
Soil

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (μg/kg)	Chemical
76131	6.34E+03	1,1,2-Trichloro-1,2,2-trifluoroethane

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
				Totals must add up to value of L_t (cell G28)					
20	15	30.48	213.36	30.48	0	0	SC		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	15036.8	4572	670.56	0.1	0.25	5

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1
				Used to calculate risk-based soil concentration.	

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
3.76E-02	8.59E-06	5.26E-01	25	6,463	320.70	487.30	1.11E+04	1.70E+02	0.0E+00	3.0E+01	L

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R ($\mu g/kg$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	15.48	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	39,218	6.34E+03	3.20E+06

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
6.93E+07	5.66E-05	15	6,840	4.32E-01	1.80E+01	1.78E-04	9.70E-04	0.00E+00	0.00E+00	9.70E-04	15.48	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
2.23E+01	4.65E+06	0.10	8.33E+01	9.70E-04	3.92E+03	1.34E+95	NA	NA	5.31E+01	1.82E-06	3.83E+08	YES

Finite source indoor attenuation coefficient, <α> (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	5.19E+01	NA	5.19E+01	NA	3.0E+01

END

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (μg/kg)	Indoor exposure soil conc., noncarcinogen (μg/kg)	Risk-based indoor exposure soil conc., (μg/kg)	Soil saturation conc., C_{sat} (μg/kg)	Final indoor exposure soil conc., (μg/kg)
NA	NA	NA	4.16E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	1.2E-03

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Residential

Freon-113

Soil

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (μg/kg)	Chemical
76131	6.34E+03	1,1,2-Trichloro-1,2,2-trifluoroethane

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
				Totals must add up to value of L_t (cell G28)					
20	15	30.48	213.36	30.48	0	0	SC		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil Parameters					Lookup Soil Parameters					Lookup Soil Parameters				
SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	5

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based soil concentration.	

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
3.76E-02	8.59E-06	5.26E-01	25	6,463	320.70	487.30	1.11E+04	1.70E+02	0.0E+00	3.0E+01	L

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R ($\mu g/kg$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	15.48	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	4,000	6.34E+03	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	6,840	4.32E-01	1.80E+01	1.78E-04	9.70E-04	0.00E+00	0.00E+00	9.70E-04	15.48	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
2.23E+01	4.65E+06	0.10	8.33E+01	9.70E-04	4.00E+02	#NUM!	NA	NA	1.80E+00	1.82E-06	5.00E+07	YES

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.25E+02	NA	1.25E+02	NA	3.0E+01

END

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (μg/kg)	Indoor exposure soil conc., noncarcinogen (μg/kg)	Risk-based indoor exposure soil conc., (μg/kg)	Soil saturation conc., C_{sat} (μg/kg)	Final indoor exposure soil conc., (μg/kg)
NA	NA	NA	4.16E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	4.0E-03

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Non-Residential
Tetrachloroethene
Groundwater

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
127184	3.50E+02	Tetrachloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
20	15	213.56	213.56	0	0	A	SC	SC		

(Stratum A, B, C thicknesses: Totals must add up to value of L_{WT} (cell G28))

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
SC	1.63	0.385	0.197	SC	1.63	0.385	0.197	SC	1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	15036.8	4572	670.56	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based groundwater concentration.

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
5.00E-02	9.50E-06	1.77E-02	25	8,288	394.40	620.20	1.55E+02	2.06E+02	2.6E-07	4.0E-02

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
7.88E+08	198.56	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	30.00	0.385	0.030	0.355	39,218

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
3.20E+06	6.93E+07	5.66E-05	15	9,451	1.35E-02	5.61E-01	1.78E-04	1.29E-03	0.00E+00	0.00E+00	6.54E-06	4.21E-05	198.56

Convection path length, L_p (cm)	Source vapor conc., C_{source} (μg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m^3)	Unit risk factor, URF (μg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
15	1.96E+05	0.10	8.33E+01	1.29E-03	3.92E+03	2.77E+71	3.90E-06	7.66E-01	2.6E-07	4.0E-02

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	2.06E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
4.9E-08	1.3E-02

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Residential

Tetrachloroethene

Groundwater

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
127184	3.50E+02	Tetrachloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
			Totals must add up to value of L_{WT} (cell G28)							
20	15	213.56	213.56	0	0	A	SC	SC		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
SC	1.63	0.385	0.197	SC	1.63	0.385	0.197	SC	1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
5.00E-02	9.50E-06	1.77E-02	25	8,288	394.40	620.20	1.55E+02	2.06E+02	2.6E-07	4.0E-02

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	198.56	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	30.00	0.385	0.030	0.355	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	9,451	1.35E-02	5.61E-01	1.78E-04	1.29E-03	0.00E+00	0.00E+00	6.54E-06	4.21E-05	198.56

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.96E+05	0.10	8.33E+01	1.29E-03	4.00E+02	#NUM!	1.32E-05	2.60E+00	2.6E-07	4.0E-02

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	2.06E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
2.8E-07	6.2E-02

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Non-Residential
Tetrachloroethene
Soil

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
127184	3.00E+02	Tetrachloroethylene

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Totals must add up to value of L_t (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
20	15	60.96	152.4	60.96	0	0	SC		

MORE ↓

ENTER Stratum A SCS soil type Lookup Soil Parameters	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type Lookup Soil Parameters	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type Lookup Soil Parameters	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	15036.8	4572	670.56	0.1	0.25	5

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based soil concentration.

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
5.00E-02	9.50E-06	1.77E-02	25	8,288	394.40	620.20	1.55E+02	2.06E+02	2.6E-07	4.0E-02	L

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R ($\mu g/kg$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	45.96	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	39,218	3.00E+02	3.20E+06

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
6.93E+07	5.66E-05	15	9,451	1.35E-02	5.61E-01	1.78E-04	1.29E-03	0.00E+00	0.00E+00	1.29E-03	45.96	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
3.10E-01	3.39E+05	0.10	8.33E+01	1.29E-03	3.92E+03	2.77E+71	NA	NA	2.44E+01	4.24E-07	1.19E+08	YES

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.23E+00	NA	1.23E+00	2.6E-07	4.0E-02

END

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (μg/kg)	Indoor exposure soil conc., noncarcinogen (μg/kg)	Risk-based indoor exposure soil conc., (μg/kg)	Soil saturation conc., C_{sat} (μg/kg)	Final indoor exposure soil conc., (μg/kg)
NA	NA	NA	1.02E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
7.8E-08	2.1E-02

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Residential
Tetrachloroethene
Soil

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (μg/kg)	Chemical
127184	3.00E+02	Tetrachloroethylene

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)		ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
				Totals must add up to value of L_t (cell G28)				OR	
20	15	60.96	152.4	60.96	0	0	SC		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25		5

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based soil concentration.	

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
5.00E-02	9.50E-06	1.77E-02	25	8,288	394.40	620.20	1.55E+02	2.06E+02	2.6E-07	4.0E-02	L

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (μg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	45.96	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	4,000	3.00E+02	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	9,451	1.35E-02	5.61E-01	1.78E-04	1.29E-03	0.00E+00	0.00E+00	1.29E-03	45.96	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
3.10E-01	3.39E+05	0.10	8.33E+01	1.29E-03	4.00E+02	#NUM!	NA	NA	1.36E+00	4.24E-07	1.10E+07	YES

Finite source indoor attenuation coefficient, <α> (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	2.96E+00	NA	2.96E+00	2.6E-07	4.0E-02

END

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (μg/kg)	Indoor exposure soil conc., noncarcinogen (μg/kg)	Risk-based indoor exposure soil conc., (μg/kg)	Soil saturation conc., C_{sat} (μg/kg)	Final indoor exposure soil conc., (μg/kg)
NA	NA	NA	1.02E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
3.2E-07	7.1E-02

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Non-Residential
1,1,1-Trichloroethane
Groundwater

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
71556	2.10E+03	1,1,1-Trichloroethane

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
20	15	213.36	213.36	0	0	A	SC	SC		

Totals must add up to value of L_{WT} (cell G28) (applies to thickness of soil strata A, B and C)

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SC	1.63	0.385	0.197	SC	1.63	0.385	0.197	SC	1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	15036.8	4572	670.56	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based groundwater concentration.

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
6.48E-02	9.60E-06	1.72E-02	25	7,136	347.24	545.00	1.10E+02	1.29E+03	0.0E+00	5.0E+00

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
7.88E+08	198.36	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	30.00	0.385	0.030	0.355	39,218

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
3.20E+06	6.93E+07	5.66E-05	15	7,776	1.38E-02	5.72E-01	1.78E-04	1.67E-03	0.00E+00	0.00E+00	7.37E-06	4.76E-05	198.36

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.20E+06	0.10	8.33E+01	1.67E-03	3.92E+03	1.31E+55	4.33E-06	5.20E+00	NA	5.0E+00

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	1.29E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	7.1E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Residential

1,1,1-Trichloroethane

Groundwater

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
71556	2.10E+03	1,1,1-Trichloroethane

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (^{o}C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
20	15	213.36	213.36	0	0	A	SC	SC		

Thickness columns: Totals must add up to value of L_{WT} (cell G28)

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SC	1.63	0.385	0.197	SC	1.63	0.385	0.197	SC	1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1

Used to calculate risk-based groundwater concentration.

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
6.48E-02	9.60E-06	1.72E-02	25	7,136	347.24	545.00	1.10E+02	1.29E+03	0.0E+00	5.0E+00

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	198.36	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	30.00	0.385	0.030	0.355	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	7,776	1.38E-02	5.72E-01	1.78E-04	1.67E-03	0.00E+00	0.00E+00	7.37E-06	4.76E-05	198.36

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
15	1.20E+06	0.10	8.33E+01	1.67E-03	4.00E+02	#NUM!	1.50E-05	1.80E+01	NA	5.0E+00

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	1.29E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	3.4E-03

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Non-Residential
1,1,1-Trichloroethane
Soil

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (μg/kg)	Chemical
71556	1.20E+01	1,1,1-Trichloroethane

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Totals must add up to value of L_t (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
20	15	60.96	152.4	60.96	0	0	SC		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	15036.8	4572	670.56	0.1	0.25	5

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1
				Used to calculate risk-based soil concentration.	

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3$)$^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
6.48E-02	9.60E-06	1.72E-02	25	7,136	347.24	545.00	1.10E+02	1.29E+03	0.0E+00	5.0E+00	L

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R ($\mu g/kg$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	45.96	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	39,218	1.20E+01	3.20E+06

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
6.93E+07	5.66E-05	15	7,776	1.38E-02	5.72E-01	1.78E-04	1.67E-03	0.00E+00	0.00E+00	1.67E-03	45.96	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
2.20E-01	1.69E+04	0.10	8.33E+01	1.67E-03	3.92E+03	1.31E+55	NA	NA	3.13E+01	6.83E-07	9.41E+07	YES

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	4.91E-02	NA	4.91E-02	NA	5.0E+00

END

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (μg/kg)	Indoor exposure soil conc., noncarcinogen (μg/kg)	Risk-based indoor exposure soil conc., (μg/kg)	Soil saturation conc., C_{sat} (μg/kg)	Final indoor exposure soil conc., (μg/kg)
NA	NA	NA	5.25E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	6.7E-06

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Residential

1,1,1-Trichloroethane

Soil

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (μg/kg)	Chemical
71556	1.20E+01	1,1,1-Trichloroethane

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
				Totals must add up to value of L_t (cell G28)					
20	15	60.96	152.4	60.96	0	0	SC		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	5

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based soil concentration.	

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3$)$^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
6.48E-02	9.60E-06	1.72E-02	25	7,136	347.24	545.00	1.10E+02	1.29E+03	0.0E+00	5.0E+00	L

END

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R ($\mu g/kg$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	45.96	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	4,000	1.20E+01	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	7,776	1.38E-02	5.72E-01	1.78E-04	1.67E-03	0.00E+00	0.00E+00	1.67E-03	45.96	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
2.20E-01	1.69E+04	0.10	8.33E+01	1.67E-03	4.00E+02	#NUM!	NA	NA	1.46E+00	6.83E-07	7.16E+06	YES

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.18E-01	NA	1.18E-01	NA	5.0E+00

END

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (μg/kg)	Indoor exposure soil conc., noncarcinogen (μg/kg)	Risk-based indoor exposure soil conc., (μg/kg)	Soil saturation conc., C_{sat} (μg/kg)	Final indoor exposure soil conc., (μg/kg)
NA	NA	NA	5.25E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	2.3E-05

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Non-Residential
1,1-Dichloroethane
Groundwater

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
75343	2.80E+02	1,1-Dichloroethane

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
20	15	213.36	213.36	0	0	A	SC	SC		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SC	1.63	0.385	0.197	SC	1.63	0.385	0.197	SC	1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	15036.8	4572	670.56	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1
				Used to calculate risk-based groundwater concentration.	

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
8.36E-02	1.06E-05	5.62E-03	25	6,895	330.55	523.00	3.16E+01	5.04E+03	1.6E-06	0.0E+00

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
7.88E+08	198.36	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	30.00	0.385	0.030	0.355	39,218

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
3.20E+06	6.93E+07	5.66E-05	15	7,339	4.55E-03	1.89E-01	1.78E-04	2.16E-03	0.00E+00	0.00E+00	1.69E-05	1.07E-04	198.36

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
15	5.30E+04	0.10	8.33E+01	2.16E-03	3.92E+03	4.89E+42	8.06E-06	4.27E-01	1.6E-06	NA

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	5.04E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.7E-07	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Residential

1,1-Dichloroethane

Groundwater

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
75343	2.80E+02	1,1-Dichloroethane

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
20	15	213.36	213.36	0	0	A	SC	SC		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SC	1.63	0.385	0.197	SC	1.63	0.385	0.197	SC	1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
8.36E-02	1.06E-05	5.62E-03	25	6,895	330.55	523.00	3.16E+01	5.04E+03	1.6E-06	0.0E+00

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	198.36	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	30.00	0.385	0.030	0.355	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	7,339	4.55E-03	1.89E-01	1.78E-04	2.16E-03	0.00E+00	0.00E+00	1.69E-05	1.07E-04	198.36

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	5.30E+04	0.10	8.33E+01	2.16E-03	4.00E+02	#NUM!	3.35E-05	1.77E+00	1.6E-06	NA

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	5.04E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.2E-06	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Non-Residential
1,1-Dichloroethane
Soil

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (μg/kg)	Chemical
75343	7.90E+00	1,1-Dichloroethane

MORE ↓

ENTER Average soil temperature, T_S (^oC)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)		ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
				Totals must add up to value of L_t (cell G28)				OR	
20	15	60.96	152.4	60.96	0	0	SC		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	15036.8	4572	670.56	0.1	0.25		5

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1
				Used to calculate risk-based soil concentration.	

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
8.36E-02	1.06E-05	5.62E-03	25	6,895	330.55	523.00	3.16E+01	5.04E+03	1.6E-06	0.0E+00	L

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R ($\mu g/kg$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	45.96	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	39,218	7.90E+00	3.20E+06

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
6.93E+07	5.66E-05	15	7,339	4.55E-03	1.89E-01	1.78E-04	2.16E-03	0.00E+00	0.00E+00	2.16E-03	45.96	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
6.32E-02	7.26E+03	0.10	8.33E+01	2.16E-03	3.92E+03	4.89E+42	NA	NA	4.01E+01	5.77E-07	1.42E+08	YES

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	3.23E-02	NA	3.23E-02	1.6E-06	NA

END

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (μg/kg)	Indoor exposure soil conc., noncarcinogen (μg/kg)	Risk-based indoor exposure soil conc., (μg/kg)	Soil saturation conc., C_{sat} (μg/kg)	Final indoor exposure soil conc., (μg/kg)
NA	NA	NA	1.04E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.3E-08	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Residential
1,1-Dichloroethane
Soil

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (μg/kg)	Chemical
75343	7.90E+00	1,1-Dichloroethane

MORE ↓

ENTER Average soil temperature, T_S (^oC)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
				Totals must add up to value of L_t (cell G28)					
20	15	60.96	152.4	60.96	0	0	SC		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	5

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based soil concentration.	

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
8.36E-02	1.06E-05	5.62E-03	25	6,895	330.55	523.00	3.16E+01	5.04E+03	1.6E-06	0.0E+00	L

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R ($\mu g/kg$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	45.96	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	4,000	7.90E+00	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	7,339	4.55E-03	1.89E-01	1.78E-04	2.16E-03	0.00E+00	0.00E+00	2.16E-03	45.96	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
6.32E-02	7.26E+03	0.10	8.33E+01	2.16E-03	4.00E+02	#NUM!	NA	NA	1.60E+00	5.77E-07	8.94E+06	YES

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	7.79E-02	NA	7.79E-02	1.6E-06	NA

END

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (μg/kg)	Indoor exposure soil conc., noncarcinogen (μg/kg)	Risk-based indoor exposure soil conc., (μg/kg)	Soil saturation conc., C_{sat} (μg/kg)	Final indoor exposure soil conc., (μg/kg)
NA	NA	NA	1.04E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
5.1E-08	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Non-Residential
1,1-Dichloroethylene
Groundwater

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
75354	2.90E+02	1,1-Dichloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (^{o}C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
20	15	213.36	213.36	0	0	A	SC	SC		

MORE ↓

ENTER Stratum A SCS soil type Lookup Soil Parameters	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type Lookup Soil Parameters	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type Lookup Soil Parameters	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SC	1.63	0.385	0.197	SC	1.63	0.385	0.197	SC	1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	15036.8	4572	670.56	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1
				Used to calculate risk-based groundwater concentration.	

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
8.63E-02	1.10E-05	2.61E-02	25	6,247	304.75	576.05	5.89E+01	2.42E+03	0.0E+00	2.0E-01

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
7.88E+08	198.36	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	30.00	0.385	0.030	0.355	39,218

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
3.20E+06	6.93E+07	5.66E-05	15	6,326	2.18E-02	9.04E-01	1.78E-04	2.23E-03	0.00E+00	0.00E+00	7.63E-06	4.95E-05	198.36

Convection path length, L_p (cm)	Source vapor conc., C_{source} (μg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m^3)	Unit risk factor, URF (μg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
15	2.62E+05	0.10	8.33E+01	2.23E-03	3.92E+03	2.48E+41	4.48E-06	1.17E+00	NA	2.0E-01

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	2.42E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	4.0E-03

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Residential
1,1-Dichloroethylene
Groundwater

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
75354	2.90E+02	1,1-Dichloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
20	15	213.36	213.36	0	0	A	SC	SC		

Totals must add up to value of L_{WT} (cell G28) [applies to thickness of soil strata A, B, C]

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
SC	1.63	0.385	0.197	SC	1.63	0.385	0.197	SC	1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1

Used to calculate risk-based groundwater concentration. [applies to TR and THQ]

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
8.63E-02	1.10E-05	2.61E-02	25	6,247	304.75	576.05	5.89E+01	2.42E+03	0.0E+00	2.0E-01

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	198.36	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	30.00	0.385	0.030	0.355	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	6,326	2.18E-02	9.04E-01	1.78E-04	2.23E-03	0.00E+00	0.00E+00	7.63E-06	4.95E-05	198.36

Convection path length, L_p (cm)	Source vapor conc., C_{source} (μg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m^3)	Unit risk factor, URF (μg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
15	2.62E+05	0.10	8.33E+01	2.23E-03	4.00E+02	#NUM!	1.56E-05	4.08E+00	NA	2.0E-01

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	2.42E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	2.0E-02

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Non-Residential
1,1-Dichloroethylene
Soil

DATA ENTRY SHEET

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (μg/kg)	Chemical
75354	8.00E+01	1,1-Dichloroethylene

MORE ↓

ENTER Average soil temperature, T_S (^oC)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
20	15	60.96	152.4	60.96	0	0	SC		

Totals must add up to value of L_t (cell G28)

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	15036.8	4572	670.56	0.1	0.25	5

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based soil concentration.

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
8.63E-02	1.10E-05	2.61E-02	25	6,247	304.75	576.05	5.89E+01	2.42E+03	0.0E+00	2.0E-01	L

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R ($\mu g/kg$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	45.96	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	39,218	8.00E+01	3.20E+06

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
6.93E+07	5.66E-05	15	6,326	2.18E-02	9.04E-01	1.78E-04	2.23E-03	0.00E+00	0.00E+00	2.23E-03	45.96	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
1.18E-01	2.11E+05	0.10	8.33E+01	2.23E-03	3.92E+03	2.48E+41	NA	NA	4.14E+01	1.71E-06	4.94E+07	YES

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	3.28E-01	NA	3.28E-01	NA	2.0E-01

END

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (μg/kg)	Indoor exposure soil conc., noncarcinogen (μg/kg)	Risk-based indoor exposure soil conc., (μg/kg)	Soil saturation conc., C_{sat} (μg/kg)	Final indoor exposure soil conc., (μg/kg)
NA	NA	NA	8.30E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	1.1E-03

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Residential
1,1-Dichloroethylene
Soil

DATA ENTRY SHEET

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (μg/kg)	Chemical
75354	8.00E+01	1,1-Dichloroethylene

MORE ↓

Totals must add up to value of L_t (cell G28)

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
20	15	60.96	152.4	60.96	0	0	SC		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	5

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1

Used to calculate risk-based soil concentration.

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
8.63E-02	1.10E-05	2.61E-02	25	6,247	304.75	576.05	5.89E+01	2.42E+03	0.0E+00	2.0E-01	L

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (μg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	45.96	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	4,000	8.00E+01	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	6,326	2.18E-02	9.04E-01	1.78E-04	2.23E-03	0.00E+00	0.00E+00	2.23E-03	45.96	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (μg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m^3)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
1.18E-01	2.11E+05	0.10	8.33E+01	2.23E-03	4.00E+02	#NUM!	NA	NA	1.62E+00	1.71E-06	3.04E+06	YES

Finite source indoor attenuation coefficient, <α> (unitless)	Mass limit bldg. conc., $C_{building}$ (μg/m^3)	Finite source bldg. conc., $C_{building}$ (μg/m^3)	Final finite source bldg. conc., $C_{building}$ (μg/m^3)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	7.88E-01	NA	7.88E-01	NA	2.0E-01

END

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (μg/kg)	Indoor exposure soil conc., noncarcinogen (μg/kg)	Risk-based indoor exposure soil conc., (μg/kg)	Soil saturation conc., C_{sat} (μg/kg)	Final indoor exposure soil conc., (μg/kg)
NA	NA	NA	8.30E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	3.8E-03

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Non-Residential
Acetone
Groundwater

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
67641	1.40E+02	Acetone

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
20	15	213.36	213.36	0	0	A	SC	SC		

Totals must add up to value of L_{WT} (cell G28) [applies to thickness of soil strata A, B and C]

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
SC	1.63	0.385	0.197	SC	1.63	0.385	0.197	SC	1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	15036.8	4572	670.56	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1

Used to calculate risk-based groundwater concentration. [applies to TR and THQ]

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
1.06E-01	1.15E-05	3.50E-05	25	6,955	329.20	508.10	5.75E-01	1.00E+06	0.0E+00	3.1E+01

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
7.88E+08	198.36	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	30.00	0.385	0.030	0.355	39,218

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
3.20E+06	6.93E+07	5.66E-05	15	7,435	2.83E-05	1.17E-03	1.78E-04	3.03E-03	0.00E+00	0.00E+00	2.10E-03	2.84E-03	198.36

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
15	1.64E+02	0.10	8.33E+01	3.03E-03	3.92E+03	2.81E+30	2.40E-05	3.95E-03	NA	3.1E+01

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	1.00E+09	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	8.7E-08

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

Residential

Acetone

Groundwater

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
67641	1.40E+02	Acetone

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (^{o}C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
20	15	213.36	213.36	0	0	A	SC	SC		

Totals must add up to value of L_{WT} (cell G28)

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SC	1.63	0.385	0.197	SC	1.63	0.385	0.197	SC	1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1

Used to calculate risk-based groundwater concentration.

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
1.06E-01	1.15E-05	3.50E-05	25	6,955	329.20	508.10	5.75E-01	1.00E+06	0.0E+00	3.1E+01

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	198.36	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	30.00	0.385	0.030	0.355	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	7,435	2.83E-05	1.17E-03	1.78E-04	3.03E-03	0.00E+00	0.00E+00	2.10E-03	2.84E-03	198.36

Convection path length, L_p (cm)	Source vapor conc., C_{source} (μg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m^3)	Unit risk factor, URF (μg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
15	1.64E+02	0.10	8.33E+01	3.03E-03	4.00E+02	3.39E+298	7.58E-04	1.25E-01	NA	3.1E+01

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	1.00E+09	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	3.9E-06

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

Non-Residential
Acetone
Soil

DATA ENTRY SHEET

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
67641	3.20E+02	Acetone

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Totals must add up to value of L_t (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
20	15	60.96	152.4	60.96	0	0	SC		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	15036.8	4572	670.56	0.1	0.25	5

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1
				Used to calculate risk-based soil concentration.	

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3$)$^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
1.06E-01	1.15E-05	3.50E-05	25	6,955	329.20	508.10	5.75E-01	1.00E+06	0.0E+00	3.1E+01	L

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (μg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	45.96	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	39,218	3.20E+02	3.20E+06

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
6.93E+07	5.66E-05	15	7,435	2.83E-05	1.17E-03	1.78E-04	3.03E-03	0.00E+00	0.00E+00	3.03E-03	45.96	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (μg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m^3)	Finite source β term (unitless)	Finite source ψ term (sec)$^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
1.15E-03	3.08E+03	0.10	8.33E+01	3.03E-03	3.92E+03	2.81E+30	NA	NA	5.59E+01	8.47E-09	1.34E+10	NO

Finite source indoor attenuation coefficient, <α> (unitless)	Mass limit bldg. conc., $C_{building}$ (μg/m^3)	Finite source bldg. conc., $C_{building}$ (μg/m^3)	Final finite source bldg. conc., $C_{building}$ (μg/m^3)	Unit risk factor, URF (μg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
2.55E-05	NA	7.86E-02	7.86E-02	NA	3.1E+01

END

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (μg/kg)	Indoor exposure soil conc., noncarcinogen (μg/kg)	Risk-based indoor exposure soil conc., (μg/kg)	Soil saturation conc., C_{sat} (μg/kg)	Final indoor exposure soil conc., (μg/kg)
NA	NA	NA	1.22E+08	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	1.7E-06

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based soil concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

Residential

Acetone

Soil

DATA ENTRY SHEET

SL-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (μg/kg)	Chemical
67641	3.20E+02	Acetone

MORE ↓

ENTER Average soil temperature, T_S (^oC)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)		ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
				Totals must add up to value of L_t (cell G28)				OR	
20	15	60.96	152.4	60.96	0	0	SC		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil Parameters					Lookup Soil Parameters					Lookup Soil Parameters				
SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002	SC	1.63	0.385	0.197	0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	5

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based soil concentration.	

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
1.06E-01	1.15E-05	3.50E-05	25	6,955	329.20	508.10	5.75E-01	1.00E+06	0.0E+00	3.1E+01	L

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (μg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	45.96	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	4,000	3.20E+02	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	7,435	2.83E-05	1.17E-03	1.78E-04	3.03E-03	0.00E+00	0.00E+00	3.03E-03	45.96	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
1.15E-03	3.08E+03	0.10	8.33E+01	3.03E-03	4.00E+02	3.39E+298	NA	NA	1.84E+00	8.47E-09	6.66E+08	YES

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	3.15E+00	NA	3.15E+00	NA	3.1E+01

END

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (μg/kg)	Indoor exposure soil conc., noncarcinogen (μg/kg)	Risk-based indoor exposure soil conc., (μg/kg)	Soil saturation conc., C_{sat} (μg/kg)	Final indoor exposure soil conc., (μg/kg)
NA	NA	NA	1.22E+08	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	9.8E-05

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based soil concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

Non-Residential

Freon-12

Groundwater

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
75718	6.80E+02	Dichlorodifluoromethane

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
			Totals must add up to value of L_{WT} (cell G28)							
20	15	213.36	213.36	0	0	A	SC	SC		

MORE ↓

ENTER Stratum A SCS soil type Lookup Soil Parameters	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	ENTER Stratum B SCS soil type Lookup Soil Parameters	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum C SCS soil type Lookup Soil Parameters	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
SC	1.63	0.385	0.197	SC	1.63	0.385	0.197	SC	1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	15036.8	4572	670.56	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1
				Used to calculate risk-based groundwater concentration.	

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
7.60E-02	1.08E-05	3.42E-01	25	9,421	243.20	384.95	4.57E+02	2.80E+02	0.0E+00	1.0E-01

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
7.88E+08	198.36	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	30.00	0.385	0.030	0.355	39,218

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
3.20E+06	6.93E+07	5.66E-05	15	8,087	2.71E-01	1.13E+01	1.78E-04	1.96E-03	0.00E+00	0.00E+00	4.63E-06	3.02E-05	198.36

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	7.66E+06	0.10	8.33E+01	1.96E-03	3.92E+03	1.00E+47	2.93E-06	2.25E+01	NA	1.0E-01

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	2.80E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	1.5E-01

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Residential
Freon-12
Groundwater

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
75718	6.80E+02	Dichlorodifluoromethane

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
20	15	213.36	213.36	0	0	A	SC	SC		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SC	1.63	0.385	0.197	SC	1.63	0.385	0.197	SC	1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3$)$^{-1}$	Reference conc., RfC (mg/m^3)
7.60E-02	1.08E-05	3.42E-01	25	9,421	243.20	384.95	4.57E+02	2.80E+02	0.0E+00	1.0E-01

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	198.36	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	30.00	0.385	0.030	0.355	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	8,087	2.71E-01	1.13E+01	1.78E-04	1.96E-03	0.00E+00	0.00E+00	4.63E-06	3.02E-05	198.36

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	7.66E+06	0.10	8.33E+01	1.96E-03	4.00E+02	#NUM!	9.52E-06	7.29E+01	NA	1.0E-01

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	2.80E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	7.0E-01

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Non-Residential
Isopropylbenzene
Groundwater

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
98828	4.60E+01	Cumene

MORE ↓

ENTER Average soil/groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
			Totals must add up to value of L_{WT} (cell G28)							
20	15	213.36	213.36	0	0	A	SC	SC		

MORE ↓

ENTER Stratum A SCS soil type Lookup Soil Parameters	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	ENTER Stratum B SCS soil type Lookup Soil Parameters	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum C SCS soil type Lookup Soil Parameters	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
SC	1.63	0.385	0.197	SC	1.63	0.385	0.197	SC	1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	15036.8	4572	670.56	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1
				Used to calculate risk-based groundwater concentration.	

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
6.03E-02	7.86E-06	1.15E-02	25	10,335	425.56	631.10	4.89E+02	6.13E+01	0.0E+00	4.0E-01

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
7.88E+08	198.36	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	30.00	0.385	0.030	0.355	39,218

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
3.20E+06	6.93E+07	5.66E-05	15	12,504	8.02E-03	3.34E-01	1.78E-04	1.56E-03	0.00E+00	0.00E+00	8.56E-06	5.49E-05	198.36

Convection path length, L_p (cm)	Source vapor conc., C_{source} (μg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m^3)	Unit risk factor, URF (μg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
15	1.53E+04	0.10	8.33E+01	1.56E-03	3.92E+03	1.70E+59	4.87E-06	7.47E-02	NA	4.0E-01

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	6.13E+04	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	1.3E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Residential

Isopropylbenzene

Groundwater

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
98828	4.60E+01	Cumene

MORE ↓

ENTER Average soil/groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
20	15	213.36	213.36	0	0	A	SC	SC		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SC	1.63	0.385	0.197	SC	1.63	0.385	0.197	SC	1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-05	1
				Used to calculate risk-based groundwater concentration.	

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3$)$^{-1}$	Reference conc., RfC (mg/m^3)
6.03E-02	7.86E-06	1.15E-02	25	10,335	425.56	631.10	4.89E+02	6.13E+01	0.0E+00	4.0E-01

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	198.36	0.188	0.188	0.188	0.299	1.77E-09	0.837	1.48E-09	30.00	0.385	0.030	0.355	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	12,504	8.02E-03	3.34E-01	1.78E-04	1.56E-03	0.00E+00	0.00E+00	8.56E-06	5.49E-05	198.36

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.53E+04	0.10	8.33E+01	1.56E-03	4.00E+02	#NUM!	1.72E-05	2.65E-01	NA	4.0E-01

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	6.13E+04	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	6.3E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END