COMPLIANCE STATUS REPORT
(REVISED MARCH 15, 2018) &
PROGRESS REPORT

FOUNTAIN OAKS SHOPPING CENTER

4920 Roswell Road, NE
Sandy Springs, Fulton County, Georgia 37347

HSI No. 10807

Prepared for:
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March 15, 2018

MEI Project No. 17675

Professional Certification

This report has been prepared by Marion Environmental Inc. under the supervision of the Professionals whose signatures appear hereon. The findings, recommendations, specifications, or professional opinions are presented within the limits prescribed by the client, after being prepared in accordance with generally accepted professional practice. No other warranty is expressed or implied.

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Georgia Professional Engineer #40859
Georgia Professional Geologist #1360

STATEMENT OF FINDINGS

The Fountain Oaks Shopping Center (FOSC), 4920 Roswell Road NE, Sandy Springs, Fulton County, Georgia (the subject site) is currently listed on the Georgia Hazardous Site Inventory (HSI) as HSI No. 10807. The Subject site and two associated properties currently are regulated under the auspices of the Georgia Voluntary Remediation Program (VRP). These three properties are:

1. Fountain Oaks Shopping Center (subject site), 4920 Roswell Rd NE, Sandy Springs, GA 30342 Fulton County Assessor Parcel No 17 009300061319.

2. 115 West Belle Isle Road (FOSC Outparcel), Sandy Springs, Georgia 30342 Fulton County Assessor Parcel No 17 009300021073.

3. Long Island Terrace property (undeveloped), Sandy Springs, Georgia 30342 Fulton County Assessor Parcel No 17 009300060881.

The extent of on-site and off-site soil, groundwater and soil vapor contaminants of concern (COC) impacts and potential exposure risks have been delineated to default risk reduction standards to the extent technically practicable in accordance with the VRP Act. These impacts and potential risks were examined over the course of multiple investigations conducted from 2005 to 2015 by Marion Environmental, Inc. (MEI) and others.

A soil remediation project conducted by others on the FOSC out-parcel in 2007-2008 removed all on-site soils exceeding approved Risk Reduction Standards (RRS). A vapor intrusion (VI) mitigation system was installed by others beneath the north tenant wing of the FOSC and operated for approximately two and a half years, from December 2008 to May 2011. Exposure risks associated with former on-site soil impacts were successfully mitigated.

The FOSC site was originally placed on the HSI because of soil contamination from a release of tetrachloroethene (PCE) and 14 associated contaminants of concern (COCs). As documented in multiple reports prepared by MEI and others, and summarized herein:

1. On the FOSC parcel:
    a. Soil is in compliance with Type 4 risk reduction standards (RRS).
    b. Groundwater is in compliance with Type 5 RRS onsite and Type 1 RRS at the plume's point of exposure (POE).
    c. Groundwater at the property meets the site-specific Type 5 RRS in accordance with the VRP Act (the Act) through the use of a UEC.
2. On the 115 West Belle Isle Road parcel (FOSC outparcel):
    a. Soil is in compliance with Type 4 RRS.
    b. Groundwater is in compliance with Type 5 RRS onsite and Type 1 RRS at the plume's POE.
    c. Groundwater at the property meets the site-specific RRS in accordance with the Act through the use of a UEC.
3. On the Long Island Terrace parcel (undeveloped property):
    a. Soil and groundwater are in compliance with Type 1/2 RRS.

The most recent, March 2015 groundwater analytical results indicated that COC concentrations exceeded commercial Type 3/Type 4 RRS at 14 on-site monitoring wells. These COCs and 14 exceedance locations were:

- Benzene (MWs-20, 21 & 28)
- cDCE (MWs-2, 4, 16, 20 & 28)
- PCE (MWs-2, 3, 5, 9, 13S, 14, 16, 20, 22, 23 & 28)
- TCE (MWS-2, 4, 6, 16, 20 & 28)
- VC (MWs-16 & 28)

Additionally, USEPA vapor intrusion screening level (VISL) calculations using maximum COC concentrations from the March 2015 groundwater sampling event, as presented in MEI's December 11, 2015 CSR & VRP Application and our May 31, 2017 Revised CSR, indicated the *potential* presence of VI risks. However, risk calculations completed with the online VISL calculator and site-specific assumptions indicate no unacceptable risk or hazards for commercial receptors potentially exposed via indoor air vapor emissions based on current site conditions. Further, VI modeling using the Johnson & Ettinger (J&E) model with maximum March 2015 concentrations support the conclusion that there is no vapor risk to indoor air based on current or projected future land use.

There are no *off-site* soil or groundwater impacts that are associated with the on-site release in excess of applicable Residential RRS (Type 1 or Type 2 RRS).

- No soil sample collected from any off-site monitoring well boring (MW-24, MW-25, MW-29, MW-30, MW-31 & MW-32) contained any COC in excess of applicable Residential RRS (Type 1 or Type 2).
- No groundwater sample collected from any off-site monitoring well contained any COCs in excess of applicable Residential RRS (Type 1 or Type 2).
- A surface water sample collected from the stream on the Long Island Terrace property on May 3, 2017 did not contain any detectible chlorinated VOCs.

The conceptual site model (CSM) of the FOSC subject location is of a site where:

- Release sources and substances released have been well defined.
- The lateral and vertical extent and magnitude of soil contamination on-site and potential exposure risks have been well defined through exhaustive subsurface investigations.
- Soil contamination on-site in excess of approved RRS has been removed.
- The lateral and vertical extent and magnitude of groundwater contamination on and off-site and associated exposure risks have been well defined.
- Groundwater flow and subsurface contaminant migration patterns in soil and groundwater are/were significantly affected by the pre-development topography.
- The groundwater contaminant plume, although in excess of RRS in several locations on site, is stable and rapidly attenuating.
- Groundwater fate & transport modeling has demonstrated that:
    - There was a *potential* risk of PCE from the on-site groundwater plume migrating to discharge into surface water at levels exceeding Georgia In Stream standards on the undeveloped Long Island Terrace property. However:
        - A surface water sample collected from the stream on the Long Island Terrace property on May 3, 2017 did not contain any chlorinated VOCs.

        - Hence, groundwater to surface water migration is an incomplete exposure pathway.
    - On-site groundwater RRS exceedances are not a significant health risk to hypothetical off-site residential receptors 1,000 ft downgradient.
    - The contaminant plume is stable, and is not anticipated to migrate downgradient beyond current dimensions.
- Regarding *potential* vapor intrusion (VI) risks:
    - Vapor intrusion (VI) impacts for existing on-site commercial worker receptors have been:
        - Assessed through soil vapor sampling, a soil vapor survey, indoor air sampling, VI modeling, and soil gas sampling; and
        - Mitigated through operation of an on-site VI mitigation system.
    - Modeling conducted by both MEI and Amec Foster Wheeler (AFW) using the VISL and Johnson & Ettinger (J&E) models, as well as site-specific data collected by others (including soil vapor and indoor air sampling) provide additional lines of evidence supporting the position that there is no vapor risk to indoor air based on current or likely future land use.
    - The VI assessments, mitigation measures, and modeling results described herein therefore support the conclusion that the site is compliant with vapor risk requirements under HSRA and the VRP for delisting.
- Potential dense non-aqueous phase liquid (DNAPL), i.e., "free product" was investigated and determined not to be present beneath the site.
- No off-site properties, including the Long Island Terrace property contain soil, groundwater, or vapor intrusion (VI) impacts in excess of RRS/risk-based levels.
    - The off-site Long Island Terrace property:
        - Has not had any soil contamination detected on the property in excess of applicable Residential RRS (Type 1 or Type 2).
        - Has not had any groundwater contamination detected on the property in excess of Residential RRS (Type 1 or Type 2).
        - Did not have any detectible surface water contamination in a May 3, 2017 stream sample.

The overall FOSC conceptual site model (CSM) is a site that has been thoroughly investigated, the potential human health and environmental risks have been evaluated and the site complies with applicable RRS for soil and groundwater. Groundwater contamination on-site is not a human health or environmental risk due to incomplete exposure pathways, and a plume that is rapidly attenuating.

There are no on-site exposure domains, due to the following:

- Although, groundwater COC concentrations exceed commercial Type 3/Type 4 RRS for the incomplete, but *potentially complete* groundwater ingestion pathway.
    - The FOSC site is a non-drinking water source.
    - The groundwater contaminant plume is naturally attenuating at a rapid rate.
    - An institutional control will be executed to address this potentially complete exposure pathway.
    - Groundwater fate & transport modeling suggests a potential risk of PCE impacts to off-site surface water in excess of Georgia In Stream Standards at the stream on the undeveloped Long Island Terrace property. However,

        - A surface water sample collected from the stream on the Long Island Terrace property on May 3, 2017 did not contain any detectible chlorinated VOCs.
- Potential VI exposure does not exceed commercial RRS.
    - Vapor intrusion (VI) impacts for on-site commercial worker receptors have been:
        - Assessed through soil vapor sampling, a soil vapor survey, indoor air sampling, VI modeling, and soil gas sampling; and
        - Mitigated through operation of an on-site VI mitigation system.
    - VISL modeling using site specific groundwater indicated that no unacceptable VI risk or hazard is present on site.
    - J&E modeling using site-specific data and maximum on-site groundwater contaminant concentrations support the conclusion that there is no unacceptable VI risk or hazards based on current or projected future land use.
    - The VI assessments, mitigation measures, and modeling results thus indicate that the site is compliant with vapor risk requirements under HSRA and the VRP for delisting.

There is no off-site exposure domain because:

- The FOSC site is a non-drinking water source.
- There are no off-site groundwater COC concentrations exceeding applicable RRS
- The groundwater contaminant plume is naturally attenuating at a rapid rate
- Fate & transport modeling suggests that the groundwater contaminant (PCE) migration to surface water on the Long Island Terrace property was a potential concern.
    - However, the surface water sample collected from the stream on May 3, 2017 shows that groundwater migration to surface water discharge is an incomplete exposure pathway.
- Groundwater fate & transport modeling demonstrates a lack of risk for off-site groundwater ingestion by hypothetical residential receptors 1,000 feet downgradient from the site.
- VI assessments and modeling results indicate that the site is compliant with vapor risk requirements under HSRA and the VRP for delisting.

No soil remediation, and thus no remediation plan, is necessary for on or off-site soil, because:

- No COCs in excess of applicable RRS have been detected in off-site soils.
- The extent of on-site contamination was exhaustively delineated
- On-site soil exceeding RRS was removed during the 2007-2008 soil remediation project
- Remaining in-situ concentrations of COCs in on-site soil below RRS have been exhaustively demonstrated through collection of excavation verification samples and samples from borings & monitoring wells installed on-site.

The excavation of approximately 3,831 tons of contaminated soil from the release source area and immediate downgradient area in 2007-2008 removed a significant secondary source of groundwater contamination via the soil-to-groundwater leaching pathway. As a result, groundwater COC concentrations in on-site release source and downgradient areas and have been rapidly attenuating as have associated exposure risk levels.

MEI requests closure of all downgradient and cross-gradient wells associated with the former on-site release, for the following reasons:

- The contaminated soil that would have acted as an ongoing secondary source of groundwater contamination (via soil to groundwater leaching) has been removed,
- The groundwater contaminant plume is rapidly attenuating, and
- There are no off-site, downgradient groundwater impacts in excess of applicable RRS.

Therefore, MEI requests abandonment of the following 13 wells.

1. MW-2
2. MW-4
3. MW-9
4. MW-17
5. MW-26
6. MW-27
7. MW-3
8. MW-13D
9. MW-13S
10. MW-29
11. MW-30
12. MW-31
13. MW-3

No expansion of existing facilities is planned for the immediate future. No engineering or institutional controls are necessary for mitigation of VI risks in existing or potential future buildings.

Institutional controls, including deed notices and restrictive covenants prohibiting groundwater use are proposed to help mitigate potential exposure risks from on-site groundwater exceeding applicable RRS.

A revised draft uniform environmental covenant (UEC) for the combined FOSC and 115 West Belle Isle Road property is included in this CSR. The specific language of this covenant includes groundwater use prohibitions.

The following four required generic milestones have either already been completed or should be considered to have been completed with the submittal of this updated CSR and Progress Report:

1. Horizontal delineation of the release and associated COCs on property accessible at the time of enrollment;
2. Horizontal delineation of the release and associated COCs on property inaccessible at the time of enrollment;
3. Update CSM to include vertical delineation, finalize the remediation plan and provide a preliminary cost estimate for implementation of remediation and associated continuing actions; and
4. Submit the compliance status report (CSR) required under the VRP, including requisite certifications.

The FOSC subject site, along with the two associated parcels, is eligible for de-listing from the HSI for the following reasons:

1. On the FOSC parcel:
    a. Soil is in compliance with Type 4 risk reduction standards (RRS).
    b. Groundwater is in compliance with Type 5 RRS onsite and Type 1 RRS at the plume’s point of exposure (POE).
    c. Groundwater at the property meets the site-specific RRS in accordance with the VRP Act (the Act) upon the execution of an UEC.

2. On the 115 West Belle Isle Road parcel (FOSC outparcel):
    a. Soil is in compliance with Type 4 RRS.
    b. Groundwater is in compliance with Type 5 RRS onsite and Type 1 RRS at the plume's POE.
    c. Groundwater at the property meets the site-specific RRS in accordance with the Act upon the execution of an UEC.
3. On the Long Island Terrace parcel (undeveloped property):
    a. Soil and groundwater are in compliance with Type 1/2 RRS.

Therefore, as documented herein, the Fountain Oaks Shopping Center site and two associated parcels are eligible for delisting.

CERTIFICATION OF COMPLIANCE

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, and my review of the findings of reports prepared by others on file at the Georgia Department of Natural Resources, Environmental Protection Division (EPD), Hazardous Site Response Program (HSRP), with respect to the risk reduction standards (RRSs) of the Rules for Hazardous Site Response, Rule 391-3-19-.07, I have determined the following:

1. Tax Parcel ID No. 17 009300061319 [Fountain Oaks Shopping Center (FOSC) Property] is in compliance with Type 4 risk reduction standards (RRS) for soil. Groundwater is in compliance with Type 5 RRS onsite and Type 1 RRS at the plume's point of exposure (POE). Groundwater at the property meets the site-specific RRS in accordance with the VRP Act (the Act) through the use of a UEC.

2. Tax Parcel ID No. 17 009300021073 [115 Bell Isle Road, FOSC Outparcel] is in compliance with Type 4 RRS for soil. Groundwater is in compliance with Type 5 RRS onsite and Type 1 RRS at the plume's POE. Groundwater at the property meets the site-specific RRS in accordance with the Act through the use of a UEC.

3. Tax Parcel ID No. 17 009300060881 [Long Island Terrace property, undeveloped], which is immediately downgradient (west) of the FOSC, is in compliance with Type 1/2 RRS for soil and groundwater.

[signature] George Bright for LIA

(Signature) (Typed Name)

Pres.

(Title)

Fletcher Bright Company
537 Market Street, Suite 400
Chattanooga, TN 37402
(423) 755-8830

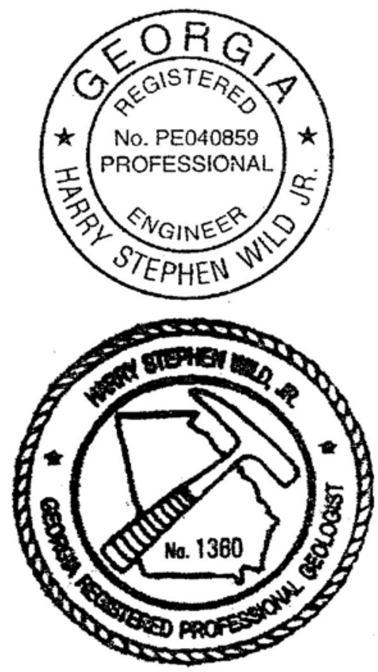
GROUNDWATER SCIENTIST STATEMENT

I certify that I am a qualified groundwater scientist who has a bachelors and masters degree in Geology as well as a bachelor's degree in Chemical Engineering. I have sufficient training and experience in groundwater hydrology and related fields (as demonstrated by state registration and completion of accredited university courses) that enables me to make sound professional judgments regarding groundwater monitoring as well as contaminant fate and transport. I further certify that this Compliance Status Report and Progress Report as well as accompanying documents for the Fountain Oaks Shopping Center at 4920 Roswell Road, and two associated properties in Sandy Springs, Fulton County, Georgia, except where noted otherwise, were prepared by me and appropriately qualified colleagues and subordinates working under my direction.

(Signature)

Steve Wild, P.E., P.G.
MARION ENVIRONMENTAL, INC.

Georgia Professional Engineer #40859
Georgia Professional Geologist #1360



Georgia Stamp or Seal

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LIST OF ACRONYMS AND ABBREVIATIONS

BGS	Below Ground Surface
COC	Chemical/Contaminant of Concern
cDCE	cis-1,2-dichloroethene
DC	Dry Cleaner
DCE	Dichloroethene
DNR	Georgia Department of Natural Resources
DP	Direct Push (i.e., “Geoprobe) borings
EPA	Environmental Protection Agency
EPD	[Georgia] Environmental Protection Division
ESA	Environmental Site Assessment
FOSC	Fountain Oaks Shopping Center
HSRA	[Georgia] Hazardous Site Response Act
HSRP	Hazardous Site Response Program
MEI	Marion Environmental, Incorporated
:g/kg	micrograms per kilogram (equivalent to ppb)
:g/L	micrograms per Liter (equivalent to ppb)
MCL	[Drinking Water] Maximum Contaminant Level
mg/kg	milligrams per kilogram (equivalent to ppm)
mg/L	milligrams per Liter (equivalent to ppm)
msl	mean sea level
MW	Monitor Well
NC	Notification Concentration
PCE	Tetrachloroethene (Perchloroethene)
POE	Point of Exposure
ppb	parts per billion
ppm	parts per million
RRS	Risk Reduction Standards
RRFM	Roswell Road Food Mart
TCE	Trichloroethene
tDCE	trans-1,2-dichloroethene
UC	United Consulting
USRIF	U.S. Retail Income Fund VIII-D
UST	Underground Storage Tank
VC	Vinyl Chloride
VI	Vapor Intrusion
VIA	Vapor Intrusion Assessment
VOC	Volatile Organic Compound
VRP	Voluntary Remediation Program

1.0 INTRODUCTION

The Fountain Oaks Shopping Center (FOSC), 4920 Roswell Road NE, Sandy Springs, Fulton County, Georgia (the subject site) site is currently listed on the Georgia Hazardous Site Inventory (HSI) as HSI No. 10807. Through participation in the Georgia Voluntary Remediation Program (VRP), the responsible party (responsible for on-site groundwater impacts and off-site impacts) and current property owners seek to have the three subject properties de-listed from the HSI.

1.1. Applicability and Site Qualifications

Long Island Associates (LIA) is a responsible party, as defined by the Georgia Hazardous Site Response Act (HSRA), for groundwater contamination beneath property located at 4920 Roswell Road in Sandy Springs, Fulton County, Georgia (the subject property). The subject property also includes two associated parcels, one located at 115 West Belle Isle Drive (0.25 acre) and an undeveloped parcel on Long Island Terrace (0.74 acre).

LIA previously submitted a VRP Application for the subject properties under the Georgia Voluntary Remediation Program Act (VRPA) pursuant to Official Code of Georgia Annotated (O.C.G.A.) § 12-8-100, et seq. The properties were accepted into the VRP on November 30, 2016.

According to O.C.G.A. § 12-8-105, in order to be considered a "qualifying property," a property must be listed on the Hazardous Site Inventory (HSI), meet the criteria of the Georgia Hazardous Site Reuse and Redevelopment Act ("the Brownfields Act"), or have a release of regulated substances to the environment. The subject property was first listed on the HSI on July 15, 2005 as the Fountain Oaks Shopping Center (FOSC), 4920 Roswell Road NE, HSI Site Number 10807.

An adjacent property at 4980 Roswell Road NE, occupied by Chastain Cleaners, was sub-listed as part of HSI 10807 on October 3, 2008. However, the Chastain Cleaners site was not included in the VRP application since it is an off-site dry cleaning solvent release source (as discussed subsequently in **Section 2.3** herein) whose release migrated onto the FOSC site.

Under O.C.G.A. § 12-8-105, in order to qualify for entry into the VRP, the property could not be subject to any of the following limitations:

1. It cannot be listed on the federal National Priorities List (“the NPL” or “Superfund” list).
2. It cannot be currently undergoing response activities required by an Order of the Regional Administration of the U.S. Environmental Protection Agency (EPA).
3. It shall not be a facility that is required to have a permit under the Georgia Hazardous Waste Management Act.
4. It shall not violate the terms and conditions under which the Georgia Environmental Protection Division (EPD) operates and administers remedial programs by delegation or similar authorization from the U.S. EPA.
5. It shall not have any lien filed under the Hazardous Waste Management Act or the Georgia Underground Storage Tank Management Act.

None of the limiting criteria listed in items 1 through 5 above apply to the subject properties. Therefore, the FOSC site is a “qualifying property” under the VRP.

According to O.C.G.A. § 12-8-106, the following criteria must be met in order for the Participant to meet the qualifications of the VRP:

1. The Participant must be the owner of the property or have express permission to enter another’s property to perform corrective action, including, to the extent applicable, implementing controls for the site pursuant to written lease, license, order, or indenture.
2. The Participant must not be in violation of any order, judgment, statute, rule, or regulation subject to the enforcement authority of the Director.
3. The Participant must meet other such criteria as may be established by the Georgia Department of Natural Resources (DNR) Board.

Since the Participant meets all of the criteria stated above, the Participant is qualified under the VRP. The owner of the property is as follows:

AMREIT Fountain Oaks LP
8 Greenway Plaza, Suite 1000
Houston, TX 77046
Telephone: (713) 850 1400

The Applicant requested entry into the VRP with the express consent of the current property owner, AMREIT Fountain Oaks, LP.

The three properties that were the subject of the VRP application were (**Figure 2 in Appendix A**):

1. Fountain Oaks Shopping Center (subject site)
   4920 Roswell Rd NE, Sandy Springs, GA 30342
   Fulton County Assessor Parcel No 17 009300061319. Area: 13.5 acres.

2. 115 West Belle Isle Road, Sandy Springs, Georgia 30342
   Fulton County Assessor Parcel No 17 009300021073. Area: 0.2571 acres.

3. Long Island Terrace property (undeveloped), Sandy Springs, Georgia 30342
   Fulton County Assessor Parcel No 17 009300060881. Area: 0.74 acres.

1.2. Site Location & Description

The VRP application was prepared to obtain entry into the Georgia VRP for the Fountain Oaks Shopping Center (FOSC) site, 4920 Roswell Road NE, Sandy Springs, Fulton County, Georgia (**Figures 1 & 2** in **Appendix A**). The FOSC site is Georgia Hazardous Site Index (HSI) Site Number 10807. Former dry cleaning (DC) operations at the FOSC resulted in the release of compounds to the environment that are regulated under the Georgia Hazardous Site Response Act.

Additionally, two off-site, upgradient sources have released regulated constituents into groundwater that has migrated onto the FOSC site. Chlorinated solvent constituents have been identified in groundwater on the Chastain Cleaners property, located northeast of the site, directly across W. Belle Isle Road. Gasoline constituents have been identified in groundwater on the Roswell Road Food Mart property, located adjacent to the northeast corner of the site. Similar constituents have been detected in groundwater on the FOSC subject site immediately downgradient of these off-site sources. Refer to **Section 2.3** for further discussion.

The FOSC site encompasses approximately 13.5 acres and contains a retail shopping center with a Kroger grocery store as well as service and retail shops (**Figure 2**). Three buildings are located on the FOSC subject property. The largest of the buildings is located on the western half of the property, and consists of three contiguous structures; a north wing and south wing separated by a Kroger grocery store. Both the north and south wings of that building contain multiple commercial, retail, and professional tenant spaces.

The north wing contains five tenant spaces. The south wing is a two-story structure comprised of multiple tenant spaces. The next smaller building on the property is also a two-story, multiple-tenant structure located on the southern portion of the FOSC subject site. The third building on the property is a freestanding petroleum UST facility/fuel station located centrally on the easternmost side as shown on **Figure 2 in Appendix A**.

2.0 PREVIOUS INVESTIGATIONS & REMEDIAL ACTIONS

2.1 Overview - Previous Investigations & Remedial Actions

Records obtained from the Georgia Department of Natural Resources, Environmental Protection Division (EPD) and other sources show that the site was developed into the current retail shopping center in 1987 by Long Island Associates, Ltd. Dry cleaning (DC) operations were conducted in the northernmost tenant bay under the business ownership of several different entities for approximately 20 years from November 1987 until approximately March 2007. LIA sold the FOSC to U.S. Retail Income Fund VIII-D (USRIF) in December 2003. Hence, DC operations were conducted on site during both LIA's and USRIF's ownership of the property.

Former on-site DC ownership details are documented in multiple reports on file with the EPD HSRP. Previous work conducted at the site includes soil and groundwater investigations, a soil remediation project, vapor intrusion assessments, a soil vapor survey, indoor air testing and groundwater monitoring. All of this work is detailed in documents previously submitted to and are on file with the EPD HSRP. All previous investigation & remediation work is briefly described herein, and is summarized in **Table 1** as follows, which includes the document, date and pages where the work is described in detail.

A release of chlorinated solvents and other chlorinated volatile organic compounds (CVOCs) associated with on-site DC operations was discovered in March 2005 during a Phase II Environmental Site Assessment conducted by Keramida Environmental, Inc. The presence of CVOC contamination in on-site soil was reported to EPD on May 31, 2005. The exact date of the release of the dry cleaning solvent tetrachloroethene (PCE, also known as perchloroethylene or “perc”) is unknown, but clearly occurred sometime between 1987 and 2005.

Following initial discovery of the release in March 2005, multiple soil and groundwater investigations were conducted between March 2005 and June 2007 by Keramida Environmental and United Consulting (UC). These investigations determined the extent of soil contamination on site in excess of calculated Risk Reduction Standards (RRS) and the magnitude of groundwater contamination in multiple locations on site.

The results of these 2005-2007 investigations indicated that there were three release sources for on-site soil and/or groundwater contamination from both DC solvents and petroleum hydrocarbons (see discussion in **Section 2.3**):

1. A former on-site DC tenant bay,
2. An off-site, upgradient DC operation (Chastain Cleaners), and
3. An off-site, upgradient petroleum underground storage tank (UST) facility, (CITGO/Roswell Road Food Mart).

The methods, results and conclusions of the previous investigations conducted by others are documented in multiple reports on file with the EPD HSRP, the most recent being MEI’s 2015 CSR & VRP Application. The list of COCs detected during these soil investigations is discussed in **Section 2.4** herein.

Following delineation of the lateral and vertical extent of on-site soil contamination in excess of RRS, a soil remediation project was conducted by USRIF between November 2007 and May 2008. That project resulted in the removal of 3,830.53 tons of impacted soil and the collection and analysis of 213 soil verification/confirmation samples, and 146 split verification/ confirmation samples.

TABLE 1 - Summary of Previous Investigation, Remediation, & Mitigation Activities

Investigation/ Report Date	Entity/Consultant/ Contractor Performing Investigation/Remediation	Investigation/Remediation Summary	Document on file at EPD where work described/documented, Document Date, Location within Document
1992	U.S. EPA	Emergency removal of abandoned drums. Drums not associated with on-site drycleaner. No soil or groundwater sampling conducted	UC PPCAP, 28-NOV-05, Page 4
29-Oct-03	National Assessment Corp.	Phase I ESA. No Phase II ESA recommended	UC PPCAP, 28-NOV-05, Page 4
14-Mar-05	Prof. Svc. Industries, Inc.	Phase I ESA. Phase II ESA recommended	UC PPCAP, 28-NOV-05, Pages 4-5
30-Mar-05	Keramida Environmental Inc. (Keramida)	Phase II ESA. Eleven borings installed inside & outside drycleaner bay. Soil contaminated with PCE at 0.014 to 34.8 ppm discovered	UC PPCAP, 28-NOV-05, Page 5
29-Apr-05	Keramida	Installation of 4 monitoring wells (MWs) (MW-1 to MW-4). Groundwater PCE, TCE and cDCE contamination discovered.	UC PPCAP, 28-NOV-05, Page 5
May-June 2005	United Consulting	PPCAP Investigation. Installation of 23 direct push (DP) soil borings and 3 monitoring wells (MWs) (MW-5 to MW-11). Collection of 59 soil and 7 groundwater samples.	UC PPCAP, 28-NOV-05, Page 5-9 & 38-42, Tables 1 & 2
21-Feb-08	United Consulting	Vapor Intrusion Assessment & Mitigation Design	UC VIA & Mitigation Design Rpt, 21-FEB-2008
Nov. 2006 - June 2007	United Consulting	PPCSR Investigation. Installation of 49 DP borings. Installation of 5 MWs (MW-8 to MW-12). Field screen soil every 2 ft. Analyze one soil sample per boring. Define areas where soil corrective action necessary.	UC PPCSR, 10-JUN-08, Pages 13-21, Tables 1 & 2
Nov. 2007 - May 2008	United Consulting/ Greenleaf Environmental	Soil remediation project. Removal of 3,830.53 tons of impacted soil. Collection & analysis of 213 soil verification/confirmation samples and 146 split verification/confirmation samples (by MEI).	UC PPCSR, 10-JUN-08, Pages 34-45, Tables 7 & 8
11-Dec-07	Marion Environmental Inc.	Preliminary Corrective Action Plan (PCAP). Proposed soil vapor survey of site to identify impacted areas. Groundwater investigation proposed to follow soil vapor survey. Calculation of Risk Reduction Standards (RRS) proposed.	MEI PCAP, 11-Dec-07
May 2008 - May 2009	Marion Environmental Inc.	PCAP/CSR GW Investigation. Installation of 22 MWs (MW-13S to MW-33). Define extent of groundwater contamination on and off-site. Confirm no off-site soil impacts.	MEI CSR, 14-JAN-10, Pages 26-51, Tables 1-4
25-Aug-08	Marion Env. Inc./Atlantic Environmental Inc.	Off-Site indoor residential air sampling. Sample results confirm no impacts to off-site indoor air quality.	MEI CSR, 14-JAN-10, Pages 59-61, Appendix G
Sep-08	Marion Environmental Inc./ W.L. Gore & Assoc.	Soil vapor survey. Survey indentifies three distinct commingled plumes originating from one on-site and two off-site release sources.	MEI CSR, 14-JAN-10, Pages 51-58, Appendix F
Dec-2008	United Consulting	Installation of vapor intrusion mitigation system (VIMS) incl: passive soil vapor barrier in former DC tenant bay, passive sub-slab depressurization system beneath former DC tenant bay, installation of eight north-south horizontal borings beneath entire northern wing of FOSC center manifolded to regenerative blower.	UC Vapor Mitigation System Implementation Rpt, 3-JUN-2009
May-2011	United Consulting	Shut down and abandon vapor intrustion mitigation system in accordance with VI mitigation, sampling and modeling showing no existing impacts or potential VI impacts in excess of 1E-05 carcinogenic or HQ=1 non-carcinogenic health effects.	UC Vapor System Sampling and Modeling for Closure Rpt, 25-FEB-2011. UC Vapor Intrusion Mitigation System (VIMS) Closure Report, 26-MAY-2011. EPD Approval Ltr 8-AUG-2011
Jun-2013	Property Solutions	Phase II ESA. Indoor air & soil gas sampling. Groundwater sampling.	3-JUN-13 Prop. Solutions Report (MEI CSR, 31-MAY-15, Appendix H)
Mar-2015	Marion Environmental Inc.	Groundwater sampling event. Site-wide comprehensive sampling all wells. Document significant natural attenuation of groundwater contamination. Updated RRS calculated.	MEI GW Monitoring Rpt., 14-MAY-15
Dec-2015	Marion Environmental Inc.	Compliance Status Report and application for entry into Voluntary Remediation Program.	MEI CSR & VRP Application, 11-DEC-15
May-2017	Marion Environmental Inc.	Compliance Status Report (Revised) and Progress Report	MEI CSR Rev. & Progress Report, 31-MAY-17

The results of the soil remediation and verification sampling indicated that all impacted soil in excess of calculated RRS was successfully removed from the site. This work is documented in UC's June 8, 2010 Prospective Purchaser Compliance Status Report (PPCSR). Maps based on the data in UC's PPCSR, showing soil excavation areas with associated soil verification sample analytical results for PCE, TCE and cDCE are provided as **Figures 12 - 23 in Appendix A**. The soil verification analytical results from the 2007-2008 soil remediation project are also tabulated in **Table 22 in Appendix B**. Comparisons of residual COC levels in off-site soil and on-site soil to applicable residential and commercial RRS are respectively presented in **Tables 14 and 15 in Appendix B.**

The potential presence of dense non-aqueous phase liquid (DNAPL) or "free product" was evaluated by UC using procedures in EPA guidance documents during investigatory phases of soil impact assessment and during excavation/verification sampling. Although PCE concentrations slightly exceeded 1 % of the solubility limit in some groundwater samples, other potential DNAPL indicators were not present. Therefore, based on the results of extensive testing and observations, DNAPL was not considered present in soil or groundwater.

Following the soil remediation project, UC installed a vapor intrusion mitigation system (VIMS) beneath the former DC tenant bay and the north tenant wing of the FOSC site. This system consisted of a passive vapor barrier and sub slab depressurization system installed beneath the former DC facility and an active vapor mitigation system was installed beneath the remaining units in the north FOSC wing. The VIMS was operated for approximately two and a half years, from December 2008 to May 2011.

EPD authorized shutdown of the VIMS system after soil gas sampling results and VI modeling results both indicated that there were no VI risks present in excess of target levels. The system was shut down, decommissioned and the shallow vapor monitoring wells abandoned in May 2011. This VI mitigation and monitoring work is documented in three reports prepared by UC:

- Vapor Intrusion Assessment and Mitigation Design Report (21-FEB-2008)
- Vapor Intrusion Mitigation System Implementation Report (3-JUN-2009), and
- Vapor System Sampling and Modeling for Closure Report (25-FEB-2011)

MEI initiated investigations of the full on- and off-site extent of groundwater contamination and the extent of off-site soil and groundwater contamination after completion of the soil remediation project. Twenty-three monitoring wells were installed on- and off-site between May 2008 and May 2009. Collection and analysis of soil and groundwater samples confirmed that the full extent, depth and magnitude of the groundwater contaminant plume were defined by these investigations. Soil analytical results from samples collected during the groundwater investigation confirmed that there are no off-site soil impacts associated with the former on-site DC release source. This work is documented in MEI's January 14, 2010 CSR, previously submitted to and on file with the HSRP.

The locations of groundwater monitoring wells installed by MEI are shown on **Figure 3 in Appendix A**. Groundwater analytical results showing only those compounds detected in groundwater during the most recent, March 2015 groundwater sampling event are tabulated in **Table 2 in Appendix B**. A discussion of COCs detected in groundwater during any previous sampling event in comparison to only those COCs detected during the most recent, March 2015 sampling event is contained in **Section 2.4** herein.

An investigation of nearby off-site, indoor residential air quality at 79 West Belle Isle Road, located immediately west of FOSC was conducted by Industrial Hygiene consultants Atlantic Environmental Inc. (AEI) in August 2008, under subcontract to MEI. The results of this study confirmed that there were no impacts to off-site indoor residential air quality associated with vapor intrusion of contaminants released from former on-site DC operations.

Since the 2008 indoor air sampling event, during which no DC vapors were detected, recent groundwater analytical results (March 2015) show that contaminant concentrations have declined in the nearest upgradient well (MW-13S) by an average of 93.6%. This remarkable reduction in upgradient groundwater contaminant concentrations is evidence of significantly reduced off-site vapor intrusion risk for the neighboring property. The 2008 indoor air sampling work is documented in AEI's report, included as Appendix G MEI's January 14, 2010 CSR.

A soil vapor survey on the northern portion of the FOSC site and adjacent off-site areas was conducted by MEI in September 2008. One hundred and twenty-four (124) W.L. Gore & Associates (now Amplified Geochemical Imaging LLC) Gore-Sorber® soil vapor absorption modules were deployed on the northern portion of the FOSC site. These modules were installed outside of structures at an approximate 50-foot-by-50-foot grid shown on the figures included within Gore's report to MEI, which is included as Appendix F of MEI's January 14, 2010 CSR.

The results of this soil vapor survey identified three distinct contaminant plumes commingled on the FOSC site. These three plumes originated from one on-site source (the former DC operations) and from two off-site sources (Chastain Cleaners and the CITGO/Roswell Road Food Mart ("CITGO/RRFM").

As stated previously, all of the above prior work detailed herein was described in MEI's January 14, 2010 CSR. On March 9, 2015, the EPD HSRP issued a review letter for the CSR.

The EPD noted in their March 9, 2015 letter that the CSR had certified that the site did not comply with Risk Reduction Standards (RRS) and that monitored natural attenuation (MNA) had been recommended by MEI as the groundwater remediation method. Further, the EPD directed LIA to perform the following activities:

1. Conduct a site-wide comprehensive groundwater monitoring event.
2. Construct specific geologic cross-sections.
3. Evaluate the vapor intrusion pathway using up-to-date groundwater analytical results.
4. Calculate updated Risk Reduction Standards (RRS) based on current toxicity values.

In response to the EPD's letter, MEI conducted a comprehensive groundwater monitoring event in March 2015. Groundwater samples were collected from all 29 existing wells and analyzed for VOC concentrations. The methods and results of this sampling event were documented in MEI's Groundwater Monitoring Report dated May 14, 2015, on file with the EPD HSRP.

Groundwater analytical results from the March 2015 sampling event show that 13 compounds were present in on-site groundwater, while five compounds were detected in off-site groundwater (**Table**

2). Comparison of the March 2015 groundwater sampling results with those of the previous 2008 or 2009 event at each well generally indicate significant reductions in PCE, TCE and cDCE across the site, with few exceptions. At 12 wells surrounding and downgradient from the former on-site drycleaner (MWs-2, 3, 4, 9, 13S, 14, 18, 19, 26, 27 and 30), PCE declined by an average of approximately 74%, TCE by approximately 49% and cDCE by approximately 19% between 2008/2009 and 2015.

Comparison of the March 2015 and previous groundwater analytical data showed clearly that COC concentrations in the on-site source area and downgradient areas declined sharply from 2008/2009 levels due to natural attenuation. Hence, there is ample evidence that removal of the secondary source material (the impacted soil) followed by rapid natural attenuation has proven to be an effective remedy for cleanup of groundwater impacted by former on-site DC operations.

Vapor intrusion screening for the groundwater volatilization to indoor air inhalation pathway for a commercial worker was performed utilizing the U.S. EPA Vapor Intrusion Screening Level (VISL – Version 3.3.1, updated May 2014) calculator. The VISL "Groundwater Concentration to Indoor Air Concentration" (GWC-IAC) calculator indicated that three compounds, PCE, TCE and benzene, were present in on-site groundwater at concentrations capable of exceeding indoor air inhalation targets.

The VISL calculator indicated that two compounds, TCE and benzene, potentially exceed the 1E-05 carcinogenic risk for commercial workers via the indoor air inhalation pathway. Similarly, the calculator suggested two compounds, PCE and TCE, potentially exceed the toxicity effects hazard quotient (HQ) of 1.0 for commercial workers. Hence the VISL-calculated target concentrations of PCE, TCE and benzene, the five locations at which these targets are exceeded, and the groundwater concentrations of these three VOCs are:

Compound	VISL Target Conc.	Exceedance Locations (MAR-2015 Concentration)		
PCE	240 µg/L	MW-2 (775 µg/L)	MW-22 (520 µg/L)	
TCE	22 µg/L	MW-2 (71.5 µg/L)	MW-4 (120 µg/L)	MW-16 (35 µg/L)
Benzene	69 µg/L	MW-28 (135 µg/L)		

The groundwater contamination exceeding the VISL groundwater target concentrations at monitoring wells MW-16, MW-22 and MW-28 was released from the off-site release sources, Chastain Cleaners and the CITGO/RRFM. Therefore, the release from the former on-site drycleaner appears only to have affected the VISL target exceedances at on-site source area wells MW-2 and MW-4. However, as discussed further in **Section 3.5** and documented in **Appendices E and G** herein, multiple lines of evidence including subsequent modeling using both the VISL and Johnson & Ettinger models support the conclusion that the vapor intrusion pathway does not pose a risk to current or future commercial receptors.

Updated groundwater Risk Reduction Standards (RRS) were calculated using current (May 2016 – current at the time of calculation) U.S. EPA toxicity values. These updated RRS values were submitted to EPD in MEI's May 31, 2017 Revised CSR and Progress Report. Email correspondence with indicates that EPD has approved the revised RRS in the May 31, 2017 report.

2.2 On-Site Petroleum UST Facility

An on-site petroleum UST facility containing three fiberglass double-walled tanks was installed at the FOSC in November 2005. This on-site UST facility is not the source of petroleum-contaminated groundwater on the FOSC site as evidenced by the following:

- There are no records of a release from this facility (Facility ID No. 10001030) in Georgia EPD, UST Management Program (USTMP) records.
- There is an USTMP record of a confirmed release from the Roswell Road Food Mart (CITGO/RRFM), 4968 Roswell Rd, Facility ID No. 9000005, on May 2, 1989, as well as USTMP records of multiple "suspected releases" on the following dates:
  - 09/24/1997
  - 05/13/1998
  - 06/05/1998
  - 07/13/1999
  - 04/16/2001
  - 05/14/2001
  - 02/26/2002
  - 10/26/2011
- The most recent investigation at the CITGO/RRFM in 1997 confirmed the presence of the petroleum VOCs benzene, toluene, ethylbenzene and xylenes (BTEX) in groundwater on the property (see discussion in **Section 2.3**).

- Groundwater contamination from benzene and methyl tert-butyl ether (MTBE) was detected in samples collected from MW-5, downgradient from the CITGO/RRFM, in April and June 2005, prior to installation of the on-site UST facility in November 2005.
- MTBE is associated with the on-site groundwater petroleum contamination (**Table 2**)
  - MTBE is an oxygenate (oxygen-containing compound) used in U.S. gasoline at low levels as an octane enhancer since 1979, and at higher levels in 1992-2005 to fulfill oxygenate requirements for reformulated gasoline (RFG) set by Congress in the 1990 Clean Air Act Amendments.
  - According to EPA data, MTBE has not been used in significant quantities in RFG (non-compliance) areas since 2005. A similar decrease in MTBE use was also observed in conventional gasoline areas (Kinner, 2001) and (http://archive.epa.gov/mtbe/web/html/faq.html).
  - Therefore it is unlikely that gasoline stored in the modern USTs installed in November 2005 at the on-site fuel station ever contained MTBE.
  - MTBE is very soluble in groundwater (approximately 50,000 mg/L); approximately 30 times more soluble, and significantly less volatile, than are the petroleum hydrocarbon constituents of gasoline.
  - MTBE does not readily sorb to soil, rock surfaces, or organic carbon in soil because of its high solubility. In contrast, the BTEX compounds (benzene, toluene, ethylbenzene, xylenes) are retarded relative to groundwater velocity because they sorb to soil/rock surfaces and organic carbon in soil. Hence, MTBE moves faster and further in groundwater than the BTEX compounds.
  - Because of its high solubility and lack of retardation, MTBE tends to form a "halo" of groundwater contamination along the leading edge of a gasoline contaminant plume, where the released fuel contained MTBE. This is exactly the situation in the petroleum contaminant plume at FOSC (see Figure 21 in MEI's 2015 CSR & **Table 2** herein).
- Groundwater contaminated with benzene and MTBE is present at wells MW-5, MW-20 and MW-21, hydraulically *upgradient* from the on-site Kroger fuel station. The March 12, 2015 sample from MW-21, approximately 100 feet upgradient from the on-site fuel station, contained 2,500 µg/L of MTBE.

- The 2008 soil vapor survey map for BTEX indicates an area of concentrated BTEX vapor (a vapor "hot spot") north of, and hydraulically upgradient from the on-site fuel station.

Hence, the on-site Kroger fuel station is not the source of petroleum hydrocarbons detected in on-site groundwater. The petroleum release source is clearly the off-site CITGO/RRFM facility.

2.3 Source Area Summary

There are three release source areas associated with soil and/or groundwater contamination on the FOSC site: one on-site source, and two off-site sources. These three release sources are:

On-Site Source: Former Dry Cleaning Operation
Fountain Oaks Shopping Center
4920 Roswell Road NE, Sandy Springs, GA 30342
Parcel ID No. 17 00930006131
HSI Site No. 10807

Property Owner Information:
AMREIT Fountain Oaks LP
8 Greenway Plaza, Suite 1000, Houston, TX 77046

Off-Site Source: Active Dry Cleaning Operation
Chastain Cleaners
4980 Roswell Road NE, Sandy Springs, Georgia 30342
Parcel ID No. 17 009300021826

Property Owner Information:
Give Us Inc
740 Woodscape Trail, Johns Creek, GA 30022
Roswell, Georgia 30022

Off-Site Source: Active Petroleum UST Facility
Roswell Road Food Mart
4968 Roswell Road NE, Sandy Springs, Georgia 30342
Parcel ID No. 17 -009300021842
UST Facility ID No. 09000005

Property Owner Information:
The Rock It Inc
P O Box 19695, Atlanta, GA 30325

Chastain Cleaners and Roswell Road Food Mart (RRFM) are both directly upgradient of the FOSC subject site, based on the directions of groundwater flow as shown on **Figure 4 in**

Appendix A. Groundwater contaminant plumes originating on each of these properties have migrated onto the FOSC subject site.

Chastain Cleaners is sub-listed on the HSI with FOSC as HSI No. 10807. The most recent investigation at Chastain Cleaners in 2009 confirmed chlorinated volatile organic compounds (CVOCS) in groundwater, including PCE, TCE, cDCE and VC. Based on groundwater flow directions, distances from impacted off-site wells to the former dry cleaners at FOSC, and the documented presence of CVOCs in groundwater on this upgradient property, CVOCs were released from the Chastain Cleaners property and migrated onto the FOSC subject site.

The Roswell Road Food Mart site (RRFM, formerly EZ Serve gas station) was granted "No Further Action" (NFA) status for a confirmed petroleum release by the Georgia EPD UST Management Program in 1998. The most recent investigation at RRFM in 1997 confirmed the presence of gasoline VOCs benzene, toluene, ethylbenzene and xylenes (BTEX) in groundwater on the property. Based on groundwater flow directions, the documented presence of petroleum compounds in groundwater on the upgradient RRFM parcel, and the lack of any documented release from the UST facility on the FOSC property (see **Section 2.2**), the release of BTEX that migrated onto the FOSC subject site originated on the RRFM property.

2.4 Chemicals/Contaminants of Concern

Multiple potential chemicals of concern (COC) have been detected during previous soil and groundwater investigations. The CSR prepared by MEI, dated January 14, 2010, presented the potential COCs detected in groundwater. The PPCAP prepared by UC dated November 28, 2005, also presented multiple potential COCs for soil. The combined list of potential COCs from these two documents include:

1. acetone
2. benzene
3. 2-butanone (aka methyl ethyl ketone, MEK)
4. n-butylbenzene
5. sec-butylbenzene
6. carbon disulfide (CD)
7. chlorobenzene

8. chloroform
9. cyclohexane
10. 1,2-dichloroethane (1,2-DCA)
11. cis-1,2-dichloroethene (cDCE)
12. diisopropyl ether
13. ethylbenzene
14. isopropylbenzene (cumene)
15. methyl cyclohexane
16. 4-methyl-2-pentanone (aka methyl isobutyl ketone, MIBK)
17. methyl-tertiary butyl ether (MTBE)
18. n-propylbenzene
19. tetrachloroethene (PCE)
20. toluene
21. trichloroethene (TCE)
22. 1,2,3-trimethylbenzene (1,2,3-TMB)
23. 1,2,4- trimethylbenzene (1,2,4-TMB)
24. 1,3,5- trimethylbenzene (1,3,5-TMB)
25. vinyl chloride (VC)
26. xylenes

One additional previously undetected PCE/TCE degradation daughter compound, trans-1,2-dichloroethene (tDCE), was reported to be present in on-site groundwater for the first time in March 2015 (**Table 2 in Appendix B**).

Of the 27 total *potential* COCs, the following nine compounds are not listed in EPD Rules, Chapter 391-3-19, Appendix I, *Regulated Substances and Soil Concentrations That Trigger Notification* and are therefore not regulated under the HSRP:

1. n-butylbenzene
2. sec-butylbenzene
3. diisopropyl ether
4. methyl cyclohexane
5. methyl-tertiary butyl ether (MTBE)

6. n-propylbenzene
7. 1,2,3-trimethylbenzene (1,2,3-TMB)
8. 1,2,4- trimethylbenzene (1,2,4-TMB)
9. 1,3,5- trimethylbenzene (1,3,5-TMB)

Chlorobenzene was only detected in two soil samples from a single location, directly beneath the former location of a DC machine in boring I-DP-2 at 1 foot (0.0065 mg/kg) and 9 feet (0.0078 mg/kg) below ground surface (BGS). The HSRP notification concentration (NC) for chlorobenzene is 4.18 mg/kg, while the final approved Type 3 RRS is 10 mg/kg. Soil was excavated to a depth of 13 to 16 feet BGS in this area. No soil verification sample from this area or any other soil or groundwater sample collected on site contained any chlorobenzene. Hence, chlorobenzene is not a COC.

Additionally, the following seven compounds were either only detected in groundwater at a single location during a single sampling event, or were not detected in groundwater during the most recent, March 2015 sampling event. Justification for elimination of these compounds from consideration as COCs is presented below. The seven compounds not detected in groundwater during the March 2015 groundwater sampling event that should be eliminated from consideration as COCs are:

1. 1,2-dichloroethane (1,2-DCA) (detected once at MW-28, 3 μg/L, 5/20/2009)
2. cyclohexane (detected once at MW-5, 12 μg/L, 4/20/2006)
3. ethylbenzene (last detected at MW-19, 1.4 μg/L, 5/21/2009)
4. methyl cyclohexane (only detected at MW-5, 6.5 μg/L, 4/20/06 & 6.7 μg/L, 11/1/06)
5. 4-methyl-2-pentanone (MIBK) (detected once at MW-25, 16 μg/L, 5/22/2009)
6. toluene (last detected at MW-19, 11 μg/L, 5/21/2009)
7. xylenes (last detected at MW-5, 20 μg/L, 5/20/2009 & MW-19, 24 μg/L, 5/21/2009)

Hence, for the purposes of this VRP application, the 10 COCs are:

1. acetone
2. benzene
3. chloroform

4. cis-1,2-dichloroethene (cDCE)
5. trans-1,2-dichloroethene (tDCE)
6. isopropylbenzene (cumene)
7. methyl ethyl ketone (MEK) or 2-butanone
8. tetrachloroethene (PCE)
9. trichloroethene (TCE)
10. vinyl chloride (VC)

2.5 Existing Regulatory Framework

The FOSC site is currently regulated by the Georgia Voluntary Remediation Program (VRP) as authorized by the Georgia Voluntary Remediation Program Act (VRPA) pursuant to Official Code of Georgia Annotated (O.C.G.A.) § 12-8-100, et seq.

As stated in **Section 2.1** previously, DC operations were conducted on site under the ownership of both the original developer of the property (LIA) and the subsequent purchaser (USRIF). The magnitude and extent of contamination documented during initial subsurface investigations in 2005 suggested groundwater contamination originated during LIA's ownership of the property. Since DC operations had continued under USRIF's subsequent ownership, on-going contributions to on-site soil contamination could not be ruled out.

Subsequently, investigation and remediation of groundwater contamination was delegated to the original developer of the property (LIA), while investigation and remediation of soil contamination and potential DNAPL impacts were delegated to the purchaser (USRIF). USRIF subsequently voluntarily investigated and remediated on-site soil impacts and investigated potential DNAPL. LIA was responsible for the investigation and remediation (if necessary) of on-site groundwater and off-site soil and groundwater impacts. Investigation and remediation of both soil and groundwater impacts on and off site were previously regulated under the HSRP.

Additionally, the property was granted a limitation of liability (LOL) by the EPD in a letter dated March 6, 2006 pursuant to the 2005 Amendment (Georgia Senate Bill 277) to O.C.G.A. Section §12-8-200 et seq. of the Hazardous Site Reuse and Redevelopment Act ("the Georgia

Brownfields Act”). EPD determined that the property owner at that time, U.S. Retail Income Fund VIII-D (USRIF), was eligible to receive a LOL for preexisting releases that occurred prior to December 31, 2003, subject to a number of specific conditions outlined in the approval letter. The Georgia Brownfield Program Summary Table (https://epd.georgia.gov/brownfield#links) shows that the FOSC site is on the list of Brownfield properties, with [soil] cleanup completed 18-JUL-08, with restricted, non-residential land use, and Type 3 and 4 RRS applicable.

2.6 Risk Reduction Standards

2.6.1 Soil Risk Reduction Standards

Soil Risk Reduction Standards (RRS) were calculated by UC on behalf of USRIF, the party voluntarily performing investigation and remediation of on-site soil contamination under the auspices of the Georgia Brownfields Program. Type 3 and 4 RRS were calculated for multiple COCs in soil and subsequently approved by EPD. Type 1, default RRS were reported to have been provided by the EPD in a letter dated May 10, 2007. Hence, Type 1 default, Type 3 and/or Type 4 RRS for on-site soil were calculated for following 14 compounds (UC PPCSR, 10-JUN-08, Table 5):

1. acetone
2. carbon disulfide (CD)
3. chlorobenzene
4. cumene (isopropylbenzene)
5. 1,1-dichloroethene (1,1-DCE)
6. cis-1,2-dichloroethene (cDCE)
7. trans-1,2-dichloroethene (tDCE)
8. ethylbenzene
9. 4-methyl-2-pentanone (methyl isobutyl ketone) (MIBK)
10. tetrachloroethene (PCE)
11. toluene
12. trichloroethene (TCE)
13. xylenes
14. vinyl chloride (VC)

Two additional, previously undetected compounds, benzene and 2-butanone (a.k.a., methyl ethyl ketone or “MEK”), were found to be present in on-site soil during MEI’s 2008-2009 subsurface investigations. Type 4 commercial RRS were calculated by MEI for these two compounds using USEPA Risk Assessment Guidance for Superfund (RAGS), Part B, Equation 6 (carcinogenic health effects) and Equation 7 (non-carcinogenic effects) (USEPA, 1991). As requested by EPD, MEI re-calculated soil volatilization factor (VF) inputs into RRS calculations using up to date, (May 2016) physical parameters from the US EPA Regional Screening Levels (RSLs) table, online at: https://www.epa.gov/sites/production/files/2016-06/documents/params_sl_table_01run_may2016.pdf. These soil VFs are tabulated in **Table 9 in Appendix B**.

Type 1 and 2 RRS for off-site residential soil calculated by MEI are summarized in **Table 12 in Appendix B**. A comparison of off-site soil COC concentrations to calculated residential Type 1 / Type 2 RRS is presented as **Table 14 in Appendix B.** Soil to groundwater leaching calculations used in determining the Type 2 residential RRS are included as **Tables C1 – C10 in Appendix C**.

Type 3 and 4 RRS for on-site commercial soil calculated by MEI are summarized in **Table 13 in Appendix B**. A comparison of off-site soil COC concentrations to calculated commercial Type 3 / Type 4 RRS is presented as **Table 15 in Appendix B.** Soil to groundwater leaching calculations used in determining the Type 4 commercial RRS are included as **Tables C11 – C20 in Appendix C**.

Comparison of both the previously approved and calculated RRS to soil verification sample analytical data collected during the 2007-2008 remediation project indicate that all impacted soil exceeding applicable RRS was successfully removed from the site (see **Figures 12-23 in Appendix A** and **Table 22 in Appendix B**). Analytical data from MEI’s 2008-2009 subsurface investigation confirmed that no COCs were present in on-site or off-site soil in excess of applicable RRS (see **Tables 14 and 15 in Appendix B**). A Certification of Compliance verifying the compliance of on-site soil with all applicable RRS is included on page ix of this CSR.

2.6.2 Groundwater Risk Reduction Standards

Groundwater RRS were calculated using May 2016 U.S. EPA toxicity values. Toxicity values were obtained from the U.S. EPA Regional Screening Level (RSL) calculator website. Additional guidance was obtained from the U.S. EPA Region 4 Human Health Risk Assessment Supplemental Guidance and from the Georgia EPD HSRP.

MEI calculated Type 2 RRS for off-site residential land use for both potential carcinogenic and non-carcinogenic effects and both resident adult and child receptors. Likewise, MEI calculated Type 4 RRS for on-site commercial land use for carcinogenic and non-carcinogenic effects for a commercial worker.

In accordance with EPD Rules, the highest of the Type 1 default RRS, or the calculated Type 2 RRS is the final RRS for the residential use scenario. Similarly, the higher of either the Type 3 default or calculated site-specific Type 4 RRS is the final RRS for commercial usage. EPD correspondence indicates that they are in concurrence with the RRS calculations in MEI's May 31, 2017 Revised CSR and Progress Report.

Comparison of the RRS values with March 2015 groundwater concentrations show off-site groundwater is within applicable Type 1/Type 2 RRS.

The results of the Type 3/Type 4 RRS evaluation indicated that five compounds were present in on-site groundwater in excess of the RRS for commercial use:

- benzene
- cis-1,2-dichloroethylene (cDCE)
- tetrachloroethene (PCE)
- trichloroethene (TCE)
- vinyl chloride (VC)

Groundwater isoconcentration contour/plume delineation maps for these five COCs subject to Type 5 RRS are presented as **Figures 7-11 in Appendix A**. **However, as stated in the**

Statement of Findings and Certificate of Compliance herein, groundwater on site is in compliance with site-specific Type 5 RRS through the use of an institutional control, upon execution of the UEC for the FOSC and 115 West Belle Isle properties..

3.0 CONCEPTUAL SITE MODEL (CSM)

3.1 Conceptual Site Model - Overview

The overall conceptual site model (CSM) of the FOSC subject location is of a site where:

- The release sources, one on-site and two off-site, and substances released into the environment on and surrounding the FOSC site have been well defined.
- The lateral and vertical extent and magnitude of soil contamination on-site and potential human health risks associated with the former DC operation were well defined through a series of exhaustive subsurface investigations.
- Soil contamination on-site in excess of applicable RRS was successfully removed via a 2007-2008 soil remediation/excavation project.
- The lateral and vertical extent and magnitude of groundwater contamination on and off-site, and associated human health risks, were defined through during a thorough 2008-2009 investigation.
- Groundwater flow, and subsurface contaminant migration patterns in soil and groundwater, are/were significantly affected by the pre-development topography.
- The groundwater contaminant plume is stable and naturally attenuating at a rapid rate due to removal of the contaminated source area soils/secondary source material.
- Groundwater on site is in compliance with site-specific Type 5 RRS.
- Potential vapor intrusion (VI) impacts for both on-site commercial receptors and off-site residential receptors:
    - Have been assessed through soil vapor sampling, a soil vapor survey, indoor air sampling, and VI modeling.
    - Have been mitigated through operation of an on-site VI mitigation system.
- Potential on-site VI impacts/residual soil gas COC concentrations are currently well below applicable risk-based levels.

  - Detections of constituents in six indoor air samples taken in 2013 did not exceed applicable standards in the EPA OSWER Vapor Intrusion Screening Level (VISL) Calculator using a Target Risk Concentration of 1.00E-05.
  - VI modeling with the Johnson & Ettinger model indicate that even under a hypothetical worst-case scenario using maximum on-site contaminant concentrations, total potential VI risk is well below the target levels of 1E-05 and HQ of 1.0 (refer to **Section 3.5** herein).
- The potential presence of DNAPL was investigated. DNAPL was determined not to be present on or beneath the site.
- There are no soil, groundwater, or vapor intrusion (VI) impacts in excess of RRS/risk-based levels on off-site properties.

Hence, the overall CSM of the FOSC site is of a site that:

- Has been thoroughly investigated,
- The potential human health and environmental risks evaluated, and
- Complies with applicable RRS for soil, groundwater and vapor intrusion.

Detailed descriptions of the individual components of the CSM outlined above are presented in the following sections of this document.

3.2 Geologic and Hydrogeologic Setting

The FOSC site is located within the Piedmont Physiographic Province of Georgia, which is composed of hard igneous and metamorphic rocks derived from the recrystallization of ancient (300 to 600 million year old) sediments. In this type of geologic setting, the direction of groundwater flow is anticipated generally to conform to topographic slope or to that of nearby surface water. The water table is generally 30 to 100 feet below the ground surface on hilltops and hillsides, but is at or near the ground surface in stream valleys and draws.

Data obtained at the FOSC site are demonstrative of this regional groundwater flow system. The groundwater is flowing principally in the soil above bedrock and to a lesser degree through the bedrock system. In some areas, the rock surface extends above the groundwater table.

3.2.1 Topography and Drainage

The surface relief of the Piedmont is characterized by relatively low, rolling hills with heights above sea level between 200 feet (50 m) and 800 to 1,000 feet (250 m to 300 m). Based on the U.S. Geological Survey (USGS) 7.5-minute Sandy Springs, Georgia topographic quadrangle map (1955, photo-revised 1983) pre-development elevations at the FOSC site ranged from approximately 1,010 ft msl to approximately 1,030 ft msl. The elevations on and immediately surrounding the FOSC site range from approximately 960 to 990 ft msl, as determined by surveyed surface elevations at each of the 22 monitor wells installed by MEI in 2008-2009,

A historic topographic map, dated 1928 (**Figure 5**), shows the FOSC site in an area of gently rolling hills with elevations of approximately 990 feet above mean sea level (ft msl) to 1,040 ft msl. Two small valleys traversed the FOSC site in a general northeast to southwest orientation. One valley small was located on the northern portion of the site, originating in the approximate area of the off-site Chastain Cleaners facility and traversing the site to the southwest, beneath the location of the former on-site DC tenant bay.

The second small valley was shown on the southern portion of the FOSC site. The two previously existing small valleys were apparently filled for the construction of the FOSC development. The unfilled remnants of these two small valleys are still present west and southwest of the FOSC site, as shown on the 2014 USGS Sandy Springs topographic map (**Figure 5**).

The 2014 USGS topographic map (**Figure 1**) shows the eastern portion of the site sloping westward, and then leveling to the west. Surface water flow at the FOSC site and immediate vicinity generally flows west and southwest.

3.2.2 Geology - Soil/Unconsolidated Residuum

Soil samples collected and logged during the multiple subsurface investigations performed at the site indicate that there is approximately 1-22 feet of fill material overlaying residual native soils on site. The fill soils generally consisted of silts with varying amounts of clay, fine sand, mica, weathered mica schist (saprolite), and less-weathered rock fragments.

Residual soil/unconsolidated residuum was encountered below the fill materials, above competent bedrock. The residual soils were generally classified as silts and fine sand with varying amounts of clay, mica, and weathered rock fragments.

As noted previously, fill materials are present near land surface across the majority of the FOSC site with thicknesses ranging from approximately one to twenty-two feet. The in-filling of the site is suggested by the presence of two small valleys shown on 1927-1930 topographic maps geo-referenced to current Atlanta-area street maps, with the approximately boundary of the FOSC site and structures overlain (**Figure 5**) (http://disc.library.emory.edu/atlantamaps/atlanta-1927-30-topographic-maps-with-open-street-map-overlay/) . Hence, consistent with the previously existing topography, fill thickness generally thickens from east to west

3.2.3 Bedrock Geology

As stated herein in **Section 3.2.3**, according to the Georgia Geological Survey publication "Geology of the Greater Atlanta Area" (Bulletin 96, 1984), the rocks underlying the FOSC site are undifferentiated, ductally sheared rocks of the Brevard fault zone. According to the Georgia Geological Survey publication "Geologic Map of Georgia" (1979, Atlanta Area, North 4 East 2) rocks beneath the site are "button mica schist," a type of high-grade metamorphic rock.

The mica schist rock type mapped by the Georgia Geological Survey was confirmed to be present beneath the FOSC site during rock drilling conducted by MEI in 2008 to 2009, as shown in MEI's January 14, 2010 CSR. Further, the mica schist beneath the site was found to be interfingered with more highly metamorphosed gneiss and amphibolite. Depth to competent bedrock at the FOSC site varies from approximately 40 to 65 feet below surface grade (BGS).

3.3 CSM - Soil/Residuum

As noted previously, there is approximately 1-22 feet of fill material overlaying residual native soils on site. The in-filling of two small valleys formerly at the FOSC was necessary to level and develop the site into its current, relatively level configuration. The original, pre-development topographic surface has played a significant role in the migration of contaminants released from the former on-site DC source and the two off-site sources. The original topography of the site is shown on a 1927-1930 topographic map with the approximate boundary of the FOSC site and associated structures overlain (**Figure 15**).

3.3.1 Delineation of COC Concentrations

The extent of on-site soil contamination was delineated through previous investigations conducted initially by Keramida Environmental and through subsequent exhaustive soil boring and sampling conducted by UC. During the course of these previous soil investigations, the following activities were performed to delineate the lateral and vertical extent of soil contamination on site:

1. Keramida (Phase II ESA, March 30, 2005) installation of 11 soil borings, including:
    a. Seven borings between 18 and 30 ft deep (four converted to monitoring wells).
    b. Four shallow borings within the former DC tenant bay.
    c. Collection and analysis of 18 soil samples for VOC concentrations.
    d. PCE present in 16 of 18 samples at 0.014 to 34.8 mg/kg.

2. UC (PPCAP, 28-NOV-05):
    a. Installation of 18 direct push borings.
    b. Installation of 8 groundwater monitoring wells.
    c. Collection and analysis of 63 soil samples for VOCs concentrations
    d. PCE present in 25 of 63 soil samples at concentrations up to 380 mg/kg
    .

3. UC extent of contamination investigation (PPCSR, 10-JUN-08):
    a. Installation of 49 direct push (DP) environmental assessment borings, (EAB-1 - EAB-49), to assess extent of PCE in soil for remedial actions.
    b. Installation of two hand-auger borings (HA-1 & HA-2) inside coin dealer & restaurant tenant spaces to assess the extent of PCE under these facilities for remedial actions;
    c. Collection and field screening of soil samples every two feet from DP borings.
    d. Selection of two to three soil samples from each DP & hand auger boring for analytical testing for PCE concentrations.
    e. PCE present in 97 of 106 samples collected.

f. PCE present in excess of NCs in 56 samples.
g. PCE present in excess of approved Type 4 RRS (1.18 mg/kg) in 35 samples.

Additionally, following the soil remediation project (**Sections 2.1 and 3.2.2**)**,** MEI installed 22 monitoring wells and 4 DP borings, and collected and analyzed 33 soil samples during our 2008-2009 PCAP/CSR investigation. Analysis of these soil samples indicated that on-site concentrations of PCE (the principle COC) ranged from below detection limits (BDL) to 300 micrograms per kilogram (µg/kg). Additionally, during MEI's 2008-2009 investigation, no soil sample collected from an off-site boring contained any COCs in excess of default, Type 1 RRS.

Hence, through the installation of approximately 106 borings and collection and analysis of approximately 220 soil samples, the extent of soil contamination on the FOSC site was well defined. Consequently, the potential human health risks associated with on-site soil contamination was well defined prior to initiation of the 2007-2008 soil remediation project. An isoconcentration contour map showing the delineated extent of PCE in soil was provided as Figure 4 in UC's 10-JUN-2008 PPCSR.

3.3.2 Soil Remediation

A soil remediation/excavation project was conducted in the area surrounding and within the former on-site DC tenant bay. Prior to excavating the contaminated soil, the lateral and vertical extent of impacts exceeding the Type 4 RRS for PCE, the principle COC, was defined through the installation of 49 environmental assessment borings and collection and analysis of 106 soil samples (see discussion in **Section 3.3.1**).

Prior to commencement of the corrective actions, PCE was the only constituent detected in soil above the Type 4 RRS. PCE was therefore the primary COC driving soil corrective action.

Remedial operations included excavation and disposal of impacted soils with COC concentrations exceeding the approved 1.18 mg/kg Type 4 RRS for PCE. Excavation began in November 2007 and concluded in May 2008.

Analytical testing of initial verification samples indicated the presence of COCs in approximately 1-5% of excavated areas at concentrations greater than the approved RRS. Re-excavation was then conducted in these areas with subsequent follow-up verification sampling. This process continued until the results of the verification sampling demonstrated that the soils remaining in place complied with the approved RRS.

During excavation of Areas 5 and 6 undercutting the adjacent tenant space restaurant, an approximate 3-foot diameter cylindrical excavation was observed directly below the spread footing for the south wall of the former DC facility. The origin of the cylindrical excavation was likely a former test boring for a caisson foundation. This cylindrical excavation/preferential pathway (Area EA 6A) was remediated by over drilling with a 6-foot diameter auger to a depth of 31 ft BGS, at which point competent rock was encountered.

Through the soil remediation process:

- Five stages of excavation, follow-up verification sampling and subsequent overexcavation were conducted at some locations.
- Approximately 3,830 tons of impacted soils were removed
- A preferential vertical pathway to groundwater was discovered directly beneath the former DC tenant bay.
- Collection and analysis of 213 soil verification samples indicated that all soil in excess of RRS was successfully removed.
- Collection and analysis of 146 split verification samples provided separate confirmation that all soil in excess of RRS was successfully removed.

The results of the soil remediation verification sampling therefore confirm successful removal of all impacted soil in excess of calculated RRS. This work is documented in UC's June 8, 2010 Prospective Purchaser Compliance Status Report (PPCSR). Maps based on the data in UC's PPCSR, showing soil excavation areas with associated soil verification analytical results for PCE, TCE and cDCE are provided as **Figures 12 - 23 in Appendix A**. These soil verification analytical results from the 2007-2008 soil remediation project are also tabulated in **Table 22 in**

Appendix B. As documented in **Table 22** and on **Figures 12-23,** all of the soil exceeding the EPD-approved RRS for PCE, TCE and cDCE was successfully removed.

Hence, the on-site soil portion of the CSM is of formerly contaminated soil that has been remediated and therefore does not pose a significant human health or environmental risk.

3.3.3 Magnitude and Extent of Remaining COC Concentrations

The results of soil verification sample analyses collected during the soil remediation project indicate that the following are the maximum concentrations of the principle COCs remaining in on-site soil:

Compound	Approx. Max. Residual	Type 4 RRS
• Benzene	0.016 mg/kg	53.1 mg/kg
• PCE	1.1 mg/kg	1.18 mg/kg
• TCE	0.18 mg/kg	0.7 mg/kg
• cDCE	0.2 mg/kg	1.84 mg/kg
• VC	Not Detected	0.2 mg/kg

These remaining COC concentrations in soil are all below applicable RRS.

3.4 CSM - Groundwater

3.4.1 Groundwater Flow Directions, Gradients and Velocity

Groundwater elevation data were used to construct potentiometric map for the FOSC site for the most recent, March 10, 2015 groundwater sampling event (**Figure 4 in Appendix A)**. Based on the potentiometric map included as **Figure 4**, groundwater flow on site is complex, with a groundwater flow divide. This groundwater divide and groundwater flow clearly mimics the pre-development topography at the site, as evidence by an overlay of the March 10, 2015 groundwater potentiometric surface with the 1928 topographic map of the site (**Figure 5**).

As shown on **Figure 4**, Groundwater flows toward the southwest to west-southwest on the northern portion of the property, including the on-site release source area. Groundwater beneath the southern portion of the property flows toward the south to south-southwest (**Figure 4**).

The groundwater hydraulic gradient in the source area generally varies from approximately 0.01 to 0.05 feet/foot (ft/ft), with an average of approximately 0.03 ft/ft. As shown on **Figure 4**, the direction of groundwater flow is generally from the north-northeast toward the south-southwest.

According to a previous hydrogeological assessment, described by UC in their November 28, 2005 PPCAP, the overall porosity of the residuum beneath the site is approximately 0.22, while the effective porosity is approximately 0.20. Additionally, the hydraulic conductivity of unconsolidated residuum beneath the site is reported to vary between approximately 2.29E-05 centimeters per second (cm/s) and approximately 2.64E-04 cm/s, with a geometric mean of approximately 7.78E-05 cm/s.

Groundwater flow velocity (Darcy velocity) was calculated using the site-specific data above and the Darcy Equation:

$$v = K * i / n$$

Where:

K = hydraulic conductivity = 7.78E-05 cm/s = 80.4 ft/yr

i = hydraulic gradient (dimensionless slope) ≈ 0.03 (average value)

n = porosity ≈ 0.2 (20% porosity) estimated for residuum.

Therefore,

v = (80.4 ft/yr)(0.03)/0.2

v = 12 ft/yr = approximate average groundwater flow velocity.

Hence, the average groundwater flow velocity is approximately 12 ft/yr, with a flow direction toward the west-southwest near the former on-site DC release source area, and a south-southwesterly flow direction beneath the southern portion of the site.

3.4.2 Water Resources

3.4.2.1 Drinking Water Supplies

The City of Atlanta's water supply and treatment system is owned and operated by the City of Atlanta Department of Watershed Management (DWM). The geographic area served by the City of Atlanta water treatment and distribution system covers an area greater than 650 square miles and includes the City of Sandy Springs (www.atlantaga.gov/modules/showdocument.aspx?documentid=2831). Additional public water supplies in the area are operated by the Dekalb County Department of Watershed Management (DWM) (http://dekalbwatershed.com/Chattahoochee.htm)

The intakes for these two municipal water supplies are located the following distances from the FOSC site:

- Atlanta DWM – Atlanta – Fulton County Water Treatment Plant 12.6 miles
- Atlanta DWM – Chattahoochee Water Treatment Plant 6.1 miles
- Atlanta DWM – Hemphill Water Treatment Plant 7.0 miles
- Dekalb County DWM – Chattahoochee Raw Water Transmission Main 6.9 miles

A search of U.S. Geological Survey records of wells in Georgia (http://waterdata.usgs.gov/ga/nwis/inventory) indicates that there are no water supply wells located within a two-mile radius of the FOSC site. Specifically, there are no records of any water supply wells within a four-mile-by-four-mile latitude and longitude defined "box" centered on the FOSC site. Hence, groundwater impacts on the FOSC site are not a potential threat to public or private water supplies.

3.4.2.2 Surface Water

The 2014 USGS Sandy Springs topographic quadrangle map (**Figure 1**) shows that the nearest downgradient surface water stream is an unnamed tributary to Nancy Creek located approximately 1,200 feet southwest of the on-site groundwater contaminant plume.

The 1928 USGS topographic map (**Figure 5**) shows two intermittent streams/drainage conveyances in the two pre-development valleys within the footprint of the FOSC site.

Subsequent USGS Sandy Springs quadrangle topographic maps from 1955, 1968, 1973 and 1983 do not indicate the presence of these streams within the two valleys. The FOSC site was originally developed in 1987, at which time the valleys were filled in, and the northernmost of the two intermittent streams / drainage conveyances shown on the 1928 topo map was apparently channelized into a culvert.

The culvert discharges on the undeveloped Long Island Terrace property, into a drainage conveyance near the base of the fill material, within the valley shown on the 1928 topographic map (**Figure 5**). The discharge location of the culvert is also shown on **Figures 2-11 in Appendix A.**

MEI collected a grab sample of the water exiting the culvert on May 3, 2017 as directed in EPD's Comment Letter of November 30, 2016, Item #6. This sample was collected in accordance with EPA Region 4 Science & Environmental Support Division (SESD) "Quality System & Technical Procedures" – "Surface Water Sampling" operating procedures. The sample was immediately placed on ice after collection and was shipped under chain of custody protocols to Environmental Science Laboratory in Mount Juliet, Tennessee. The sample was analyzed for VOCs concentrations by EPA Method 8260B.

The results of this analysis show that there were no chlorinated hydrocarbons or VOCs were present in the sample. Therefore, the surface water analytical results confirm that there is no evidence that the subsurface contaminant plume originating from the former onsite DC operation impacted the channelized surface water runoff within the culvert.

Since the downgradient extent of the groundwater contaminant plume has been defined, and the surface water sample did not indicate the presence of any chlorinated hydrocarbons, the FOSC site is not a potential threat to underlying conveyances or downgradient surface water bodies.

3.4.3 Groundwater Contaminant Plumes

3.4.3.1 Plume Delineation

The groundwater contaminant plume was delineated through the installation of 33 monitoring wells between 2005 and 2009 and through the collection and analysis of 163 groundwater samples from these wells between 2005 and 2015. The results of both the 2008/2009 and 2015 groundwater sampling events indicate that the lateral and vertical extent of groundwater contamination has been defined.

The results of the March 2015 groundwater sampling event indicate that there were 14 locations on site (listed below) where groundwater exceeded commercial Type 3/Type 4 RRS for one of five COCs (**Table 20 and Figure 7-11**). These COCs and locations were:

- Benzene (MWs-20, 21 & 28)
- cDCE (MWs-2, 4, 16, 20 & 28)
- PCE (MWs-2, 3, 5, 9, 13S, 14, 16, 20, 22, 23 & 28)
- TCE (MWS-2, 4, 6, 16, 20 & 28)
- VC (MWs-16 & 28)

However, groundwater on site is in compliance with site-specific Type 5 RRS through the use of institutional controls. Specifically, groundwater on site complies with the TYPE 5 RRS upon execution of an UEC for the FOSC and 115 West Belle Isle properties.

The March 2015 groundwater sampling results also indicate that there are no off-site groundwater COC concentrations in excess of applicable Type 1/Type 2 RRS (**Tables 2 & 18**). The 22 μg/L of PCE reported in March 2015 at monitoring well MW-13S, adjacent to the western property boundary, suggests the possibility that off-site groundwater may be impacted above the 19 μg/L Type 1/Type 2 residential RRS. However, at two wells located farther downgradient, MW-30 and MW-31, the March 2015 PCE concentrations were 10 μg/L and <1 μg/L (i.e., “BDL”) respectively. Hence the downgradient extent of the plume is defined west of and downgradient from the former on-site release source area.

A groundwater quality map showing analytical results of the March 2015 groundwater sampling event in comparison to previous (2008/2009) analytical results at each well is included as **Figure**

6. Groundwater isoconcentration contour/plume delineation maps for five COCs subject to the Type 5 RRS are presented as **Figures 7-11 in Appendix A**.

3.4.3.2 Qualifying Delineation Criteria

The Georgia VRP Act (O.C.G.A. §12-8-100 et seq.) defines five potential criteria that may be used as satisfactory evidence of the delineation of the horizontal and vertical extent of soil or groundwater contamination. These five criteria are (O.C.G.A. §12-8-108):

1. Concentrations from an appropriate number of samples that are representative of local ambient or anthropogenic background conditions not affected by the subject site release;
2. Soil concentrations less than those concentrations that require notification under standards (i.e., notification concentrations or “NCs”);
3. Two times the laboratory lower detection limit concentration using an applicable analytical test method recognized by the USEPA;
4. For metals in soils… [Not Applicable]
5. <u>Default, residential cleanup standards;</u>

The groundwater contaminant plume that originated from the former on-site DC source has been defined under criteria number 5 above. Specifically, COC levels are below default, Type 1 residential cleanup standards in the monitoring wells farthest downgradient to the south and southeast (MWs 7, 33 and 15), farthest downgradient to the west (within the in-filled topographic valley beneath the site) (MWs 30 & 31) and cross-gradient to the north (MW-25). Groundwater isoconcentration contour/plume delineation maps for five COCs (benzene, cDCE, PCE, TCE and VC) subject to the Type 5 RRS are presented as **Figures 7-11 in Appendix A**.

Collection of soil samples during multiple site investigations by MEI and others have defined the extent of soil contamination to within default, Type 1 RRS. Hence, the downgradient and cross-gradient extent of soil and groundwater contamination associated with the release from the former on-site DC operation have been delineated in accordance with applicable language in the authorizing statute. Delineation of the upgradient extent of groundwater contamination associated with the two off-site release sources, Chastain Cleaners and the CITGO/RRFM, are the responsibilities of the respective property owners and/or business operators at those two locations.

3.4.3.3 Plume Stability & Natural Attenuation

The groundwater contaminant plume associated with the former on-site DC release source is stable and naturally attenuating at a rapid rate. Comparison of the results of the most recent, March 2015 groundwater sampling event with those of the previous 2009 or 2008 event (the most recent previous event varies well to well) generally indicate significant and/or remarkable reductions in PCE, TCE and cDCE across the site, with few exceptions (**Figure 6**)

The rapid natural attenuation of groundwater contamination is illustrated on a groundwater quality map included as **Figure 6**, which shows the PCE, TCE, cDCE and VC results from the March 2015 sampling event, as well as the previous results from 2008 or 2009. As shown by the data on **Figure 6**, at 12 wells surrounding and downgradient from the former on-site drycleaner (MWs-2, 3, 4, 9, 13S, 14, 18, 19, 26, 27 and 30), PCE declined by an average of approximately 74%, TCE by approximately 49% and cDCE by approximately 19%.

These reductions in PCE, TCE and cDCE concentrations in the release source and downgradient areas show clearly that natural attenuation is occurring at a rapid pace. Remediation of the contaminated source area soils (secondary source material) has no doubt been an important contributing factor to the observed rapid natural attenuation of groundwater contamination.

Hence, the groundwater contaminant plume aspect of the CSM is of a delineated, stable plume that is rapidly attenuating.

3.4.4 Groundwater Fate & Transport/Natural Attenuation Modeling

3.4.4.1 Domenico Steady-State Fate & Transport / Natural Attenuation Model

The Domenico analytical model (Domenico, 1987) is a solution to the advection-dispersion partial-differential equation of contaminant transport in groundwater. The Domenico model is commonly used to predict downgradient groundwater contaminant concentrations along a straight-line flow path at a given distance from a release point source (USEPA, 2002; USEPA, 1996; ASTM, 1995).

The analytical solution form of the Domenico equation was programmed into a Microsoft Excel spreadsheet to perform the modeling documented herein. The model was applied to the FOSC groundwater contaminant plume to estimate downgradient COC concentrations in groundwater at a 1000-foot distance downgradient from the delineated plume boundary, as specified in the Georgia VRP Act (O.C.G.A. § 12-8-102 (b)(11)(C)). The model was also used to estimate the maximum downgradient extent of the groundwater contaminant plume for the five COCs exceeding Type 3/4 Commercial RRS in on-site groundwater.

Use of the model requires contaminant concentration data at a minimum of one source area monitoring well and one to two downgradient wells. The groundwater data must show a reasonable plume pattern typical of "point sources" (i.e., contaminant concentration is highest in the source well and gradually decreasing in downgradient wells). The model is calibrated by adjusting three model input parameters to fit groundwater concentration spatial pattern based on the spatial concentration distribution data. The model after calibration is then used to predict the horizontal plume length in groundwater.

The Domenico analytical model is based on the advection-dispersion partial-differential equation for organic contaminant transport processes in groundwater as described in Domenico and Robbins (1985). Under conditions of a steady state, continuous source with one-dimensional groundwater velocity, three-dimensional dispersion, and a first order degradation rate constant, the analytical solution can be expressed as the following equation (Domenico 1987):

$$\frac{C_x}{C_0} = \exp\left\{\frac{x}{2\alpha_x}\left[1-\left(1+\frac{4\lambda\alpha_x}{\upsilon}\right)^{\frac{1}{2}}\right]\right\} erf\left[\frac{Y}{4(\alpha_y x)^{\frac{1}{2}}}\right] erf\left[\frac{Z}{4(\alpha_z x)^{\frac{1}{2}}}\right]$$

Where,

C_x - contaminant concentration in a downgradient well at distance x (mg/L),

C_o - contaminant concentration in the source well (mg/L),

x - centerline distance between the source well and downgradient well (cm),

α_x, α_y & α_z - longitudinal, transverse, and vertical dispersivity (cm), respectively,

λ- degradation rate constant (day^{-1}),

v - groundwater velocity (cm/day),

Y - source width (cm),

Z - source depth (cm),

erf - error function,

exp - exponential function.

The Domenico groundwater contaminant fate & transport model assumes:

1. A source of finite width and thickness dimensions perpendicular to groundwater flow,
2. A steady state (steady or fixed concentration) source,
3. Homogeneous aquifer properties,
4. One dimensional groundwater flow,
5. First order degradation rate,
6. Contaminant concentration estimated at the centerline of the plume,
7. Molecular diffusion based on concentration gradient is neglected,
8. No retardation (e.g., sorption) in transport processes.

Understanding model assumptions is crucial for simulating transport processes of contaminants in groundwater. The inherent assumptions in the model equation make it a conservative means of estimating downgradient contaminant concentrations. Specifically, the model assumes a steady-state, fixed concentration contamination source within a rectangular area perpendicular to the direction of groundwater flow/plume migration. As documented in **Section 3.4.3.4**, groundwater contaminant concentrations in the release source area and downgradient areas are rapidly attenuating.

Hence, the steady-state (fixed concentration) assumption implicit in the model is a conservative assumption. MEI utilized the highest groundwater concentrations of benzene, cDCE, PCE, TCE and VC measured in groundwater during the March 2015 sampling event as the steady-state source area groundwater concentration (C_{source}). The source area width (W) was assumed to be approximately 32.4 feet, based on the 30-foot north-south width of the former DC tenant bay, and a composite groundwater flow direction toward the west-southwest, with a bearing of 250 degrees. Hence, the width of the former DC tenant bay perpendicular to flow (at a 90° angle to 250°, i.e., 160° or 340°) is approximately 32.4 feet, the assumed width of the source area.

The value of the source area depth was left at the default value of 200 cm, to be conservative. Source zone / mixing zone thickness was estimated at 216 cm (7.1 ft), which is the average distance between the depth at which groundwater was first encountered in borings and depth to competent bedrock/refusal.

Understanding chemical properties in relation to model assumptions also is critical in interpreting the transport model results. For example, MTBE has a low potential for sorption onto soil particles/organic carbon due to its low soil-groundwater organic carbon partition coefficient (K_{oc}) value (12 L/kg) while PCE has a relatively high K_{oc} value (94.95 L/kg) and a corresponding high retardation potential.

"Retardation" is the slower movement of a contaminant in groundwater, relative to the groundwater velocity, due to sorption of the contaminant onto soil particles and organic carbon. Thus, the speed of contaminant transport is "retarded" relative to groundwater velocity.

Therefore, the lack of retardation in the model, assumption No. 8 above, may not be a significant factor for MTBE, but suggests the model tends to overestimate downgradient concentrations of COCs with higher K_{oc} values like benzene, PCE and TCE. Hence, for these compounds, the predicted downgradient concentration is a conservative estimate.

All model input parameters consisted of one the following:

- Site-specific information contained in this report, and/or in previous reports on the FOSC site by MEI and others, as documented in **Table 1.**
- Conservative, default values published by:
  - The US EPA Regional Screening Levels (RSL) Table,
    - (May 2016 and November 2016)
  - The American Society for Testing and Materials (ASTM)

        - (Standards E2081-00 & E1739-95)
    - The Georgia EPD
- Values from public or published, documented sources
    - (U.S. National Weather Service, Weidemeir, et al., 1999).

All fate and transport model input parameters, parameter values, data sources, formulas for individual/intermediate variables, conversion factors, and intermediate and final calculations are documented in **Tables 3-8 in Appendix B**.

An implicit assumption is that model input parameters are in consistent units, hence modeled linear dimensions (distances, depths, widths, etc.) are in centimeters (cm); velocities (distance/time) are in cm/day or cm/year. Concentration values were input in milligrams per liter (mg/L). Corresponding site-specific values more commonly expressed in feet, inches, ft/yr, in/yr, micrograms per liter (µg/L), etc., and corresponding conversion factors/formulas, are all given in the groundwater fate & transport modeling calculations documented in **Tables 3-8 in Appendix B**

Significant aspects of the groundwater fate and transport modeling relative to VRP regulatory compliance, derivation of natural attenuation constants, calculation of the soil-to-groundwater leaching source term and model calibration are discussed in **Sections 3.4.4.2 – 3.4.4.5** as follows. Groundwater fate and transport modeling results are discussed in **Section 3.4.4.6**, and are summarized in **Tables 3-8 in Appendix B**.

3.4.4.2 Point of Exposure, Estimation of Centerline Distance Modeled

The Domenico fate and transport model was applied to estimate downgradient COC concentrations at a 1000-foot distance downgradient from the delineated plume boundary, at the "point of exposure" (POE) as defined in the Georgia VRP Act (O.C.G.A. § 12-8-102 (b)(11)(C)).

However, EPD's November 30, 2016 "Comment Letter" reviewing MEI's December 2015 CSR, Comment #6, stated the following:

> "EPD does not agree with Section 3.4.2.2 of the December 2015 VRP and CSR, which stated that because the downgradient extent of the groundwater plume has been defined, the downgradient surface water stream would not be impacted by the constituents of concern (COC) from the subject property in the future. The nearest surface water body originates on-site along the western boundary of the subject property, as observed during EPD's October 5, 2016 site visit, not 1,200 feet southwest of the plume as stated in Section 3.4.2.2. Please collect a minimum of one (1) sample from the surface water and include a figure illustrating the creek as the nearest Point of Exposure (POE)."

MEI has performed several tasks in response to this comment. First, as described in **Section 3.4.2.2 "Surface Water"**, a grab sample of the water exiting the culvert on the undeveloped Long Island Terrace property was collected on May 3, 2017 and analyzed for VOC concentrations by EPA Method 8260B. The results of this analysis indicate that there were no VOCs detected present in the sample.

Additionally, MEI modeled the fate & transport of the five compounds in on-site groundwater subject to site-specific Type 5 RRS using both potential downgradient points of exposure, i.e., both the culvert outlet on the Long Island Terrace property, and a hypothetical drinking water well 1000 feet downgradient.

Figures 7 – 11 in Appendix A are groundwater isoconcentration contour/plume delineation maps showing the creek as the nearest POE for the five COCs subject to site-specific Type 5 RRS (benzene, cDCE, PCE, TCE & VC) in on-site groundwater. The fate & transport model results shown on **Figures 7 – 11** illustrate the model calculations shown on **Tables 3-8 in Appendix B**. Groundwater plume delineation maps for these five compounds showing the hypothetical 1,000 foot downgradient well as the POE are presented as **Figures 7 – 11 in Appendix A**.

One of the conditions for using the Domenico Model to simulate contaminant fate & transport is that the selected downgradient well must be along the plume centerline, at a distance specified by the user. The distances modeled, from release source to POE includes both distance from the delineated downgradient edge of the contaminant plume to the POE, as well as the distance along flow path from the release source to the delineated edge of the plume.

The on-site release source area for chlorinated COCs is the former DC tenant bay on the northern tip of the FOSC north wing (**Figure 3**). Groundwater beneath the northwest portion of the FOSC, including the release source, and adjacent off-site area flows predominantly toward the west-southwest, or on an approximate bearing of 250 degrees. The distances from the release source to the downgradient delineated plume edges for three of the five chlorinated COCs subject to Type 5 RRS (cDCE, PCE and TCE), along the 250° groundwater flow path, were estimated from the plume maps included as **Figures 7-11**.

Although the release source for benzene is the off-site CITGO/RRFM, the location of the highest groundwater benzene concentration on the FOSC site is monitoring well MW-28 (135 μg/L). Likewise, the location of the highest vinyl chloride (VC) concentration on site is also at MW-28. Hence, for purposes of modeling the fate & transport of benzene and VC in groundwater, MW-28 was used as a surrogate on-site "release source area" for these two compounds.

The distances from the surrogate source area (MW-28) to downgradient delineated plume edges, along the predominant groundwater flow path (250° bearing), were estimated from the benzene and VC isoconcentration / plume delineation maps (**Figures 7 & 11**). Other source area parameters, such as source width and thickness, depth to impacted soil, mixing zone thickness, etc. were assumed to remain constant at both the actual on-site release source (the former DC tenant bay) and the surrogate release source (MW-28).

The estimated distances from the on-site release source area, and surrogate benzene release source area, and the total plume centerline/groundwater fate & transport distances modeled are summarized below:

Point of Exposure – Stream on Long Island Terrace Property

COC	Distance: Source - Delin. Plume Edge	Distance: Plume Edge Pt. of Exposure	Distance, total
Benzene	50 ft (1,524 cm)	405 ft (12,344 cm)	455 ft (13,868 cm)
cDCE (N. Source Area)	70 ft (2,134 cm)	305 ft (9,296 cm)	375 ft (11,430 cm)

cDCE (S. Source Area)	50 ft (1,524 cm)	200 ft (6,096 cm)	250 ft (7,620 cm)
PCE	300 ft (9,144 cm)	75 ft (2,286 cm)	375 ft (11,430 cm)
TCE	175 ft (5,334 cm)	200 ft (6,096 cm)	375 ft (11,430 cm)
VC	87 ft (1,433 cm)	163 ft (6,645 cm)	250 ft (8,077 cm)

Point of Exposure – Hypothetical 1,000 ft Downgradient Water Well

COC	Distance: Source - Delin. Plume Edge	Distance: Plume Edge Pt. of Exposure	Distance, total
Benzene	50 ft (1,524 cm)	1,000 ft (30,480 cm)	1,050 ft (32,004 cm)
cDCE	70 ft (2,134 cm)	1000 ft (30,480 cm)	1,070 ft (32,614 cm)
PCE	300 ft (9,144 cm)	1000 ft (30,480 cm)	1,300 ft (39,624 cm)
TCE	175 ft (5,334 cm)	1000 ft (30,480 cm)	1,175 ft (35,814 cm)
VC	87 ft (1,433 cm)	1000 ft (30,480 cm)	1,087 ft (31,913 cm)

3.4.4.3 Derivation of Natural Attenuation Rate/Decay Constants

MEI utilized USEPA methods to derive site-specific attenuation/”decay” rate constants (i.e., values of lambda, λ) for use in the contaminant fate & transport modeling. These methods are described in the EPA documents "Calculation and Use of First-Order Rate Constants for Monitored Natural Attenuation Studies" (USEPA, 2002) and “Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water” (USEPA, 1998). Calculated site-specific values of the attenuation rate constant, lambda (or K_{point} in USEPA, 2002) were compared to values published in Howard, et al. (1991) “Handbook of Environmental Degradation Rates.”

First, MEI calculated approximate attenuation rate constants for the five COCs subject to site specific Type 5 RRS in on-site groundwater using the measured changes in contaminant concentrations at each well from the time of peak contaminant concentration, i.e., 2008 or 2009 levels, to the most March 2015 levels with the exponential growth/decay equation:

$$\mathbf{C_t = C_o\, e^{-kt}}$$

Where:	C_t	=	Concentration at time (t), i.e., 2015
	C_o	=	Original (peak) concentration (in 2008 or 2009)
	e	=	natural exponent
	k	=	attenuation rate constant (time^{-1})
	t	=	time.

The exponential decay equation was then rearranged to solve for k, the attenuation/degradation rate constant for a single COC at a single well:

$$k = \ln (C_t / C_o) / t$$

The geometric mean of attenuation rate constants were calculated for groups of wells within each of three areas: the release source area (immediately downgradient from the on-site release source), the downgradient plume (originating from the on-site release source), and wells impacted from the off-site release sources.

MEI also utilized the method for determination of the "Concentration vs. Time Attenuation Rate Constant" described in EPA (2002). This method requires a linear-linear plot of the natural log (ln) of contaminant concentration on the y-axis against elapsed time (days) on the x-axis.

An exponential regression analysis through the plotted points gives the equation of the line of best fit. If the data plot to a straight line, the degradation rate relationship is first order. The slope of this regression line is the attenuation rate constant, k_{point}.

The concentration versus time attenuation rate constant at a single monitoring well (k_{point}) is not indicative of plume trends. However, the calculation of k_{point} at multiple wells within the entire plume can be used to assess plume attenuation and trends (EPA, 2002). The geometric mean of k_{point} attenuation rate constants were calculated for groups of wells within the release source area, the downgradient plume, and wells impacted from off-site release sources.

These geometric means k_{point} values for the source area (k_{source}), downgradient plume, and off-site source groups were then compared to published values (Howard, et al., 1991). In all cases, the calculated site-specific geometric mean attenuation rate was within the published range of values.

At most contaminant release sites, the source area attenuation rate is slower than the rate in the downgradient plume. Hence, concentration profiles tend to retreat toward the source over time. The lifecycle of the plume is thus determined by source attenuation rates, which can be predicted by concentration versus time plots for the most contaminated wells (EPA, 2002).

MEI utilized the lower, more conservative calculated geometric mean value of lambda/k_{point} (i.e., slower decay) from either the source area (k_{source}) or downgradient plume in the contaminant fate & transport modeling.

3.4.4.4 Soil to Groundwater Leaching

As stated previously, the Domenico model uses a steady state (fixed concentration) rectangular source of fixed width and depth/thickness, oriented perpendicular to the direction of groundwater flow/plume transport. Leaching of residual soil contamination into underlying groundwater contributes to source area groundwater contaminant concentrations.

Since source area soils have been remediated, contributions to existing groundwater contamination from soil-to-groundwater leaching (C_{leach}) are relatively minor. Nonetheless, out of an abundance of caution, MEI calculated soil-to-groundwater leaching concentrations for the contaminant fate & transport modeling.

MEI utilized the highest groundwater concentrations of benzene, cDCE, PCE, TCE and VC measured in groundwater during the March 2015 sampling event, plus the calculated soil-to-groundwater leaching as the C_{source} concentration. Hence, the steady-state groundwater source area concentration is:

$$C_{source} = C_{max,\ gw} + C_{leach,\ soil}$$

Where:

C_{source} – Steady-state groundwater concentration in source zone.

$C_{max, gw}$ – Maximum groundwater contaminant concentration in source zone.

$C_{leach, soil}$ – Soil-to-groundwater leachate concentration contributing to source.

Soil to groundwater leaching calculations (**Appendix C**) were performed using the equations and methods outlined in American Society of Testing and Materials (ASTM) Standard Guide E2081 "Standard Guide for Risk-Based Corrective Action" (ASTM, 2015). Soil to groundwater leaching model input parameters, similar to the input parameters for the fate & transport modeling, were a combination of the following:

- Site-specific information contained in this report, and/or in previous reports on the FOSC site by MEI and others, as documented in **Table 1.**
- Conservative, default values published by:
  - The US EPA (Regional Screening Levels (RSL) Table, May 2016)
  - The American Society for Testing and Materials (E2081-00 & E1739-95),
  - The Georgia EPD
- Values from public or published, documented sources (U.S. National Weather Service, Weidemeir, et al., 1999)

Surface water precipitation infiltration (I) into soil was estimated as a percentage of total rainfall using the following empirical formula (Wiedemeir, et al., 1999, p. 52):

$$I = P^2 * k_i$$

Where:

I = infiltration (cm/yr)

P = annual precipitation (cm/yr)

k_i = infiltration coefficient (yr/cm)

The annual normal precipitation for Atlanta is 49.71 inches per year (126 cm/yr), according to National Weather Service, Peachtree City, Georgia on-line records (http://www.srh.noaa.gov/ffc/?n=rainfall_scorecard). The value of k_i is dependent upon soil type, with values of 0.0018 for sandy soil, 0.0009 for silty soil, and 0.00018 for clay soil (Wiedemeir, et al., 1999). Hence the empirically estimated precipitation infiltration rate is:

$$I = (126 \text{ cm/yr})^2 * (0.0009 \text{ yr/cm}) = 14.3 \text{ cm/yr} = 5.65 \text{ in/yr} =$$

Soil to groundwater leaching formulas, input parameters, parameter values, data sources, and calculation results are presented in **Tables 3-8 in Appendix B**. The results of the soil to groundwater leaching calculations are briefly summarized below.

COC	Soil - Maximum Residual Concentration	Soil to GW Leaching Concentration
Benzene	0.016 mg/kg	0.0014 mg/L
cDCE	0.30 mg/kg	0.089 mg/L
PCE	1.1 mg/kg	0.14 mg/L
TCE	0.18 mg/kg	0.036 mg/L
VC	ND – Subst. 0.0012 MDL	0.00052 mg/L

3.4.4.5 Model Calibration

The historically observed downgradient transport of PCE from the source area to downgradient wells was used to calibrate the model. PCE was used since it was the substance originally released on from the on-site former DC source.

The model was calibrated using the following site-specific values:

- Distances from the source area to downgradient wells.
- Historical groundwater PCE concentrations:
  - Source area maximum concentrations, both historical and recent
  - Downgradient well concentrations
- Groundwater velocity
- Attenuation rate constant

The farthest downgradient well from the release source where PCE has been detected is MW-30 (**Figure 9, Table 2**). Fortuitously, MW-30 is also located virtually directly hydraulically downgradient from the release source, at a distance of approximately 300 feet. This well was installed May 13, 2009 (**Table 2**) and first sampled on May 21, 2009. Source area well MW-2 (downgradient from the former DC source), which has historically contained the highest concentrations of dissolved contaminants, was sampled May 22, 2009. Hence, May 2009 is the first date on which there is groundwater plume data from both the source area and farthest downgradient well. The May 2009 PCE concentration in MW-2 was 2,900 µg/L, while the concentration at MW-30 was 42 µg/L.

The highest groundwater PCE concentrations were previously reported in groundwater closer to the DC release source, 11,000 µg/L at now-destroyed well MW-10 on 11/21/2006, approximately 60 ft downgradient from the DC tenant bay. However, no corresponding downgradient data is available for this earlier date. Hence, determining the proper initial source area groundwater concentration ($C_{max,\ gw}$) for model calibration was problematic, since this concentration could vary between 2,900 µg/L (the 05/2009 value for which both source and downgradient data were available) and 11,000 µg/L (the highest reported value, from 11/2006).

Estimation of a source area soil PCE concentration ($C_{max,\ soil}$) for estimation of the soil to groundwater leaching concentration (C_{leach}) was also challenging. The maximum pre-remediation PCE concentration in soil at a single location, at boring I-DP-2, directly beneath a former DC machine location, was 380 mg/kg. However, the geometric mean of the maximum reported PCE concentrations, where PCE was present, in 10 select pre-remediation borings in and immediately surrounding the former DC tenant bay is 6 mg/kg PCE. Hence, the PCE soil source term ($C_{max,\ soil}$) could vary between 6 and 380 mg/kg.

MEI therefore adopted the following approach to model calibration. Initially, values of dispersivity and attenuation rate were held constant. A 2,900 µg/L PCE concentration was assumed for $C_{max,\ gw}$ (05/2009 concentration at MW-2) and the soil source area term was adjusted until the PCE concentration 300 feet downgradient matched the 05/2009 42 µg/L concentration measured at MW-30. A soil source area concentration of 200 mg/kg produced the best fit.

A sensitivity analysis was then conducted for the Domenico model by varying input parameter values, one at a time, within reasonable ranges. Model outputs from various input values were compared with the "baseline" case. The sensitivity analysis results indicate that model output is sensitive to the following model input parameters:

- Longitudinal dispersivity (α_x)
- Groundwater velocity (v)
- Downgradient transport distance (x), and
- Attenuation rate constant (λ).

Since site-specific values of v, x, and λ have been calculated herein previously, but v and λ have a narrow range of values, a sensitivity analysis was performed for varying values of these parameters. The four parameters were used to calibrate the model by changing the values of these parameters to best fit the May 2009 analytical data.

3.4.4.6 Downgradient Extent of Contaminant Plume

As stated previously, the Domenico model was used to estimate the maximum downgradient extent of the groundwater contaminant plume for the five COCs exceeding Type 3/Type 4 Commercial RRS in on-site groundwater. The model input parameters utilized were identical to those listed above, with one exception.

Instead of specifying a fixed distance downgradient (x) at which point the model would calculate a concentration (C_x), a trial-and-error approach was utilized to determine the distance downgradient at which the concentration, C_x, equaled the default Type 1 RRS. This trial-and-error determination was performed using the Microsoft Excel "Goal Seek" function.

The goal seek function allows the user to specify the desired result of a formula to find the input value necessary to achieve that result. In the Goal Seek dialog box, the user specifies the cell containing the formula ("Set Cell"), the desired value for the formula to return ("To Value", in this case, C_x = Type 1 RRS) and one of the source cells that the formula is dependent upon ("By Changing Cell", in this case, the downgradient distance, x). Both of the cell specifications must be a single cell reference or name. The "To Value" must be a number. The source cell specified to change ("By Changing Cell") to obtain the desired "To Value", must contain a number, rather than a formula.

The Goal Seek command then uses a simple linear search beginning with guesses on the positive or negative side of the value in the source cell (By Changing Cell). Excel uses the initial guesses and recalculates the formula. Guesses bringing the formula result closer to the targeted result (To Value) is the direction (positive or negative) in which Goal Seek continues to guess. If neither direction appears to approach the target value, Goal Seek makes additional guesses further away from the initial source cell value. After the direction is determined, Goal Seek uses an iterative process in which the source cell value changes incrementally at varying rates until converging upon the target value.

The results of the calculations estimating the downgradient extent of the contaminant plume(s) are summarized in **Section 3.4.4.7**. The calculated downgradient extent of each of the five COCs exceeding commercial RRS on site are shown on **Figures 7-11 in Appendix A**.

3.4.4.7 Fate & Transport / Natural Attenuation Model Results

The results of the groundwater fate & transport modeling calculations are briefly summarized below.

Point of Exposure – Off-Site Stream – Long Island Terrace Property

COC	Modeled Downgradient POE Concentration	Georgia In Stream Water Quality Standard	Distance fm Source - Downgrad. POE
Benzene*1	0.83 µg/L	51 µg/L	455 ft
cDCE*2	2.68 µg/L	70 µg/L*3	375 ft
cDCE*3	3.83 µg/L	70 µg/L*3	250 ft
PCE*2	**8.03 µg/L**	3.3 µg/L	375 ft
TCE*2	1.40 µg/L	30 µg/L	375 ft
VC*3	0.24 µg/L	2 µg/L	250 ft

Notes: **1 Modeled Source Area = Surrogate Source at MW-28*
**2 Modeled Source Area = Former Onsite Drycleaner*
**3 Modeled Source Area = Surrogate Source at MW-16*
**4 No In Stream Standard for cDCE, Drinking Water MCL/Type 1 RRS substituted*

Point of Exposure – Hypothetical 1,000 ft Downgradient Water Well

COC	Modeled Downgradient POE Concentration	Default, Type 1 RRS/ Drinking Water MCL
Benzene	0.15 µg/L	5 µg/L
cDCE	0.29 µg/L	70 µg/L
PCE	0.10 µg/L	5 µg/L
TCE	0.11 µg/L	5 µg/L
VC	0.014 µg/L	2 µg/L

The results of the contaminant fate & transport modeling calculations in **Tables 3-8** and summarized above indicate that of the five COCs subject to Type 5 RRS in on-site groundwater, only PCE poses a potential surface water contamination risk at the off-site stream POE. However, the results of the surface water sampling conducted on May 3, 2017 (discussion in **Section 3.4.2.2**, results in **Appendix G**) showed that no VOCs were present in the water within this stream. Hence, the groundwater contaminant plume does not represent a potential contamination threat to off-site surface water.

Additionally, the modeling results summarized above also show that the projected concentration at a POE 1000 ft downgradient from the delineated plume was significantly below default, Type 1 RRS/Drinking Water MCLs. Further, since there is no retardation in the Domenico model relative to groundwater velocity, the predicted downgradient PCE, TCE and benzene concentrations are conservative, maximum approximations. Therefore, the modeling results demonstrate that on-site groundwater contamination does not pose a significant risk to a hypothetical groundwater user at a downgradient point of exposure (POE) 1,000 feet from the defined plume boundary.

The calculated downgradient extent of the contaminant plume for the five COCs exceeding commercial RRS on site are shown on **Figures 7-11**. As shown on plume maps for cDCE and PCE, **Figures 8 & 9**, respectively, the calculated maximum downgradient extent of the contaminant plume for these two COCs is somewhat less than the current extent of each plume. The possible explanations for the difference between the calculated maximum downgradient extent and the current extent of the plume include:

- The groundwater source area concentration (C_{source}) utilized in the modeling calculations are the most recent, March 2015 concentrations. Past concentrations of PCE and cDCE in source area groundwater were orders of magnitude greater than at present, resulting in a larger present-day plume in comparison to the estimated extent of a future plume.
- The plume did not originally degrade as rapidly in the past, before soil/secondary source removal, as it does at present, resulting in farther downgradient COC transport in comparison to estimated future transport.

Hence, the modeling results show that the downgradient extent of PCE and cDCE are not anticipated to expand significantly beyond current plume dimensions. The modeling results therefore confirm that the plume is stable and that on-site groundwater contamination in excess of Commercial RRS does not pose a significant human health risk to potential off-site users.

3.5 CSM – Vapor Intrusion

3.5.1 Vapor Intrusion Assessments

Multiple soil vapor investigations/assessments, vapor intrusion (VI) modeling, indoor air testing and a soil vapor survey were all performed to quantify potential human health risks from the VI exposure pathway. Previous VI assessments and mitigation efforts are described in the following reports:

- Vapor Intrusion Assessment and Mitigation Design Report (UC, 21-FEB-2008),
- Vapor Intrusion Mitigation System Implementation Report (UC, 3-JUN-2009),
- Vapor System Sampling and Modeling for Closure Report (UC, 25-FEB-2011), and
- Limited Subsurface Investigation (Property Solutions, 6-JUN-2013).

Hence, the VI aspect of the CSM is of a site where potential VI issues have been well investigated and potential impacts in excess of risk-based standards have been abated. The assessment, modeling, sampling and mitigation work upon which this description is based are detailed below.

3.5.2 Vapor Intrusion Modeling

Initially, vapor intrusion modeling was performed by UC as described in their 21-FEB-2008 Vapor Intrusion Assessment and Mitigation Design Report. UC used the Johnson & Ettinger (J&E) model (U.S. EPA, 1991). This J&E modeling work performed by UC concluded:

- There was a potential for vapor intrusion into the proposed buildings from the impacted groundwater, using a target risk level of one in a million (1:1,000,000), (1E-06) for the DC and adjacent tenant spaces up to, but not including the Kroger.
  Note: EPD uses a target risk level of 1:100,000 or 1E-05.
- The health risk in excess of 1E-06 could be mitigated with the installation of a vapor venting system.
- The Kroger and tenant spaces to the south were not at risk.

A VI mitigation system (VIMS) was subsequently installed and operated by UC for approximately two and a half years (**Section 3.5.5**). The opportunity for potential closure of the VIMS was identified by UC following a review of MEI's January 14, 2010 CSR. UC performed revised VI modeling using the J&E model, 1E-05 target carcinogenic risk levels and site-specific parameters. Based on UC's revised model results, COCs in soil gas did not result in a carcinogenic risk exceeding risk levels of 1E-5 or non-carcinogenic toxicity effects exceeding a hazard quotient of 1.0 for potential commercial workers.

MEI initially performed VI modeling during our 2008-2009 CSR investigation (MEI CSR, 14-JAN-2010) using the J&E model to evaluate potential health effects of occupant exposure to COC vapors. MEI utilized a target risk level of 1E-05, target hazard quotient of 1.0 and site specific subsurface data to calculate the acceptable groundwater concentrations associated with both carcinogenic and non-carcinogenic effects, for both residential and commercial usage. The results of MEI's J&E VI modeling indicated that no COCs were present in 2008/2009, in on or off-site groundwater at concentrations that would cause carcinogenic or non-carcinogenic risk to exceed target levels for either commercial workers on the FOSC site or for residential receptors at neighboring off-site properties.

MEI performed VI screening using the U.S. EPA's Vapor Intrusion Screening Level (VISL) calculator, version 3.5.1 (May 2016) for our May 31, 2017 Revised CSR/Status Report. This screening was performed for the groundwater volatilization to indoor air inhalation pathway for a commercial worker. User inputs into the calculator are limited, but include target carcinogenic risk level (1E-05), groundwater temperature (17.6 °C; interpolated from U.S. EPA maps) and groundwater COC concentrations. MEI utilized *maximum* March 2015 concentrations of COCs in groundwater in the VISL calculator.

The VISL "Groundwater Concentration to Indoor Air Concentration" (GWC-IAC) calculator indicated that the maximum concentrations of TCE and benzene were present in groundwater at concentrations *potentially capable* of exceeding 1E-05 carcinogenic risk for commercial workers via the indoor air inhalation pathway. Similarly, the GWC-IAC calculator indicated that PCE and TCE were present in on-site groundwater at concentrations *potentially capable* of exceeding the target hazard quotient of 1.0 for commercial workers via the indoor air inhalation pathway. Hence, the VISL screening in MEI's May 31, 2017 CSR identified three compounds, PCE, TCE and benzene, in on-site groundwater at concentrations capable of exceeding indoor air inhalation targets for carcinogenic or non-carcinogenic effects.

However, recent VISL modeling of "Additional Evaluation of the Vapor Intrusion Pathway" conducted by Amec Foster Wheeler (AFW), included herein as **Appendix E,** indicates that potential VI risks are below EPD target levels. AFW evaluated the vapor intrusion pathway for both soil and groundwater sources respectively using the online VISL calculator. AFW's evaluation identified multiple lines of evidence to support the conclusion that the vapor intrusion pathway does not pose a risk to current or future commercial receptors, and concludes:

> "Risk calculations were completed using the May 2013 soil vapor sampling results and the March 2015 groundwater sampling results in the online VISL Calculator in order to estimate the indoor air concentrations and risks and hazards for detected constituents in soil vapor and groundwater. When site-specific conditions are included in the calculations, the resulting estimated cumulative hazards and risks indicate no unacceptable risk or hazards for commercial receptors potentially exposed via indoor air vapor emissions based on maintaining the current hard cover and current building parameters. Therefore, the site is compliant with requirements under HSRA and the VRP for delisting."

Additionally, at EPD's request, MEI performed additional J&E modeling using maximum groundwater concentrations on site. MEI used the current version of the J&E model (Version 6.0, updated September 2017) and the maximum March 2015 groundwater concentrations of all 10 contaminants of concern.

Similar to the approach utilized by AFW, MEI used the model to simulate hypothetical worst case exposure scenarios for both the northern portion of the site (on-site release source) and the southern portion of the site (off-site sources). MEI would like to emphasize that the maximum groundwater concentrations input into the J&E model may be from different areas of the site, and thus represent unlikely, but conservative worst case exposure scenarios.

Model inputs included site specific:

- Groundwater COC concentrations from March 2015,
- Soil property data (porosity, bulk density, etc.) from UC's February 25, 2011 "Vapor System Sampling and Modeling for Closure" Report, and
- Foundation, slab thickness, enclosed air space dimensions, mixing height and air exchange rate data from UC's February 25, 2011 "Vapor System Sampling and Modeling for Closure" Report.

The sources of data used as model inputs into the J&E model are documented in the comments contained on the spreadsheet models outputs. J&E model results using maximum groundwater COC concentrations are contained in **Appendix G.**

MEI utilized the "Multi_Chem_Input" and "Multi_Chem_Output" modules of the J&E model to calculate the cumulative risk and HQ of all 10 COCs listed in **Section 2.4** combined. The maximum groundwater concentration of each of the 10 COCs was entered into the multi-chemical input module. The cumulative risk calculated using the multi-chemical output was 1.15E-07, while the cumulative HQ calculated was 8.61 E-03 (see **Table 21** and J&E model outputs in **Appendix G**). Therefore, the J&E modeling conducted by MEI using maximum groundwater contaminant concentrations on site to simulate an unlikely "worst case scenario" further demonstrates that there is no unacceptable VI risk or hazard at the FOSC site based on current or future commercial use of the property. **Hence, based on the modeling results described herein, the site is compliant with vapor risk requirements under HSRA and the VRP for delisting.**

3.5.3 Soil Vapor Survey

MEI conducted a soil vapor survey at the FOSC site in September 2008. One hundred twenty-four (124) Gore-Sorber modules were employed on an approximate 50 by 50-foot grid over the entire northern portion of the FOSC site and neighboring public rights-of-way. The methods and results of the soil vapor survey are described MEI's 14-JAN-2010 CSR and in W. L. Gore & Associates' report included as Appendix F therein.

Four principle COCs were chosen for soil vapor survey color contour mapping for their utility in determining the on-site extent of contamination and documenting the migration of impacted groundwater from offsite onto the FOSC site:

- Tetrachloroethene (PCE)
- Trichloroethene (TCE)
- cis-1,2-dichloroethene (cDCE)
- Benzene, toluene, ethylbenzene, and xylenes (BTEX).

PCE was detected at 92 of the 124 module locations. The maximum calculated PCE concentration on site was approximately 42,608 micrograms per cubic meter ($\mu g/m^3$), at a location approximately 50 feet north of the former on-site dry cleaner. The results of the soil vapor study indicated that the highest PCE concentrations were present around the perimeter of the former on-site dry cleaner.

A secondary area of elevated PCE concentration was located approximately 100 feet southwest of Chastain Cleaners. This area of elevated concentration was approximately 400 feet east and hydraulically upgradient of the former on site dry cleaner tenant space.

TCE was detected in 32 of 124 modules during the survey, with calculated concentrations ranging from 0.68 $\mu g/m^3$ to 460.14 $\mu g/m^3$. Maximum concentrations mirrored the results of PCE. Two areas of higher concentrations were just north of the former on-site dry cleaners and southwest of Chastain Cleaners.

Detections of cDCE were lower than PCE or TCE. cDCE was detected at 9 of the 124 module locations, in concentrations calculated to range from 0.85 $\mu g/m^3$ to 194.62 $\mu g/m^3$. Two cDCE areas of elevated concentration were identified, one hydraulically downgradient of the former on-site dry cleaner and one downgradient from Chastain Cleaners.

BTEX was detected at 91 of the 124 module locations at concentrations ranging from 0.01 $\mu g/m^3$ to 72.95 $\mu g/m^3$. The highest reported detections were located in the northeastern corner of the FOSC parking lot, downgradient from the off-site petroleum release source.

The soil vapor survey showed that there were clearly two separate sources for chlorinated solvent (CVOCs) contamination in soil gas at the FOSC site, the former on-site DC operation and Chastain Cleaners off site. The results of the soil vapor survey also showed that all significant BTEX contamination was associated with the CITGO/RRFM filling station northeast of the FOSC site.

Hence, the soil vapor survey confirmed the presence of three commingled groundwater contaminant plumes on the FOSC site from one on-site and two off-site sources.

3.5.4 Indoor Air Quality Sampling

MEI contracted with industrial hygiene consultants Atlantic Environmental, Inc. (AEI) to perform air sampling inside the residence 79 West Belle Isle Road on August 25, 2008. This work is described in MEI’s 14-JAN-2010 CSR and in AEI’s report to MEI included as Appendix G in the CSR**.**

Air samples were collected using SUMMA® Canisters at locations pre-defined by MEI in concert with the property owner. Ambient or "background" air sampling was also performed at two locations outside the residence.

Laboratory analytical results indicated that there were no indoor air concentrations of the DC COCs (PCE or TCE) or any daughter products (DCE and VC) in any sample. In the conclusion of their report, AEI stated, "Based on AEI's physical findings and laboratory results, no further work is necessary at this time."

Since the indoor air sampling in August 2008, groundwater concentrations of PCE, TCE and cDCE have declined precipitously (**Table 2**) at the nearest upgradient monitoring well, MW-13S. The July 2008 and March 2015 concentrations of these three compounds at this well, and the percent declines in COC concentrations, are listed as follows.

MW-13S - PCE, TCE & cDCE Groundwater Concentrations

	7-JUL-08 Avg. Conc.	10-MAR-15 Avg. Conc.	% Reduction
PCE	1,005 µg/L	22 µg/L	-97.8%
TCE	29 µg/L	1.95 µg/L	-93.3 %
cDCE	33 µg/L	3.4 µg/L	-89.7%

Since no indoor vapors were detected during sampling in 2008, and groundwater contaminant concentrations have declined in the nearest upgradient well by an average of 93.6%, the risk of off-site VI appears minuscule. Hence, in accordance with discussions with EPD HSRP personnel in a meeting of February 27, 2015, the previous indoor air sampling conducted at the residence at 79 West Belle Isle Road, in concert with the remarkable reductions in groundwater COC concentrations, are evidence that there is no VI risk for this neighboring property.

Additionally, in May 2013, Property Solutions performed a Limited Subsurface Investigation of the FOSC site, including indoor air and soil vapor sampling. Six indoor air samples were collected over a period of 8 hours using laboratory-supplied Summa® canisters with laboratory-supplied flow regulators. Summa® canisters were placed within the Kroger store (Suite 20) and four of the suites within the north wing of the FOSC center.

From the results of this indoor air sampling, Property Solutions concluded:

> "Detections of constituents in indoor air did not exceed the Target Indoor Air Concentrations (TIAs) as provided in the EPA OSWER Vapor Intrusion Screening Level (VISL) Calculator Version 3.0 (November 2012) using a Target Risk Concentration (TCR) of 1.00E-05.
>
> Detections of constituents in indoor air did not exceed the TIAs as provided in the EPA OSWER VISL) Calculator Version 3.0 (November 2012) using a more stringent TCR of 1.00E-06, with the exception of chloroform in two samples. Indoor air sources of chloroform include the use of municipal (chlorinated) water, bleaches, and refrigerants. It is the opinion of Property Solutions that based on the results of soil gas samples, chloroform detections are likely the result of sources other than the subsurface."

Hence the results of indoor air sampling conducted in multiple FOSC commercial suites within and adjacent to the former on-site release source confirm that the potential subsurface to indoor air exposure pathway is incomplete, and no further action appears warranted. Similarly, indoor air sampling at the nearest downgradient, off-site residence likewise confirm that the subsurface to indoor air exposure pathway is incomplete, and no further action appears warranted.

3.5.5 On-Site Vapor Mitigation System

UC installed a vapor intrusion mitigation system (VIMS) beneath the former DC tenant bay and the north tenant wing of the FOSC site. This system consisted of:

- A passive vapor barrier and sub slab depressurization system installed beneath the former DC facility. Slotted piping was placed in a gravel bed and covered with a high-density polyethylene (HDPE) below the concrete subfloor. The slotted piping was connected to a vertical riser and passive wind turbine.
- An active vapor mitigation system was installed beneath the remaining units in the north FOSC wing. A system of eight north-south slotted gas collection pipes were hydraulically jacked under these units. The eight collection pipes were manifolded together in an alternating pattern and connected to roof-mounted vacuum blowers.

- A telemetry system was installed to monitor blower operation by monitoring the vacuum pressure at both of the discharge pipes of the active VIMS on one-hour intervals.
- Monitoring ports including two sets of three 8-foot deep monitoring wells along each of the east and west sides of the building. A total of nine shallow vapor monitoring ports were installed
- The pressure monitoring of the VIMS indicated that negative pressures were generated at least 12 feet away from the collection piping, with greater negative pressure generation closer to the system. Thus, the VIMS operated as designed, depressurizing the soil beneath the tenant spaces of the north section of the FOSC.

This system was operation for approximately two and a half years, from December 2008 to May 2011. EPD authorized shutdown of the VIMS system after soil gas sampling results and VI modeling results both indicated that there were no VI risks present on site in excess of target levels. The system was shut down, decommissioned and the shallow vapor monitoring wells abandoned in May 2011. This work is documented in three reports prepared by UC:

- Vapor Intrusion Assessment and Mitigation Design Report (21-FEB-2008)
- Vapor Intrusion Mitigation System Implementation Report (3-JUN-2009), and
- Vapor System Sampling and Modeling for Closure Report (25-FEB-2011)

Hence, there are no residual VI risks from soil sources in excess of applicable target levels present on the FOSC site.

3.6 CSM – Exposure Model

The conceptual exposure model of the FOSC site is one in which, based on current and projected future property and groundwater uses, there are no immediate threats to human health or the environment in excess of applicable risk-based levels. Specifically, potential exposure sources (soil, groundwater, DNAPL & soil vapor) and pathways (ingestion, inhalation, etc.) have been thoroughly assessed, exposure risks have been quantified and excess risk has been mitigated. The details of the conceptual site exposure model are described below.

3.6.1 Current and Future Land Uses

3.6.1.1 Fountain Oaks Shopping Center (FOSC)

The principle FOSC parcel at 4920 Roswell Road NE, Parcel ID 17 009300061319, is a commercial retail shopping center and will continue to be used for commercial purposes for the foreseeable future. The site is zoned C-1, "Community Business District" by the City of Sandy Springs, as shown on the online geographic information system (GIS) zoning map (gis.sandyspringsga.gov/flexviewers/Gen_Flex/). MEI understands that no expansion of existing facilities is planned for the immediate future.

3.6.1.2 115 West Belle Isle Road – FOSC Outparcel

The small outparcel on the FOSC site at 115 West Belle Isle Road, Parcel ID 17 009300021073, is located in the parking lot immediately west of the FOSC north wing (**Figure 1**). Although the site is currently zoned R-4, "Single Family Dwelling" according to the Sandy Springs GIS website, it is also currently a parking area in a commercial development.

Hence, the property at 115 West Belle Isle Road will continue to be used for commercial purposes for the foreseeable future. The site will therefore be occupied exclusively by commercial worker and/or construction worker receptors for the foreseeable future.

3.6.1.3 Long Island Terrace – Undeveloped Property

The undeveloped property on Long Island Terrace, Parcel ID 17 009300060881, is zoned R-3 "Single Family Dwelling District" by the City of Sandy Springs. However, the property is "land-locked" with no road access and occupies a topographic basin. It is unlikely that this property will be developed for residential use given the steep slopes, uneven terrain, viewshed, and land-locked nature of the parcel. However, the property is considered "residential" and assumed to be occupied by residential receptors for exposure modeling purposes.

3.6.1.4 Off-Site Neighboring Properties

The neighboring cross gradient properties to the north of the FOSC site, and the downgradient properties to the west of FOSC are all single-family residences. These properties are likely to continue being used for residential purposes and occupied by potential residential receptors for the foreseeable future.

3.6.2 Exposure Pathways & Receptors

There are only five *potentially* complete *on-site* exposure pathways for the following potential receptors:

- Soil – Dermal Contact (construction worker receptor)
- Groundwater – Dermal Contact (construction worker receptor)
- Soil – Vapor intrusion to indoor air inhalation (commercial worker receptor)
- Groundwater - Vapor intrusion to indoor air inhalation (commercial worker receptor)
- Groundwater – Ingestion (commercial worker receptor)

Each of these potentially complete exposure pathways is addressed herein as follows.

Soil – Dermal Contact (Construction Worker Receptor)

Comparison of residual on-site and off-site soil concentrations to calculated RRS show that there are no concentrations of COCs in either on-site or off-site soil exceeding RRS. Calculation of Type 3/Type 4 RRS includes consideration of the dermal contact for a construction worker exposure pathway. The 2007-2008 soil remediation project removed all soil from the site in excess of Type 3/Type 4 RRS. Hence, this is an incomplete exposure pathway.

Groundwater – Dermal Contact (Construction Worker Receptor)

The potential dermal contact exposure pathway for a construction worker receptor is an incomplete pathway, due to the depth to groundwater on site. The average depth to groundwater across the entire FOSC site is approximately 34 feet, while average depth to groundwater surrounding the on-site release source area is approximately 36.7 feet. These depths to groundwater are well below depths that construction projects typically penetrate into the subsurface. Hence, groundwater- dermal contact for a potential construction worker receptor is an incomplete exposure pathway.

Soil – Vapor Intrusion to Indoor Air Inhalation (Commercial Worker Receptor)

As described in **Section 3.5.2**, vapor intrusion modeling conducted by UC and MEI, both before and following on-site VI mitigation , have demonstrated that there is no excess risk present on site for the Soil - VI to indoor air pathway for a commercial worker receptor.

Groundwater - Vapor Intrusion to Indoor Air Inhalation (Commercial Worker Receptor)

Vapor intrusion modeling conducted by MEI and AFW as discussed in **Section 3.5.2** herein, using both the EPA VISL and J&E models show that no unacceptable risk or hazards for commercial receptors potentially exposed via indoor air vapors based on current or potential future commercial property uses. Therefore, the site is compliant with vapor risk requirements under HSRA and the VRP for delisting."

Groundwater – Ingestion (Commercial Worker Receptor)

As described in **Section 3.4.2.1**, there are no drinking water supply sources within a two-mile radius of the site. The FOSC site is a non-drinking water site. Hence, the potential exposure pathway, groundwater ingestion by commercial worker receptor is an incomplete pathway.

3.6.3 Exposure Domains

As defined in the Georgia VRP Act (§ O.C.G.A. 12-8-102), "exposure domains" are the contaminated geographical areas of a site that can result in exposure to a particular receptor via a specified exposure pathway. Specifically:

- The soil exposure domain for surficial contact with site soils is the area impacted by COCs from the ground surface down to a depth of two feet BGS.
- The soil exposure domain for exposure of construction workers is the impacted area of soils from the ground surface down to the depth of construction; and
- The soil exposure domain for protection of groundwater at an established point of exposure is the impacted area of site soils from the ground surface down to the uppermost groundwater zone.

The potential on-site exposure domains for this CSM include those areas of the site where:

- Groundwater COC concentrations exceed Type 3/Type 4 commercial RRS (but comply with site specific Type 5 RRS) for the incomplete groundwater ingestion pathway (**Tables 19 & 20**). These COCs and 14 former on-site exceedance locations are:
    - Benzene (MWs-20, 21 & 28)
    - cDCE (MWs-2, 4, 16, 20 & 28)
    - PCE (MWs-2, 3, 5, 9, 13S, 14, 16, 20, 22, 23 & 28)
    - TCE (MWS-2, 4, 6, 16, 20 & 28)
    - VC (MWs-16 & 28)
    - Benzene (MWs-20, 21 & 28)
- VISL screening calculations using maximum groundwater contaminant concentrations as model inputs indicated that there were *potential* VI risks exceeding target levels at five monitoring wells (MW-2, MW-4, MW-16, MW-22 & MW-28). However,
    - Subsequent VISL modeling by AFW using 95% UCL contaminant concentrations as model inputs showed that there were *no areas on site* where potential VI risks exceed target levels.
    - J&E modeling conducted by MEI using maximum on-site groundwater COC concentrations to simulate hypothetical "worst case scenarios" also indicated that there are no areas on site where potential VI risks exceed target levels.

Hence, there are no exposure domains on the FOSC site.

The only *potential* off-site exposure domain would be a limited area of groundwater contamination immediately adjacent to FOSC for the incomplete groundwater ingestion pathway for a potential residential receptor. Hence, there is no off-site exposure domain because:

- The FOSC site is a non-drinking water site (see **Section 3.4.2.1**).
- There are no off-site groundwater COC concentrations exceeding applicable RRS (see **Section 3.4.3.2**).
- The groundwater contaminant plume is naturally attenuating at a relatively rapid rate (see **Section 3.4.3.4**.).

- Groundwater contaminant fate & transport modeling suggests that PCE could impact the surface water stream point of compliance on the undeveloped Long Island Terrace property adjacent to the FOSC site, at levels exceeding the Georgia In Stream Standard.
    - However, a surface water sample collected from this stream on May 3, 2017 did not contain any detectible VOCs. Hence, this potential exposure domain is associated with an incomplete exposure pathway.
- Groundwater contaminant fate & transport modeling demonstrates a lack of risk for off-site groundwater ingestion by hypothetical remote residential receptors 1,000 feet from the contaminant plume.

The use of an institutional control to mitigate *potential* on-site exposure risks associated with the incomplete exposure pathways is described in **Section 4.0** as follows.

4.0 VOLUNTARY REMEDIATION PLAN

4.1. Voluntary Remediation Plan - Soil

No soil remediation, and thus no remediation plan, is necessary for on- or off-site soil because:

- The extent of soil on-site contamination was exhaustively delineated (see **Section 3.3.1**),
- On-site soil exceeding approved RRS was removed during the 2007-2008 soil remediation project (see **Section 3.3.2**),
- The remaining in-situ concentrations of COCs in on-site soil were exhaustively demonstrated through collection of verification samples and borings/monitoring wells installed by MEI (see **Section 3.3.3**), and
- No COCs in excess of applicable RRS are present in off-site soils (see **Section 3.3.1**)

<u>Soil</u> at the FOSC site <u>is in compliance with all applicable/EPD-approved RRS</u>, as certified in the report Certification of Compliance on page viii herein. Since the site was initially listed on the HSI for a release of tetrachloroethene (PCE) to soil, and on-site soil has been remediated and is now in compliance with applicable RRS, the FOSC site is eligible for de-listing from the HSI.

4.2. Voluntary Remediation Plan – Groundwater

As noted in **Section 3.6.3**, there were two potential exposure domains on the FOSC site and one off site:

- On-site areas where groundwater COC concentrations exceed applicable RRS for the incomplete, but *potentially complete* groundwater ingestion pathway,
- On-site areas where VISL screening calculations indicated *potential* VI risks exceeding target levels, and
- The off-site stream where fate & transport modeling suggests PCE levels could exceed the Georgia In Stream Standard,
    - Surface water sampling results show that this is an incomplete exposure pathway.

However, as documented previously herein, there are no on-site or off-site exposure domains. Therefore, upon execution of the institutional control/UEC, groundwater at the site will be in compliance with Type 5 RRS and thus eligible for delisting.

4.2.1. Secondary Source Removal & Natural Attenuation

The excavation of approximately 3,831 tons of contaminated soil from the release source area and immediate downgradient area in 2007-2008 (see **Sections 2.1 and 3.3.2**) removed this significant secondary source of groundwater contamination via the soil-to-groundwater leaching pathway. As a result, groundwater COC concentrations in both the on-site release source and downgradient areas have been rapidly attenuating (see **Section 3.4.3.4**) and associated exposure risk levels have been rapidly declining. Therefore, no additional active remediation efforts appear to be required for remediation of groundwater contamination.

4.2.2. Monitoring Well Abandonment

EPD personnel gave tentative verbal approval to abandon several wells in a meeting on February 27, 2015, including (**Figure 3**):

- MW-4
- MW-9
- MW-26
- MW-27

MEI requests closure of all downgradient and cross-gradient wells associated with the former on-site release, for the following reasons:

- The contaminated soil that would have acted as an ongoing secondary source of groundwater contamination (via soil to groundwater leaching) has been removed,
- The groundwater contaminant plume is rapidly attenuating, and
- There are no off-site, downgradient groundwater impacts in excess of applicable RRS.

Therefore, MEI requests abandonment of the following wells.

1. MW-2
2. MW-4
3. MW-9
4. MW-17
5. MW-26
6. MW-27
7. MW-3
8. MW-13D
9. MW-13S
10. MW-29
11. MW-30
12. MW-31
13. MW-32

4.3. Engineering Controls

MEI understands that no expansion of existing facilities is planned for the immediate future. Engineering controls are not necessary since there are no exposure domains on site. Engineering controls are unnecessary due to the following:

- VISL and J&E model results indicate that there are no significant VI exposure risks.
- Indoor air sampling results conducted during a Limited Subsurface Investigation in 2013 (**Appendix H**) confirm that the potential subsurface to indoor air exposure pathway is incomplete.

4.4. Institutional Controls

MEI, AFW and the property owners AMREIT Fountain Oaks LP propose the use of an institutional control, specifically, a restrictive Uniform Environmental Covenant, to mitigate potential exposure risks from on-site groundwater exceeding Type 3/Type 4 Commercial RRS. Upon execution of the institutional control/UEC, groundwater at the site will be in compliance with Type 5 RRS and eligible for delisting.

4.4.1. Restrictive Covenants

Restrictive environmental covenants are proposed between the FOSC and 115 West Belle Isle property owners and EPD as a means of mitigating potential exposure to contaminated groundwater. A Draft Uniform Environmental Covenant (UEC) for FOSC & 115 West Belle Isle Road properties is contained herein in **Appendix D.** The specific language of the covenant includes a prohibition on the use of groundwater beneath the site.

5.0 PROGRESS REPORT

Since submittal of the VRP Application and CSR in December 2015, the following events have transpired regarding the FOSC site:

- No expansion of existing facilities is planned for the immediate future.
- MEI collected a water sample from the stream on the undeveloped Long Island Terrace property on May 3, 2017.
  - This sample was analyzed for VOCs by EPA Method 8260B.
  - The results of the analysis showed that no chlorinated VOCs were present in in the sample.
  - The absence of chlorinated VOCs in the sample confirms that groundwater migration to surface water discharge is an incomplete exposure pathway.
- AFW conducted an "Additional Evaluation of the Vapor Intrusion Pathway" to address comments raised by EPD in its November 30, 2016 letter regarding vapor modeling.
- MEI submitted a Revised CSR and Progress Report on May 31, 2017.
- AFW conducted revised VISL modeling in accordance with EPD review comments (**Appendix E**). The results of this modeling indicate that there is no potential VI risk in excess of target levels.

- MEI conducted revised J&E modeling in accordance with EPD review comments (**Appendix G**) to simulate a hypothetical worst case VI exposure scenario. The results of this modeling indicate that there is no potential VI risk in excess of target levels.

No other significant activities related to the environmental or regulatory status of the site have been performed since submittal of the December 2015 CSR & VRP Application.

6.0 MILESTONE SCHEDULE

As listed on the VRP application form, the following four required generic milestones must be included in this initial application:

1. Within 12 months of enrollment (into the VRP):
    a. Horizontal delineation of the release and associated COCs on property where access is available at the time of enrollment;
2. Within 24 months of enrollment:
    a. Horizontal delineation of the release and associated constituents of concern extending onto property for which access was not available at the time of enrollment;
3. Within 30 months of enrollment:
    a. Update the site CSM to include vertical delineation, finalize the remediation plan and provide a preliminary cost estimate for implementation of remediation and associated continuing actions; and
4. Within 60 months after enrollment,
    a. Submit the compliance status report (CSR) required under the VRP, including requisite certifications.

Please note that all of item numbers 1, 2 and 3 above have been completed and this information submitted to EPD. Item number 4 should be considered completed upon submittal of this updated CSR. A milestone schedule Gantt chart is included as **Appendix F**.

7.0 SUMMARY & CONCLUSIONS

The Fountain Oaks Shopping Center (FOSC), 4920 Roswell Road NE, Sandy Springs, Fulton County, Georgia (the subject site) is currently listed on the Georgia Hazardous Site Inventory (HSI) as HSI No. 10807. The Subject site and two associated properties currently are regulated under the auspices of the Georgia Voluntary Remediation Program (VRP). These three properties are:

1. Fountain Oaks Shopping Center (subject site), 4920 Roswell Rd NE, Sandy Springs, GA 30342 Fulton County Assessor Parcel No 17 009300061319.

2. 115 West Belle Isle Road (FOSC Outparcel), Sandy Springs, Georgia 30342
   Fulton County Assessor Parcel No 17 009300021073.

3. Long Island Terrace property (undeveloped), Sandy Springs, Georgia 30342
   Fulton County Assessor Parcel No 17 009300060881.

The extent of on-site and off-site soil, groundwater and soil vapor contaminants of concern (COC) impacts and potential exposure risks have been delineated to default risk reduction standards to the extent technically practicable in accordance with the VRP Act. These impacts and potential risks were examined over the course of multiple investigations conducted from 2005 to 2015 by Marion Environmental, Inc. (MEI) and others.

A soil remediation project conducted by others on the FOSC out-parcel in 2007-2008 removed all on-site soils exceeding approved Risk Reduction Standards (RRS). A vapor intrusion (VI) mitigation system was installed by others beneath the north tenant wing of the FOSC and operated for approximately two and a half years, from December 2008 to May 2011. Exposure risks associated with former on-site soil impacts were successfully mitigated.

The FOSC site was originally placed on the HSI because of soil contamination from a release of tetrachloroethene (PCE) and 14 associated contaminants of concern (COCs). As documented in multiple reports prepared by MEI and others, and summarized herein:

1. On the FOSC parcel:
   a. Soil is in compliance with Type 4 risk reduction standards (RRS).
   b. Groundwater is in compliance with Type 5 RRS onsite and Type 1 RRS at the plume's point of exposure (POE).
   c. Groundwater at the property meets the site-specific Type 5 RRS in accordance with the VRP Act (the Act) through the use of a UEC.
2. On the 115 West Belle Isle Road parcel (FOSC outparcel):
   a. Soil is in compliance with Type 4 RRS.
   b. Groundwater is in compliance with Type 5 RRS onsite and Type 1 RRS at the plume's POE.

    c. Groundwater at the property meets the site-specific RRS in accordance with the Act through the use of a UEC.
3. On the Long Island Terrace parcel (undeveloped property):
    a. Soil and groundwater are in compliance with Type 1/2 RRS.

The most recent, March 2015 groundwater analytical results indicated that COC concentrations exceeded commercial Type 3/Type 4 RRS at 14 on-site monitoring wells. These COCs and 14 exceedance locations were:

- Benzene (MWs-20, 21 & 28)
- cDCE (MWs-2, 4, 16, 20 & 28)
- PCE (MWs-2, 3, 5, 9, 13S, 14, 16, 20, 22, 23 & 28)
- TCE (MWS-2, 4, 6, 16, 20 & 28)
- VC (MWs-16 & 28)

Additionally, USEPA vapor intrusion screening level (VISL) calculations using maximum COC concentrations from the March 2015 groundwater sampling event, as presented in MEI's December 11, 2015 CSR & VRP Application and our May 31, 2017 Revised CSR, indicated the *potential* presence of VI risks at five monitoring wells for PCE (MW-2 & MW-22), TCE (MW-2, MW-4 & MW-16) and benzene (MW-28). However, subsequent VI modeling using both the VISL model with 95% upper confidence limit groundwater concentrations, and the Johnson & Ettinger (J&E) model with maximum March 2015 concentrations support the conclusion that there is no vapor risk to indoor air based on current or projected future land use.

There are no *off-site* soil or groundwater impacts that are associated with the on-site release in excess of applicable Residential RRS (Type 1 or Type 2 RRS):

- No soil sample collected from any off-site monitoring well boring (MW-24, MW-25, MW-29, MW-30, MW-31 & MW-32) contained any COC in excess of applicable Residential RRS (Type 1 or Type 2).
- No groundwater sample collected from any off-site monitoring well contained any COCs in excess of applicable Residential RRS (Type 1 or Type 2).
- A surface water sample collected from the stream on the Long Island Terrace property on May 3, 2017 did not contain any detectible chlorinated VOCs.

The conceptual site model (CSM) of the FOSC subject location is of a site where:

- Release sources and substances released have been well defined.
- The lateral and vertical extent and magnitude of soil contamination on-site and potential exposure risks have been well defined through exhaustive subsurface investigations.
- Soil contamination on-site in excess of approved RRS has been removed.
- The lateral and vertical extent and magnitude of groundwater contamination on and off-site and associated exposure risks have been well defined.
- Groundwater flow and subsurface contaminant migration patterns in soil and groundwater are/were significantly affected by the pre-development topography.
- The groundwater contaminant plume, although in excess of RRS in several locations on site, is stable and rapidly attenuating.
- Groundwater fate & transport modeling has demonstrated that:
    - There was a *potential* risk of PCE from the on-site groundwater plume migrating to discharge into surface water at levels exceeding Georgia In Stream standards on the undeveloped Long Island Terrace property. However:
        - A surface water sample collected from the stream on the Long Island Terrace property on May 3, 2017 did not contain any chlorinated VOCs.
        - Hence, groundwater to surface water migration is an incomplete exposure pathway.
    - On-site groundwater RRS exceedances are not a significant health risk to hypothetical off-site residential receptors 1,000 ft downgradient.
    - The contaminant plume is stable, and is not anticipated to migrate downgradient beyond current dimensions.
- Potential on-site vapor intrusion (VI) impacts modeled using the US EPA VISL calculator and maximum March 2015 groundwater concentrations suggested there was a *potential* VI risk associated with PCE, TCE and benzene at five on-site wells. However:
    - There are no building structures currently above the areas with concentrations that exceeded the screening criteria using the maximum groundwater concentrations.
    - Modeling conducted by both MEI and Amec Foster Wheeler (AFW) using the Vapor Intrusion Screening Level (VISL) and Johnson & Ettinger (J&E) models, as well as site-specific data collected by others (including soil vapor and indoor air sampling) provide additional lines of evidence supporting the position that

there is no vapor risk to indoor air at the site based on current or likely future land use..

    - Vapor intrusion (VI) impacts for existing on-site commercial worker receptors have been:
        - Assessed through soil vapor sampling, a soil vapor survey, indoor air sampling, VI modeling, and soil gas sampling; and
        - Mitigated through operation of an on-site VI mitigation system.
    - The VI assessments, mitigation measures, and modeling results described herein therefore support the conclusion that the site is compliant with vapor risk requirements under HSRA and the VRP for delisting.
- Potential dense non-aqueous phase liquid (DNAPL), i.e., "free product" was investigated and determined not to be present beneath the site.
- No off-site properties, including the Long Island Terrace property contain any soil, groundwater, or vapor intrusion (VI) impacts in excess of RRS/risk-based levels.
    - The off-site Long Island Terrace property:
        - Has not had any soil contamination detected on the property in excess of applicable Residential RRS (Type 1 or Type 2).
        - Has not had any groundwater contamination detected on the property in excess of Residential RRS (Type 1 or Type 2).
        - Did not have any detectible surface water contamination in a May 3, 2017 stream sample.

The overall FOSC conceptual site model (CSM) is a site that has been thoroughly investigated, the potential human health and environmental risks have been evaluated and the site complies with applicable RRS for soil and groundwater. Groundwater contamination on-site is not a human health or environmental risk due to incomplete exposure pathways, and a plume that is rapidly attenuating.

There are no on-site exposure domain, due to the following:

- Although, groundwater COC concentrations exceed commercial Type 3/Type 4 RRS for the incomplete, but *potentially complete* groundwater ingestion pathway.
    - The FOSC site is a non-drinking water source.

    - The groundwater contaminant plume is naturally attenuating at a rapid rate.
    - An institutional control will be executed to address this potentially complete exposure pathway.
    - Groundwater fate & transport modeling suggests a potential risk of PCE impacts to off-site surface water in excess of Georgia In Stream Standards at the stream on the undeveloped Long Island Terrace property. However,
        - A surface water sample collected from the stream on the Long Island Terrace property on May 3, 2017 did not contain any detectible chlorinated VOCs.
- Although VISL screening calculations indicated that *potential* VI risks exceed target levels, as stated previously herein:
    - There are no building structures currently above the areas with concentrations exceeding the VISL screening criteria.
    - J&E modeling using site-specific data and maximum on-site groundwater contaminant concentrations support the conclusion that there is no vapor risk to indoor air on site based on current or projected future land use.
    - The VI assessments, mitigation measures, and modeling results indicate that the site is compliant with vapor risk requirements under HSRA and the VRP for delisting.

There is no off-site exposure domain because:

- The FOSC site is a non-drinking water source.
- There are no off-site groundwater COC concentrations exceeding applicable RRS
- The groundwater contaminant plume is naturally attenuating at a rapid rate
- Fate & transport modeling suggests that the groundwater contaminant (PCE) migration to surface water on the Long Island Terrace property was a potential concern.
    - However, the surface water sample collected from the stream on May 3, 2017 shows that groundwater migration to surface water discharge is an incomplete exposure pathway.
- Groundwater fate & transport modeling demonstrates a lack of risk for off-site groundwater ingestion by hypothetical residential receptors 1,000 feet downgradient from the site.

- VI assessments and modeling results indicate that the site is compliant with vapor risk requirements under HSRA and the VRP for delisting.

No soil remediation, and thus no remediation plan, is necessary for on or off-site soil, because:

- No COCs in excess of applicable RRS have been detected in off-site soils.
- The extent of on-site contamination was exhaustively delineated
- On-site soil exceeding RRS was removed during the 2007-2008 soil remediation project
- Remaining in-situ concentrations of COCs in on-site soil below RRS have been exhaustively demonstrated through collection of excavation verification samples and samples from borings & monitoring wells installed on-site.

The excavation of approximately 3,831 tons of contaminated soil from the release source area and immediate downgradient area in 2007-2008 removed a significant secondary source of groundwater contamination via the soil-to-groundwater leaching pathway. As a result, groundwater COC concentrations in on-site release source and downgradient areas and have been rapidly attenuating as have associated exposure risk levels.

MEI requests closure of all downgradient and cross-gradient wells associated with the former on-site release, for the following reasons:

- The contaminated soil that would have acted as an ongoing secondary source of groundwater contamination (via soil to groundwater leaching) has been removed,
- The groundwater contaminant plume is rapidly attenuating, and
- There are no off-site, downgradient groundwater impacts in excess of applicable RRS.

Therefore, MEI requests abandonment of the following 13 wells.

1. MW-2
2. MW-4
3. MW-9
4. MW-17
5. MW-26
6. MW-27
7. MW-3
8. MW-13D
9. MW-13S
10. MW-29
11. MW-30
12. MW-31
13. MW-3

No expansion of existing facilities is planned for the immediate future. No engineering or institutional controls are necessary for mitigation of VI risks in existing or potential future buildings.

Institutional controls, including deed notices and restrictive covenants prohibiting groundwater use are proposed to help mitigate potential exposure risks from on-site groundwater exceeding applicable RRS.

A revised draft uniform environmental covenant (UEC) for the combined FOSC and 115 West Belle Isle Road property is included in this CSR. The specific language of this covenant includes groundwater use prohibitions.

The following four required generic milestones have either already been completed or should be considered to have been completed with the submittal of this updated CSR and Progress Report:

1. Horizontal delineation of the release and associated COCs on property accessible at the time of enrollment;
2. Horizontal delineation of the release and associated COCs on property inaccessible at the time of enrollment;
3. Update CSM to include vertical delineation, finalize the remediation plan and provide a preliminary cost estimate for implementation of remediation and associated continuing actions; and
4. Submit the compliance status report (CSR) required under the VRP, including requisite certifications.

The FOSC subject site, along with the two associated parcels, is eligible for de-listing from the HSI for the following reasons:

1. On the FOSC parcel:
    a. Soil is in compliance with Type 4 risk reduction standards (RRS).
    b. Groundwater is in compliance with Type 5 RRS onsite and Type 1 RRS at the plume’s point of exposure (POE).

    c. Groundwater at the property meets the site-specific RRS in accordance with the VRP Act (the Act) upon the execution of an UEC.
2. On the 115 West Belle Isle Road parcel (FOSC outparcel):
    a. Soil is in compliance with Type 4 RRS.
    b. Groundwater is in compliance with Type 5 RRS onsite and Type 1 RRS at the plume's POE.
    c. Groundwater at the property meets the site-specific RRS in accordance with the Act upon the execution of an UEC.
3. On the Long Island Terrace parcel (undeveloped property):
    a. Soil and groundwater are in compliance with Type 1/2 RRS.

Therefore, as documented herein, the Fountain Oaks Shopping Center site and two associated parcels are eligible for delisting.

8.0 REFERENCES

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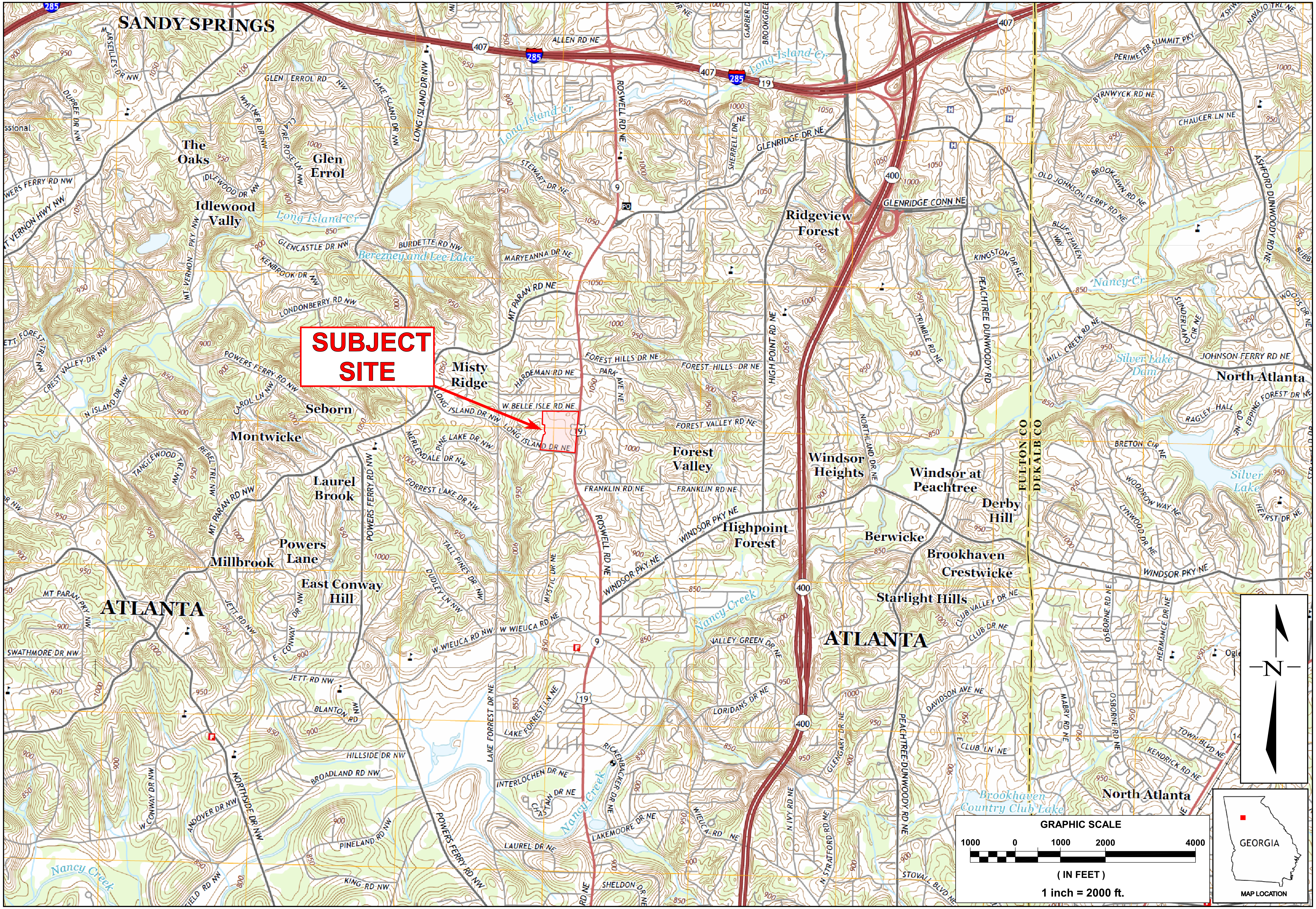
Appendix A

Figures



TOPOGRAPHIC SITE VICINITY MAP

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL ROAD, SANDY SPRINGS, GA

PROJECT: 15513

FACILITY: HSI No. 10807

DATE REVISED: 11/30/15

DATE:

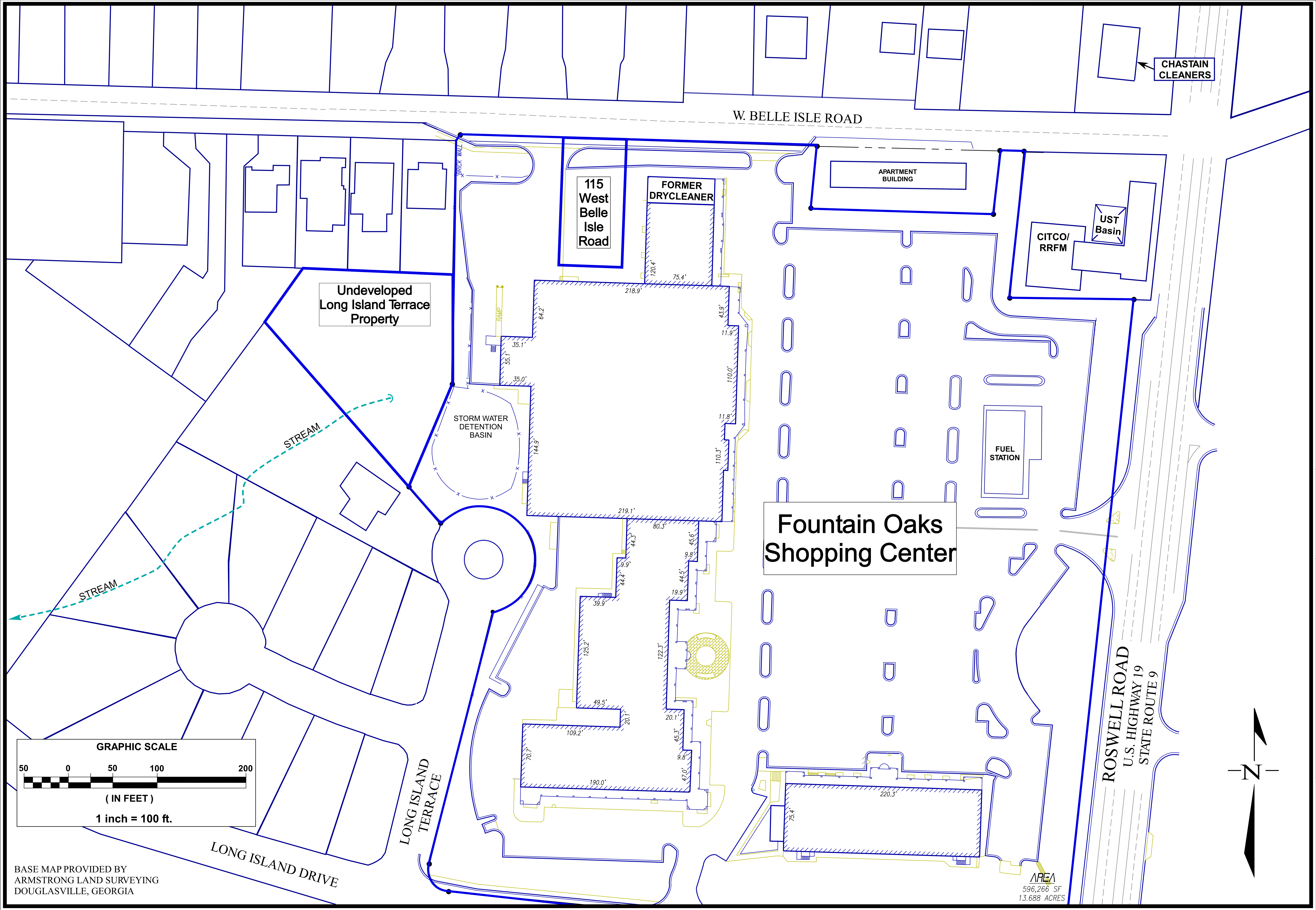
SCALE: Ref. Scale Bar

APPROVED:

MARION ENVIRONMENTAL, INC.
115 PARMENAS LANE
CHATTANOOGA, TN
423-499-4919
www.marionenv.com

MEI

FIGURE 1



SITE MAP

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL ROAD, SANDY SPRINGS, GA

PROJECT: 16577	DATE: 09/30/15
FACILITY: HSI No. 10807	SCALE: 1" = 100'
DATE REVISED: 05/02/2017	APPROVED:

MARION ENVIRONMENTAL, INC.
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423-499-4919
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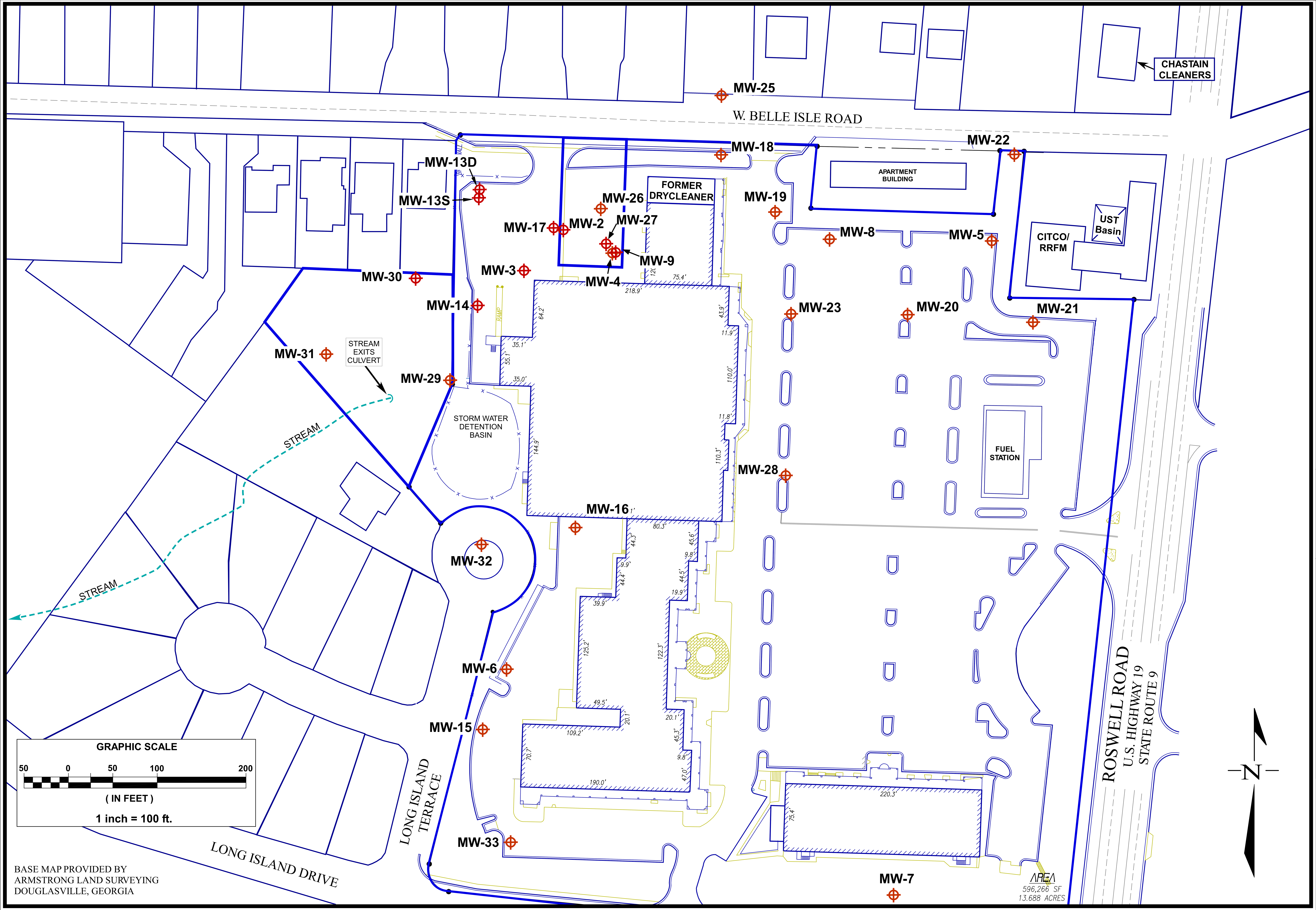
FIGURE 2



MONITORING WELL & SURFACE WATER LOCATION MAP

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL ROAD, SANDY SPRINGS, GA

PROJECT: 16577	FACILITY: HSI No. 10807
DATE: 09/30/15	SCALE: 1" = 100'
DATE REVISED: 05/02/2017	APPROVED:

MARION ENVIRONMENTAL, INC.
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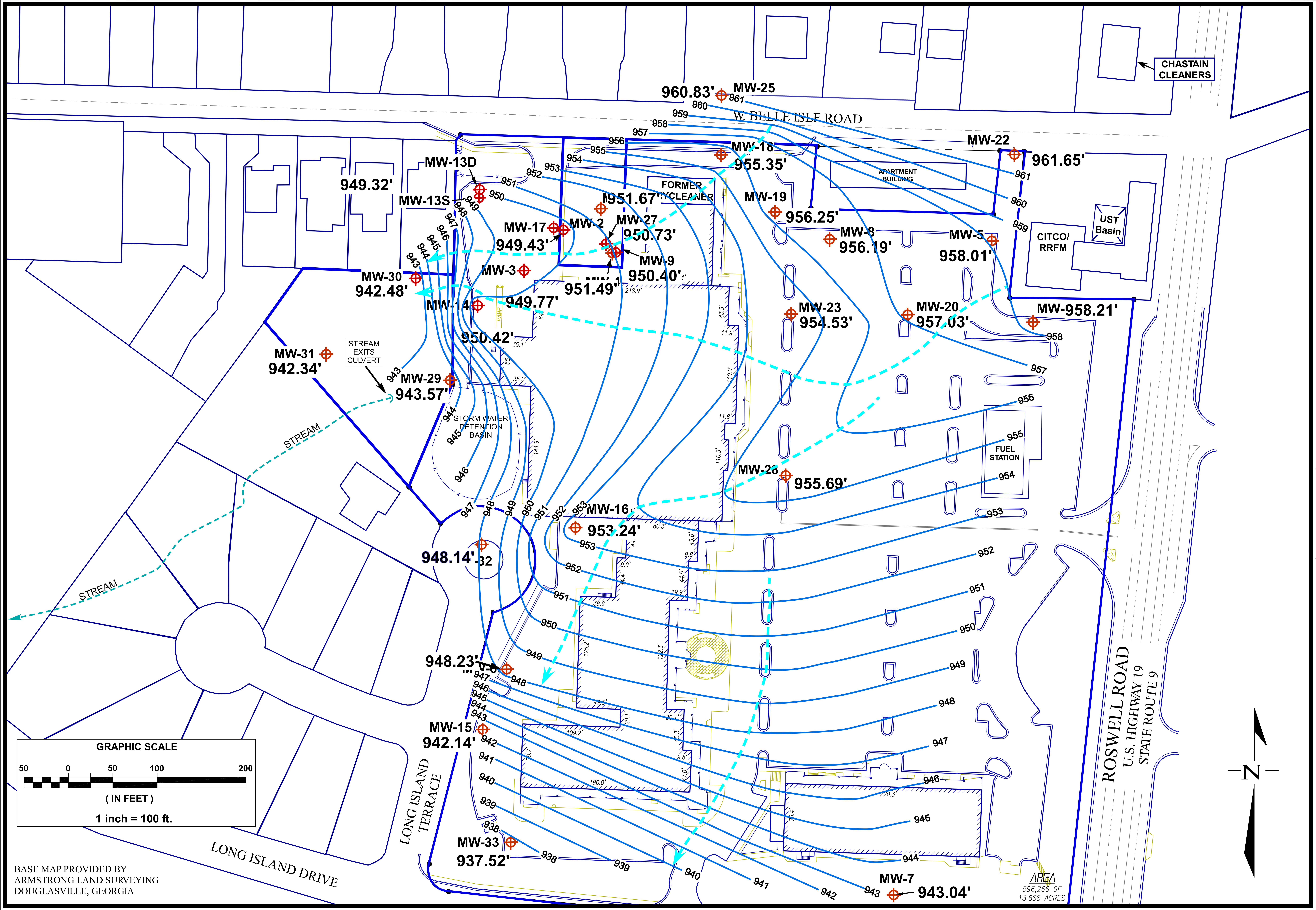
FIGURE 3



GROUNDWATER POTENTIOMETRIC SURFACE
10-MARCH-2015

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL ROAD, SANDY SPRINGS, GA

PROJECT: 16577
FACILITY: HSI No. 10807
DATE REVISED: 05/02/2017
DATE: 09/30/15
SCALE: 1" = 100'
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115 PARTMENAS LANE
CHATTANOOGA, TN
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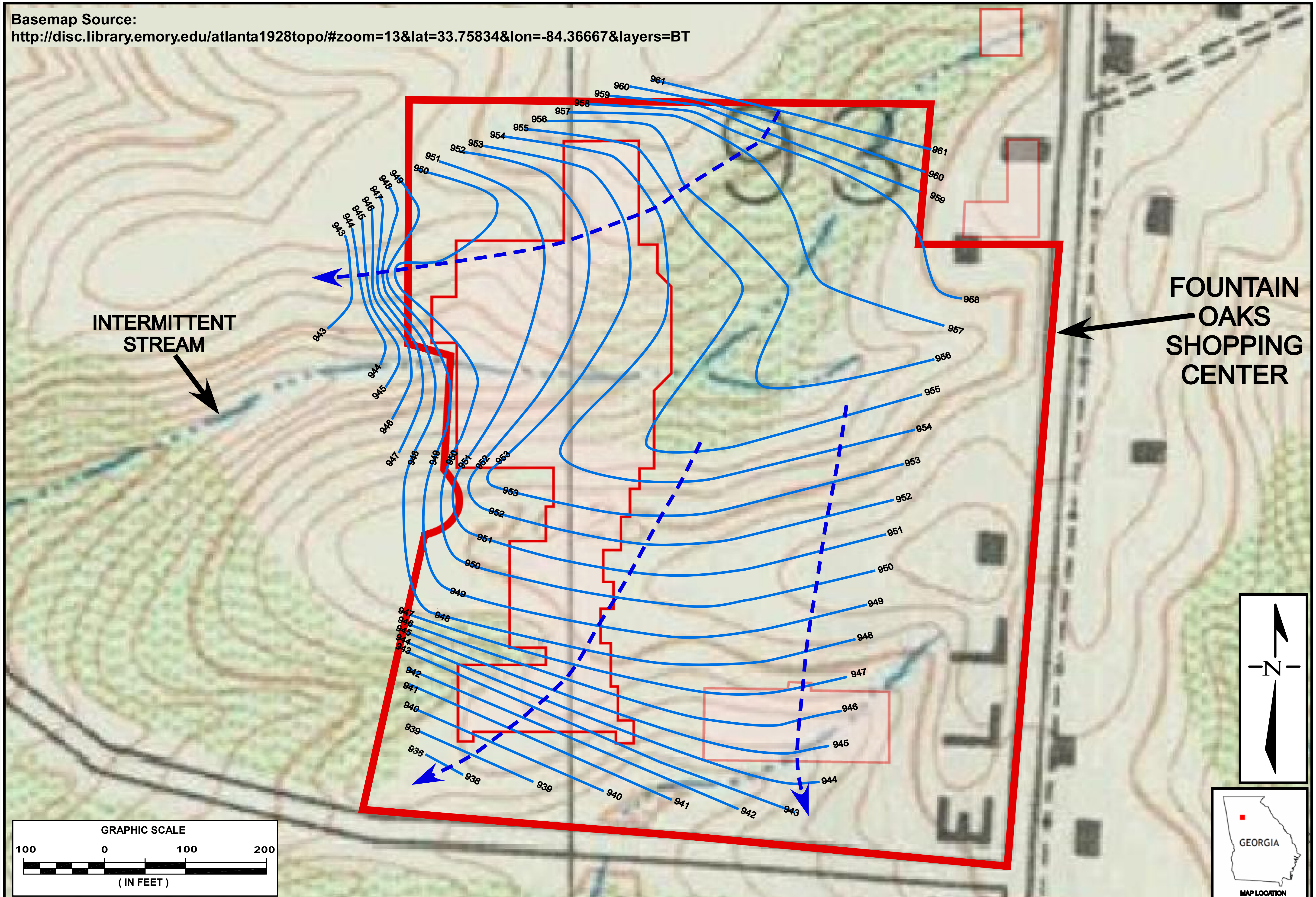
FIGURE 4



1928 TOPOGRAPHIC MAP WITH 10-MARCH-2015 POTENTIOMETRIS SURFACE OVERLAY

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL ROAD, SANDY SPRINGS, GA

PROJECT: 16577
FACILITY: HSI No. 10807
DATE REVISED: 05/12/17
DATE:
SCALE: Ref. Scale Bar
APPROVED:

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CHATTANOOGA, TN
423-499-4919
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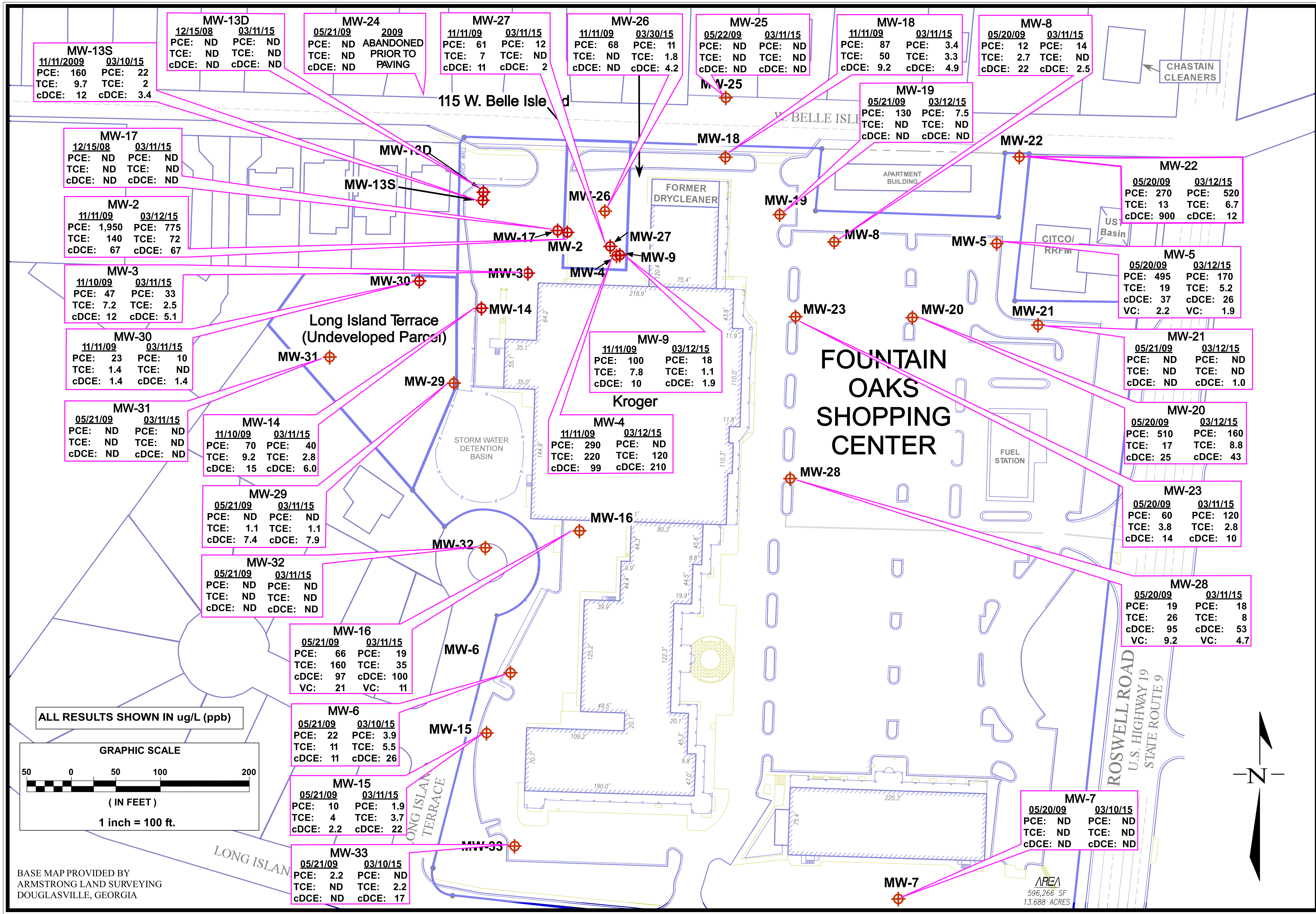
FIGURE 5



GROUNDWATER QUALITY MAP
MARCH 2015 & MOST RECENT PREVIOUS RESULTS

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL ROAD, SANDY SPRINGS, GA

PROJECT: 16577
FACILITY: HSI No. 10807
DATE REVISED: 05/12/17
DATE: 03/31/2015
SCALE: 1" = 100'
APPROVED:

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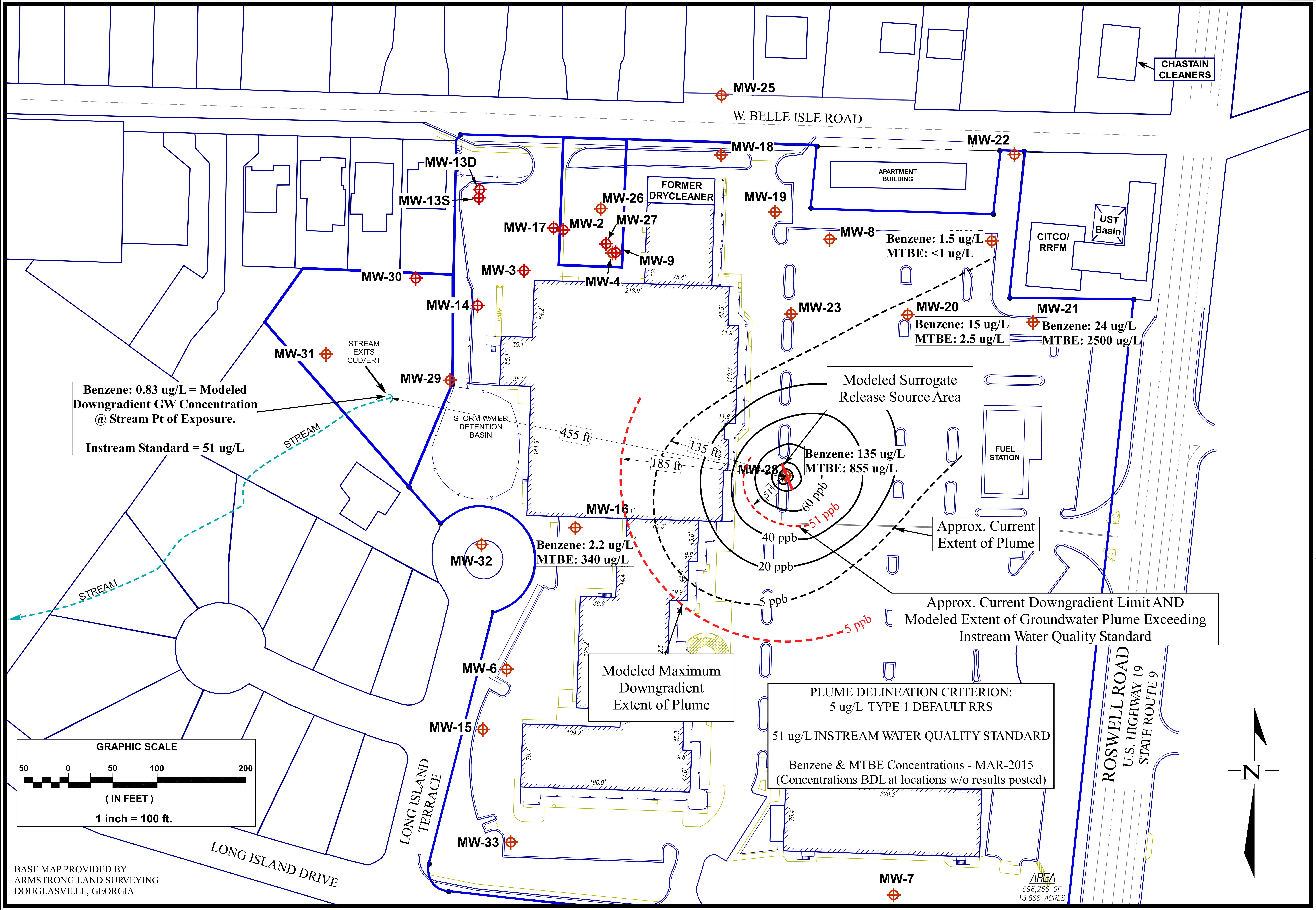
FIGURE 6



BENZENE PLUME DELINEATION & MODELING RESULTS MAP

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL ROAD, SANDY SPRINGS, GA

PROJECT: 17675	FACILITY: HSI No. 10807
DATE: 09/30/15	SCALE: 1" = 100'
DATE REVISED: 02/21/2018	APPROVED:

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CHATTANOOGA, TN
423-499-4919
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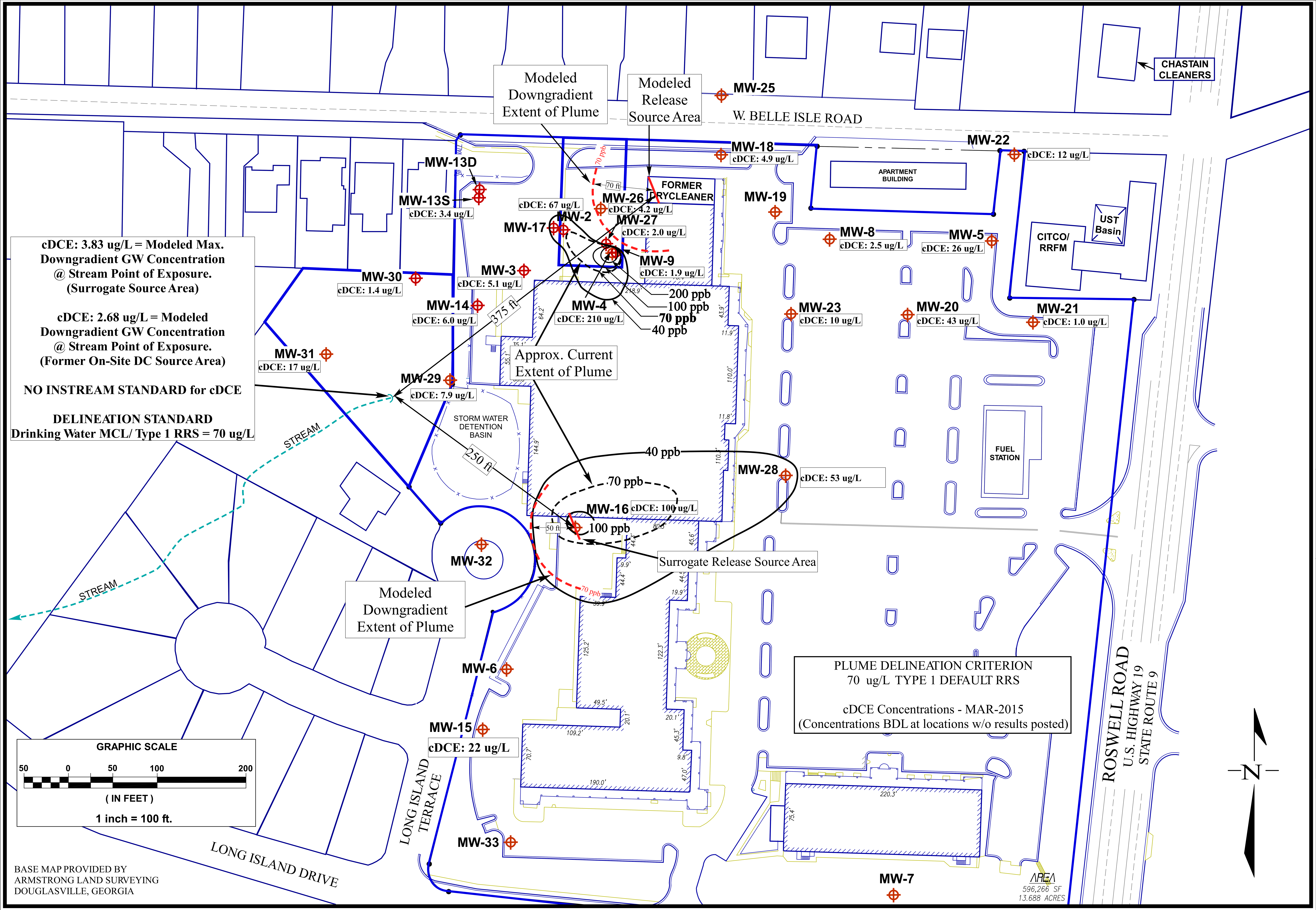
FIGURE 7



cis-1,2-DICHLOROETHENE (cDCE) PLUME DELINEATION & MODELING RESULTS MAP

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL ROAD, SANDY SPRINGS, GA

PROJECT:	16577
FACILITY:	HSI No. 10807
DATE REVISED:	05/02/2017
DATE:	09/30/15
SCALE:	1" = 100'
APPROVED:	

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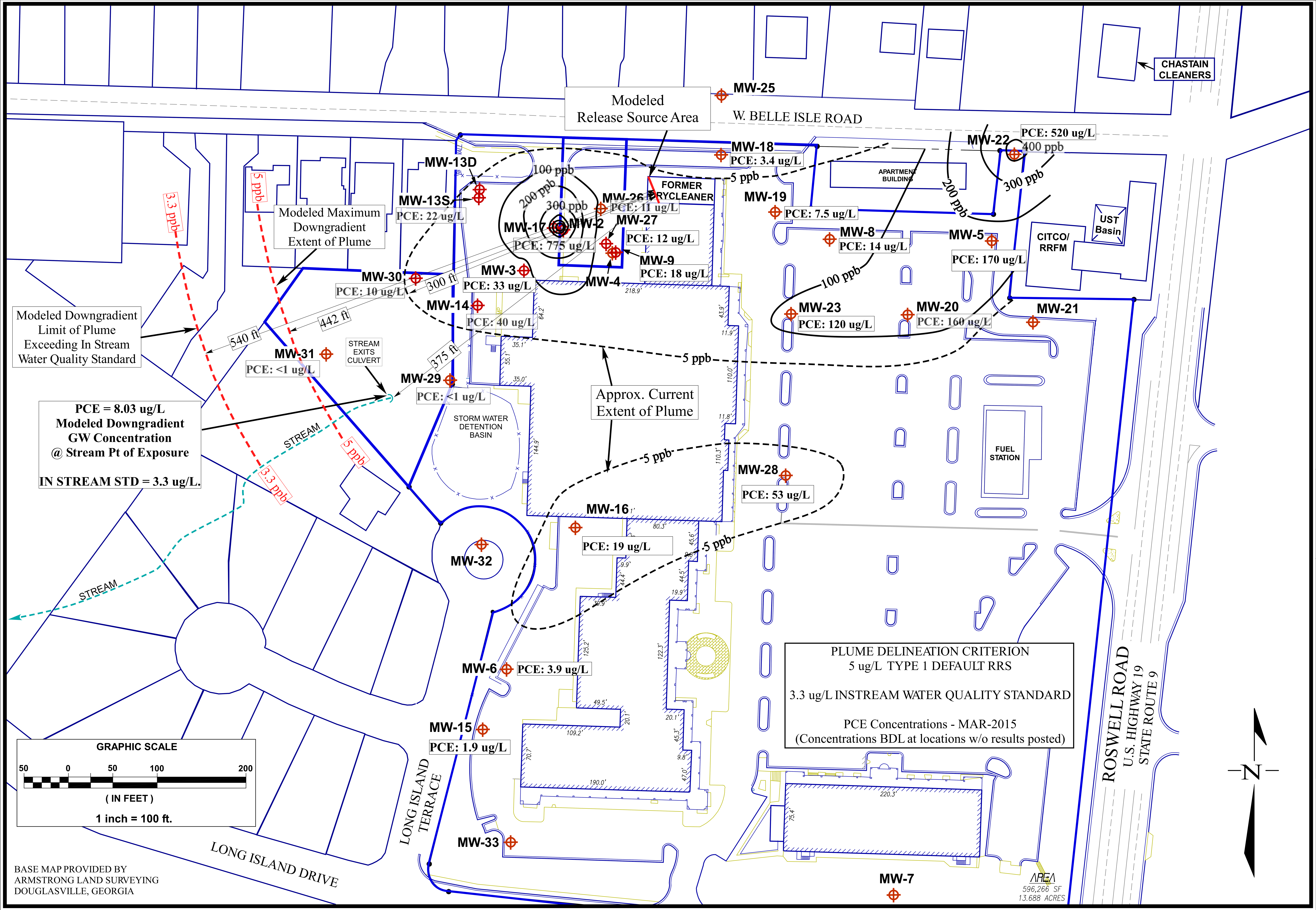
FIGURE 8



TETRACHLOROETHYLENE (PCE) PLUME DELINEATION & MODELING RESULTS MAP

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL ROAD, SANDY SPRINGS, GA

PROJECT: 17675
FACILITY: HSI No. 10807
DATE REVISED: 02/21/2018
DATE: 09/30/15
SCALE: 1" = 100'
APPROVED:

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FIGURE 9

Modeled Maximum Downgradient Extent of Plume
Modeled Release Source Area
MW-25
CHASTAIN CLEANERS
W. BELLE ISLE ROAD
MW-18
TCE: 3.3 ug/L
MW-22
TCE: 6.7 ug/L
APARTMENT BUILDING
MW-13D
MW-13S
TCE: 2.0 ug/L
5 ppb
10 ppb
20 ppb
FORMER DRYCLEANER
MW-26
TCE: 1.8 ug/L
MW-19
MW-17
MW-2
MW-27
MW-8
MW-5
TCE: 5.2 ug/L
CITCO/ RRFM
UST Basin
TCE: 72 ug/L
MW-9
TCE: 1.1 ug/L
MW-30
TCE: <1 ug/L
MW-3
TCE: 2.5 ug/L
MW-4
TCE: 120 ug/L
MW-23
TCE: 2.8 ug/L
MW-20
TCE: 8.8 ug/L
MW-21
MW-14
TCE: 2.8 ug/L
MW-31
TCE: <1 ug/L
STREAM EXITS CULVERT
375 ft
MW-29
TCE: 1.1 ug/L
Approximate Downgradient Limit of Plume Exceeding 30 ug/L Instream Water Quality Standard
Approx. Current Extent of Plume
TCE = 1.4 ug/L
Modeled Downgradient GW Concentration @ Stream Pt of Exposure.
In Stream Standard = 30 ug/L
STREAM
STORM WATER DETENTION BASIN
FUEL STATION
MW-28
TCE: 8.0 ug/L
MW
TCE: 35 ug/L
20 ppb
10 ppb
MW-32
MW-6
TCE: 5.5 ug/L
PLUME DELINEATION CRITERION
5 ug/L TYPE 1 DEFAULT RRS
30 ug/L INSTREAM WATER QUALITY STANDARD
TCE Concentrations - MAR-2015
(Concentrations BDL at locations w/o results posted)
MW-15
TCE: 3.7 ug/L
GRAPHIC SCALE
50 0 50 100 200
(IN FEET)
1 inch = 100 ft.
LONG ISLAND TERRACE
LONG ISLAND DRIVE
ROSWELL ROAD
U.S. HIGHWAY 19
STATE ROUTE 9
N
MW-33
TCE: 2.2 ug/L
MW-7
AREA
596,266 SF
13.688 ACRES
BASE MAP PROVIDED BY
ARMSTRONG LAND SURVEYING
DOUGLASVILLE, GEORGIA
TRICHLOROETHYLENE (TCE)
PLUME DELINEATION &
MODELING RESULTS MAP
FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL ROAD, SANDY SPRINGS, GA
PROJECT: 17675
FACILITY: HSI No. 10807
DATE REVISED: 02/21/2018
DATE: 09/30/15
SCALE: 1" = 100'
APPROVED:
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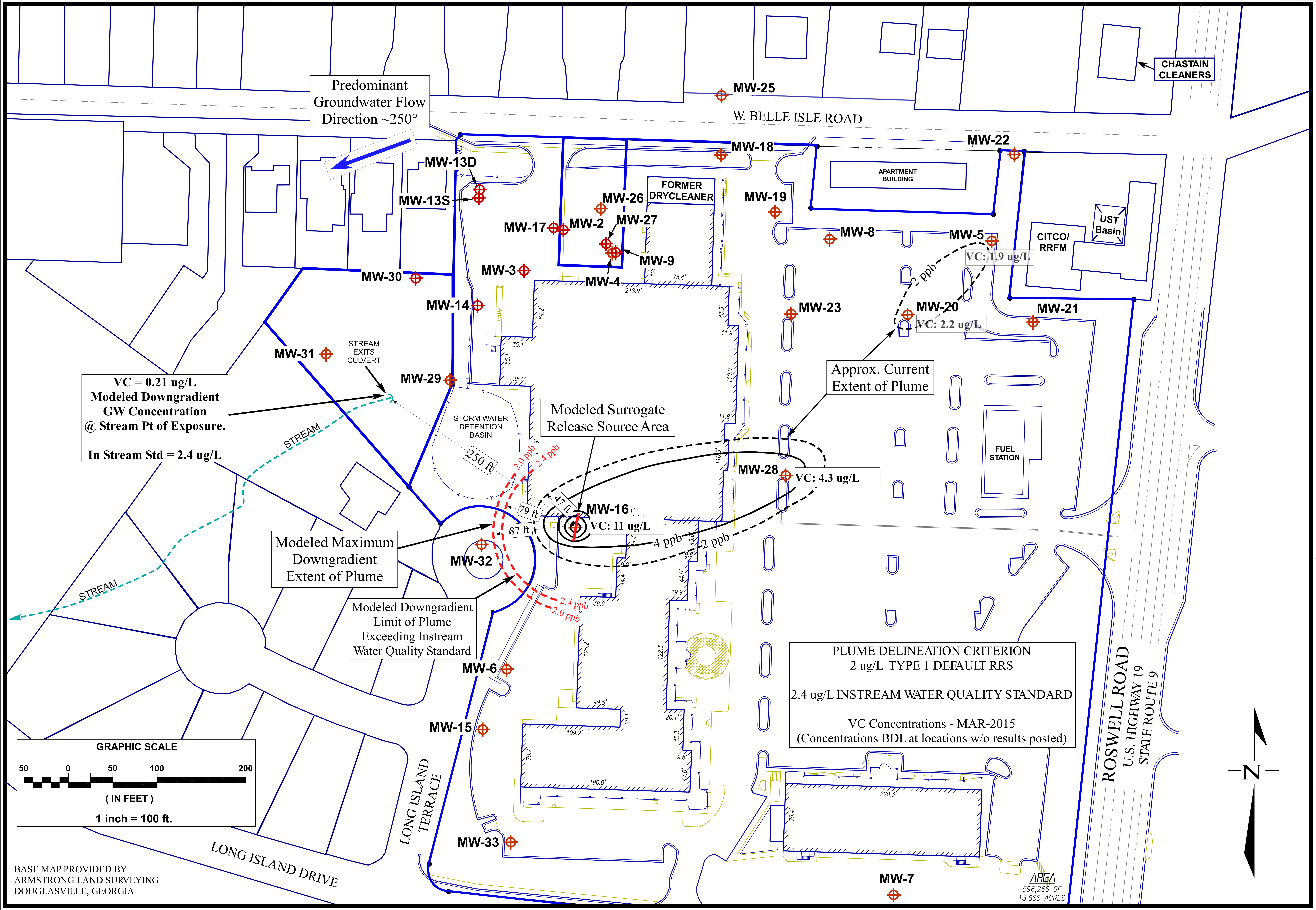
FIGURE 10



VINYL CHLORIDE (VC)
PLUME DELINEATION &
MODELING RESULTS MAP

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL ROAD, SANDY SPRINGS, GA

PROJECT: 17675
FACILITY: HSI No. 10807
DATE REVISED: 02/21/2018
DATE: 09/30/15
SCALE: 1" = 100'
APPROVED:

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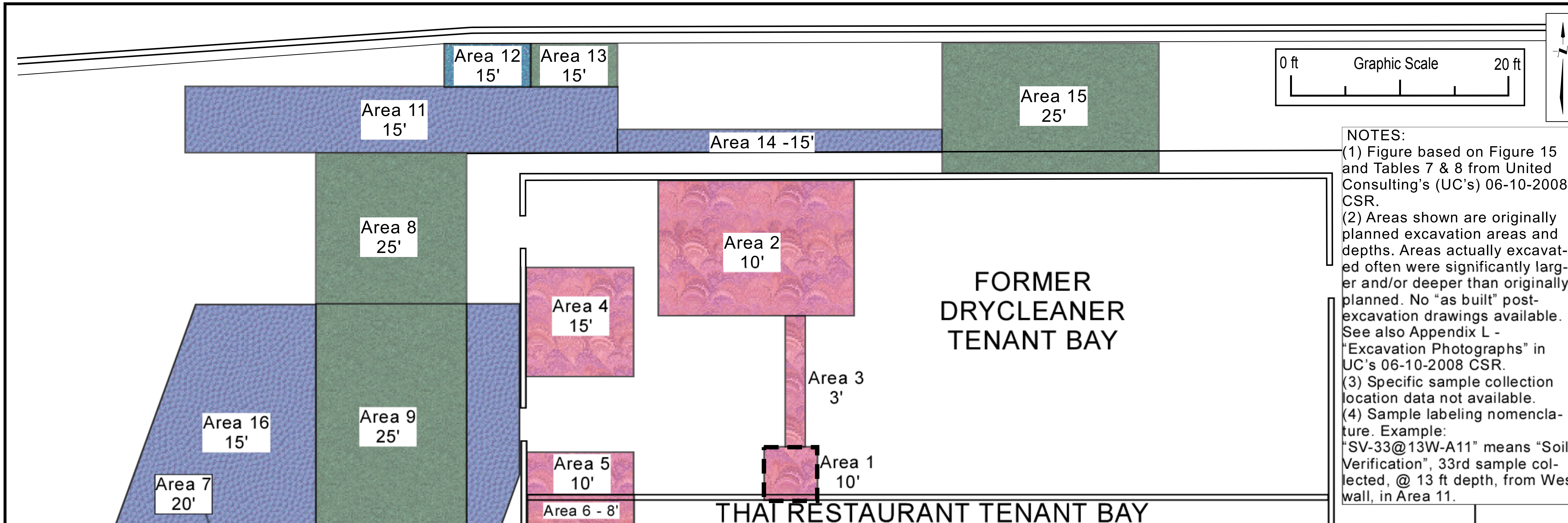
FIGURE 11



NOTES:
(1) Figure based on Figure 15 and Tables 7 & 8 from United Consulting's (UC's) 06-10-2008 CSR.
(2) Areas shown are originally planned excavation areas and depths. Areas actually excavated often were significantly larger and/or deeper than originally planned. No "as built" post-excavation drawings available. See also Appendix L - "Excavation Photographs" in UC's 06-10-2008 CSR.
(3) Specific sample collection location data not available.
(4) Sample labeling nomenclature. Example: "SV-33@13W-A11" means "Soil Verification", 33rd sample collected, @ 13 ft depth, from West wall, in Area 11.

Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	1st Re-Verification Sample Descr.	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	2nd Re-Verification Sample Descr.	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	Comments
EPD-Approved TYPE 4 RRS			1.18	0.7	1.84	EPD-Approved TYPE 4 RRS			1.18	0.7	1.84	EPD-Approved TYPE 4 RRS			1.18	0.7	1.84	Comments
SV-1@11'	UC	Area 1	**5.9**	0.012	0.044	←Excavation Expanded Into Adjacent Area												
SV-1@11'	MEI	Area 1	**5.3**	<0.65	<0.065	←Excavation Expanded Into Adjacent Area												
SV-2@8'	UC	Area 1	**1.3**	<0.0050	<0.0050	←Excavation Expanded Into Adjacent Area												
SV-2@8'	MEI	Area 1	0.26	0.0061	0.0042	←Excavation Expanded Into Adjacent Area												
SV-3@8'	UC	Area 1	**210**	<26	<26	←Excavation Expanded Into Adjacent Area												
SV-3@8'	MEI	Area 1	**2200**	<3.6	<3.6	←Excavation Expanded Into Adjacent Area												
SV-4@7'	UC	Area 1	**11**	<0.250	0.28	←Excavation Expanded Into Adjacent Area												
SV-4@7'	MEI	Area 1	**7.7**	0.11	0.23	←Excavation Expanded Into Adjacent Area												
SV-177@5W-A1	UC	Area 1	**1.2**	0.017	0.052	←Excavation Expanded Into Adjacent Area												
SV-177@5W-A1	MEI	Area 1	**1.8**	0.036	0.1	←Excavation Expanded Into Adjacent Area												
SV-178@11W-A1	UC	Area 1	0.018	<0.0042	<0.0042													
SV-178@11W-A1	MEI	Area 1	0.09	0.0016	0.0095													
SV-179@5S-A1	UC	Area 1	**1.3**	0.057	0.034	SV-185@5S-A1	UC	Area 1	**3.9**	0.078	0.033	SV-186@5S-A1	UC	Area 1	**1.4**	0.023	0.012	←Excavation Expanded Into Adjacent Area
SV-179@5S-A1	MEI	Area 1	**1.8**	0.035	0.027	SV-185@5S-A1	MEI	Area 1	0.095	<0.0074	<0.0074	SV-186@5S-A1	MEI	Area 1	0.72	0.012	0.0079	←Excavation Expanded Into Adjacent Area
SV-180@11S-A1	UC	Area 1	0.0054	<0.0043	<0.0043													
SV-180@11S-A1	MEI	Area 1	0.023	<0.0012	<0.0012													
SV-181@5E-A1	UC	Area 1	0.32	<0.0043	0.0072													
SV-181@5E-A1	MEI	Area 1	0.35	0.0081	0.016													
SV-182@11E-A1	UC	Area 1	0.11	<0.0046	0.0079													
SV-182@11E-A1	MEI	Area 1	0.13	0.0025	0.0094													
SV-183@14B(N)-A1	UC	Area 1	0.18	<0.0056	0.023													
SV-183@14B(N)-A1	MEI	Area 1	0.12	0.0024	0.015													
SV-184@14B(S)-A1	UC	Area 1	0.24	<0.0044	0.011													
SV-184@14B(S)-A1	MEI	Area 1	0.26	0.0018	0.0074													

SOIL REMEDIATION - VERIFICATION SAMPLE RESULTS
AREA 1

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL RD NE, SANDY SPRINGS, GA 37347

PROJECT: 17675
FACILITY:
DATE REVISED: 02/23/2018
DATE: 06/10/2008
SCALE: Ref. Scale Bar
APPROVED:

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CHATTANOOGA, TN 37405
423-499-4919
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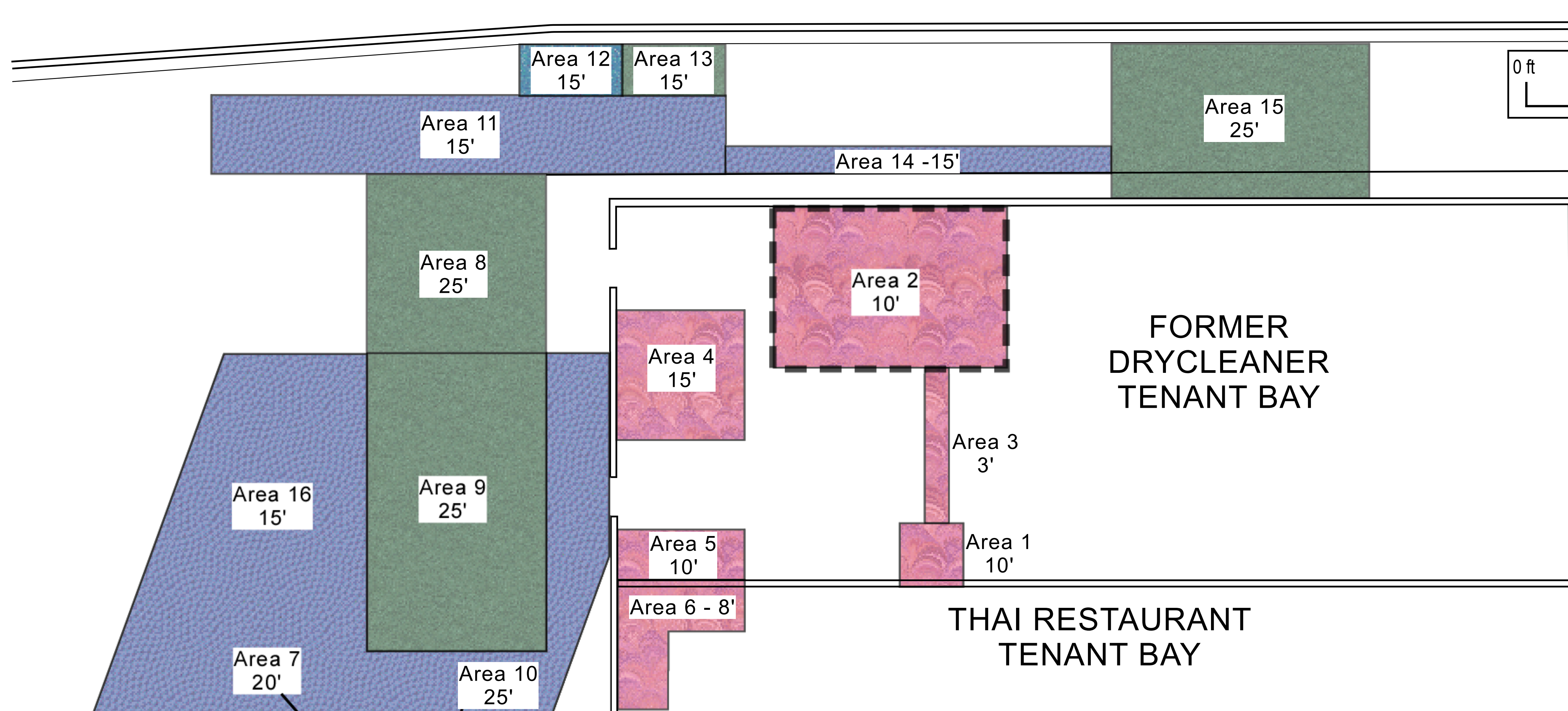
FIGURE 12



NOTES:
(1) Figure based on Figure 15 and Tables 7 & 8 from United Consulting's (UC's) 06-10-2008 CSR.
(2) Areas shown are originally planned excavation areas and depths. Areas actually excavated often were significantly larger and/or deeper than originally planned. No "as built" post-excavation drawings available. See also Appendix L - "Excavation Photographs" in UC's 06-10-2008 CSR.
(3) Specific sample collection location data not available.
(4) Sample labeling nomenclature. Example: "SV-33@13W-A11" means "Soil Verification", 33rd sample collected, @ 13 ft depth, from West wall, in Area 11.

Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	First Re-Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	
EPD-Approved TYPE 4 Risk Reduction Standards			**1.18**	**0.7**	**1.84**	**EPD-Approved TYPE 4 Risk Reduction Standards**			**1.18**	**0.7**	**1.84**	
SV-5@10'	UC	Area 2	**1.3**	0.0063	0.018	←Excavation Expanded Into Adjacent Area						
SV-5@10'	MEI	Area 2	0.6	0.01	0.013	←Excavation Expanded Into Adjacent Area						
SV-6@7'	UC	Area 2	**4.9**	0.033	0.0051	←Excavation Expanded Into Adjacent Area						
SV-6@7'	MEI	Area 2	**9.5**	0.14	<0.13	←Excavation Expanded Into Adjacent Area						
SV-7@7'	UC	Area 2	0.065	<0.0044	<0.0044	←Excavation Expanded Into Adjacent Area						
SV-7@7'	MEI	Area 2	0.18	0.0067	0.0022	←Excavation Expanded Into Adjacent Area						
SV-8@7'	UC	Area 2	**12**	0.047	0.0063	←Excavation Expanded Into Adjacent Area						
SV-8@7'	MEI	Area 2	**19**	0.1	<0.065	←Excavation Expanded Into Adjacent Area						
SV-9@7'	UC	Area 2	**12**	0.046	0.11	←Excavation Expanded Into Adjacent Area						
SV-9@7'	MEI	Area 2	**13**	<0.12	0.12	←Excavation Expanded Into Adjacent Area						
SV-138@8N-A2	UC	Area 2	**59**	0.016	0.013	SV-152@5N-A14	UC	Area 14	0.16	<0.0056	<0.0056	←Excavation Expanded Into Adjacent Area
SV-138@8N-A2	MEI	Area 2	**23**	<0.23	<0.23	SV-152@5N-A14	MEI	Area 14	0.22	<0.0014	0.0033	←Excavation Expanded Into Adjacent Area
SV-139@8N-A2	UC	Area 2	0.064	<0.0042	<0.0042	SV-153@8N-A14	UC	Area 14	0.5	<0.0061	0.026	←Excavation Expanded Into Adjacent Area
SV-139@8N-A2	MEI	Area 2	0.93	<0.0013	0.0021	SV-153@8N-A14	MEI	Area 14	0.72	0.0026	0.012	←Excavation Expanded Into Adjacent Area
SV-140@13N-A2	UC	Area 2	**16**	0.0057	0.026	SV-154@13N-A14	UC	Area 14	0.66	<0.0076	0.026	←Excavation Expanded Into Adjacent Area
SV-140@13N-A2	MEI	Area 2	**14**	<0.056	<0.056	SV-154@13N-A14	MEI	Area 14	0.51	0.01	0.037	←Excavation Expanded Into Adjacent Area
SV-141@5W-A2	UC	Area 2	**9**	0.037	0.093	SV-155@5W-A2	UC	Area 2	0.5	0.012	0.065	
SV-141@5W-A2	MEI	Area 2	**2.3**	0.016	0.034	SV-155@5W-A2	MEI	Area 2	0.55	0.008	0.045	

SOIL REMEDIATION - VERIFICATION SAMPLE RESULTS
AREA 2 - (PAGE 1 OF 2)

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL RD NE, SANDY SPRINGS, GA 37347

PROJECT: 17675
FACILITY:
DATE REVISED: 02/23/2018
DATE: 06/10/2008
SCALE: Ref. Scale Bar
APPROVED:

MARION ENVIRONMENTAL, INC.
115 PARMENAS LANE
CHATTANOOGA, TN 37405
423-499-4919
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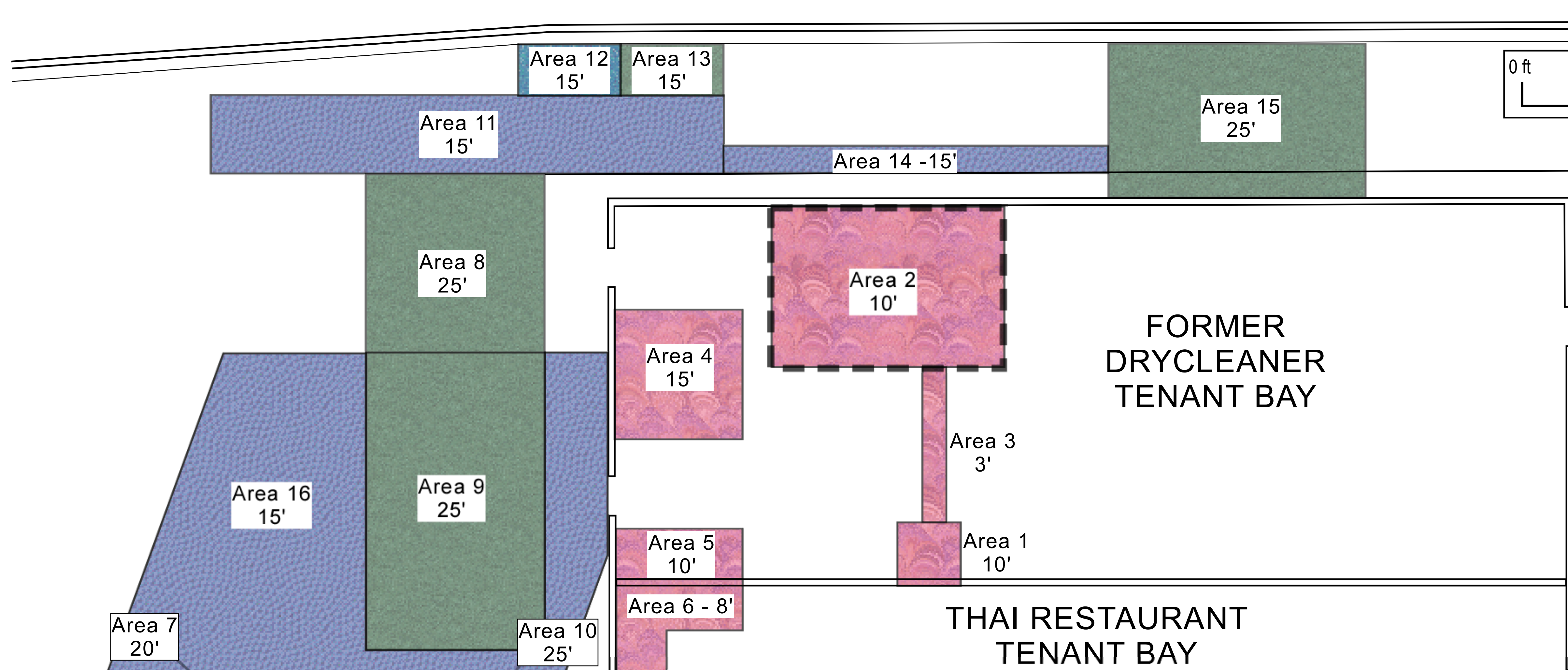
FIGURE 13



0 ft Graphic Scale 20 ft

NOTES:
(1) Figure based on Figure 15 and Tables 7 & 8 from United Consulting's (UC's) 06-10-2008 CSR.
(2) Areas shown are originally planned excavation areas and depths. Areas actually excavated often were significantly larger and/or deeper than originally planned. No "as built" post-excavation drawings available. See also Appendix L - "Excavation Photographs" in UC's 06-10-2008 CSR.
(3) Specific sample collection location data not available.
(4) Sample labeling nomenclature. Example: "SV-33@13W-A11" means "Soil Verification", 33rd sample collected, @ 13 ft depth, from West wall, in Area 11.

Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	1st Re-Verification Sample Descr.	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	2nd Re-Verification Sample Descr.	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)
EPD-Approved TYPE 4 RRS			1.18	0.7	1.84	EPD-Approved TYPE 4 RRS			1.18	0.7	1.84	EPD-Approved TYPE 4 RRS			1.18	0.7	1.84
SV-142@6W-A2	UC	Area 2	**17**	0.01	0.077	SV-156@8W-A2	UC	Area 2	**8.1**	0.12	0.72	←Excavation Expanded Into Adjacent Area					
SV-142@6W-A2	MEI	Area 2	**24**	0.2	0.97	SV-156@8W-A2	MEI	Area 2	**5.2**	0.066	0.66	←Excavation Expanded Into Adjacent Area					
SV-143@13W-A2	UC	Area 2	0.58	<0.0043	0.014	SV-157@13W-A2	UC	Area 2	0.25	<0.0074	0.039						
SV-143@13W-A2	MEI	Area 2	0.37	0.0026	0.014	SV-157@13W-A2	MEI	Area 2	0.61	0.007	0.065						
SV-144@5S-A2	UC	Area 2	0.87	0.039	0.11	SV-158@5S-A2	UC	Area 2	**2.1**	0.11	0.26	←Excavation Expanded Into Adjacent Area					
SV-144@5S-A2	MEI	Area 2	0.8	0.043	0.12	SV-158@5S-A2	MEI	Area 2	**2.8**	0.035	0.096	←Excavation Expanded Into Adjacent Area					
SV-145@8S-A2	UC	Area 2	**1.4**	0.083	0.064	SV-159@8S-A2	UC	Area 2	0.18	0.0058	0.018						
SV-145@8S-A2	MEI	Area 2	**2.3**	0.016	0.034	SV-159@8S-A2	MEI	Area 2	0.14	0.0026	0.019						
SV-146@13S-A2	UC	Area 2	**3.0**	0.017	0.14	SV-160@13S-A2	UC	Area 2	0.092	<0.006	0.0082						
SV-146@13S-A2	MEI	Area 2	0.86	0.0087	0.054	SV-160@13S-A2	MEI	Area 2	0.32	0.0037	0.022						
SV-147@5E-A2	UC	Area 2	**1.9**	0.0046	0.0084	SV-161@5E-A2	UC	Area 2	0.21	<0.0054	0.0097						
SV-147@5E-A2	MEI	Area 2	<0.0012	0.076	0.0014	SV-161@5E-A2	MEI	Area 2	0.16	0.0026	0.0056						
SV-148@8E-A2	UC	Area 2	0.074	<0.0046	<0.0046												
SV-148@8E-A2	MEI	Area 2	0.12	<0.0013	0.0031												
SV-149@13E-A2	UC	Area 2	0.064	<0.0047	<0.0047												
SV-149@13E-A2	MEI	Area 2	0.12	<0.0011	0.002												
SV-150@15B(W)-A2	UC	Area 2	0.78	0.0063	0.039	SV-162@16B-NW-A2	UC	Area 2	**1.3**	0.012	0.045	SV-175@18B(N)-A2	UC	Area 2	0.057	<0.0049	0.005
SV-150@15B(W)-A2	MEI	Area 2	**5.1**	0.015	0.011	SV-162@16B-NW-A2	MEI	Area 2	**1.5**	0.015	0.048	SV-175@18B(N)-A2	MEI	Area 2	<0.0056	<0.0056	<0.0056
						SV-163@16B-SW-A2	UC	Area 2	**1.6**	0.017	0.057	SV-176@18B(S)-A4	UC	Area 2	0.21	<0.0049	0.014
						SV-163@16B-SW-A2	MEI	Area 2	**2.4**	0.024	0.11	SV-176@18B(S)-A4	MEI	Area 2	0.013	<0.0062	<0.0062
SV-151@15B(E)-A2	UC	Area 2	0.24	<0.0047	<0.0047												
SV-151@15B(E)-A2	MEI	Area 2	0.4	0.0023	0.0086												

SOIL REMEDIATION - VERIFICATION SAMPLE RESULTS
AREA 2 - (PAGE 2 OF 2)

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL RD NE, SANDY SPRINGS, GA 37347

PROJECT: 17675
FACILITY:
DATE REVISED: 02/23/2018
DATE: 06/10/2008
SCALE: Ref. Scale Bar
APPROVED:

MARION ENVIRONMENTAL, INC.
115 PARMENAS LANE
CHATTANOOGA, TN 37405
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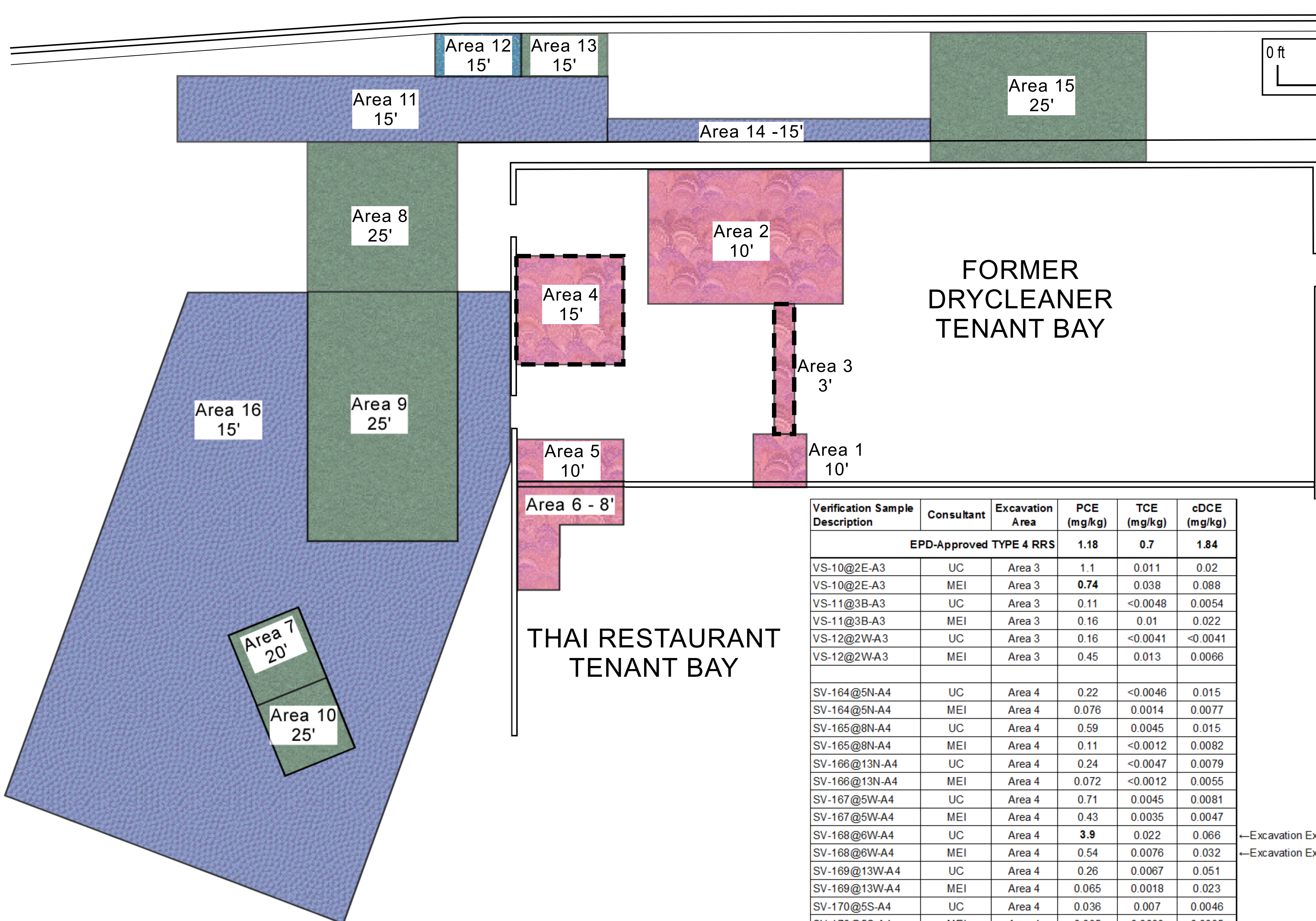
FIGURE 14



NOTES:
(1) Figure based on Figure 15 and Tables 7 & 8 from United Consulting's (UC's) 06-10-2008 CSR.
(2) Areas shown are originally planned excavation areas and depths. Areas actually excavated often were significantly larger and/or deeper than originally planned. No "as built" post-excavation drawings available. See also Appendix L - "Excavation Photographs" in UC's 06-10-2008 CSR.
(3) Specific sample collection location data not available.
(4) Sample labeling nomenclature. Example: "SV-33@13W-A11" means "Soil Verification", 33rd sample collected, @ 13 ft depth, from West wall, in Area 11.

Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	
		EPD-Approved TYPE 4 RRS	**1.18**	**0.7**	**1.84**	
VS-10@2E-A3	UC	Area 3	1.1	0.011	0.02	
VS-10@2E-A3	MEI	Area 3	**0.74**	0.038	0.088	
VS-11@3B-A3	UC	Area 3	0.11	<0.0048	0.0054	
VS-11@3B-A3	MEI	Area 3	0.16	0.01	0.022	
VS-12@2W-A3	UC	Area 3	0.16	<0.0041	<0.0041	
VS-12@2W-A3	MEI	Area 3	0.45	0.013	0.0066	
SV-164@5N-A4	UC	Area 4	0.22	<0.0046	0.015	
SV-164@5N-A4	MEI	Area 4	0.076	0.0014	0.0077	
SV-165@8N-A4	UC	Area 4	0.59	0.0045	0.015	
SV-165@8N-A4	MEI	Area 4	0.11	<0.0012	0.0082	
SV-166@13N-A4	UC	Area 4	0.24	<0.0047	0.0079	
SV-166@13N-A4	MEI	Area 4	0.072	<0.0012	0.0055	
SV-167@5W-A4	UC	Area 4	0.71	0.0045	0.0081	
SV-167@5W-A4	MEI	Area 4	0.43	0.0035	0.0047	
SV-168@6W-A4	UC	Area 4	**3.9**	0.022	0.066	←Excavation Expanded Into Adjacent Area
SV-168@6W-A4	MEI	Area 4	0.54	0.0076	0.032	←Excavation Expanded Into Adjacent Area
SV-169@13W-A4	UC	Area 4	0.26	0.0067	0.051	
SV-169@13W-A4	MEI	Area 4	0.065	0.0018	0.023	
SV-170@5S-A4	UC	Area 4	0.036	0.007	0.0046	
SV-170@5S-A4	MEI	Area 4	0.035	0.0033	0.0035	
SV-171@6S-A4	UC	Area 4	0.023	<0.0044	0.0045	
SV-171@6S-A4	MEI	Area 4	0.016	<0.0011	0.044	
SV-172@13S-A4	UC	Area 4	0.04	<0.0045	0.0054	
SV-172@13S-A4	MEI	Area 4	0.3	0.0044	0.014	
SV-173@16B(N)-A4	UC	Area 4	0.28	<0.0047	0.03	
SV-173@16B(N)-A4	MEI	Area 4	0.08	0.0014	0.012	
SV-174@16B(S)-A4	UC	Area 4	0.26	0.0075	0.055	
SV-174@16B(S)-A4	MEI	Area 4	0.11	0.0018	0.017	

SOIL REMEDIATION - VERIFICATION SAMPLE RESULTS
AREAS 3 & 4

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL RD NE, SANDY SPRINGS, GA 37347

PROJECT: 17675
FACILITY:
DATE REVISED: 02/23/2018
DATE: 06/10/2008
SCALE: Ref. Scale Bar
APPROVED:

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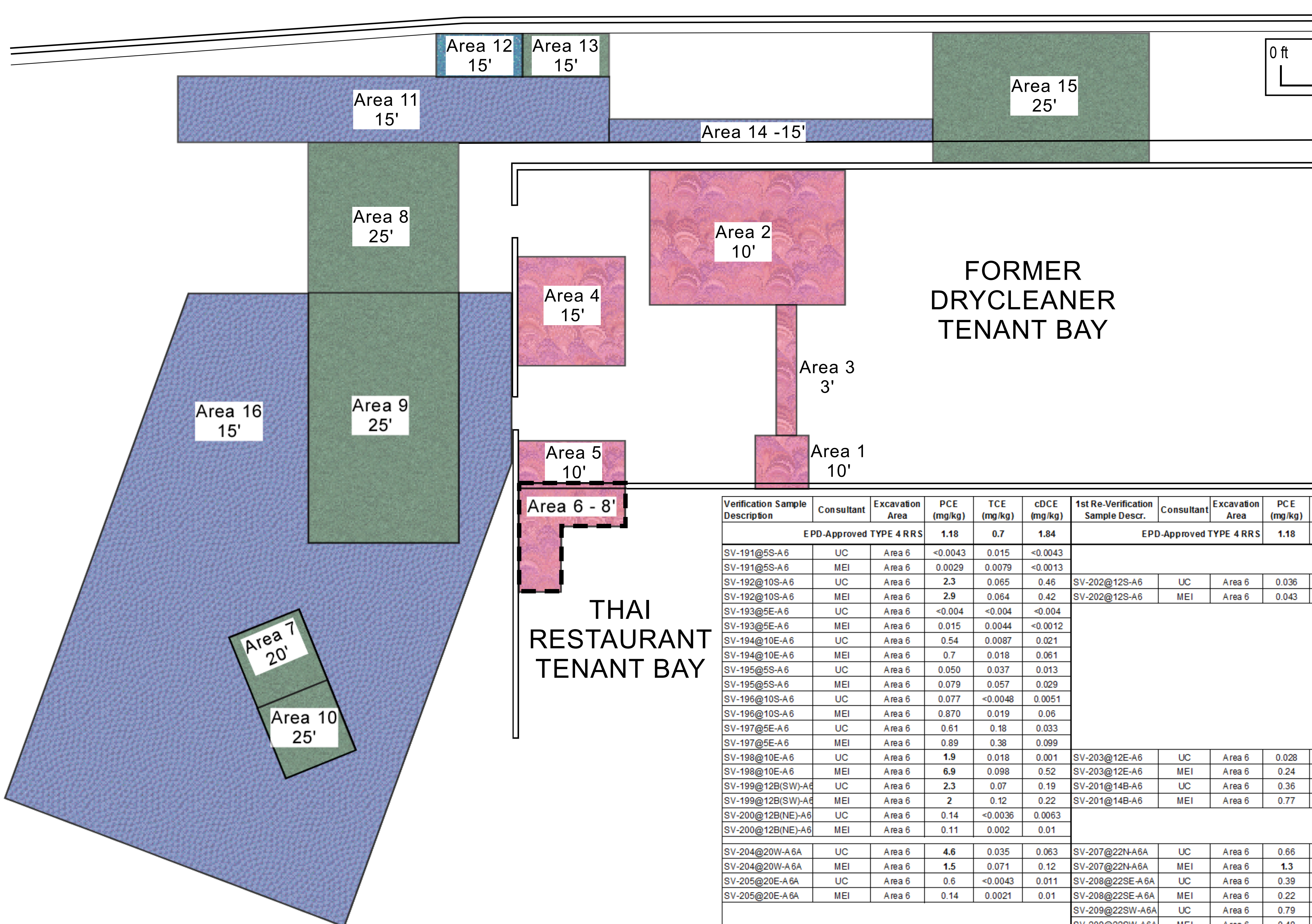
FIGURE 15



0 ft Graphic Scale 20 ft

NOTES:
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(2) Areas shown are originally planned excavation areas and depths. Areas actually excavated often were significantly larger and/or deeper than originally planned. No "as built" post-excavation drawings available. See also Appendix L - "Excavation Photographs" in UC's 06-10-2008 CSR.
(3) Specific sample collection location data not available.
(4) Sample labeling nomenclature. Example: "SV-33@13W-A11" means "Soil Verification", 33rd sample collected, @ 13 ft depth, from West wall, in Area 11.

Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	1st Re-Verification Sample Descr.	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	
EPD-Approved TYPE 4 RRS			1.18	0.7	1.84	EPD-Approved TYPE 4 RRS			1.18	0.7	1.84	
SV-191@5S-A6	UC	Area 6	<0.0043	0.015	<0.0043							
SV-191@5S-A6	MEI	Area 6	0.0029	0.0079	<0.0013							
SV-192@10S-A6	UC	Area 6	**2.3**	0.065	0.46	SV-202@12S-A6	UC	Area 6	0.036	<0.0051	<0.0051	
SV-192@10S-A6	MEI	Area 6	**2.9**	0.064	0.42	SV-202@12S-A6	MEI	Area 6	0.043	<0.0012	0.0019	
SV-193@5E-A6	UC	Area 6	<0.004	<0.004	<0.004							
SV-193@5E-A6	MEI	Area 6	0.015	0.0044	<0.0012							
SV-194@10E-A6	UC	Area 6	0.54	0.0087	0.021							
SV-194@10E-A6	MEI	Area 6	0.7	0.018	0.061							
SV-195@5S-A6	UC	Area 6	0.050	0.037	0.013							
SV-195@5S-A6	MEI	Area 6	0.079	0.057	0.029							
SV-196@10S-A6	UC	Area 6	0.077	<0.0048	0.0051							
SV-196@10S-A6	MEI	Area 6	0.870	0.019	0.06							
SV-197@5E-A6	UC	Area 6	0.61	0.18	0.033							
SV-197@5E-A6	MEI	Area 6	0.89	0.38	0.099							
SV-198@10E-A6	UC	Area 6	**1.9**	0.018	0.001	SV-203@12E-A6	UC	Area 6	0.028	<0.005	<0.005	
SV-198@10E-A6	MEI	Area 6	**6.9**	0.098	0.52	SV-203@12E-A6	MEI	Area 6	0.24	0.0041	0.015	
SV-199@12B(SW)-A6	UC	Area 6	**2.3**	0.07	0.19	SV-201@14B-A6	UC	Area 6	0.36	0.0095	0.034	
SV-199@12B(SW)-A6	MEI	Area 6	**2**	0.12	0.22	SV-201@14B-A6	MEI	Area 6	0.77	0.023	0.14	
SV-200@12B(NE)-A6	UC	Area 6	0.14	<0.0036	0.0063							
SV-200@12B(NE)-A6	MEI	Area 6	0.11	0.002	0.01							
SV-204@20W-A6A	UC	Area 6	**4.6**	0.035	0.063	SV-207@22N-A6A	UC	Area 6	0.66	0.02	0.070	< Excavated to Rock
SV-204@20W-A6A	MEI	Area 6	**1.5**	0.071	0.12	SV-207@22N-A6A	MEI	Area 6	**1.3**	0.021	0.062	< Excavated to Rock
SV-205@20E-A6A	UC	Area 6	0.6	<0.0043	0.011	SV-208@22SE-A6A	UC	Area 6	0.39	<0.0045	0.0071	
SV-205@20E-A6A	MEI	Area 6	0.14	0.0021	0.01	SV-208@22SE-A6A	MEI	Area 6	0.22	0.0023	0.008	
						SV-209@22SW-A6A	UC	Area 6	0.79	0.0093	0.023	
						SV-209@22SW-A6A	MEI	Area 6	0.48	0.0066	0.02	
SV-206@21B-A6A	UC	Area 6	**2100**	3.3	0.013							< Excavated to Rock
SV-206@21B-A6A	MEI	Area 6	**160**	0.29	0.096							< Excavated to Rock
SV-210@31E-A6A	UC	Area 6	0.63	0.0087	0.019							
SV-210@31E-A6A	MEI	Area 6	0.0017	<0.0011	<0.0011							
SV-211@31SE-A6A	UC	Area 6	1.1	0.011	0.014							
SV-211@31SE-A6A	MEI	Area 6	0.27	0.0035	0.01							
SV-212@31SW-A6A	UC	Area 6	1.1	0.015	0.023							
SV-212@31SW-A6A	MEI	Area 6	0.56	0.0092	0.017							
SV-213@22N-A6A	UC	Area 6	0.19	<0.0048	0.03							
SV-213@22N-A6A	MEI	Area 6	0.14	0.0035	0.038							

SOIL REMEDIATION - VERIFICATION SAMPLE RESULTS
AREA 6

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL RD NE, SANDY SPRINGS, GA 37347

PROJECT: 17675
FACILITY:
DATE REVISED: 02/23/2018
DATE: 06/10/2008
SCALE: Ref. Scale Bar
APPROVED:

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115 PARMENAS LANE
CHATTANOOGA, TN 37405
423-499-4919
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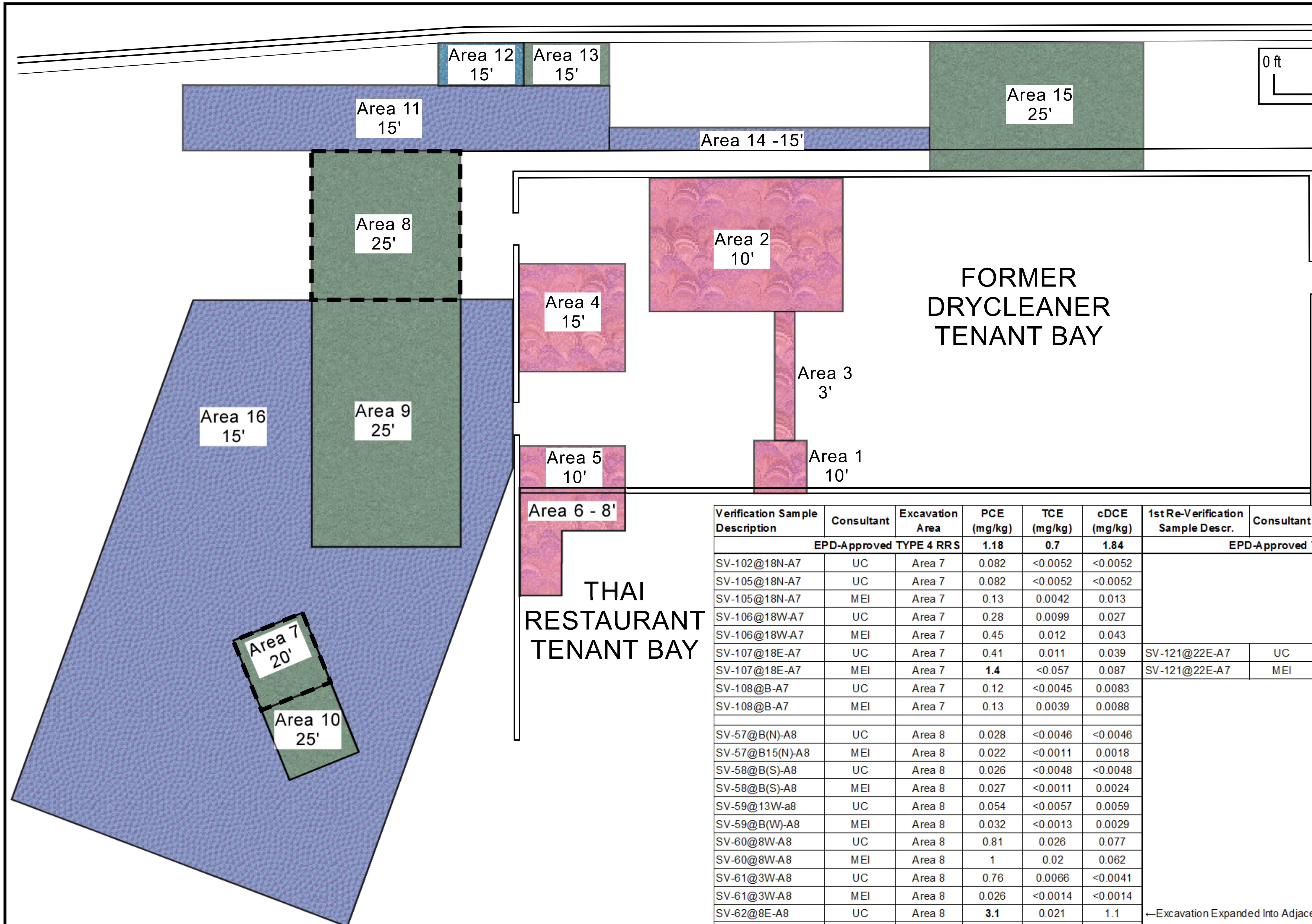
FIGURE 16



NOTES:
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(3) Specific sample collection location data not available.
(4) Sample labeling nomenclature. Example: "SV-33@13W-A11" means "Soil Verification", 33rd sample collected, @ 13 ft depth, from West wall, in Area 11.

Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	1st Re-Verification Sample Descr.	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)
	EPD-Approved TYPE 4 RRS		1.18	0.7	1.84		EPD-Approved TYPE 4 RRS		1.18	0.7	1.84
SV-102@18N-A7	UC	Area 7	0.082	<0.0052	<0.0052						
SV-105@18N-A7	UC	Area 7	0.082	<0.0052	<0.0052						
SV-105@18N-A7	MEI	Area 7	0.13	0.0042	0.013						
SV-106@18W-A7	UC	Area 7	0.28	0.0099	0.027						
SV-106@18W-A7	MEI	Area 7	0.45	0.012	0.043						
SV-107@18E-A7	UC	Area 7	0.41	0.011	0.039	SV-121@22E-A7	UC	Area 7	0.14	<0.0054	0.012
SV-107@18E-A7	MEI	Area 7	**1.4**	<0.057	0.087	SV-121@22E-A7	MEI	Area 7	0.18	0.0062	0.019
SV-108@B-A7	UC	Area 7	0.12	<0.0045	0.0083						
SV-108@B-A7	MEI	Area 7	0.13	0.0039	0.0088						
SV-57@B(N)-A8	UC	Area 8	0.028	<0.0046	<0.0046						
SV-57@B15(N)-A8	MEI	Area 8	0.022	<0.0011	0.0018						
SV-58@B(S)-A8	UC	Area 8	0.026	<0.0048	<0.0048						
SV-58@B(S)-A8	MEI	Area 8	0.027	<0.0011	0.0024						
SV-59@13W-a8	UC	Area 8	0.054	<0.0057	0.0059						
SV-59@B(W)-A8	MEI	Area 8	0.032	<0.0013	0.0029						
SV-60@8W-A8	UC	Area 8	0.81	0.026	0.077						
SV-60@8W-A8	MEI	Area 8	1	0.02	0.062						
SV-61@3W-A8	UC	Area 8	0.76	0.0066	<0.0041						
SV-61@3W-A8	MEI	Area 8	0.026	<0.0014	<0.0014						
SV-62@8E-A8	UC	Area 8	**3.1**	0.021	1.1	←Excavation Expanded Into Adjacent Area					
SV-62@8E-A8	MEI	Area 8	0.17	<0.048	**3.3**	←Excavation Expanded Into Adjacent Area					
SV-129@16W-A8	UC	Area 8	0.09	<0.0042	<0.0042						
SV-129@16W-A8	MEI	Area 8	0.052	<0.0012	0.0026						
SV-132@8W-A8	UC	Area 8	**1.4**	0.017	0.029	←Excavation Expanded Into Adjacent Area					
SV-132@8W-A8	MEI	Area 8	**1.2**	0.097	0.14	←Excavation Expanded Into Adjacent Area					
SV-135@8E-A8	UC	Area 8	0.1	<0.0039	0.0043						
SV-135@8E-A8	MEI	Area 8	0.069	<0.0013	0.0018						

SOIL REMEDIATION - VERIFICATION SAMPLE RESULTS
AREAS 7 & 8

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL RD NE, SANDY SPRINGS, GA 37347

PROJECT: 17675
FACILITY:
DATE REVISED: 02/23/2018
DATE: 06/10/2008
SCALE: Ref. Scale Bar
APPROVED:

MARION ENVIRONMENTAL, INC.
115 PARMENAS LANE
CHATTANOOGA, TN 37405
423-499-4919
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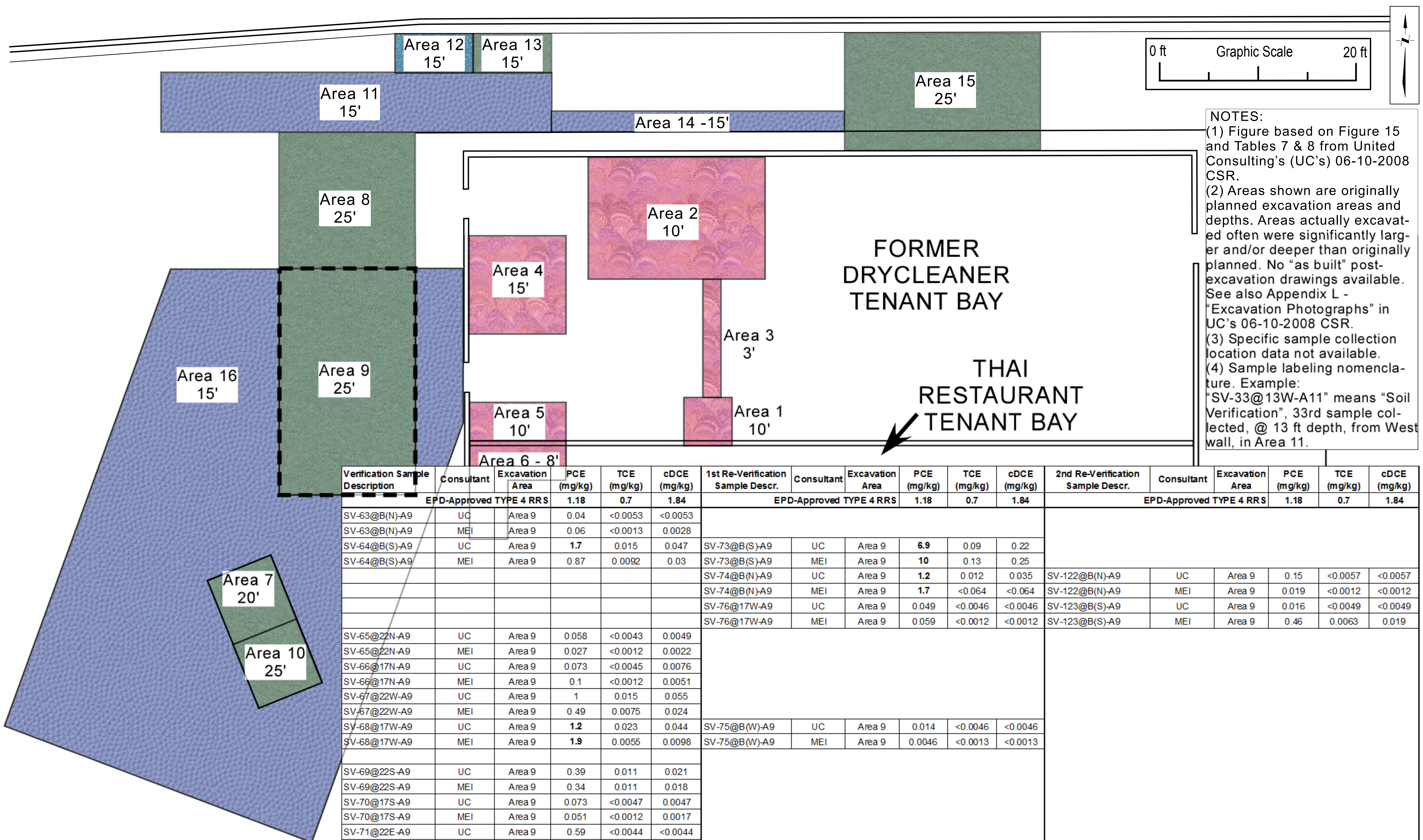
FIGURE 17



NOTES:
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(2) Areas shown are originally planned excavation areas and depths. Areas actually excavated often were significantly larger and/or deeper than originally planned. No "as built" post-excavation drawings available. See also Appendix L - "Excavation Photographs" in UC's 06-10-2008 CSR.
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(4) Sample labeling nomenclature. Example: "SV-33@13W-A11" means "Soil Verification", 33rd sample collected, @ 13 ft depth, from West wall, in Area 11.

Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	1st Re-Verification Sample Descr.	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	2nd Re-Verification Sample Descr.	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)
	EPD-Approved TYPE 4 RRS		1.18	0.7	1.84		EPD-Approved TYPE 4 RRS		1.18	0.7	1.84		EPD-Approved TYPE 4 RRS		1.18	0.7	1.84
SV-63@B(N)-A9	UC	Area 9	0.04	<0.0053	<0.0053												
SV-63@B(N)-A9	MEI	Area 9	0.06	<0.0013	0.0028												
SV-64@B(S)-A9	UC	Area 9	**1.7**	0.015	0.047	SV-73@B(S)-A9	UC	Area 9	**6.9**	0.09	0.22						
SV-64@B(S)-A9	MEI	Area 9	0.87	0.0092	0.03	SV-73@B(S)-A9	MEI	Area 9	**10**	0.13	0.25						
						SV-74@B(N)-A9	UC	Area 9	**1.2**	0.012	0.035	SV-122@B(N)-A9	UC	Area 9	0.15	<0.0057	<0.0057
						SV-74@B(N)-A9	MEI	Area 9	**1.7**	<0.064	<0.064	SV-122@B(N)-A9	MEI	Area 9	0.019	<0.0012	<0.0012
						SV-76@17W-A9	UC	Area 9	0.049	<0.0046	<0.0046	SV-123@B(S)-A9	UC	Area 9	0.016	<0.0049	<0.0049
						SV-76@17W-A9	MEI	Area 9	0.059	<0.0012	<0.0012	SV-123@B(S)-A9	MEI	Area 9	0.46	0.0063	0.019
SV-65@22N-A9	UC	Area 9	0.058	<0.0043	0.0049												
SV-65@22N-A9	MEI	Area 9	0.027	<0.0012	0.0022												
SV-66@17N-A9	UC	Area 9	0.073	<0.0045	0.0076												
SV-66@17N-A9	MEI	Area 9	0.1	<0.0012	0.0051												
SV-67@22W-A9	UC	Area 9	1	0.015	0.055												
SV-67@22W-A9	MEI	Area 9	0.49	0.0075	0.024												
SV-68@17W-A9	UC	Area 9	**1.2**	0.023	0.044	SV-75@B(W)-A9	UC	Area 9	0.014	<0.0046	<0.0046						
SV-68@17W-A9	MEI	Area 9	**1.9**	0.0055	0.0098	SV-75@B(W)-A9	MEI	Area 9	0.0046	<0.0013	<0.0013						
SV-69@22S-A9	UC	Area 9	0.39	0.011	0.021												
SV-69@22S-A9	MEI	Area 9	0.34	0.011	0.018												
SV-70@17S-A9	UC	Area 9	0.073	<0.0047	0.0047												
SV-70@17S-A9	MEI	Area 9	0.051	<0.0012	0.0017												
SV-71@22E-A9	UC	Area 9	0.59	<0.0044	<0.0044												
SV-71@22E-A9	MEI	Area 9	0.17	<0.0012	<0.0012												
SV-72@17E-A9	UC	Area 9	0.016	<0.0059	<0.0059												
SV-72@17E-A9	MEI	Area 9	0.0067	<0.0012	<0.0012												
SV-130@16W-A9	UC	Area 9	0.008	<0.0038	<0.0038												
SV-130@16W-A9	MEI	Area 9	0.16	0.0026	<0.0013												
SV-133@8W-A9	UC	Area 9	0.092	<0.0042	<0.0042												
SV-133@8W-A9	MEI	Area 9	0.014	<0.0012	<0.0012												
SV-136@8E-A9	UC	Area 9	0.063	<0.0036	<0.0036												
SV-136@8E-A9	MEI	Area 9	0.037	0.0032	<0.0013												

SOIL REMEDIATION - VERIFICATION SAMPLE RESULTS
AREA 9

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL RD NE, SANDY SPRINGS, GA 37347

PROJECT: 17675
FACILITY:
DATE REVISED: 02/23/2018
DATE: 06/10/2008
SCALE: Ref. Scale Bar
APPROVED:

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115 PARMENAS LANE
CHATTANOOGA, TN 37405
423-499-4919
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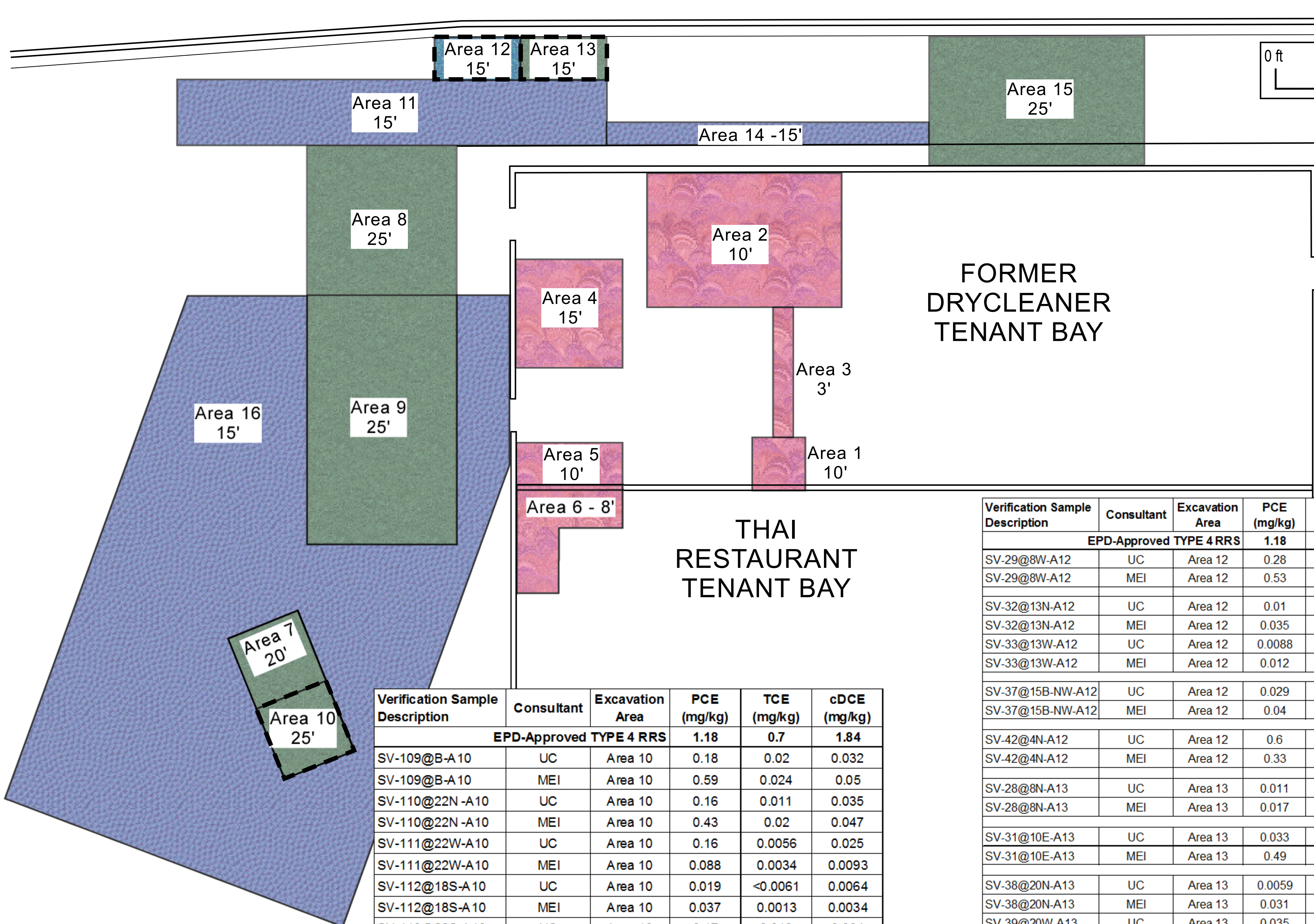
FIGURE 18



NOTES:
(1) Figure based on Figure 15 and Tables 7 & 8 from United Consulting's (UC's) 06-10-2008 CSR.
(2) Areas shown are originally planned excavation areas and depths. Areas actually excavated often were significantly larger and/or deeper than originally planned. No "as built" post-excavation drawings available. See also Appendix L - "Excavation Photographs" in UC's 06-10-2008 CSR.
(3) Specific sample collection location data not available.
(4) Sample labeling nomenclature. Example: "SV-33@13W-A11" means "Soil Verification", 33rd sample collected, @ 13 ft depth, from West wall, in Area 11.

Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)
EPD-Approved TYPE 4 RRS			1.18	0.7	1.84
SV-109@B-A10	UC	Area 10	0.18	0.02	0.032
SV-109@B-A10	MEI	Area 10	0.59	0.024	0.05
SV-110@22N -A10	UC	Area 10	0.16	0.011	0.035
SV-110@22N -A10	MEI	Area 10	0.43	0.02	0.047
SV-111@22W-A10	UC	Area 10	0.16	0.0056	0.025
SV-111@22W-A10	MEI	Area 10	0.088	0.0034	0.0093
SV-112@18S-A10	UC	Area 10	0.019	<0.0061	0.0064
SV-112@18S-A10	MEI	Area 10	0.037	0.0013	0.0034
SV-113@22S-A10	UC	Area 10	0.17	0.019	0.064
SV-113@22S-A10	MEI	Area 10	0.054	0.0023	0.0064
SV-114@22E-A10	UC	Area 10	0.12	0.0063	0.02
SV-114@22E-A10	MEI	Area 10	0.49	<0.060	<0.060

Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)
EPD-Approved TYPE 4 RRS			1.18	0.7	1.84
SV-29@8W-A12	UC	Area 12	0.28	<0.0045	<0.0045
SV-29@8W-A12	MEI	Area 12	0.53	0.0033	0.0012
SV-32@13N-A12	UC	Area 12	0.01	<0.0051	<0.0051
SV-32@13N-A12	MEI	Area 12	0.035	<0.0015	<0.0015
SV-33@13W-A12	UC	Area 12	0.0088	<0.0050	<0.0050
SV-33@13W-A12	MEI	Area 12	0.012	<0.0011	<0.0011
SV-37@15B-NW-A12	UC	Area 12	0.029	<0.0047	<0.0047
SV-37@15B-NW-A12	MEI	Area 12	0.04	<0.0011	<0.0011
SV-42@4N-A12	UC	Area 12	0.6	<0.0041	<0.0041
SV-42@4N-A12	MEI	Area 12	0.33	0.0013	<0.0012
SV-28@8N-A13	UC	Area 13	0.011	<0.0047	<0.0047
SV-28@8N-A13	MEI	Area 13	0.017	<0.0013	<0.0013
SV-31@10E-A13	UC	Area 13	0.033	<0.005	<0.005
SV-31@10E-A13	MEI	Area 13	0.49	0.002	0.0014
SV-38@20N-A13	UC	Area 13	0.0059	<0.0045	<0.0045
SV-38@20N-A13	MEI	Area 13	0.031	<0.0011	<0.0011
SV-39@20W-A13	UC	Area 13	0.035	<0.0047	<0.0047
SV-39@20W-A13	MEI	Area 13	0.22	0.0033	0.0056
SV-40@20S-A13	UC	Area 13	0.039	<0.0050	<0.0050
SV-40@20S-A13	MEI	Area 13	0.03	<0.0014	<0.0014
SV-41@20E-A13	UC	Area 13	0.0077	<0.0034	<0.0034
SV-41@20E-A13	MEI	Area 13	0.0081	<0.0014	<0.0014
SV-45@4E-A13	UC	Area 13	0.2	<0.0041	<0.0041
SV-45@4E-A13	MEI	Area 13	0.22	<0.0015	0.0016

SOIL REMEDIATION - VERIFICATION SAMPLE RESULTS
AREAS 10, 12 & 13

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL RD NE, SANDY SPRINGS, GA 37347

PROJECT: 17675
FACILITY:
DATE REVISED: 02/23/2018
DATE: 06/10/2008
SCALE: Ref. Scale Bar
APPROVED:

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115 PARMENAS LANE
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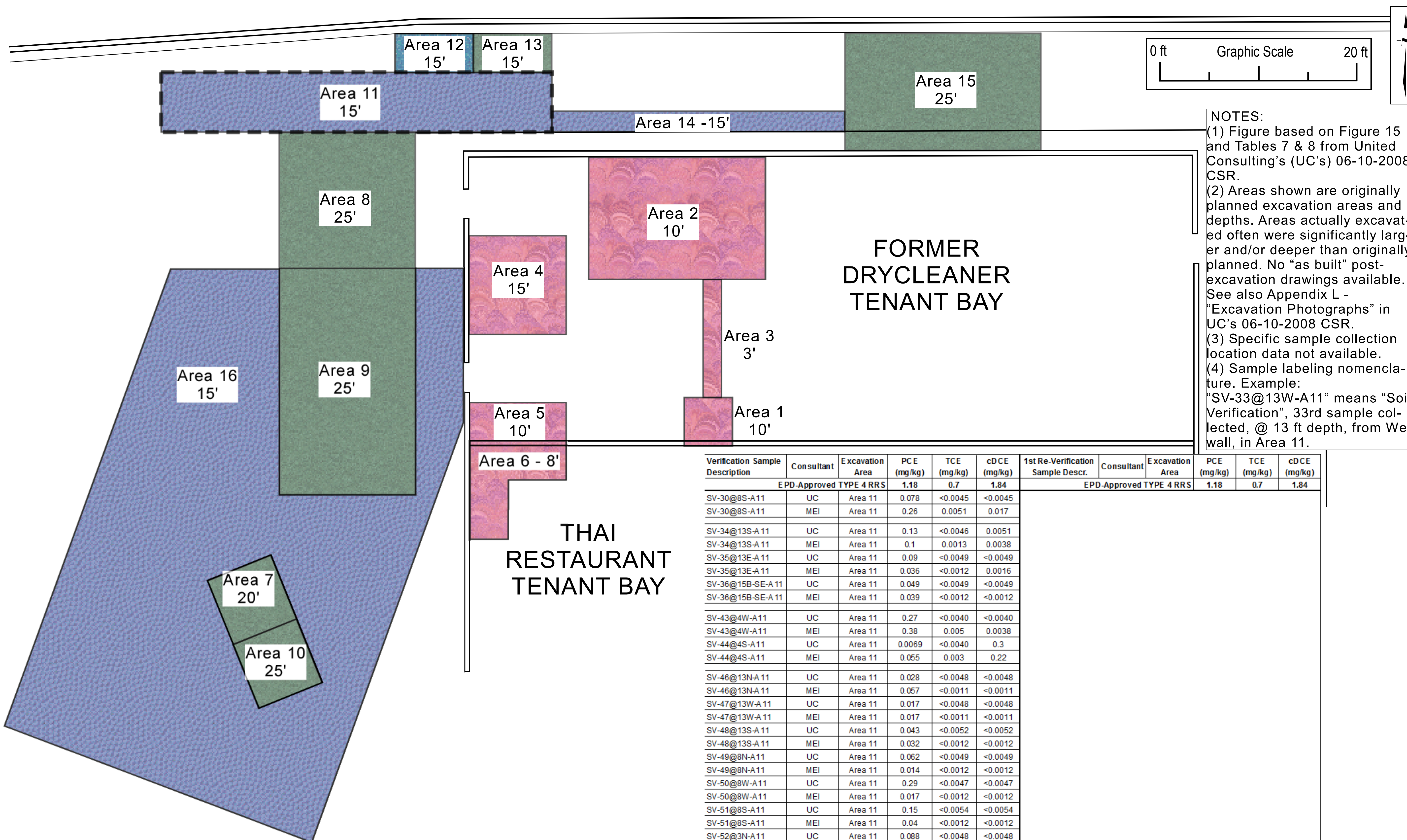
FIGURE 19



NOTES:
(1) Figure based on Figure 15 and Tables 7 & 8 from United Consulting's (UC's) 06-10-2008 CSR.
(2) Areas shown are originally planned excavation areas and depths. Areas actually excavated often were significantly larger and/or deeper than originally planned. No "as built" post-excavation drawings available. See also Appendix L - "Excavation Photographs" in UC's 06-10-2008 CSR.
(3) Specific sample collection location data not available.
(4) Sample labeling nomenclature. Example: "SV-33@13W-A11" means "Soil Verification", 33rd sample collected, @ 13 ft depth, from West wall, in Area 11.

Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	1st Re-Verification Sample Descr.	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)
	EPD-Approved TYPE 4 RRS		**1.18**	**0.7**	**1.84**		EPD-Approved TYPE 4 RRS		**1.18**	**0.7**	**1.84**
SV-30@8S-A11	UC	Area 11	0.078	<0.0045	<0.0045						
SV-30@8S-A11	MEI	Area 11	0.26	0.0051	0.017						
SV-34@13S-A11	UC	Area 11	0.13	<0.0046	0.0051						
SV-34@13S-A11	MEI	Area 11	0.1	0.0013	0.0038						
SV-35@13E-A11	UC	Area 11	0.09	<0.0049	<0.0049						
SV-35@13E-A11	MEI	Area 11	0.036	<0.0012	0.0016						
SV-36@15B-SE-A11	UC	Area 11	0.049	<0.0049	<0.0049						
SV-36@15B-SE-A11	MEI	Area 11	0.039	<0.0012	<0.0012						
SV-43@4W-A11	UC	Area 11	0.27	<0.0040	<0.0040						
SV-43@4W-A11	MEI	Area 11	0.38	0.005	0.0038						
SV-44@4S-A11	UC	Area 11	0.0069	<0.0040	0.3						
SV-44@4S-A11	MEI	Area 11	0.055	0.003	0.22						
SV-46@13N-A11	UC	Area 11	0.028	<0.0048	<0.0048						
SV-46@13N-A11	MEI	Area 11	0.057	<0.0011	<0.0011						
SV-47@13W-A11	UC	Area 11	0.017	<0.0048	<0.0048						
SV-47@13W-A11	MEI	Area 11	0.017	<0.0011	<0.0011						
SV-48@13S-A11	UC	Area 11	0.043	<0.0052	<0.0052						
SV-48@13S-A11	MEI	Area 11	0.032	<0.0012	<0.0012						
SV-49@8N-A11	UC	Area 11	0.062	<0.0049	<0.0049						
SV-49@8N-A11	MEI	Area 11	0.014	<0.0012	<0.0012						
SV-50@8W-A11	UC	Area 11	0.29	<0.0047	<0.0047						
SV-50@8W-A11	MEI	Area 11	0.017	<0.0012	<0.0012						
SV-51@8S-A11	UC	Area 11	0.15	<0.0054	<0.0054						
SV-51@8S-A11	MEI	Area 11	0.04	<0.0012	<0.0012						
SV-52@3N-A11	UC	Area 11	0.088	<0.0048	<0.0048						
SV-52@3N-A11	MEI	Area 11	0.054	<0.0012	<0.0012						
SV-53@3W-A11	UC	Area 11	**1.2**	0.01	<0.0043	SV-77@B(W)-A11	UC	Area 11	0.049	<0.0048	<0.0048
SV-53@3W-A11	MEI	Area 11	**2**	0.0037	<0.0012	SV-77@B(W)-A11	MEI	Area 11	0.042	<0.0012	<0.0012
						SV-78@6W-A11	UC	Area 11	0.25	<0.0051	<0.0051
						SV-78@6W-A11	MEI	Area 11	0.2	0.0014	<0.0013
SV-54@3S-A11	UC	Area 11	0.089	<0.0042	<0.0042						
SV-54@3S-A11	MEI	Area 11	0.56	0.0057	0.0025						
SV-55@B15(E)-A11	UC	Area 11	0.023	<0.0050	<0.0050						
SV-55@B15(E)-A11	MEI	Area 11	0.012	<0.0012	<0.0012						
SV-56@B15(E)-A11	UC	Area 11	0.047	<0.0049	<0.0049						
SV-56@B15(W)-A11	MEI	Area 11	0.018	<0.0012	<0.0012						

SOIL REMEDIATION - VERIFICATION SAMPLE RESULTS
AREA 11

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL RD NE, SANDY SPRINGS, GA 37347

PROJECT: 17675
FACILITY:
DATE REVISED: 02/23/2018
DATE: 06/10/2008
SCALE: Ref. Scale Bar
APPROVED:

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115 PARMENAS LANE
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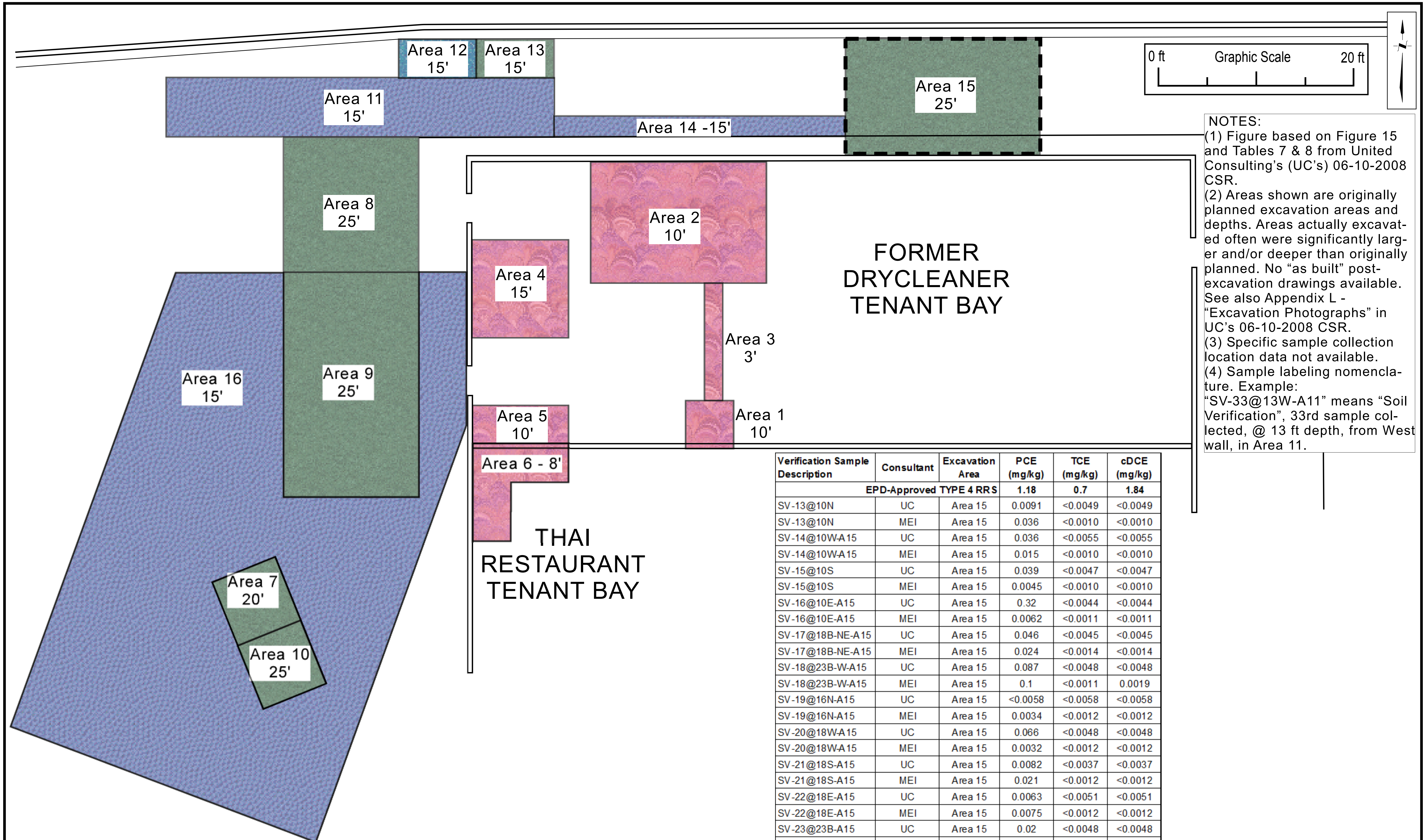
FIGURE 20



NOTES:
(1) Figure based on Figure 15 and Tables 7 & 8 from United Consulting's (UC's) 06-10-2008 CSR.
(2) Areas shown are originally planned excavation areas and depths. Areas actually excavated often were significantly larger and/or deeper than originally planned. No "as built" post-excavation drawings available. See also Appendix L - "Excavation Photographs" in UC's 06-10-2008 CSR.
(3) Specific sample collection location data not available.
(4) Sample labeling nomenclature. Example: "SV-33@13W-A11" means "Soil Verification", 33rd sample collected, @ 13 ft depth, from West wall, in Area 11.

Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)
EPD-Approved TYPE 4 RRS			1.18	0.7	1.84
SV-13@10N	UC	Area 15	0.0091	<0.0049	<0.0049
SV-13@10N	MEI	Area 15	0.036	<0.0010	<0.0010
SV-14@10W-A15	UC	Area 15	0.036	<0.0055	<0.0055
SV-14@10W-A15	MEI	Area 15	0.015	<0.0010	<0.0010
SV-15@10S	UC	Area 15	0.039	<0.0047	<0.0047
SV-15@10S	MEI	Area 15	0.0045	<0.0010	<0.0010
SV-16@10E-A15	UC	Area 15	0.32	<0.0044	<0.0044
SV-16@10E-A15	MEI	Area 15	0.0062	<0.0011	<0.0011
SV-17@18B-NE-A15	UC	Area 15	0.046	<0.0045	<0.0045
SV-17@18B-NE-A15	MEI	Area 15	0.024	<0.0014	<0.0014
SV-18@23B-W-A15	UC	Area 15	0.087	<0.0048	<0.0048
SV-18@23B-W-A15	MEI	Area 15	0.1	<0.0011	0.0019
SV-19@16N-A15	UC	Area 15	<0.0058	<0.0058	<0.0058
SV-19@16N-A15	MEI	Area 15	0.0034	<0.0012	<0.0012
SV-20@18W-A15	UC	Area 15	0.066	<0.0048	<0.0048
SV-20@18W-A15	MEI	Area 15	0.0032	<0.0012	<0.0012
SV-21@18S-A15	UC	Area 15	0.0082	<0.0037	<0.0037
SV-21@18S-A15	MEI	Area 15	0.021	<0.0012	<0.0012
SV-22@18E-A15	UC	Area 15	0.0063	<0.0051	<0.0051
SV-22@18E-A15	MEI	Area 15	0.0075	<0.0012	<0.0012
SV-23@23B-A15	UC	Area 15	0.02	<0.0048	<0.0048
SV-23@23B-A15	MEI	Area 15	0.019	<0.0012	<0.0012
SV-24@5N-A15	UC	Area 15	0.03	<0.0046	<0.0046
SV-24@5N-A15	MEI	Area 15	0.011	<0.0013	<0.0013
SV-25@5W-A15	UC	Area 15	0.063	<0.0043	<0.0043
SV-25@5W-A15	MEI	Area 15	0.14	<0.0012	<0.0012
SV-26@5E-A15	UC	Area 15	0.061	<0.0045	<0.0045
SV-26@5E-A15	MEI	Area 15	0.17	<0.0013	<0.0013
SV-27@5S-A15	UC	Area 15	0.36	<0.0046	<0.0046
SV-27@5S-A15	MEI	Area 15	0.34	0.0022	0.0017

SOIL REMEDIATION - VERIFICATION SAMPLE RESULTS
AREA 15

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL RD NE, SANDY SPRINGS, GA 37347

PROJECT: 17675
FACILITY:
DATE REVISED: 02/23/2018
DATE: 06/10/2008
SCALE: Ref. Scale Bar
APPROVED:

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CHATTANOOGA, TN 37405
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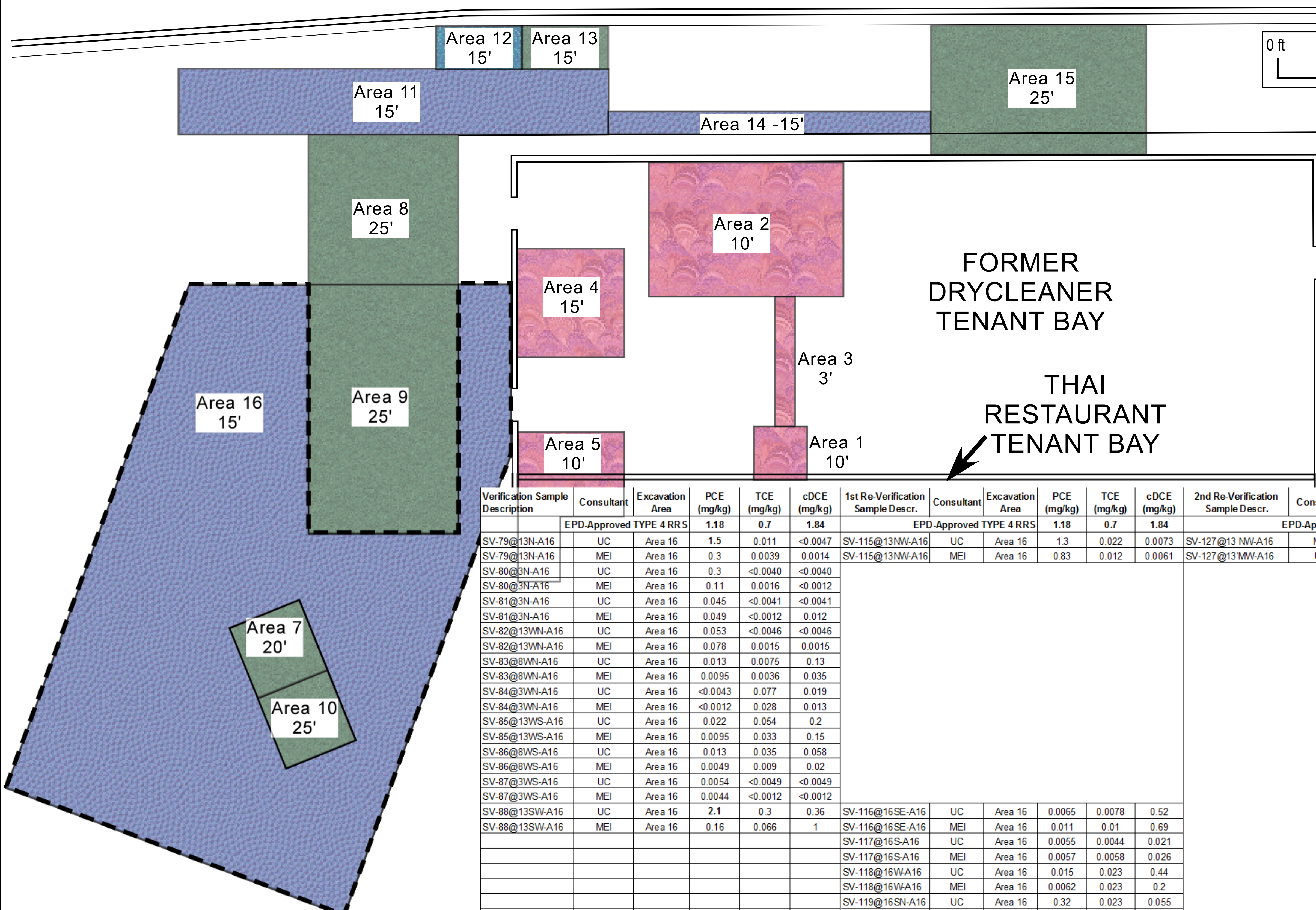
FIGURE 21



NOTES:
(1) Figure based on Figure 15 and Tables 7 & 8 from United Consulting's (UC's) 06-10-2008 CSR.
(2) Areas shown are originally planned excavation areas and depths. Areas actually excavated often were significantly larger and/or deeper than originally planned. No "as built" post-excavation drawings available. See also Appendix L - "Excavation Photographs" in UC's 06-10-2008 CSR.
(3) Specific sample collection location data not available.
(4) Sample labeling nomenclature. Example: "SV-33@13W-A11" means "Soil Verification", 33rd sample collected, @ 13 ft depth, from West wall, in Area 11.

Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	1st Re-Verification Sample Descr.	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	2nd Re-Verification Sample Descr.	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)
	EPD-Approved TYPE 4 RRS		**1.18**	**0.7**	**1.84**	EPD-Approved TYPE 4 RRS			**1.18**	**0.7**	**1.84**	EPD-Approved TYPE 4 RRS			**1.18**	**0.7**	**1.84**
SV-79@13N-A16	UC	Area 16	**1.5**	0.011	<0.0047	SV-115@13NW-A16	UC	Area 16	1.3	0.022	0.0073	SV-127@13 NW-A16	MEI	Area 16	0.23	0.0044	0.0035
SV-79@13N-A16	MEI	Area 16	0.3	0.0039	0.0014	SV-115@13NW-A16	MEI	Area 16	0.83	0.012	0.0061	SV-127@13'MW-A16	UC	Area 16	0.068	<0.0052	<0.0052
SV-80@3N-A16	UC	Area 16	0.3	<0.0040	<0.0040												
SV-80@3N-A16	MEI	Area 16	0.11	0.0016	<0.0012												
SV-81@3N-A16	UC	Area 16	0.045	<0.0041	<0.0041												
SV-81@3N-A16	MEI	Area 16	0.049	<0.0012	0.012												
SV-82@13WN-A16	UC	Area 16	0.053	<0.0046	<0.0046												
SV-82@13WN-A16	MEI	Area 16	0.078	0.0015	0.0015												
SV-83@8WN-A16	UC	Area 16	0.013	0.0075	0.13												
SV-83@8WN-A16	MEI	Area 16	0.0095	0.0036	0.035												
SV-84@3WN-A16	UC	Area 16	<0.0043	0.077	0.019												
SV-84@3WN-A16	MEI	Area 16	<0.0012	0.028	0.013												
SV-85@13WS-A16	UC	Area 16	0.022	0.054	0.2												
SV-85@13WS-A16	MEI	Area 16	0.0095	0.033	0.15												
SV-86@8WS-A16	UC	Area 16	0.013	0.035	0.058												
SV-86@8WS-A16	MEI	Area 16	0.0049	0.009	0.02												
SV-87@3WS-A16	UC	Area 16	0.0054	<0.0049	<0.0049												
SV-87@3WS-A16	MEI	Area 16	0.0044	<0.0012	<0.0012												
SV-88@13SW-A16	UC	Area 16	**2.1**	0.3	0.36	SV-116@16SE-A16	UC	Area 16	0.0065	0.0078	0.52						
SV-88@13SW-A16	MEI	Area 16	0.16	0.066	1	SV-116@16SE-A16	MEI	Area 16	0.011	0.01	0.69						
						SV-117@16S-A16	UC	Area 16	0.0055	0.0044	0.021						
						SV-117@16S-A16	MEI	Area 16	0.0057	0.0058	0.026						
						SV-118@16W-A16	UC	Area 16	0.015	0.023	0.44						
						SV-118@16W-A16	MEI	Area 16	0.0062	0.023	0.2						
						SV-119@16SN-A16	UC	Area 16	0.32	0.023	0.055						
						SV-119@16SN-A16	MEI	Area 16	0.36	0.0096	0.022						
SV-89@8SW-A16	UC	Area 16	<0.0040	<0.0040	<0.0040												
SV-89@8SW-A16	MEI	Area 16	0.0016	0.004	0.0022												
SV-90@3SW-A16	UC	Area 16	<0.0049	<0.0049	<0.0049												
SV-90@3SW-A16	MEI	Area 16	<0.0012	<0.0012	<0.0012												
SV-91@13SE-A16	UC	Area 16	0.0082	<0.0042	<0.0042												
SV-91@13SE-A16	MEI	Area 16	0.018	0.0041	0.0029												
SV-92@8SE-A16	UC	Area 16	0.0096	0.0068	<0.0046												
SV-92@8SE-A16	MEI	Area 16	0.0052	0.0095	0.0052												
SV-93@3SE-A16	UC	Area 16	0.027	<0.0039	<0.0039												
SV-93@3SE-A16	MEI	Area 16	0.0065	<0.0012	<0.0012												

SOIL REMEDIATION - VERIFICATION SAMPLE RESULTS
AREA 16 - (PAGE 1 OF 2)

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL RD NE, SANDY SPRINGS, GA 37347

PROJECT: 17675
FACILITY:
DATE REVISED: 02/23/2018
DATE: 06/10/2008
SCALE: Ref. Scale Bar
APPROVED:

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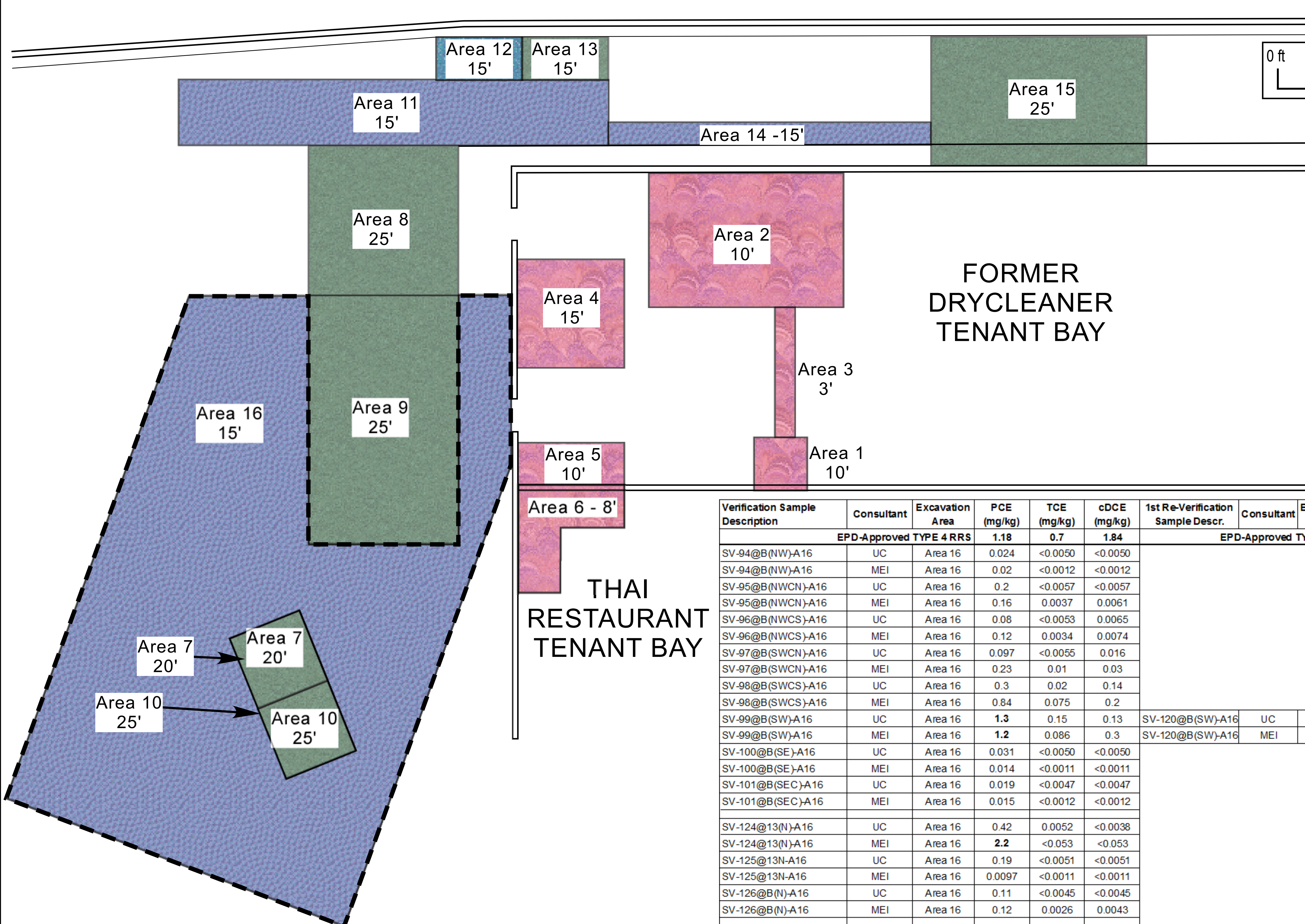
FIGURE 22



NOTES:
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(2) Areas shown are originally planned excavation areas and depths. Areas actually excavated often were significantly larger and/or deeper than originally planned. No "as built" post-excavation drawings available. See also Appendix L - "Excavation Photographs" in UC's 06-10-2008 CSR.
(3) Specific sample collection location data not available.
(4) Sample labeling nomenclature. Example: "SV-33@13W-A11" means "Soil Verification", 33rd sample collected, @ 13 ft depth, from West wall, in Area 11.

Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	1st Re-Verification Sample Descr.	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)
EPD-Approved TYPE 4 RRS			1.18	0.7	1.84	EPD-Approved TYPE 4 RRS			1.18	0.7	1.84
SV-94@B(NW)-A16	UC	Area 16	0.024	<0.0050	<0.0050						
SV-94@B(NW)-A16	MEI	Area 16	0.02	<0.0012	<0.0012						
SV-95@B(NWCN)-A16	UC	Area 16	0.2	<0.0057	<0.0057						
SV-95@B(NWCN)-A16	MEI	Area 16	0.16	0.0037	0.0061						
SV-96@B(NWCS)-A16	UC	Area 16	0.08	<0.0053	0.0065						
SV-96@B(NWCS)-A16	MEI	Area 16	0.12	0.0034	0.0074						
SV-97@B(SWCN)-A16	UC	Area 16	0.097	<0.0055	0.016						
SV-97@B(SWCN)-A16	MEI	Area 16	0.23	0.01	0.03						
SV-98@B(SWCS)-A16	UC	Area 16	0.3	0.02	0.14						
SV-98@B(SWCS)-A16	MEI	Area 16	0.84	0.075	0.2						
SV-99@B(SW)-A16	UC	Area 16	**1.3**	0.15	0.13	SV-120@B(SW)-A16	UC	Area 16	0.14	0.01	0.036
SV-99@B(SW)-A16	MEI	Area 16	**1.2**	0.086	0.3	SV-120@B(SW)-A16	MEI	Area 16	0.14	0.0079	0.046
SV-100@B(SE)-A16	UC	Area 16	0.031	<0.0050	<0.0050						
SV-100@B(SE)-A16	MEI	Area 16	0.014	<0.0011	<0.0011						
SV-101@B(SEC)-A16	UC	Area 16	0.019	<0.0047	<0.0047						
SV-101@B(SEC)-A16	MEI	Area 16	0.015	<0.0012	<0.0012						
SV-124@13(N)-A16	UC	Area 16	0.42	0.0052	<0.0038						
SV-124@13(N)-A16	MEI	Area 16	**2.2**	<0.053	<0.053						
SV-125@13N-A16	UC	Area 16	0.19	<0.0051	<0.0051						
SV-125@13N-A16	MEI	Area 16	0.0097	<0.0011	<0.0011						
SV-126@B(N)-A16	UC	Area 16	0.11	<0.0045	<0.0045						
SV-126@B(N)-A16	MEI	Area 16	0.12	0.0026	0.0043						
SV-128@B(MW)-A16	UC	Area 16	0.045	<0.0044	<0.0044						
SV-128@B(NE)-A16	MEI	Area 16	0.013	<0.0011	<0.0011						
SV-131@16W-A16	UC	Area 16	0.021	<0.0046	0.0058						
SV-131@16W-A16	MEI	Area 16	0.17	0.0064	0.0095						
SV-134@8W-A16	UC	Area 16	0.084	<0.0041	<0.0041						
SV-134@8W-A16	MEI	Area 16	0.063	0.0025	0.0028						
SV-137@8E-A16	UC	Area 16	0.12	<0.0049	<0.0049						
SV-137@8E-A16	MEI	Area 16	0.031	<0.0013	0.0025						

SOIL REMEDIATION - VERIFICATION SAMPLE RESULTS
AREA 16 - (PAGE 2 OF 2)

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL RD NE, SANDY SPRINGS, GA 37347

PROJECT: 17675
FACILITY:
DATE REVISED: 02/23/2018
DATE: 06/10/2008
SCALE: Ref. Scale Bar
APPROVED:

MARION ENVIRONMENTAL, INC.
115 PARMENAS LANE
CHATTANOOGA, TN 37405
423-499-4919
www.marionenv.com

MEI

FIGURE 23

Appendix B

Tables

TABLE 2
Fountain Oaks Shopping Center
Groundwater Analytical Results - VOCs Detected - March 2015 Sampling Event
(All concentration units in micrograms per liter (µg/L))

Well ID	Date	Acetone	Benzene	sec-Butylbenzene	Chloroform	Cumene (Isopropylbenzene)	cis-1,2-Dichloroethene (cDCE)	trans-1,2-Dichloroethene (tDCE)	Di-isopropyl ether	Methyl Ethyl Ketone (MEK) (2-Butanone)	Methyl tert. Butyl Ether (MTBE)	Tetrachloroethene (PCE)	Trichloroethene (TCE)	Vinyl chloride (VC)
MW-2	3/12/2015	<50	<1	<1	**5.6**	<1	**65**	<1	<1	<10	**1.0**	**740**	**70**	<1
(Dup.)	3/12/2015	<50	<1	<1	**6.1**	<1	**68**	<1	<1	<10	<1	**810**	**73**	<1
MW-3	3/11/2015	<50	<1	<1	**10**	<1	**5.1**	<1	<1	<10	**1.0**	**33**	**2.5**	<1
MW-4	3/12/2015	<50	<1	<1	<5	<1	**210**	**1.2**	<1	<10	<1	<10	**120**	<1
MW-5	3/12/2015	<50	**1.5**	<1	<5	<1	**26**	<1	<1	<10	<1	**170**	**5.2**	**1.9**
MW-6	3/10/2015	<50	<1	<1	<5	<1	**26**	<1	**1.7**	<10	**45**	**3.9**	**5.5**	<1
MW-7	3/10/2015	<50	<1	<1	<5	<1	<1	<1	<1	<10	<1	<1	<1	<1
MW-8	3/11/2015	<50	<1	<1	**11**	<1	**2.5**	<1	<1	<50	<1	**14**	<1	<1
MW-9	3/12/2015	<50	<1	<1	**14**	<1	**1.9**	<1	<1	<10	<1	**18**	**1.1**	<1
MW-13D	3/11/2015	**89**	<1	<1	<5	<1	<1	<1	<1	**11**	<1	<1	<1	<1
MW-13S	3/10/2015	<50	<1	<1	**12**	<1	**3.0**	<1	<1	<10	<1	**21**	**1.8**	<1
(Dup.)	3/10/2015	<50	<1	<1	**11**	<1	**3.7**	<1	<1	<10	<1	**23**	**2.1**	<1
MW-14	3/11/2015	<50	<1	<1	**9.7**	<1	**6.0**	<1	<1	<10	<1	**40**	**2.8**	<1
MW-15	3/11/2015	<50	<1	<1	<5	<1	**22**	<1	<1	<10	<1	**1.9**	**3.7**	<1
MW-16	3/11/2015	**54**	**2.2**	<1	<5	<1	**100**	<1	**5.7**	<10	**340**	**19**	**35**	**11**
MW-17	3/11/2015	<50	<1	<1	<5	<1	<1	<1	<1	<10	<1	<1	<1	<1
MW-18	3/11/2015	<50	<1	<1	<5	<1	**4.9**	<1	<1	<1	<1	**3.4**	**3.3**	<1
MW-19	3/12/2015	<50	<1	<1	**11**	<1	<1	<1	<1	<10	<1	**7.5**	<1	<1
MW-20	3/12/2015	<50	**15**	<1	<5	<1	**43**	<1	<1	<10	**2.5**	**160**	**8.8**	**2.2**
MW-21	3/12/2015	<50	**24**	<1	<5	<1	**1.0**	<1	**46**	<10	**2500**	<1	<1	<1
MW-22	3/12/2015	<50	<1	<1	**8.9**	<1	**12**	<1	<1	<10	<1	**520**	**6.7**	<1
MW-23	3/11/2015	<50	<1	<1	**5.6**	<1	**10**	<1	<1	<10	<1	**120**	**2.8**	<1
MW-25	3/11/2015	<50	<1	<10	<5	<1	<1	<1	<1	<10	<1	<1	<1	<1
MW-26	3/30/2015	<50	<1	<10	<5	<1	**4.2**	<1	<1	<10	<1	**11**	**1.8**	<1
MW-27	3/11/2015	<50	<1	<1	**12**	<1	**2.0**	<1	<1	<10	<1	**12**	<1	<1
MW-28	3/11/2015	**86**	**130**	**1.5**	<5	**2.6**	**48**	<1	**11**	<10	**820**	**16**	**7.0**	**3.9**
(Dup.)	3/11/2015	<50	**140**	**1.9**	<5	**3.2**	**58**	<1	**12**	<10	**890**	**20**	**8.9**	**4.7**
MW-29	3/11/2015	<50	<1	<10	<5	<1	**7.9**	<1	**1.0**	<10	**15**	<1	**1.1**	<1
MW-30	3/11/2015	<50	<1	<10	<5	<1	**1.4**	<1	<1	<10	<1	**10**	<1	<1
MW-31	3/11/2015	<50	<1	<10	<5	<1	<1	<1	<1	<10	<1	<1	<1	<1
MW-32	3/11/2015	<50	<1	<10	<5	<1	<1	<1	<1	<10	**1.9**	<1	<1	<1
MW-33	3/10/2015	<50	<1	<10	<5	<1	**17**	<1	<1	<10	**3.3**	<1	**2.2**	<1

NOTES: (1) Well #'s 1, 10, 11 & 12 abandoned/destroyed during 2007-2008 soil remediation. Well #24 abandoned/destroyed during 2009 road paving.
(2) The "less than" symbol (<) indicates that the analyte was not detected above the given numerical method detection limit (MDL).

Table 3
Domenico Fate & Transport/Attenutaion Model & Soil to Groundwater Leaching Calculations
Benzene
Modeled Point of Exposure - Off-Site Stream
Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching						
W	Width of Source	32.4		ft	Site-specific	MEI CSR, 2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2 * 0.009$	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$ * 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 05-2017, Figs 6&7
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat}$ * i	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenuation Factor	**2.124**	$DAF = 1 + (U_{gw} * \delta_{gw})/(I*W)$	dimensionless	Calculated	ASTM E2081-00 (2015)
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**146**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**5.2268**	$K_d = K_{oc} * f_{oc}$	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**0.23**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**5.403**	$K_{sw} = [\Theta_w + (K_d * \rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.087**	$LF_{sw} = 1/(K_{sw} * DAF)$	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**0.016**		mg/kg	Site-specific	MEI CSR, 2015, Tables 7, 8 & 22
C_{leach}	Conc. in GW by leaching	**1.4E-03**	$C_{leach} = C_{max, soil} * LF_{sw}$	mg/L	Calculated	ASTM E2081-00 (2015)
Domenico Ground Water Solute Transport Model						
$C_{max,gw}$	Max GW concentration on-site	**135**		µg/L	Site-specific	MEI CSR, 05-2017, Tbl 2
$C_{max,gw}$	Max GW concentration on-site	**0.135**		mg/L	Site-specific	
$C_{source, gw}$	Steady State GW concentration in source zone	**0.136**	$C_{source, gw} = C_{max, gw} + C_{leach}$	mg/L	Calculated	Calculated
x_{del}	Distance: Source to Downgrad. Delineated Edge of Plume	**50**		ft	Site & Compound-specific	MEI CSR, 05-2017, Figs. 10-14
x_{del}	Distance: Source to Downgrad. Delineated Edge of Plume	**1,524**	$x_{del, cm} = x_{del, ft}$ * 30.48 cm/ft	cm	Site & Compound-specific	
x_{POE}	Dist: Downgrad. Edge Delineated Plume to Pt. of Exposure	**405**		ft	Site & Compound-specific	MEI CSR, 05-2017, Figs. 10-14
x_{POE}	Dist: Downgrad. Edge Delineated Plume to Pt. of Exposure	**12,344**	$x_{POE, cm} = x_{POE, ft}$ * 30.48 cm/ft	cm	Site & Compound-specific	
x_{total}	Distance - Total to Potential Receptor	**455**		ft	Calculated	
x_{total}	Distance - Total to Potential Receptor	**13,868**	$x_{total, cm} = x_{total, ft}$ * 30.48 cm/ft	cm	Calculated	
λ	Degradation rate const.	**0.00067**		day^{-1}	Geo. Mean of Site Specific	MEI CSR, 12-2015, Table 11
α_x	Longitudinal Dispersivity	**1386.84**	$\alpha_x = x_{total}$ * 0.1	cm	Calculated	ASTM E 1739
α_y	Transverse Dispersivity	**462.28**	$\alpha_y = \alpha_x / 3$	cm	Calculated	ASTM E 1739
α_z	Vertical Dispersivity	**69.342**	$\alpha_z = \alpha_x / 20$	cm	Calculated	ASTM E 1739
u	Specific Discharge	**285.29**	$u = (K_{sat} * i) / \Theta_w$	cm/day	Calculated	ASTM E2081-00 (2015)
W	Source width (Horiz.)	**32.4**		ft	Site-specific	MEI CSR, 12-2015, Sec. 3.4.4.1
W	Source width (Horiz.)	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Calculated	
S_d	Source thickness (Vertical)	**200**		cm	Default	EPA RSL Table, 2015
Domenico Steady-State Transport/Attenuation Equation: **$C(x) = Csource * \{exp [x_{total}/(2 * \alpha_x)*(1-sqrt(1+(4*\lambda*\alpha_x/u)))] * [erf (W/(4*sqrt(\alpha y * x_{total})))] * [erf (S_d/(4*sqrt(\alpha_z * x_{total})))]\}$**						ASTM E 1739, EPA 2002
Intermed. calc.	Domenico - exponential term	-3.246E-02	$(x_{total}/(2 * \alpha_x)*(1-sqrt(1+(4*\lambda*\alpha_x/u)))$	dimensionless	Calculated	Calculated
Intermed. calc.	exp (exponential term)	9.681E-01	exp (exponential term)	dimensionless	Calculated	Calculated
Intermed. calc.	(1st term) - error function (erf) to be calc.	9.751E-02	$(W/(4*sqrt(\alpha_y * x_{total})))$	dimensionless	Calculated	Calculated
Intermed. calc.	(2nd term) - error function (erf) to be calc.	5.099E-02	$(S_d/(4*sqrt(\alpha_z * x_{total})))$	dimensionless	Calculated	Calculated
Intermed. calc.	erf (1st term)=	0.109677	$erf (W/(4*sqrt(\alpha_y * x_{total})))$	dimensionless	Calculated	Calculated
Intermed. calc.	erf (2nd term)=	0.057483	$erf (S_d/(4*sqrt(\alpha_z * x_{total})))$	dimensionless	Calculated	Calculated
Intermed. calc.	erf(1st Term) * erf (2nd Term}	6.305E-03		dimensionless	Calculated	Calculated
Intermed. calc.	Domenico Results {parenthetical term}	**6.103E-03**	{exp [exp. term] * [erf (1st term)] * [erf (2nd term)]}	dimensionless	Calculated	Calculated
C(x) =	**Downgradient Point of Exposure Concentration**	**8.3E-04**	$C_{(x)} = C_{source, gw}$ * {Domenico Eqn.}	**mg/L**	**Calculated**	**Calculated**
C(x) =	**Downgradient Point of Exposure Concentration**	**0.83**	$C_{(x)} = C_{source, gw}$ * {Domenico Eqn.}	**µg/L**	**Calculated**	**Calculated**
In Stream Standard	**Georgia In Stream Water Quaity Standard**	**51**		**µg/L**	**Default**	**EPD Rule 391-3-.03(5)(e)(iv)**

Table 4
Domenico Fate & Transport/Attenutaion Model & Soil to Groundwater Leaching Calculations
cis-1,2-Dichloroethene (cDCE) - On-Site Drycleaner Release Source
Modeled Point of Exposure - Off-Site Stream
Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching						
W	Width of Source	**32.4**		ft	Site-specific	MEI CSR, 2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor/Coefficient	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2$*0.009	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$* 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 05-2017, Figs 6&7
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat}$ * i	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenuation Factor	**2.124**	DAF = 1 + (U_{gw}*δ_{gw})/(I*W)	dimensionless	Calculated	ASTM E2081-00 (2015)
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**39.6**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**1.41768**	$K_d = K_{oc}$ * f_{oc}	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**0.17**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**1.585**	$K_{sw} = [\Theta_w + (K_d*\rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.297**	$LF_{sw} = 1/(K_{sw}$ * DAF)	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**0.3**		mg/kg	Site-specific	MEI CSR, 2015, Tables 7, 8 & 22
C_{leach}	Conc. in GW by leaching	**8.9E-02**		mg/L	Calculated	ASTM E2081-00 (2015)
Domenico Ground Water Solute Transport Model						
$C_{max,gw}$	Max GW concentration on-site	**210**		µg/L	Site-specific	MEI CSR, 05-2017, Tbl 2
$C_{max,gw}$	Max GW concentration on-site	**0.210**		mg/L	Site-specific	
$C_{source, gw}$	Steady State GW concentration in source zone	**0.299**	$C_{source, gw} = C_{max, gw} + C_{leach}$	mg/L	Calculated	Calculated
x_{del}	Distance: Source to Downgrad. Delineated Edge of Plume	**70**		ft	Site & Compound-specific	MEI CSR, 05-2017, Figs. 10-14
x_{del}	Distance: Source to Downgrad. Delineated Edge of Plume	**2,134**	$x_{del, cm} = x_{del, ft}$ * 30.48 cm/ft	cm	Site & Compound-specific	
x_{POE}	Dist: Downgrad. Edge Delineated Plume to Pt. of Exposure	**305**		ft	Site & Compound-specific	MEI CSR, 05-2017, Figs. 10-14
x_{POE}	Dist: Downgrad. Edge Delineated Plume to Pt. of Exposure	**9,296**	$x_{POE, cm} = x_{POE, ft}$ * 30.48 cm/ft	cm	Site & Compound-specific	
x_{total}	Distance - Total to Potential Receptor	**375**		ft	Site-specific	
x_{total}	Distance - Total to Potential Receptor	**11,430**	$x_{total, cm} = x_{total, ft}$ * 30.48 cm/ft	cm	Site-specific	
λ	Degradation rate const.	**0.0008**		day^{-1}	Geo. Mean of Site Specific	MEI CSR, 12-2015, Table 11
α_x	Longitudinal Dispersivity	**1143**	$\alpha_x = x_{total}$ * 0.1	cm	Calculated	ASTM E 1739
α_y	Transverse Dispersivity	**381**	$\alpha_y = \alpha_x$ / 3	cm	Calculated	ASTM E 1739
α_z	Vertical Dispersivity	**57.15**	$\alpha_z = \alpha_x$ / 20	cm	Calculated	ASTM E 1739
u	Specific Discharge	**285.29**	u = (K_{sat} * i) / Θ_w	cm/day	Calculated	ASTM E2081-00 (2015)
W	Source width (Horiz.)	**32.4**		ft	Site-specific	MEI CSR, 12-2015, Sec. 3.4.4.1
W	Source width (Horiz.)	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Calculated	
S_d	Source thickness (Vertical)	**200**		cm	Default	EPA RSL Table, 2015
Domenico Steady-State Transport/Attenuation Equation: **C(x) = Csource * {exp [x_{total}/(2 * α_x)*(1-sqrt(1+(4*λ*α_x/u)))] * [erf (W/(4*sqrt(αy * x_{total})))] * [erf (S_d/(4*sqrt(α_z * x_{total})))]}**						ASTM E 1739, EPA 2002
Intermed. calc.	Domenico - exponential term	-3.195E-02	(x_{total}/(2 * α_x)*(1-sqrt(1+(4*λ*α_x/u)))	dimensionless	Calculated	Calculated
Intermed. calc.	exp (exponential term)	9.686E-01	exp (exponential term)	dimensionless	Calculated	Calculated
Intermed. calc.	(1st term) - error function (erf) to be calc.	1.183E-01	(W/(4*sqrt(α_y * x_{total})))	dimensionless	Calculated	Calculated
Intermed. calc.	(2nd term) - error function (erf) to be calc.	6.186E-02	(S_d/(4*sqrt(α_z * x_{total})))	dimensionless	Calculated	Calculated
Intermed. calc.	erf (1st term)=	0.132876	erf (W/(4*sqrt(α_y * x_{total})))	dimensionless	Calculated	Calculated
Intermed. calc.	erf (2nd term)=	0.069717	erf (S_d/(4*sqrt(α_z * x_{total})))	dimensionless	Calculated	Calculated
Intermed. calc.	erf(1st Term) * erf (2nd Term)	9.264E-03		dimensionless	Calculated	Calculated
Intermed. calc.	Domenico Results {parenthetical term}	**8.972E-03**	{exp [exp. term] * [erf (1st term)] * [erf (2nd term)]}	dimensionless	Calculated	Calculated
C(x) =	**Downgradient Point of Exposure Concentration**	**2.7E-03**	$C_{(x)} = C_{source, gw}$ * {Domenico Eqn.}	**mg/L**	**Calculated**	**Calculated**
C(x) =	**Downgradient Point of Exposure Concentration**	**2.68**	$C_{(x)} = C_{source, gw}$ * {Domenico Eqn.}	**µg/L**	**Calculated**	**Calculated**
Type 1 RRS	**Residential RRS/ Drinking Water MCL**	**70**		**µg/L**	**Default**	**EPD Rule 391-5-.18(2)(b)**

Table 5
Domenico Fate & Transport/Attenutaion Model & Soil to Groundwater Leaching Calculations
cis-1,2-Dichloroethene (cDCE) - Surrogate Release Source
Modeled Point of Exposure - Off-Site Stream
Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
			Soil to Ground Water Leaching			
W	Width of Source	32.4		ft	Site-specific	MEI CSR, 2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor/Coefficient	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2 * 0.009$	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw,\ cm} = \delta_{gw,\ ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$ * 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 05-2017, Figs 6&7
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat} * i$	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenuation Factor	**2.124**	$DAF = 1 + (U_{gw} * \delta_{gw})/(I * W)$	dimensionless	Calculated	ASTM E2081-00 (2015)
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**39.6**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**1.41768**	$K_d = K_{oc} * f_{oc}$	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**0.17**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**1.585**	$K_{sw} = [\Theta_w + (K_d * \rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.297**	$LF_{sw} = 1/(K_{sw} * DAF)$	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max,\ soil}$	Max soil concentration on-site	**0.3**		mg/kg	Site-specific	MEI CSR, 2015, Tables 7, 8 & 22
C_{leach}	Conc. in GW by leaching	**8.9E-02**		mg/L	Calculated	ASTM E2081-00 (2015)
			Domenico Ground Water Solute Transport Model			
$C_{max,gw}$	Max GW concentration on-site	**100**		µg/L	Site-specific	MEI CSR, 05-2017, Tbl 2
$C_{max,gw}$	Max GW concentration on-site	**0.100**		mg/L	Site-specific	
$C_{source,\ gw}$	Steady State GW concentration in source zone	**0.189**	$C_{source,\ gw} = C_{max,\ gw} + C_{leach}$	mg/L	Calculated	Calculated
x_{del}	Distance: Source to Downgrad. Delineated Edge of Plume	**50**		ft	Site & Compound-specific	MEI CSR, 05-2017, Figs. 10-14
x_{del}	Distance: Source to Downgrad. Delineated Edge of Plume	**1,524**	$x_{del,\ cm} = x_{del,\ ft}$ * 30.48 cm/ft	cm	Site & Compound-specific	
x_{POE}	Dist: Downgrad. Edge Delineated Plume to Pt. of Exposure	**200**		ft	Site & Compound-specific	MEI CSR, 05-2017, Figs. 10-14
x_{POE}	Dist: Downgrad. Edge Delineated Plume to Pt. of Exposure	**6,096**	$x_{POE,\ cm} = x_{POE,\ ft}$ * 30.48 cm/ft	cm	Site & Compound-specific	
x_{total}	Distance - Total to Potential Receptor	**250**		ft	Site-specific	
x_{total}	Distance - Total to Potential Receptor	**7,620**	$x_{total,\ cm} = x_{total,\ ft}$ * 30.48 cm/ft	cm	Site-specific	
λ	Degradation rate const.	**0.0008**		day^{-1}	Geo. Mean of Site Specific	MEI CSR, 12-2015, Table 11
α_x	Longitudinal Dispersivity	**762**	$\alpha_x = x_{total} * 0.1$	cm	Calculated	ASTM E 1739
α_y	Transverse Dispersivity	**254**	$\alpha_y = \alpha_x / 3$	cm	Calculated	ASTM E 1739
α_z	Vertical Dispersivity	**38.1**	$\alpha_z = \alpha_x / 20$	cm	Calculated	ASTM E 1739
u	Specific Discharge	**285.29**	$u = (K_{sat} * i) / \Theta_w$	cm/day	Calculated	ASTM E2081-00 (2015)
W	Source width (Horiz.)	**32.4**		ft	Site-specific	MEI CSR, 12-2015, Sec. 3.4.4.1
W	Source width (Horiz.)	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Calculated	
S_d	Source thickness (Vertical)	**200**		cm	Default	EPA RSL Table, 2015
Domenico Steady-State Transport/Attenuation Equation: **$C(x) = Csource * \{exp [x_{total}/(2 * \alpha_x)*(1-sqrt(1+(4*\lambda*\alpha_x/u)))] * [erf (W/(4*sqrt(\alpha y * x_{total})))] * [erf (S_d/(4*sqrt(\alpha_z * x_{total})))]\}$**						ASTM E 1739, EPA 2002
Intermed. calc.	Domenico - exponential term	-2.132E-02	$(x_{total}/(2 * \alpha_x)*(1-sqrt(1+(4*\lambda*\alpha_x/u)))$	dimensionless	Calculated	Calculated
Intermed. calc.	exp (exponential term)	9.789E-01	exp (exponential term)	dimensionless	Calculated	Calculated
Intermed. calc.	(1st term) - error function (erf) to be calc.	1.775E-01	$(W/(4*sqrt(\alpha_y * x_{total})))$	dimensionless	Calculated	Calculated
Intermed. calc.	(2nd term) - error function (erf) to be calc.	9.280E-02	$(S_d/(4*sqrt(\alpha_z * x_{total})))$	dimensionless	Calculated	Calculated
Intermed. calc.	erf (1st term)=	0.198162	$erf (W/(4*sqrt(\alpha_y * x_{total})))$	dimensionless	Calculated	Calculated
Intermed. calc.	erf (2nd term)=	0.104409	$erf (S_d/(4*sqrt(\alpha_z * x_{total})))$	dimensionless	Calculated	Calculated
Intermed. calc.	erf(1st Term) * erf (2nd Term)	2.069E-02		dimensionless	Calculated	Calculated
Intermed. calc.	Domenico Results {parenthetical term}	**2.025E-02**	{exp [exp. term] * [erf (1st term)] * [erf (2nd term)]}	dimensionless	Calculated	Calculated
C(x) =	**Downgradient Point of Exposure Concentration**	**3.8E-03**	$C_{(x)} = C_{source,\ gw}$ * {Domenico Eqn.}	**mg/L**	**Calculated**	**Calculated**
C(x) =	**Downgradient Point of Exposure Concentration**	**3.83**	$C_{(x)} = C_{source,\ gw}$ * {Domenico Eqn.}	**µg/L**	**Calculated**	**Calculated**
Type 1 RRS	**Residential RRS/ Drinking Water MCL**	**70**		**µg/L**	**Default**	**EPD Rule 391-5-.18(2)(b)**

Table 6
Domenico Fate & Transport/Attenutaion Model & Soil to Groundwater Leaching Calculations
Tetrachloroethene
Modeled Point of Exposure - Off-Site Stream
Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching						
W	Width of Source	32.4		ft	Site-specific	MEI CSR, 2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2 * 0.009$	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$ * 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 05-2017, Figs 6&7
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat}$ * i	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenuation Factor	**2.124**	$DAF = 1 + (U_{gw} * \delta_{gw})/(I * W)$	dimensionless	Calculated	ASTM E2081-00 (2015)
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**94.94**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**3.398852**	$K_d = K_{oc} * f_{oc}$	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**0.724**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**3.647**	$K_{sw} = [\Theta_w + (K_d * \rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.129**	$LF_{sw} = 1/(K_{sw} * DAF)$	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**1.1**		mg/kg	Site-specific	MEI CSR, 2015, Tables 7, 8 & 22
C_{leach}	Conc. in GW by leaching	**1.4E-01**	$C_{leach} = C_{max, soil} * LF_{sw}$	mg/L	Calculated	ASTM E2081-00 (2015)
Domenico Ground Water Solute Transport Model						
$C_{max,gw}$	Max GW concentration on-site	**775**		µg/L	Site-specific	MEI CSR, 05-2017, Tbl 2
$C_{max,gw}$	Max GW concentration on-site	**0.775**		mg/L	Site-specific	
$C_{source, gw}$	Steady State GW concentration in source zone	**0.917**	$C_{source, gw} = C_{max, gw} + C_{leach}$	mg/L	Calculated	Calculated
x_{del}	Distance: Source to Downgrad. Delineated Edge of Plume	**300**		ft	Site & Compound-specific	MEI CSR, 05-2017, Figs. 10-14
x_{del}	Distance: Source to Downgrad. Delineated Edge of Plume	**9,144**	$x_{del, cm} = x_{del, ft}$ * 30.48 cm/ft	cm	Site & Compound-specific	
x_{POE}	Dist: Downgrad. Edge Delineated Plume to Pt. of Exposure	**75**		ft	Site & Compound-specific	MEI CSR, 05-2017, Figs. 10-14
x_{POE}	Dist: Downgrad. Edge Delineated Plume to Pt. of Exposure	**2,286**	$x_{POE, cm} = x_{POE, ft}$ * 30.48 cm/ft	cm	Site & Compound-specific	
x_{total}	Distance - Total to Potential Receptor	**375**		ft	Site-specific	
x_{total}	Distance - Total to Potential Receptor	**11,430**	$x_{total, cm} = x_{total, ft}$ * 30.48 cm/ft	cm	Site-specific	
λ	Degradation rate const.	**0.00101**		day^{-1}	Geo. Mean of Site Specific	MEI CSR, 12-2015, Table 11
α_x	Longitudinal Dispersivity	**1143**	$\alpha_x = x_{total}$ * 0.1	cm	Calculated	ASTM E 1739
α_y	Transverse Dispersivity	**381**	$\alpha_y = \alpha_x / 3$	cm	Calculated	ASTM E 1739
α_z	Vertical Dispersivity	**57.15**	$\alpha_z = \alpha_x / 20$	cm	Calculated	ASTM E 1739
u	Specific Discharge	**285.29**	$u = (K_{sat} * i) / \Theta_w$	cm/day	Calculated	ASTM E2081-00 (2015)
W	Source width (Horiz.)	**32.4**		ft	Site-specific	MEI CSR, 12-2015, Sec. 3.4.4.1
W	Source width (Horiz.)	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Calculated	
S_d	Source thickness (Vertical)	**200**		cm	Default	EPA RSL Table, 2015
Domenico Steady-State Transport/Attenuation Equation: **$C(x) = Csource * \{exp [x_{total}/(2 * \alpha_x)*(1-sqrt(1+(4*\lambda*\alpha_x/u)))] * [erf (W/(4*sqrt(\alpha y * x_{total})))] * [erf (S_d/(4*sqrt(\alpha_z * x_{total})))]\}$**						ASTM E 1739, EPA 2002
Intermed. calc.	Domenico - exponential term	-4.030E-02	$(x_{total}/(2 * \alpha_x)*(1-sqrt(1+(4*\lambda*\alpha_x/u)))$	dimensionless	Calculated	Calculated
Intermed. calc.	exp (exponential term)	9.605E-01	exp (exponential term)	dimensionless	Calculated	Calculated
Intermed. calc.	(1st term) - error function (erf) to be calc.	1.183E-01	$(W/(4*sqrt(\alpha_y * x_{total})))$	dimensionless	Calculated	Calculated
Intermed. calc.	(2nd term) - error function (erf) to be calc.	6.186E-02	$(S_d/(4*sqrt(\alpha_z * x_{total})))$	dimensionless	Calculated	Calculated
Intermed. calc.	erf (1st term)=	0.132876	$erf (W/(4*sqrt(\alpha_y * x_{total})))$	dimensionless	Calculated	Calculated
Intermed. calc.	erf (2nd term)=	0.069717	$erf (S_d/(4*sqrt(\alpha_z * x_{total})))$	dimensionless	Calculated	Calculated
Intermed. calc.	erf(1st Term) * erf (2nd Term}	9.264E-03		dimensionless	Calculated	Calculated
Intermed. calc.	Domenico Results {parenthetical term}	**8.898E-03**	{exp [exp. term] * [erf (1st term)] * [erf (2nd term)]}	dimensionless	Calculated	Calculated
C(x) =	**Downgradient Point of Exposure Concentration**	**8.2E-03**	$C_{(x)} = C_{source, gw}$ * {Domenico Eqn.}	**mg/L**	**Calculated**	**Calculated**
C(x) =	**Downgradient Point of Exposure Concentration**	**8.16**	$C_{(x)} = C_{source, gw}$ * {Domenico Eqn.}	**µg/L**	**Calculated**	**Calculated**
In Stream Standard	**Georgia In Stream Water Quaity Standard**	**3.3**		**µg/L**	**Default**	**EPD Rule 391-3-.03(5)(e)(iv)**

Table 7
Domenico Fate & Transport/Attenutaion Model & Soil to Groundwater Leaching Calculations
Trichloroethene
Modeled Point of Exposure - Off-Site Stream
Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
			Soil to Ground Water Leaching			
W	Width of Source	**32.4**		ft	Site-specific	MEI CSR, 2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2$*0.009	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$* 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 05-2017, Figs 6&7
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat}$ * i	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenuation Factor	**2.124**	DAF = 1 + (U_{gw}*δ_{gw})/(I*W)	dimensionless	Calculated	ASTM E2081-00 (2015)
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**60.7**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**2.17306**	$K_d = K_{oc}$ * f_{oc}	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**0.403**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**2.375**	$K_{sw} = [\Theta_w + (K_d*\rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.198**	$LF_{sw} = 1/(K_{sw}$ * DAF)	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**0.18**		mg/kg	Site-specific	MEI CSR, 2015, Tables 7, 8 & 22
$\mathbf{C_{leach}}$	Conc. in GW by leaching	**3.6E-02**	$C_{leach} = C_{max, soil}$ * LF_{sw}	mg/L	Calculated	ASTM E2081-00 (2015)
			Domenico Ground Water Solute Transport Model			
$C_{max,gw}$	Max GW concentration on-site	**120**		µg/L	Site-specific	MEI CSR, 05-2017, Tbl 2
$C_{max,gw}$	Max GW concentration on-site	**0.120**		mg/L	Site-specific	
$\mathbf{C_{source, gw}}$	Steady State GW concentration in source zone	**0.156**	$C_{source, gw} = C_{max, gw} + C_{leach}$	mg/L	Calculated	Calculated
x_{del}	Distance: Source to Downgrad. Delineated Edge of Plume	**175**		ft	Site & Compound-specific	MEI CSR, 05-2017, Figs. 10-14
x_{del}	Distance: Source to Downgrad. Delineated Edge of Plume	**5,334**	$x_{del, cm} = x_{del, ft}$ * 30.48 cm/ft	cm	Site & Compound-specific	
x_{POE}	Dist: Downgrad. Edge Delineated Plume to Pt. of Exposure	**200**		ft	Site & Compound-specific	MEI CSR, 05-2017, Figs. 10-14
x_{POE}	Dist: Downgrad. Edge Delineated Plume to Pt. of Exposure	**6,096**	$x_{POE, cm} = x_{POE, ft}$ * 30.48 cm/ft	cm	Site & Compound-specific	
x_{total}	Distance - Total to Potential Receptor	**375**		ft	Site-specific	
x_{total}	Distance - Total to Potential Receptor	**11,430**	$x_{total, cm} = x_{total, ft}$ * 30.48 cm/ft	cm	Site-specific	
λ	Degradation rate const.	**0.00066**		day^{-1}	Geo. Mean of Site Specific	MEI CSR, 12-2015, Table 11
α_x	Longitudinal Dispersivity	**1143**	$\alpha_x = x_{total}$ * 0.1	cm	Calculated	ASTM E 1739
α_y	Transverse Dispersivity	**381**	$\alpha_y = \alpha_x / 3$	cm	Calculated	ASTM E 1739
α_z	Vertical Dispersivity	**57.15**	$\alpha_z = \alpha_x / 20$	cm	Calculated	ASTM E 1739
u	Specific Discharge	**285.29**	u = (K_{sat} * i) / Θ_w	cm/day	Calculated	ASTM E2081-00 (2015)
W	Source width (Horiz.)	**32.4**		ft	Site-specific	MEI CSR, 12-2015, Sec. 3.4.4.1
W	Source width (Horiz.)	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Calculated	
S_d	Source thickness (Vertical)	**200**		cm	Default	EPA RSL Table, 2015
Domenico Steady-State Transport/Attenuation Equation: **C(x) = Csource * {exp [x_{total}/(2 * α_x)*(1-sqrt(1+(4*λ*α_x/u)))] * [erf (W/(4*sqrt(αy * x_{total})))] * [erf (S_d/(4*sqrt(α_z * x_{total})))]}**						ASTM E 1739, EPA 2002
Intermed. calc.	Domenico - exponential term	-2.637E-02	(x_{total}/(2 * α_x)*(1-sqrt(1+(4*λ*α_x/u)))	dimensionless	Calculated	Calculated
Intermed. calc.	exp (exponential term)	9.740E-01	exp (exponential term)	dimensionless	Calculated	Calculated
Intermed. calc.	(1st term) - error function (erf) to be calc.	1.183E-01	(W/(4*sqrt(α_y * x_{total})))	dimensionless	Calculated	Calculated
Intermed. calc.	(2nd term) - error function (erf) to be calc.	6.186E-02	(S_d/(4*sqrt(α_z * x_{total})))	dimensionless	Calculated	Calculated
Intermed. calc.	erf (1st term)=	0.132876	erf (W/(4*sqrt(α_y * x_{total})))	dimensionless	Calculated	Calculated
Intermed. calc.	erf (2nd term)=	0.069717	erf (S_d/(4*sqrt(α_z * x_{total})))	dimensionless	Calculated	Calculated
Intermed. calc.	erf(1st Term) * erf (2nd Term}	9.264E-03		dimensionless	Calculated	Calculated
Intermed. calc.	Domenico Results {parenthetical term}	**9.023E-03**	{exp [exp. term] * [erf (1st term)] * [erf (2nd term)]}	dimensionless	Calculated	Calculated
C(x) =	**Downgradient Point of Exposure Concentration**	**1.40E-03**	$C_{(x)} = C_{source, gw}$ * {Domenico Eqn.}	**mg/L**	**Calculated**	**Calculated**
C(x) =	**Downgradient Point of Exposure Concentration**	**1.40**	$C_{(x)} = C_{source, gw}$ * {Domenico Eqn.}	**µg/L**	**Calculated**	**Calculated**
In Stream Standard	**Georgia In Stream Water Quaity Standard**	**30**		**µg/L**	**Default**	**EPD Rule 391-3-.03(5)(e)(iv)**

Table 8
Domenico Fate & Transport/Attenutaion Model & Soil to Groundwater Leaching Calculations
Vinyl Chloride
Modeled Point of Exposure - Off-Site Stream
Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching						
W	Width of Source	**32.4**		ft	Site-specific	MEI CSR, 2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2$*0.009	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$* 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 05-2017, Figs 6&7
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat}$ * i	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenuation Factor	**2.124**	DAF = 1 + (U_{gw}*δ_{gw})/(I*W)	dimensionless	Calculated	ASTM E2081-00 (2015)
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**21.73**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**0.777934**	$K_d = K_{oc}$ * f_{oc}	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**1.14**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**1.085**	K_{sw} = [Θ_w + (K_d*ρ_s) + (H_{eff} * Θ_a)] / ρ_s	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.434**	LF_{sw} = 1/(K_{sw} * DAF)	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**0.0012**	NOT DETECTED - Subst. MDL	mg/kg	Site-specific	MEI CSR, 2015, Tables 7, 8 & 22
C_{leach}	Conc. in GW by leaching	**5.2E-04**	$C_{leach} = C_{max, soil}$ * LF_{sw}	mg/L	Calculated	ASTM E2081-00 (2015)
Domenico Ground Water Solute Transport Model						
$C_{max,gw}$	Max GW concentration on-site	**11**		µg/L	Site-specific	MEI CSR, 05-2017, Tbl 2
$C_{max,gw}$	Max GW concentration on-site	**0.011**		mg/L	Site-specific	
$C_{source, gw}$	Steady State GW concentration in source zone	**0.012**	$C_{source, gw} = C_{max, gw} + C_{leach}$	mg/L	Calculated	Calculated
x_{del}	Distance: Source to Downgrad. Delineated Edge of Plume	**87**		ft	Site & Compound-specific	MEI CSR, 05-2017, Figs. 10-14
x_{del}	Distance: Source to Downgrad. Delineated Edge of Plume	**2,652**	$x_{del, cm} = x_{del, ft}$ * 30.48 cm/ft	cm	Site & Compound-specific	
x_{POE}	Dist: Downgrad. Edge Delineated Plume to Pt. of Exposure	**163**		ft	Site & Compound-specific	MEI CSR, 05-2017, Figs. 10-14
x_{POE}	Dist: Downgrad. Edge Delineated Plume to Pt. of Exposure	**4,968**	$x_{POE, cm} = x_{POE, ft}$ * 30.48 cm/ft	cm	Site & Compound-specific	
x_{total}	Distance - Total to Potential Receptor	**250**		ft	Site-specific	
x_{total}	Distance - Total to Potential Receptor	**7,620**	$x_{total, cm} = x_{total, ft}$ * 30.48 cm/ft	cm	Site-specific	
λ	Degradation rate const.	**0.00032**		day^{-1}	Geo. Mean of Site Specific	MEI CSR, 12-2015, Table 11
α_x	Longitudinal Dispersivity	**762**	$\alpha_x = x_{total}$ * 0.1	cm	Calculated	ASTM E 1739
α_y	Transverse Dispersivity	**254**	$\alpha_y = \alpha_x$ / 3	cm	Calculated	ASTM E 1739
α_z	Vertical Dispersivity	**38.1**	$\alpha_z = \alpha_x$ / 20	cm	Calculated	ASTM E 1739
u	Specific Discharge	**285.29**	u = (K_{sat} * i) / Θ_w	cm/day	Calculated	ASTM E2081-00 (2015)
W	Source width (Horiz.)	**32.4**		ft	Site-specific	MEI CSR, 12-2015, Sec. 3.4.4.1
W	Source width (Horiz.)	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Calculated	
S_d	Source thickness (Vertical)	**200**		cm	Default	EPA RSL Table, 2015
Domenico Steady-State Transport/Attenuation Equation: **C(x) = Csource * {exp [x_{total}/(2 * α_x)*(1-sqrt(1+(4*λ*α_x/u)))] * [erf (W/(4*sqrt(αy * x_{total})))] * [erf (S_d/(4*sqrt(α_z * x_{total})))]}**						ASTM E 1739, EPA 2002
Intermed. calc.	Domenico - exponential term	-8.540E-03	(x_{total}/(2 * α_x)*(1-sqrt(1+(4*λ*α_x/u)))	dimensionless	Calculated	Calculated
Intermed. calc.	exp (exponential term)	9.915E-01	exp (exponential term)	dimensionless	Calculated	Calculated
Intermed. calc.	(1st term) - error function (erf) to be calc.	1.775E-01	(W/(4*sqrt(α_y * x_{total})))	dimensionless	Calculated	Calculated
Intermed. calc.	(2nd term) - error function (erf) to be calc.	9.280E-02	(S_d/(4*sqrt(α_z * x_{total})))	dimensionless	Calculated	Calculated
Intermed. calc.	erf (1st term)=	0.198162	erf (W/(4*sqrt(α_y * x_{total})))	dimensionless	Calculated	Calculated
Intermed. calc.	erf (2nd term)=	0.104409	erf (S_d/(4*sqrt(α_z * x_{total})))	dimensionless	Calculated	Calculated
Intermed. calc.	erf(1st Term) * erf (2nd Term}	2.069E-02		dimensionless	Calculated	Calculated
Intermed. calc.	Domenico Results {parenthetical term}	**2.051E-02**	{exp [exp. term] * [erf (1st term)] * [erf (2nd term)]}	dimensionless	Calculated	Calculated
C(x) =	**Downgradient Point of Exposure Concentration**	**2.4E-04**	$C_{(x)} = C_{source, gw}$ * {Domenico Eqn.}	**mg/L**	**Calculated**	**Calculated**
C(x) =	**Downgradient Point of Exposure Concentration**	**0.236**	$C_{(x)} = C_{source, gw}$ * {Domenico Eqn.}	**µg/L**	**Calculated**	**Calculated**
In Stream Standard	**Georgia In Stream Water Quaity Standard**	**2**		**µg/L**	**Default**	**EPD Rule 391-3-.03(5)(e)(iv)**

TABLE 9
Fountain Oaks Shopping Center
Soil Volatilization Factor Calculations

Variable	Variable Definition	Value	Units	Parameter Type	Data Source	Volatilization Factor Formula
LS	Length of Side - Contam. Area	45	m	Defaults	EPD Rule 391-3-19, App. III	$VF = [(LS * V * DH) / A] * [(\pi * \alpha * T)^{1/2} / (2 * D_{ei} * E * K_{as} * 1E\text{-}03\ kg/g)]$
V	Wind Speed in Mixing Zone	2.25	m/s	Defaults	EPD Rule 391-3-19, App. III	
DH	Diffusion Height	2	m	Defaults	EPD Rule 391-3-19, App. III	
A	Area of Contamination	0.5	acre	Defaults	EPD Rule 391-3-19, App. III	
A	Area of Contamination	2.02E+07	cm^2	Defaults	EPD Rule 391-3-19, App. III	
T	Exposure Interval	25	year	Defaults	EPD Rule 391-3-19, App. III	
T	Exposure Interval	7.89E+08	seconds	Defaults	EPD Rule 391-3-19, App. III	
ρ_s	Soil Dry Solids Density	2.65	g/cm^3	Defaults	EPD Rule 391-3-19, App. III	
f_{oc}	Fractional Org. Carbon	0.0200	dimensionless	Defaults	EPD Rule 391-3-19, App. III	
E	Porosity - Total Soil	0.35	dimensionless	Defaults	EPD Rule 391-3-19, App. III	

Analyte	Henry's Law Constant	Diffusivity in Air	Diffusivity - Effective	Soil Organic Carbon-Water Partition Coefficient	Soil-Water Partition/ Sorption Coeff.	Soil-Air Partition Coefficient	Alpha (α)	Volatilization Factor (VF)
	H (atm-m^3/mol)	D_{ia} (cm^2/s)	$D_{ei} = D_i * E^{0.33}$ (cm^2/s)	K_{oc} (L/kg)	$K_d = K_{oc} * f_{oc}$ (g-W/g-soil)	$K_{as} = H / K_d * 41$ (g-soil/cm^3-air)	$\alpha = \{(D_{ei}*E) / [(E+(\rho_s)(1-E))/K_{as}]\}$ (cm/s)	m^3/kg
Acetone	3.5E-05	1.1E-01	7.5E-02	2.4E+00	4.7E-02	3.0E-02	3.8E-04	6.1E+03
Benzene	5.6E-03	9.0E-02	6.3E-02	1.5E+02	2.9E+00	7.9E-02	8.4E-04	4.1E+03
Chloroform	3.7E-03	7.7E-02	5.4E-02	3.2E+01	6.4E-01	2.4E-01	2.2E-03	2.6E+03
Cumene	1.2E-02	6.0E-02	4.3E-02	7.0E+02	1.4E+01	3.5E-02	2.5E-04	7.5E+03
Dichloroethylene, 1,2-cis-	4.1E-03	8.8E-02	6.3E-02	4.0E+01	7.9E-01	2.1E-01	2.2E-03	2.5E+03
Dichloroethylene, 1,2-trans-	9.4E-03	8.8E-02	6.2E-02	4.0E+01	7.9E-01	4.9E-01	5.1E-03	1.7E+03
Methyl Ethyl Ketone (MEK) (2-Butanone)	5.7E-05	9.1E-02	6.5E-02	4.5E+00	9.0E-02	2.6E-02	2.8E-04	7.1E+03
Tetrachloroethylene	1.8E-02	5.0E-02	3.6E-02	9.5E+01	1.9E+00	3.9E-01	2.3E-03	2.5E+03
Trichloroethylene	9.9E-03	6.9E-02	4.9E-02	6.1E+01	1.2E+00	3.3E-01	2.7E-03	2.3E+03
Vinyl Chloride	2.8E-02	1.1E-01	7.6E-02	2.2E+01	4.3E-01	2.6E+00	3.4E-02	6.5E+02

Notes:

(1) Volatilization Factors (VFs) calculated using formulas and constant values as specified in EPD Rule 391-3-19, Appendix III

TABLE 10

Risk Reduction Standards - Exposure Parameter Values
Fountain Oaks Shopping Center

Variable	Value
Target cancer risk (TR) - unitless	1.0E-05
Target hazard quotient (THQ) - unitless	1
Averaging time for carcinogens, resident adult ($AT_{c, ar}$) - years	70
Averaging time for carcinogens, resident child ($AT_{c, cr}$) - years	70
Averaging time for carcinogens, commercial ($AT_{c, c}$) - years	70
Averaging time for noncarcinogens, resident adult ($AT_{nc, ar}$) - years	30
Averaging time for noncarcinogens, resident child ($AT_{nc, cr}$) - years	6
Averaging time for noncarcinogens, commercial ($AT_{nc, c}$) - years	25
Averaging time - days/year	365
Body Weight - adult (BW_a) - kg	70
Body Weight - children 1-6 yr (BW_c) - kg	15
Exposure frequency (EF), residential - days/yr	350
Exposure frequency (EF), commercial - days/yr	250
Exposure duration, resident adult (ED_{ar}) - years	30
Exposure duration, resident child (ED_{cr}) - years	6
Exposure duration, commercial (ED_c) - years	25
Exposure Time (ET) hours/day	24
Ingestion Rate, Soil, residential ($IR_{soil, r}$) - mg/day	114
Ingestion Rate, Soil, commercial ($IR_{soil, c}$) - mg/day	50
Ingestion Rate, Water - resident adult (IRW_{cr}) - L/day	2
Ingestion Rate, Water - resident child (IRW_{cr}) - L/day	1
Ingestion Rate, Water - commercial (IRW_c) - L/day	1
Inhalation Rate, resident adult ($IR_{air, ar}$) - m3/day	15
Inhalation Rate, resident child ($IR_{air, cr}$) - m3/day	15
Inhalation Rate, Commercial ($IR_{air, c}$) - m3/day	20
Inhalation Rate, Commercial ($IR_{air, c}$) - m3/day	20
Particulate Emission Factor (PEF) - mg/kg	4.63E+09
Volatilization factor of Andelman (K) - L/m3	0.5

TABLE 11

Risk Reduction Standards - Chemical-Specific Parameter Values
Fountain Oaks Shopping Center

Chemical	CAS Number	Ingestion Cancer Slope Factor SFo (mg/kg-day)-1	Inhalation Unit Risk (ug/m^3)-1	Inhalation Cancer Slope Factor SFi (mg/kg-day)-1	Oral Chronic Reference Dose RfDo (mg/kg-day)	Inhalation Chronic Reference Concentration RfC (mg/m^3)	Inhalation Chronic Reference Dose RfDi (mg/kg-day)	Soil to Air Volatilization Factor - VF (m^3/kg)
Acetone	67-64-1	-	-	-	9.0E-01	3.1E+01	8.8E+00	6.1E+03
Benzene	71-43-2	5.5E-02	7.8E-06	2.7E-02	4.0E-03	3.0E-02	8.6E-03	4.1E+03
Chloroform	67-66-3	3.1E-02	2.3E-05	8.1E-02	1.0E-02	9.8E-02	2.8E-02	2.6E+03
Cumene (Isopropylbenzene)	98-82-8	-	-	-	1.0E-01	4.0E-01	1.1E-01	7.5E+03
Dichloroethylene, 1,2-cis- (cDCE)	156-59-2	-	-	-	2.0E-03	-	-	2.5E+03
Dichloroethylene, 1,2-trans- (tDCE)	156-60-5	-	-	-	2.0E-02	-	-	1.7E+03
Methyl Ethyl Ketone (MEK) (2-Butanone)	78-93-3	-	-	-	6.0E-01	5.0E+00	1.4E+00	7.1E+03
Tetrachloroethylene (PCE)	127-18-4	2.1E-03	2.6E-07	9.1E-04	6.0E-03	4.0E-02	1.1E-02	2.5E+03
Trichloroethylene (TCE)	79-01-6	4.6E-02	4.1E-06	1.4E-02	5.0E-04	2.0E-03	5.7E-04	2.3E+03
Vinyl Chloride (VC)	75-01-4	7.2E-01	4.4E-06	1.5E-02	3.0E-03	1.0E-01	2.9E-02	6.5E+02

Notes: (1) Chemical-specific values obtained from most recent US EPA Regional Screening Level (RSL) "Chemical Specific Parameters" table, updated May 2016.
Online at: https://www.epa.gov/sites/production/files/2016-06/documents/params_sl_table_01run_may2016.pdf

Table 12 - Soil - Type 1 & Type 2 RRS Selection Summary

1	2	3	4	5	6	7	8	9	10	11	12	13	14
					Calculated RAGS Eqn Results - Residential - Potential Type 1 or 2 RRS								
Compound	**Soil Notification Concentration (NC) (EPD Rule 391-3-19, App. I)** (mg/kg)	**Groundwater Criteria (EPD Rule 391-3-19, App. III, Table 1)** (mg/L)	**Groundwater Criterion x 100** (mg/L)	**Higher of Groundwater Criterion * 100 or Soil NC (Higher of Columns 2 or 4)** (mg/kg)	**RAGS EQN 6 ADULT TR=1.0E-5** (mg/kg)	**RAGS EQN 6 CHILD TR=1.0E-5** (mg/kg)	**RAGS EQN 7 ADULT HQ=1** (mg/kg)	**RAGS EQN 7 CHILD HQ=1** (mg/kg)	**Soil: Type 1 RRS[1] (Least of Columns 5-9) (mg/kg)**	**Type 1 RRS Note**	**Soil to GW Leaching Concentration - Causing GW to Exceed Type 1 or 2 RRS[2]** (mg/kg)	**Soil: Type 2 RRS[1] (Least of Columns 6-9 or 12) (mg/kg)**	**Type 2 RRS Note**
acetone	2.74	4	400	400	-	-	1.8E+05	3.1E+04	**4.0E+02**	GW*100	3.7E+01	**3.7E+01**	Soil to GW Leaching
benzene	0.02	0.005	0.5	0.5	1.6E+01	1.7E+01	1.6E+02	3.3E+01	**5.0E-01**	GW*100	5.8E-01	**5.0E-01**	Soil to GW Leaching
chloroform	0.68	0.08	8	8	3.6E+00	3.8E+00	3.3E+02	6.8E+01	**3.6E+00**	RAGS Eqn 6 Adult - c	2.1E+00	**2.1E+00**	Soil to GW Leaching
cumene (isopropylbenzene)	21.88	Not Listed	-	21.88	-	-	3.9E+03	8.1E+02	**2.2E+01**	Soil NC	1.0E+02	**2.2E+01**	Soil NC
cis-1,2-dichloroethene (cDCE)	0.53	0.070	7	7	-	-	-	-	**7.0E+00**	GW*100	2.2E+00	**2.2E+00**	Soil to GW Leaching
trans-1,2-dichloroethene (tDCE)	0.53	0.1	10	10	-	-	-	-	**1.0E+01**	GW*100	3.2E+00	**3.2E+00**	Soil to GW Leaching
methyl ethyl ketone (MEK)	0.79	2	200	200	-	-	4.4E+04	8.7E+03	**2.0E+02**	GW*100	1.4E+01	**1.4E+01**	Soil to GW Leaching
tetrachloroethene (PCE)	0.18	0.005	0.5	0.5	3.0E+02	3.1E+02	1.3E+02	2.8E+01	**5.0E-01**	GW*100	1.4E+00	**5.0E-01**	GW Criterion *100
trichloroethene (TCE)	0.13	0.005	0.5	0.5	1.7E+01	1.8E+01	6.3E+00	1.3E+00	**5.0E-01**	GW*100	2.4E-01	**2.4E-01**	Soil to GW Leaching
vinyl chloride (VC)	0.04	0.002	0.2	0.2	3.9E+00	3.7E+00	8.7E+01	1.8E+01	**2.0E-01**	GW*100	3.4E-02	**3.4E-02**	Soil to GW Leaching

(1) Indicates RRS calculated by MEI (Using RAGS Equations 6 & 7 with up-to-date toxicity information). Eqn 6 & 7 input values utilized are listed in tables in this VRP Application Addendum.
(2) Soil to Groundwater Leaching calculations for Type 2 Soil RRS calculated using Dilution Factor Model & default "Dilution Attenuation Factor" (DAF) of 20 per EPA Document 9355.4-23 "Soil Screening Guidance: User's Guide" 2nd Ed., Equation 11
(3) RRS Notes indicate criterion by which final RRS was selected. "c" = carcinogenic, "nc" = non-carcinogenic, "GW*100" = Groundwater criterion times 100, "Soil NC" = Soil Notification Concentration
"Soil to GW Leaching" = soil concentration that would cause groundwater to exceed higher of Type 3 or Type 4 groundwater RRS

Table 13 - Soil - Type 3 & 4 RRS Selection Summary

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Compound	**Soil Notification Concentration (NC) (EPD Rule 391-3-19, App. I)** (mg/kg)	**Groundwater Criteria (EPD Rule 391-3-19, App. III, Table 1)** (mg/L)	**Type 3 RRS ALL SOIL Higher of GW Criterion * 100 OR Soil NC** (mg/kg)	**Type 3 RRS ALL SOIL Note[4]**	**Calculated RAGS Equation Results - Residential - Potential Type 3 & 4 RRS**		**Type 3 RRS[1] SHALLOW SOIL (SOIL ≤2 ft DEEP) (Least of Columns 4, 6 &7)** **(mg/kg)**	**Type 3 RRS SHALLOW SOIL Note[4]**	**Previously Approved Type 3 RRS [3]** **(mg/kg)**	**Soil to Gw Leaching Concentration Causing GW to Exceed Type 3 or Type 4 RRS[2]** (mg/kg)	**Soil Type 4 RRS [1] ALL SOIL (Least of Columns 3, 4 or 8)** **(mg/kg)**	**Soil Type 4 RRS [1] SHALLOW SOIL (Least of Columns 3, 4 or 8)** **(mg/kg)**	**Type 4 RRS Note[4]**	**Previously Approved Type 4 RRS [3]** (mg/kg)	**Final Type 3 or 4 Commercial RRS** (mg/kg)
					RAGS EQN 6 COMMERCIAL TR=1.0E-5 (mg/kg)	**RAGS EQN 7 COMMERCIAL HQ=1** (mg/kg)									
acetone	2.74	4	**4.0E+02**	GW*100		2.4E+05	**4.0E+02**	GW*100	**4.0E+02**	2.2E+01	**2.2E+01**	**2.2E+01**	Soil to GW Leaching	NA	**4.0E+02**
benzene	0.02	0.005	**5.0E-01**	GW*100	2.1E+01	1.8E+02	**5.0E-01**	GW*100	NA	1.0E-01	**1.0E-01**	**1.0E-01**	Soil to GW Leaching	NA	**5.0E-01**
chloroform	0.68	0.08	**8.0E+00**	GW*101	4.6E+00	3.6E+02	**4.6E+00**	RAGS Eqn 6 - c	NA	2.2E-01	**2.2E-01**	**2.2E-01**	Soil to GW Leaching	NA	**4.6E+00**
cumene (isopropylbenzene)	21.88	Not Listed	**2.2E+01**	Soil NC		4.3E+03	**2.2E+01**	Soil NC	NA	5.4E+01	**5.4E+01**	**5.4E+01**	Soil to GW Leaching	NA	**5.4E+01**
cis-1,2-dichloroethene (cDCE)	0.53	0.070	**7.0E+00**	GW*100			**7.0E+00**	GW*100	NA	2.4E-01	2.4E-01	2.4E-01	Soil to GW Leaching	**1.84E+00**	**7.0E+00**
trans-1,2-dichloroethene (tDCE)	0.53	0.1	**1.0E+01**	GW*100			**1.0E+01**	GW*100	NA	3.4E-01	**3.4E-01**	**3.4E-01**	Soil to GW Leaching	NA	**1.0E+01**
methyl ethyl ketone (MEK)	0.79	2	**2.0E+02**	GW*100		5.0E+04	**2.0E+02**	GW*100	NA	7.8E+00	**7.8E+00**	**7.8E+00**	Soil to GW Leaching	NA	**2.0E+02**
tetrachloroethene (PCE)	0.18	0.005	**5.0E-01**	GW*100	3.8E+02	1.4E+02	**5.0E-01**	GW*100	NA	7.6E-01	7.6E-01	7.6E-01	Soil to GW Leaching	**1.18E+00**	**1.18E+00**
trichloroethene (TCE)	0.13	0.005	**5.0E-01**	GW*100	2.2E+01	6.7E+00	**5.0E-01**	GW*100	NA	2.6E-02	2.6E-02	2.6E-02	Soil to GW Leaching	**7.0E-01**	**7.0E-01**
vinyl chloride (VC)	0.04	0.002	**2.0E-01**	GW*100	5.6E+00	9.4E+01	**2.0E-01**	GW*100	NA	7.6E-03	7.6E-03	7.6E-03	Soil to GW Leaching	NA	**2.0E-01**

[1] Indicates RRS calculated by MEI (Using RAGS Equations 6 & 7 with up-to-date toxicity information). Eqn 6 & 7 input values utilized are listed in tables in this VRP Application Addendum.

[2] Soil to Groundwater Leaching calculations for Type 2 Soil RRS calculated using Dilution Factor Model & default "Dilution Attenuation Factor" (DAF) of 20 per EPA Document 9355.4-23 "Soil Screening Guidance: User's Guide" 2nd Ed., Equation 11

[3] RRS calculated by UC and reported to have been previously approved by EPD (UC PPCAP, 28-NOV-05, Table 5; UC CSR 10-JUN-08, Table 5)

[4] RRS Notes indicate criterion by which final RRS was selected. "c" = carcinogenic, "nc" = non-carcinogenic, "GW*100" = Groundwater criterion times 100,
"Soil to GW Leaching" = soil concentration that would cause groundwater to exceed higher of Type 3 or Type 4 RRS

Table 14 - SOIL - Type 1 & Type 2 Residential RRS vs. Off Site Residual Concentrations

Compound	Soil - Type 1 RRS [1] DELINEATION CRITERIA (mg/kg)	Previously Approved Type 1 RRS[2] (mg/kg)	Soil: Type 2 RRS[1] (mg/kg)	FINAL RESIDENTIAL RRS (mg/kg)	Off-Site Maximum Soil Concentration [3] (mg/kg)	Final Residential Type 1/2 RRS Exceeded Off-Site?
acetone	4.0E+02	-	3.7E+01	**4.0E+02**	0.081	NO
benzene	5.0E-01	-	5.0E-01	**5.0E-01**	ND	NO
chloroform	3.6E+00	-	2.1E+00	**3.6E+00**	ND	NO
cumene (isopropylbenzene)	2.2E+01	-	2.2E+01	**2.2E+01**	ND	NO
cis-1,2-dichloroethene (cDCE)	7.0E+00	-	2.2E+00	**7.0E+00**	ND	NO
trans-1,2-dichloroethene (tDCE)	1.0E+01	1.0E+01	3.2E+00	**1.0E+01**	ND	NO
methyl ethyl ketone (MEK)	2.0E+02	-	1.4E+01	**2.0E+02**	ND	NO
tetrachloroethene (PCE)	5.0E-01	-	5.0E-01	**5.0E-01**	ND	NO
trichloroethene (TCE)	5.0E-01	-	2.4E-01	**5.0E-01**	ND	NO
vinyl chloride (VC)	2.0E-01	2.0E-01	3.4E-02	**2.0E-01**	ND	NO

(1) Indicates RRS calculated by MEI (Using RAGS Equations 6 & 7 with up-to-date toxicity information).
Eqn 6 & 7 input values utilized are listed in tables in this VRP Application Addendum.

(2) Indicates RRS calculated by UC and reported to have been previously approved by EPD
(UC PPCAP, 28-NOV-05, Table 5; UC CSR 10-JUN-08, Table 5)

(3) Soil analytical information taken from UC PPCSR, Table 7 - "Soil Verification Analytical Testing Summary" and
Table 8 "Marion Split Verification Sample Test Results" and from MEI 10-JAN-10 CSR, Table 3 "Soil Analytical Results"

"ND" means "not detected"

Table 15 - Soil - Type 3 & 4 Commercial RRS vs On-Site Residual Concentrations

Compound	Soil - Type 1 RRS [1] DELINEATION CRITERIA (mg/kg)	Soil - Calculated Type 3 RRS SHALLOW SOIL[1] (mg/kg)	Previously Approved Type 3 RRS [2] (mg/kg)	Soil - Calculated Type 4 RRS [1] (mg/kg)	Previously Approved Type 4 RRS [3] (mg/kg)	Final Commercial RRS (Highest of Prev. Approved or Calculated) (mg/kg)	On-Site Maximum Residual Soil Concentration [3] (mg/kg)	Type 3/4 Commercial RRS Exceeded ON-Site? (Calc. Herein OR Prev. Approved)
acetone	4.0E+02	**4.0E+02**	**4.0E+02**	**2.2E+01**	NA	**4.0E+02**	0.29	NO
benzene	5.0E-01	**5.0E-01**	NA	**1.0E-01**	NA	**5.0E-01**	0.016	NO
chloroform	3.6E+00	**4.6E+00**	NA	**2.2E-01**	NA	**4.6E+00**	0.031	NO
cumene (isopropylbenzene)	2.2E+01	**2.2E+01**	NA	**5.4E+01**	NA	**5.4E+01**	ND	NO
cis-1,2-dichloroethene (cDCE)	7.0E+00	**7.0E+00**	NA	**2.4E-01**	**1.84E+00**	**7.0E+00**	0.3	NO
trans-1,2-dichloroethene (tDCE)	1.0E+01	**1.0E+01**	NA	**3.4E-01**	NA	**1.0E+01**	ND	NO
methyl ethyl ketone (MEK)	2.0E+02	**2.0E+02**	NA	**7.8E+00**	NA	**2.0E+02**	0.12	NO
tetrachloroethene (PCE)	5.0E-01	**5.0E-01**	NA	**7.6E-01**	**1.18E+00**	**1.18E+00**	1.1	NO
trichloroethene (TCE)	5.0E-01	**5.0E-01**	NA	**2.6E-02**	**7.0E-01**	**7.0E-01**	0.18	NO
vinyl chloride (VC)	2.0E-01	**2.0E-01**	NA	**7.6E-03**	NA	**2.0E-01**	ND	NO

(1) Indicates RRS calculated by MEI (Using RAGS Equations 6 & 7 with up-to-date toxicity information).
Eqn 6 & 7 input values utilized are listed in Tables 10 & 11 in this VRP Application Addendum.

(2) RRS calculated by UC and reported to have been previously approved by EPD (UC PPCAP, 28-NOV-05, Table 5; UC CSR 10-JUN-08, Table 5)

(3) Soil analytical information taken from UC PPCSR, Table 7 - "Soil Verification Analytical Testing Summary" and
Table 8 "Marion Split Verification Sample Test Results" and from MEI 10-JAN-10 CSR, Table 3 "Soil Analytical Results"

"ND" means "not detected"

Table 16 - Groundwater - Type 1 & Type 2 Residential RRS Selection Summary

Compound	Type 1 RRS Groundwater (mg/L)	Type 1 Groundwater RRS Note[1]	Calculated RAGS Eqn Results - Residential - Potential Type 2 RAGS EQN 1 ADULT TR=1.0E-5 (mg/L)	RAGS EQN 1 CHILD TR=1.0E-5 (mg/L)	RAGS EQN 2 ADULT HQ=1 (mg/L)	RAGS EQN 2 CHILD HQ=1 (mg/L)	Type 2 RRS Groundwater[1] (mg/L)	Type 2 RRS Note	Final Residential RRS (mg/L)	Residen-tial RRS Note
acetone	**4.0E+00**	GW Criterion	--	--	2.4E+01	8.0E+00	**8.0E+00**	nc	**8.0E+00**	nc
benzene	**5.0E-03**	GW Criterion	5.4E-03	7.0E-03	5.3E-02	1.4E-02	**5.4E-03**	c	**5.4E-03**	c
chloroform	**8.0E-02**	GW Criterion	2.6E-03	2.9E-03	1.6E-01	4.2E-02	**2.6E-03**	c	**8.0E-02**	GW Criterion
cumene (isopropylbenzene)	**1.0E-03**	Detection Limit	--	--	8.5E-01	2.1E-01	**2.1E-01**	nc	**2.1E-01**	nc
cis-1,2-dichloroethene (cDCE)	**7.0E-02**	GW Criterion	--	--	--	--	**7.0E-02**	GW Criterion	**7.0E-02**	GW Criterion
trans-1,2-dichloroethene (tDCE)	**1.0E-01**	GW Criterion	--	--	--	--	**1.0E-01**	GW Criterion	**1.0E-01**	GW Criterion
methyl ethyl ketone (MEK)	**2.0E+00**	GW Criterion	--	--	8.5E+00	2.3E+00	**2.3E+00**	nc	**2.3E+00**	nc
tetrachloroethene (PCE)	**5.0E-03**	GW Criterion	1.5E-01	2.0E-01	7.4E-02	1.9E-02	**1.9E-02**	nc	**1.9E-02**	nc
trichloroethene (TCE)	**5.0E-03**	GW Criterion	8.5E-03	1.2E-02	4.3E-03	1.0E-03	**1.0E-03**	nc	**5.0E-03**	GW Criterion
vinyl chloride (VC)	**2.0E-03**	GW Criterion	1.1E-03	2.2E-03	7.9E-02	2.6E-02	**1.1E-03**	c	**2.0E-03**	GW Criterion

(1) RRS Notes indicate criterion by which RRS was selected. "c" = carcinogenic, "nc" = non-carcinogenic, "GW Criterion" = EPD Groundwater criterion, "Detection Limit" = Laboratory Method Detection Limit.

(2) Indicates RRS calculated by MEI using RAGS Equations 1 & 2 with up-to-date toxicity information.

Table 17 - Groundwater - Type 3 & Type 4 Commercial RRS Selection Summary

Compound	Type 3 RRS Groundwater (mg/L)	Type 3 Groundwater RRS Note	Calculated RAGS Eqn Results - Residential - Potential Type 2 RRS[1] RAGS EQN 1 COMMERCIAL TR=1.0E-5 (mg/L)	RAGS EQN 2 COMMERCIAL HQ=1 (mg/L)	Type 4 RRS Groundwater (mg/L)	Type 4 RRS Note[2]	Final Commercial RRS (mg/L)	Final Commercial RRS Note[2]
acetone	**4.0E+00**	GW Criterion	--	4.6E+01	**4.6E+01**	nc	**4.6E+01**	nc
benzene	**5.0E-03**	GW Criterion	8.7E-03	7.2E-02	**8.7E-03**	C	**8.7E-03**	C
chloroform	**8.0E-02**	GW Criterion	3.4E-03	2.2E-01	**3.4E-03**	c	**8.0E-02**	GW Criterion
cumene (isopropylbenzene)	**1.0E-03**	Detection Limit	--	1.0E+00	**1.0E+00**	nc	**1.0E+00**	nc
cis-1,2-dichloroethene (cDCE)	**7.0E-02**	GW Criterion	--	--	**7.0E-02**	GW Criterion	**7.0E-02**	GW Criterion
trans-1,2-dichloroethene (tDCE)	**1.0E-01**	GW Criterion	--	--	**1.0E-01**	GW Criterion	**1.0E-01**	GW Criterion
methyl ethyl ketone (MEK)	**2.0E+00**	GW Criterion	--	1.2E+01	**1.2E+01**	nc	**1.2E+01**	nc
tetrachloroethene (PCE)	**5.0E-03**	GW Criterion	2.6E-01	9.8E-02	**9.8E-02**	nc	**9.8E-02**	nc
trichloroethene (TCE)	**5.0E-03**	GW Criterion	1.5E-02	5.2E-03	**5.2E-03**	nc	**5.2E-03**	nc
vinyl chloride (VC)	**2.0E-03**	GW Criterion	3.3E-03	1.5E-01	**3.3E-03**	c	**3.3E-03**	c

(1) Indicates RRS calculated by MEI using RAGS Equations 1 & 2 with up-to-date toxicity information.

(2) RRS Notes indicate criterion by which RRS was selected. "c" = carcinogenic, "nc" = non-carcinogenic, "GW Criterion" = EPD Groundwater criterion, "Detection Limit" = Laboratory Method Detection Limit.

Table 18 - Groundwater - Type 1 & Type 2 Residential RRS vs. Residual Concentrations Off Site

Compound	Groundwater Type 1 RRS [(1)] DELINEATION CRITERA (mg/L)	Groundwater Type 2 RRS[(1)] (mg/L)	Groundwater: Final Residential RRS[(1)] (mg/L)	Groundwater Residential RRS Note	Georgia In Stream Water Quality Standard (mg/L)	Groundwater Concentration Off-Site Maximum[(2)] (mg/L)	Residential RRS Exceeded Off-Site?
acetone	4.0E+00	8.0E+00	**8.0E+00**	Type 2	No Standard	<0.050	NO
benzene	5.0E-03	5.4E-03	**5.4E-03**	Type 2	5.1E-02	<0.001	NO
chloroform	8.0E-02	2.6E-03	**8.0E-02**	Type 1	4.7E-01	<0.005	NO
cumene (isopropylbenzene)	1.0E-03	2.1E-01	**2.1E-01**	Type 2	No Standard	<0.001	NO
cis-1,2-dichloroethene (cDCE)	7.0E-02	7.0E-02	**7.0E-02**	Type 1	No Standard	**0.0079**	NO
trans-1,2-dichloroethene (tDCE)	1.0E-01	1.0E-01	**1.0E-01**	Type 1	No Standard	<0.001	NO
methyl ethyl ketone (MEK)	2.0E+00	2.3E+00	**2.3E+00**	Type 2	No Standard	<0.010	NO
tetrachloroethene (PCE)	5.0E-03	1.9E-02	**1.9E-02**	Type 2	3.3E-03	**0.010**	NO
trichloroethene (TCE)	5.0E-03	1.0E-03	**5.0E-03**	Type 1	3.0E-02	**0.0011**	NO
vinyl chloride (VC)	2.0E-03	1.1E-03	**2.0E-03**	Type 1	2.4E-03	<0.001	NO

[(1)] Indicates RRS calculated by MEI (Using RAGS Equations 1 & 2 with up-to-date toxicity information).

[(2)] Groundwater analytical data from March 2015 groundwater sampling event, summarized Table 2.

Table 19 - Groundwater - Type 3 & 4 Commercial RRS vs. Maximum COC Concentrations On-Site

Compound	Groundwater Type 3 RRS [(1)] DELINEATION CRITERA (mg/L)	Groundwater Type 4 RRS [(1)] (mg/L)	Groundwater: Final Commercial RRS[(1)] (mg/L)	Groundwater Commercial RRS Note	Georgia In Stream Water Quality Standard (mg/L)	Groundwater Concentration On-Site Maximum Residual[(2)] (mg/L)	Commercial RRS Exceeded ON-Site?
acetone	4.0E+00	4.6E+01	**4.6E+01**	Type 4	No Standard	0.089	NO
benzene	5.0E-03	8.7E-03	**8.7E-03**	Type 4	5.1E-02	0.140	**YES**
chloroform	8.0E-02	3.4E-03	**8.0E-02**	Type 3	4.7E-01	0.014	NO
cumene (isopropylbenzene)	1.0E-03	1.0E+00	**1.0E+00**	Type 4	No Standard	0.0032	NO
cis-1,2-dichloroethene (cDCE)	7.0E-02	7.0E-02	**7.0E-02**	Type 4	No Standard	0.210	**YES**
trans-1,2-dichloroethene (tDCE)	1.0E-01	1.0E-01	**1.0E-01**	Type 4	No Standard	0.0012	NO
methyl ethyl ketone (MEK)	2.0E+00	1.2E+01	**1.2E+01**	Type 4	No Standard	0.011	NO
tetrachloroethene (PCE)	5.0E-03	9.8E-02	**9.8E-02**	Type 4	3.3E-03	0.810	**YES**
trichloroethene (TCE)	5.0E-03	5.2E-03	**5.2E-03**	Type 4	3.0E-02	0.120	**YES**
vinyl chloride (VC)	2.0E-03	3.3E-03	**3.3E-03**	Type 4	2.4E-03	0.011	**YES**

(1) Indicates RRS calculated by MEI (Using RAGS Equations 1 & 2 with up-to-date toxicity information).

(2) Groundwater analytical data from March 2015 groundwater sampling event summarized in Table 2.

TABLE 20
Commercial Risk Reduction Standards - Groundwater - Former Exceedance Locations & Release Sources
Fountain Oaks Shopping Center

COCs in On-Site Groundwater	Final Commercial RRS (mg/L)	Final Commercial RRS (µg/L)	Commercial RRS Note	Release Sources for Former Type 3/4 Commercial RRS Exceedances at Individual Wells*					
				Former On-Site Drycleaner		Off-Site Drycleaner		Off-Site Gas Station	
				Well ID	March-2015 Concentration (µg/L)	Well ID	March-2015 Concentration (µg/L)	Well ID	March-2015 Concentration (µg/L)
Acetone	**4.60E+01**	**46,000**	Type 4 RRS	No groundwater exceedences on site					
Benzene	**0.0087**	**8.7**	Type 4 RRS					MW-20	15
								MW-21	24
								MW-28	135
Chloroform	**0.080**	**80**	Type 3 RRS	No groundwater exceedences on site					
Cumene (Isopropylbenzene)	**1.0**	**1,000**	Type 3 RRS	No groundwater exceedences on site					
Dichloroethylene, 1,2-cis- (cDCE)	**0.070**	**70**	Type 3 & 4	MW-4	210	MW-16	100		
Dichloroethylene, 1,2-trans- (tDCE)	**0.1**	**100**	Type 3 & 4	No groundwater exceedences on site					
Methyl Ethyl Ketone (MEK)	**12**	**12,000**	Type 4	No groundwater exceedences on site					
Tetrachloroethylene (PCE)	**0.098**	**98**	Type 4	MW-2	775	MW-5	170		
						MW-20	160		
						MW-22	520		
						MW-23	120		
Trichloroethylene (TCE)	**0.0052**	**5.2**	Type 4	MW-2	71.5	MW-6	5.5		
				MW-4	120	MW-16	35		
						MW-20	8.8		
						MW-28	7.95		
Vinyl Chloride (VC)	**0.0033**	**3.3**	Type 4			MW-16	11		
						MW-28	4.3		

*Note: Groundwater on site is in compliance with site-specific Type 5 RRS through use of institutional controls.

Table 21
Johnson & Ettinger Model (Version 6.0) - Summary

	Max. Groundwater Concentration March 2015 (µg/L)	Location Max. 03-2015 GW Concentration	Incremental Carcinogenic Risk	Hazard Quotient From Vapor Intrusion
Acetone	89	MW-13D	"No IUR"	2.22E-08
Benzene	140	MW-28	2.88E-08	3.44E-04
Chloroform	14	MW-9	5.30E-09	6.59E-06
cis-1,2-Dichloroethylene	210	MW-4	"No IUR"	"No RfC Available"
trans-1,2-Dicholorothylene	1.2	MW-4	"No IUR"	"No RfC Available"
Isopropyl benzene (Cumene)	3.2	MW-28	"No IUR"	6.50E-07
Methyl Ethyl Ketone (MEK) (2-Butanone)	11	MW-13D	"No IUR"	1.57E-08
Tetrachloroethylene	810	MW-2	9.00E-09	2.42E-03
Trichloroethylene	120	MW-4	6.57E-08	5.78E-03
Vinyl Chloride	11	MW-16	6.02E-09	5.30E-04
	TOTAL (SUM)		**1.15E-07**	**9.08E-03**
J&E Multi_Chem_Output	**CALCULATED TOTAL**		**1.17E-07**	**8.61E-03**

Notes:

(1) Groundwater concentration inputs used in Johnson & Ettinger model were highest concentrations on site for each contaminant, regardless of the monitoring well location where this maximum concentration was located. Thus, the modeled groundwater vapor sources represent an unlikely hypothetical "worst case" exposure scenario.

(2) "No IUR" message returned by J&E model means there is no carcinogenic Inhalation Unit Risk (IUR).

(3) "No RfC Available" means there is no Inhalation Chronic Reference Concentration (RfC) available to calculate chronic toxicity effects.

TABLE 22
Soil Remediation Excavation - Verification Sample Analytical Results
Fountain Oaks Shopping Center
(Data Tabulated from Tables 7 and 8 in UC's 06-10-2008 CSR)

Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	First Re-Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	Second Re-Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	Comments
	EPD-Approved TYPE 4 RRS		**1.18**	**0.7**	**1.84**			**EPD-Approved TYPE 4 RRS**	**1.18**	**0.7**	**1.84**			**EPD-Approved TYPE 4 RRS**	**1.18**	**0.7**	**1.84**	
SV-1@11'	UC	Area 1	**5.9**	0.012	0.044	←Excavation Expanded Into Adjacent Area												
SV-1@11'	MEI	Area 1	**5.3**	<0.65	<0.065	←Excavation Expanded Into Adjacent Area												
SV-2@8'	UC	Area 1	**1.3**	<0.0050	<0.0050	←Excavation Expanded Into Adjacent Area												
SV-2@8'	MEI	Area 1	0.26	0.0061	0.0042	←Excavation Expanded Into Adjacent Area												
SV-3@8'	UC	Area 1	**210**	<26	<26	←Excavation Expanded Into Adjacent Area												
SV-3@8'	MEI	Area 1	**2200**	<3.6	<3.6	←Excavation Expanded Into Adjacent Area												
SV-4@7'	UC	Area 1	**11**	<0.250	0.28	←Excavation Expanded Into Adjacent Area												
SV-4@7'	MEI	Area 1	**7.7**	0.11	0.23	←Excavation Expanded Into Adjacent Area												
SV-5@10'	UC	Area 2	**1.3**	0.0063	0.018	←Excavation Expanded Into Adjacent Area												
SV-5@10'	MEI	Area 2	0.6	0.01	0.013	←Excavation Expanded Into Adjacent Area												
SV-6@7'	UC	Area 2	**4.9**	0.033	0.0051	←Excavation Expanded Into Adjacent Area												
SV-6@7'	MEI	Area 2	**9.5**	0.14	<0.13	←Excavation Expanded Into Adjacent Area												
SV-7@7'	UC	Area 2	0.065	<0.0044	<0.0044	←Excavation Expanded Into Adjacent Area												
SV-7@7'	MEI	Area 2	0.18	0.0067	0.0022	←Excavation Expanded Into Adjacent Area												
SV-8@7'	UC	Area 2	**12**	0.047	0.0063	←Excavation Expanded Into Adjacent Area												
SV-8@7'	MEI	Area 2	**19**	0.1	<0.065	←Excavation Expanded Into Adjacent Area												
SV-9@7'	UC	Area 2	**12**	0.046	0.11	←Excavation Expanded Into Adjacent Area												
SV-9@7'	MEI	Area 2	**13**	<0.12	0.12	←Excavation Expanded Into Adjacent Area												
VS-10@2E-A3	UC	Area 3	1.1	0.011	0.02													
VS-10@2E-A3	MEI	Area 3	**0.74**	0.038	0.088													
VS-11@3B-A3	UC	Area 3	0.11	<0.0048	0.0054													
VS-11@3B-A3	MEI	Area 3	0.16	0.01	0.022													
VS-12@2W-A3	UC	Area 3	0.16	<0.0041	<0.0041													
VS-12@2W-A3	MEI	Area 3	0.45	0.013	0.0066													
SV-13@10N	UC	Area 15	0.0091	<0.0049	<0.0049													
SV-13@10N	MEI	Area 15	0.036	<0.0010	<0.0010													
SV-14@10W-A15	UC	Area 15	0.036	<0.0055	<0.0055													
SV-14@10W-A15	MEI	Area 15	0.015	<0.0010	<0.0010													
SV-15@10S	UC	Area 15	0.039	<0.0047	<0.0047													
SV-15@10S	MEI	Area 15	0.0045	<0.0010	<0.0010													
SV-16@10E-A15	UC	Area 15	0.32	<0.0044	<0.0044													
SV-16@10E-A15	MEI	Area 15	0.0062	<0.0011	<0.0011													
SV-17@18B-NE-A15	UC	Area 15	0.046	<0.0045	<0.0045													
SV-17@18B-NE-A15	MEI	Area 15	0.024	<0.0014	<0.0014													
SV-18@23B-W-A15	UC	Area 15	0.087	<0.0048	<0.0048													
SV-18@23B-W-A15	MEI	Area 15	0.1	<0.0011	0.0019													
SV-19@16N-A15	UC	Area 15	<0.0058	<0.0058	<0.0058													
SV-19@16N-A15	MEI	Area 15	0.0034	<0.0012	<0.0012													
SV-20@18W-A15	UC	Area 15	0.066	<0.0048	<0.0048													
SV-20@18W-A15	MEI	Area 15	0.0032	<0.0012	<0.0012													
SV-21@18S-A15	UC	Area 15	0.0082	<0.0037	<0.0037													
SV-21@18S-A15	MEI	Area 15	0.021	<0.0012	<0.0012													
SV-22@18E-A15	UC	Area 15	0.0063	<0.0051	<0.0051													
SV-22@18E-A15	MEI	Area 15	0.0075	<0.0012	<0.0012													
SV-23@23B-A15	UC	Area 15	0.02	<0.0048	<0.0048													
SV-23@23B-A15	MEI	Area 15	0.019	<0.0012	<0.0012													
SV-24@5N-A15	UC	Area 15	0.03	<0.0046	<0.0046													
SV-24@5N-A15	MEI	Area 15	0.011	<0.0013	<0.0013													

Labeling: "SV##" = "soil verification" chronologic sample #. @2E-A3 = collected at 2' depth, E wall, Area 3. Example: SV-24@5N-A15 = SV - 24th sample, 5' depth, N wall, Area 15.

Data fm Tables 7 and 8 in UC's 06-2008 PPCSR.

TABLE 22
Soil Remediation Excavation - Verification Sample Analytical Results
Fountain Oaks Shopping Center
(Data Tabulated from Tables 7 and 8 in UC's 06-10-2008 CSR)

Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	First Re-Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	Second Re-Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	Comments
	EPD-Approved TYPE 4 RRS		1.18	0.7	1.84		EPD-Approved TYPE 4 RRS		1.18	0.7	1.84		EPD-Approved TYPE 4 RRS		1.18	0.7	1.84	
SV-25@5W-A15	UC	Area 15	0.063	<0.0043	<0.0043													
SV-25@5W-A15	MEI	Area 15	0.14	<0.0012	<0.0012													
SV-26@5E-A15	UC	Area 15	0.061	<0.0045	<0.0045													
SV-26@5E-A15	MEI	Area 15	0.17	<0.0013	<0.0013													
SV-27@5S-A15	UC	Area 15	0.36	<0.0046	<0.0046													
SV-27@5S-A15	MEI	Area 15	0.34	0.0022	0.0017													
SV-28@8N-A13	UC	Area 13	0.011	<0.0047	<0.0047													
SV-28@8N-A13	MEI	Area 13	0.017	<0.0013	<0.0013													
SV-29@8W-A12	UC	Area 12	0.28	<0.0045	<0.0045													
SV-29@8W-A12	MEI	Area 12	0.53	0.0033	0.0012													
SV-30@8S-A11	UC	Area 11	0.078	<0.0045	<0.0045													
SV-30@8S-A11	MEI	Area 11	0.26	0.0051	0.017													
SV-31@10E-A13	UC	Area 13	0.033	<0.005	<0.005													
SV-31@10E-A13	MEI	Area 13	0.49	0.002	0.0014													
SV-32@13N-A12	UC	Area 12	0.01	<0.0051	<0.0051													
SV-32@13N-A12	MEI	Area 12	0.035	<0.0015	<0.0015													
SV-33@13W-A12	UC	Area 12	0.0088	<0.0050	<0.0050													
SV-33@13W-A12	MEI	Area 12	0.012	<0.0011	<0.0011													
SV-34@13S-A11	UC	Area 11	0.13	<0.0046	0.0051													
SV-34@13S-A11	MEI	Area 11	0.1	0.0013	0.0038													
SV-35@13E-A11	UC	Area 11	0.09	<0.0049	<0.0049													
SV-35@13E-A11	MEI	Area 11	0.036	<0.0012	0.0016													
SV-36@15B-SE-A11	UC	Area 11	0.049	<0.0049	<0.0049													
SV-36@15B-SE-A11	MEI	Area 11	0.039	<0.0012	<0.0012													
SV-37@15B-NW-A12	UC	Area 12	0.029	<0.0047	<0.0047													
SV-37@15B-NW-A12	MEI	Area 12	0.04	<0.0011	<0.0011													
SV-38@20N-A13	UC	Area 13	0.0059	<0.0045	<0.0045													
SV-38@20N-A13	MEI	Area 13	0.031	<0.0011	<0.0011													
SV-39@20W-A13	UC	Area 13	0.035	<0.0047	<0.0047													
SV-39@20W-A13	MEI	Area 13	0.22	0.0033	0.0056													
SV-40@20S-A13	UC	Area 13	0.039	<0.0050	<0.0050													
SV-40@20S-A13	MEI	Area 13	0.03	<0.0014	<0.0014													
SV-41@20E-A13	UC	Area 13	0.0077	<0.0034	<0.0034													
SV-41@20E-A13	MEI	Area 13	0.0081	<0.0014	<0.0014													
SV-42@4N-A12	UC	Area 12	0.6	<0.0041	<0.0041													
SV-42@4N-A12	MEI	Area 12	0.33	0.0013	<0.0012													
SV-43@4W-A11	UC	Area 11	0.27	<0.0040	<0.0040													
SV-43@4W-A11	MEI	Area 11	0.38	0.005	0.0038													
SV-44@4S-A11	UC	Area 11	0.0069	<0.0040	0.3													
SV-44@4S-A11	MEI	Area 11	0.055	0.003	0.22													
SV-45@4E-A13	UC	Area 13	0.2	<0.0041	<0.0041													
SV-45@4E-A13	MEI	Area 13	0.22	<0.0015	0.0016													
SV-46@13N-A11	UC	Area 11	0.028	<0.0048	<0.0048													
SV-46@13N-A11	MEI	Area 11	0.057	<0.0011	<0.0011													
SV-47@13W-A11	UC	Area 11	0.017	<0.0048	<0.0048													
SV-47@13W-A11	MEI	Area 11	0.017	<0.0011	<0.0011													
SV-48@13S-A11	UC	Area 11	0.043	<0.0052	<0.0052													
SV-48@13S-A11	MEI	Area 11	0.032	<0.0012	<0.0012													

Labeling: "SV##" = "soil verification" chronologic sample #. @2E-A3 = collected at 2' depth, E wall, Area 3. Example: SV-24@5N-A15 = SV - 24th sample, 5' depth, N wall, Area 15.

Data fm Tables 7 and 8 in UC's 06-2008 PPCSR.

TABLE 22
Soil Remediation Excavation - Verification Sample Analytical Results
Fountain Oaks Shopping Center
(Data Tabulated from Tables 7 and 8 in UC's 06-10-2008 CSR)

Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	First Re-Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	Second Re-Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	Comments
	EPD-Approved TYPE 4 RRS		**1.18**	**0.7**	**1.84**		EPD-Approved TYPE 4 RRS		**1.18**	**0.7**	**1.84**		EPD-Approved TYPE 4 RRS		**1.18**	**0.7**	**1.84**	
SV-49@8N-A11	UC	Area 11	0.062	<0.0049	<0.0049													
SV-49@8N-A11	MEI	Area 11	0.014	<0.0012	<0.0012													
SV-50@8W-A11	UC	Area 11	0.29	<0.0047	<0.0047													
SV-50@8W-A11	MEI	Area 11	0.017	<0.0012	<0.0012													
SV-51@8S-A11	UC	Area 11	0.15	<0.0054	<0.0054													
SV-51@8S-A11	MEI	Area 11	0.04	<0.0012	<0.0012													
SV-52@3N-A11	UC	Area 11	0.088	<0.0048	<0.0048													
SV-52@3N-A11	MEI	Area 11	0.054	<0.0012	<0.0012													
SV-53@3W-A11	UC	Area 11	**1.2**	0.01	<0.0043	SV-77@B(W)-A11	UC	Area 11	0.049	<0.0048	<0.0048							
SV-53@3W-A11	MEI	Area 11	**2**	0.0037	<0.0012	SV-77@B(W)-A11	MEI	Area 11	0.042	<0.0012	<0.0012							
						SV-78@6W-A11	UC	Area 11	0.25	<0.0051	<0.0051							
						SV-78@6W-A11	MEI	Area 11	0.2	0.0014	<0.0013							
SV-54@3S-A11	UC	Area 11	0.089	<0.0042	<0.0042													
SV-54@3S-A11	MEI	Area 11	0.56	0.0057	0.0025													
SV-55@B15(E)-A11	UC	Area 11	0.023	<0.0050	<0.0050													
SV-55@B15(E)-A11	MEI	Area 11	0.012	<0.0012	<0.0012													
SV-56@B15(E)-A11	UC	Area 11	0.047	<0.0049	<0.0049													
SV-56@B15(W)-A11	MEI	Area 11	0.018	<0.0012	<0.0012													
SV-57@B(N)-A8	UC	Area 8	0.028	<0.0046	<0.0046													
SV-57@B15(N)-A8	MEI	Area 8	0.022	<0.0011	0.0018													
SV-58@B(S)-A8	UC	Area 8	0.026	<0.0048	<0.0048													
SV-58@B(S)-A8	MEI	Area 8	0.027	<0.0011	0.0024													
SV-59@13W-a8	UC	Area 8	0.054	<0.0057	0.0059													
SV-59@B(W)-A8	MEI	Area 8	0.032	<0.0013	0.0029													
SV-60@8W-A8	UC	Area 8	0.81	0.026	0.077													
SV-60@8W-A8	MEI	Area 8	1	0.02	0.062													
SV-61@3W-A8	UC	Area 8	0.76	0.0066	<0.0041													
SV-61@3W-A8	MEI	Area 8	0.026	<0.0014	<0.0014													
SV-62@8E-A8	UC	Area 8	**3.1**	0.021	1.1	←Excavation Expanded Into Adjacent Area												
SV-62@8E-A8	MEI	Area 8	0.17	<0.048	**3.3**	←Excavation Expanded Into Adjacent Area												
SV-63@B(N)-A9	UC	Area 9	0.04	<0.0053	<0.0053													
SV-63@B(N)-A9	MEI	Area 9	0.06	<0.0013	0.0028													
SV-64@B(S)-A9	UC	Area 9	**1.7**	0.015	0.047	SV-73@B(S)-A9	UC	Area 9	**6.9**	0.09	0.22							
SV-64@B(S)-A9	MEI	Area 9	0.87	0.0092	0.03	SV-73@B(S)-A9	MEI	Area 9	**10**	0.13	0.25							
						SV-74@B(N)-A9	UC	Area 9	**1.2**	0.012	0.035	SV-122@B(N)-A9	UC	Area 9	0.15	<0.0057	<0.0057	
						SV-74@B(N)-A9	MEI	Area 9	**1.7**	<0.064	<0.064	SV-122@B(N)-A9	MEI	Area 9	0.019	<0.0012	<0.0012	
						SV-76@17W-A9	UC	Area 9	0.049	<0.0046	<0.0046	SV-123@B(S)-A9	UC	Area 9	0.016	<0.0049	<0.0049	
						SV-76@17W-A9	MEI	Area 9	0.059	<0.0012	<0.0012	SV-123@B(S)-A9	MEI	Area 9	0.46	0.0063	0.019	
SV-65@22N-A9	UC	Area 9	0.058	<0.0043	0.0049													
SV-65@22N-A9	MEI	Area 9	0.027	<0.0012	0.0022													
SV-66@17N-A9	UC	Area 9	0.073	<0.0045	0.0076													
SV-66@17N-A9	MEI	Area 9	0.1	<0.0012	0.0051													
SV-67@22W-A9	UC	Area 9	1	0.015	0.055													
SV-67@22W-A9	MEI	Area 9	0.49	0.0075	0.024													
SV-68@17W-A9	UC	Area 9	**1.2**	0.023	0.044	SV-75@B(W)-A9	UC	Area 9	0.014	<0.0046	<0.0046							
SV-68@17W-A9	MEI	Area 9	**1.9**	0.0055	0.0098	SV-75@B(W)-A9	MEI	Area 9	0.0046	<0.0013	<0.0013							

Labeling: "SV##" = "soil verification" chronologic sample #. @2E-A3 = collected at 2' depth, E wall, Area 3. Example: SV-24@5N-A15 = SV - 24th sample, 5' depth, N wall, Area 15.

Data fm Tables 7 and 8 in UC's 06-2008 PPCSR.

TABLE 22
Soil Remediation Excavation - Verification Sample Analytical Results
Fountain Oaks Shopping Center
(Data Tabulated from Tables 7 and 8 in UC's 06-10-2008 CSR)

Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	First Re-Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	Second Re-Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	Comments
	EPD-Approved TYPE 4 RRS		1.18	0.7	1.84		EPD-Approved TYPE 4 RRS		1.18	0.7	1.84		EPD-Approved TYPE 4 RRS		1.18	0.7	1.84	
SV-69@22S-A9	UC	Area 9	0.39	0.011	0.021													
SV-69@22S-A9	MEI	Area 9	0.34	0.011	0.018													
SV-70@17S-A9	UC	Area 9	0.073	<0.0047	0.0047													
SV-70@17S-A9	MEI	Area 9	0.051	<0.0012	0.0017													
SV-71@22E-A9	UC	Area 9	0.59	<0.0044	<0.0044													
SV-71@22E-A9	MEI	Area 9	0.17	<0.0012	<0.0012													
SV-72@17E-A9	UC	Area 9	0.016	<0.0059	<0.0059													
SV-72@17E-A9	MEI	Area 9	0.0067	<0.0012	<0.0012													
SV-79@13N-A16	UC	Area 16	**1.5**	0.011	<0.0047	SV-115@13NW-A16	UC	Area 16	1.3	0.022	0.0073	SV-127@13 NW-A16	MEI	Area 16	0.23	0.0044	0.0035	
SV-79@13N-A16	MEI	Area 16	0.3	0.0039	0.0014	SV-115@13NW-A16	MEI	Area 16	0.83	0.012	0.0061	SV-127@13'MW-A16	UC	Area 16	0.068	<0.0052	<0.0052	
SV-80@3N-A16	UC	Area 16	0.3	<0.0040	<0.0040													
SV-80@3N-A16	MEI	Area 16	0.11	0.0016	<0.0012													
SV-81@3N-A16	UC	Area 16	0.045	<0.0041	<0.0041													
SV-81@3N-A16	MEI	Area 16	0.049	<0.0012	0.012													
SV-82@13WN-A16	UC	Area 16	0.053	<0.0046	<0.0046													
SV-82@13WN-A16	MEI	Area 16	0.078	0.0015	0.0015													
SV-83@8WN-A16	UC	Area 16	0.013	0.0075	0.13													
SV-83@8WN-A16	MEI	Area 16	0.0095	0.0036	0.035													
SV-84@3WN-A16	UC	Area 16	<0.0043	0.077	0.019													
SV-84@3WN-A16	MEI	Area 16	<0.0012	0.028	0.013													
SV-85@13WS-A16	UC	Area 16	0.022	0.054	0.2													
SV-85@13WS-A16	MEI	Area 16	0.0095	0.033	0.15													
SV-86@8WS-A16	UC	Area 16	0.013	0.035	0.058													
SV-86@8WS-A16	MEI	Area 16	0.0049	0.009	0.02													
SV-87@3WS-A16	UC	Area 16	0.0054	<0.0049	<0.0049													
SV-87@3WS-A16	MEI	Area 16	0.0044	<0.0012	<0.0012													
SV-88@13SW-A16	UC	Area 16	**2.1**	0.3	0.36	SV-116@16SE-A16	UC	Area 16	0.0065	0.0078	0.52							
SV-88@13SW-A16	MEI	Area 16	0.16	0.066	1	SV-116@16SE-A16	MEI	Area 16	0.011	0.01	0.69							
						SV-117@16S-A16	UC	Area 16	0.0055	0.0044	0.021							
						SV-117@16S-A16	MEI	Area 16	0.0057	0.0058	0.026							
						SV-118@16W-A16	UC	Area 16	0.015	0.023	0.44							
						SV-118@16W-A16	MEI	Area 16	0.0062	0.023	0.2							
						SV-119@16SN-A16	UC	Area 16	0.32	0.023	0.055							
						SV-119@16SN-A16	MEI	Area 16	0.36	0.0096	0.022							
SV-89@8SW-A16	UC	Area 16	<0.0040	<0.0040	<0.0040													
SV-89@8SW-A16	MEI	Area 16	0.0016	0.004	0.0022													
SV-90@3SW-A16	UC	Area 16	<0.0049	<0.0049	<0.0049													
SV-90@3SW-A16	MEI	Area 16	<0.0012	<0.0012	<0.0012													
SV-91@13SE-A16	UC	Area 16	0.0082	<0.0042	<0.0042													
SV-91@13SE-A16	MEI	Area 16	0.018	0.0041	0.0029													
SV-92@8SE-A16	UC	Area 16	0.0096	0.0068	<0.0046													
SV-92@8SE-A16	MEI	Area 16	0.0052	0.0095	0.0052													
SV-93@3SE-A16	UC	Area 16	0.027	<0.0039	<0.0039													
SV-93@3SE-A16	MEI	Area 16	0.0065	<0.0012	<0.0012													

Labeling: "SV##" = "soil verification" chronologic sample #. @2E-A3 = collected at 2' depth, E wall, Area 3. Example: SV-24@5N-A15 = SV - 24th sample, 5' depth, N wall, Area 15.

TABLE 22
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Fountain Oaks Shopping Center
(Data Tabulated from Tables 7 and 8 in UC's 06-10-2008 CSR)

Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	First Re-Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	Second Re-Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	Comments
	EPD-Approved TYPE 4 RRS		**1.18**	**0.7**	**1.84**		EPD-Approved TYPE 4 RRS		**1.18**	**0.7**	**1.84**		EPD-Approved TYPE 4 RRS		**1.18**	**0.7**	**1.84**	
SV-94@B(NW)-A16	UC	Area 16	0.024	<0.0050	<0.0050													
SV-94@B(NW)-A16	MEI	Area 16	0.02	<0.0012	<0.0012													
SV-95@B(NWCN)-A16	UC	Area 16	0.2	<0.0057	<0.0057													
SV-95@B(NWCN)-A16	MEI	Area 16	0.16	0.0037	0.0061													
SV-96@B(NWCS)-A16	UC	Area 16	0.08	<0.0053	0.0065													
SV-96@B(NWCS)-A16	MEI	Area 16	0.12	0.0034	0.0074													
SV-97@B(SWCN)-A16	UC	Area 16	0.097	<0.0055	0.016													
SV-97@B(SWCN)-A16	MEI	Area 16	0.23	0.01	0.03													
SV-98@B(SWCS)-A16	UC	Area 16	0.3	0.02	0.14													
SV-98@B(SWCS)-A16	MEI	Area 16	0.84	0.075	0.2													
SV-99@B(SW)-A16	UC	Area 16	**1.3**	0.15	0.13	SV-120@B(SW)-A16	UC	Area 16	0.14	0.01	0.036							
SV-99@B(SW)-A16	MEI	Area 16	**1.2**	0.086	0.3	SV-120@B(SW)-A16	MEI	Area 16	0.14	0.0079	0.046							
SV-100@B(SE)-A16	UC	Area 16	0.031	<0.0050	<0.0050													
SV-100@B(SE)-A16	MEI	Area 16	0.014	<0.0011	<0.0011													
SV-101@B(SEC)-A16	UC	Area 16	0.019	<0.0047	<0.0047													
SV-101@B(SEC)-A16	MEI	Area 16	0.015	<0.0012	<0.0012													
SV-102@18N-A7	UC	Area 7	0.082	<0.0052	<0.0052													
SV-105@18N-A7	UC	Area 7	0.082	<0.0052	<0.0052													
SV-105@18N-A7	MEI	Area 7	0.13	0.0042	0.013													
SV-106@18W-A7	UC	Area 7	0.28	0.0099	0.027													
SV-106@18W-A7	MEI	Area 7	0.45	0.012	0.043													
SV-107@18E-A7	UC	Area 7	0.41	0.011	0.039	SV-121@22E-A7	UC	Area 7	0.14	<0.0054	0.012							
SV-107@18E-A7	MEI	Area 7	**1.4**	<0.057	0.087	SV-121@22E-A7	MEI	Area 7	0.18	0.0062	0.019							
SV-108@B-A7	UC	Area 7	0.12	<0.0045	0.0083													
SV-108@B-A7	MEI	Area 7	0.13	0.0039	0.0088													
SV-109@B-A10	UC	Area 10	0.18	0.02	0.032													
SV-109@B-A10	MEI	Area 10	0.59	0.024	0.05													
SV-110@22N -A10	UC	Area 10	0.16	0.011	0.035													
SV-110@22N -A10	MEI	Area 10	0.43	0.02	0.047													
SV-111@22W-A10	UC	Area 10	0.16	0.0056	0.025													
SV-111@22W-A10	MEI	Area 10	0.088	0.0034	0.0093													
SV-112@18S-A10	UC	Area 10	0.019	<0.0061	0.0064													
SV-112@18S-A10	MEI	Area 10	0.037	0.0013	0.0034													
SV-113@22S-A10	UC	Area 10	0.17	0.019	0.064													
SV-113@22S-A10	MEI	Area 10	0.054	0.0023	0.0064													
SV-114@22E-A10	UC	Area 10	0.12	0.0063	0.02													
SV-114@22E-A10	MEI	Area 10	0.49	<0.060	<0.060													
SV-124@13(N)-A16	UC	Area 16	0.42	0.0052	<0.0038													
SV-124@13(N)-A16	MEI	Area 16	**2.2**	<0.053	<0.053													
SV-125@13N-A16	UC	Area 16	0.19	<0.0051	<0.0051													
SV-125@13N-A16	MEI	Area 16	0.0097	<0.0011	<0.0011													
SV-126@B(N)-A16	UC	Area 16	0.11	<0.0045	<0.0045													
SV-126@B(N)-A16	MEI	Area 16	0.12	0.0026	0.0043													
SV-128@B(MW)-A16	UC	Area 16	0.045	<0.0044	<0.0044													
SV-128@B(NE)-A16	MEI	Area 16	0.013	<0.0011	<0.0011													
SV-129@16W-A8	UC	Area 8	0.09	<0.0042	<0.0042													
SV-129@16W-A8	MEI	Area 8	0.052	<0.0012	0.0026													

Labeling: "SV##" = "soil verification" chronologic sample #. @2E-A3 = collected at 2' depth, E wall, Area 3. Example: SV-24@5N-A15 = SV - 24th sample, 5' depth, N wall, Area 15.

Data fm Tables 7 and 8 in UC's 06-2008 PPCSR.

TABLE 22
Soil Remediation Excavation - Verification Sample Analytical Results
Fountain Oaks Shopping Center
(Data Tabulated from Tables 7 and 8 in UC's 06-10-2008 CSR)

Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	First Re-Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	Second Re-Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	Comments
EPD-Approved TYPE 4 RRS			**1.18**	**0.7**	**1.84**	EPD-Approved TYPE 4 RRS			**1.18**	**0.7**	**1.84**	EPD-Approved TYPE 4 RRS			**1.18**	**0.7**	**1.84**	
SV-130@16W-A9	UC	Area 9	0.008	<0.0038	<0.0038													
SV-130@16W-A9	MEI	Area 9	0.16	0.0026	<0.0013													
SV-131@16W-A16	UC	Area 16	0.021	<0.0046	0.0058													
SV-131@16W-A16	MEI	Area 16	0.17	0.0064	0.0095													
SV-132@8W-A8	UC	Area 8	**1.4**	0.017	0.029	←Excavation Expanded Into Adjacent Area												
SV-132@8W-A8	MEI	Area 8	**1.2**	0.097	0.14	←Excavation Expanded Into Adjacent Area												
SV-133@8W-A9	UC	Area 9	0.092	<0.0042	<0.0042													
SV-133@8W-A9	MEI	Area 9	0.014	<0.0012	<0.0012													
SV-134@8W-A16	UC	Area 16	0.084	<0.0041	<0.0041													
SV-134@8W-A16	MEI	Area 16	0.063	0.0025	0.0028													
SV-135@8E-A8	UC	Area 8	0.1	<0.0039	0.0043													
SV-135@8E-A8	MEI	Area 8	0.069	<0.0013	0.0018													
SV-136@8E-A9	UC	Area 9	0.063	<0.0036	<0.0036													
SV-136@8E-A9	MEI	Area 9	0.037	0.0032	<0.0013													
SV-137@8E-A16	UC	Area 16	0.12	<0.0049	<0.0049													
SV-137@8E-A16	MEI	Area 16	0.031	<0.0013	0.0025													
SV-138@8N-A2	UC	Area 2	**59**	0.016	0.013	SV-152@5N-A14	UC	Area 14	0.16	<0.0056	<0.0056	←Excavation Expanded Into Adjacent Area						
SV-138@8N-A2	MEI	Area 2	**23**	<0.23	<0.23	SV-152@5N-A14	MEI	Area 14	0.22	<0.0014	0.0033	←Excavation Expanded Into Adjacent Area						
SV-139@8N-A2	UC	Area 2	0.064	<0.0042	<0.0042	SV-153@8N-A14	UC	Area 14	0.5	<0.0061	0.026	←Excavation Expanded Into Adjacent Area						
SV-139@8N-A2	MEI	Area 2	0.93	<0.0013	0.0021	SV-153@8N-A14	MEI	Area 14	0.72	0.0026	0.012	←Excavation Expanded Into Adjacent Area						
SV-140@13N-A2	UC	Area 2	**16**	0.0057	0.026	SV-154@13N-A14	UC	Area 14	0.66	<0.0076	0.026	←Excavation Expanded Into Adjacent Area						
SV-140@13N-A2	MEI	Area 2	**14**	<0.056	<0.056	SV-154@13N-A14	MEI	Area 14	0.51	0.01	0.037	←Excavation Expanded Into Adjacent Area						
SV-141@5W-A2	UC	Area 2	**9**	0.037	0.093	SV-155@5W-A2	UC	Area 2	0.5	0.012	0.065							
SV-141@5W-A2	MEI	Area 2	**2.3**	0.016	0.034	SV-155@5W-A2	MEI	Area 2	0.55	0.008	0.045							
SV-142@6W-A2	UC	Area 2	**17**	0.01	0.077	SV-156@8W-A2	UC	Area 2	**8.1**	0.12	0.72	←Excavation Expanded Into Adjacent Area						
SV-142@6W-A2	MEI	Area 2	**24**	0.2	0.97	SV-156@8W-A2	MEI	Area 2	**5.2**	0.066	0.66	←Excavation Expanded Into Adjacent Area						
SV-143@13W-A2	UC	Area 2	0.58	<0.0043	0.014	SV-157@13W-A2	UC	Area 2	0.25	<0.0074	0.039							
SV-143@13W-A2	MEI	Area 2	0.37	0.0026	0.014	SV-157@13W-A2	MEI	Area 2	0.61	0.007	0.065							
SV-144@5S-A2	UC	Area 2	0.87	0.039	0.11	SV-158@5S-A2	UC	Area 2	**2.1**	0.11	0.26	←Excavation Expanded Into Adjacent Area						
SV-144@5S-A2	MEI	Area 2	0.8	0.043	0.12	SV-158@5S-A2	MEI	Area 2	**2.8**	0.035	0.096	←Excavation Expanded Into Adjacent Area						
SV-145@8S-A2	UC	Area 2	**1.4**	0.083	0.064	SV-159@8S-A2	UC	Area 2	0.18	0.0058	0.018							
SV-145@8S-A2	MEI	Area 2	**2.3**	0.016	0.034	SV-159@8S-A2	MEI	Area 2	0.14	0.0026	0.019							
SV-146@13S-A2	UC	Area 2	**3.0**	0.017	0.14	SV-160@13S-A2	UC	Area 2	0.092	<0.006	0.0082							
SV-146@13S-A2	MEI	Area 2	0.86	0.0087	0.054	SV-160@13S-A2	MEI	Area 2	0.32	0.0037	0.022							
SV-147@5E-A2	UC	Area 2	**1.9**	0.0046	0.0084	SV-161@5E-A2	UC	Area 2	0.21	<0.0054	0.0097							
SV-147@5E-A2	MEI	Area 2	<0.0012	0.076	0.0014	SV-161@5E-A2	MEI	Area 2	0.16	0.0026	0.0056							
SV-148@8E-A2	UC	Area 2	0.074	<0.0046	<0.0046													
SV-148@8E-A2	MEI	Area 2	0.12	<0.0013	0.0031													
SV-149@13E-A2	UC	Area 2	0.064	<0.0047	<0.0047													
SV-149@13E-A2	MEI	Area 2	0.12	<0.0011	0.002													
SV-150@15B(W)-A2	UC	Area 2	0.78	0.0063	0.039	SV-162@16B-NW-A2	UC	Area 2	**1.3**	0.012	0.045	SV-175@18B(N)-A2	UC	Area 2	0.057	<0.0049	0.005	
SV-150@15B(W)-A2	MEI	Area 2	**5.1**	0.015	0.011	SV-162@16B-NW-A2	MEI	Area 2	**1.5**	0.015	0.048	SV-175@18B(N)-A2	MEI	Area 2	<0.0056	<0.0056	<0.0056	
						SV-163@16B-SW-A2	UC	Area 2	**1.6**	0.017	0.057	SV-176@18B(S)-A4	UC	Area 2	0.21	<0.0049	0.014	
						SV-163@16B-SW-A2	MEI	Area 2	**2.4**	0.024	0.11	SV-176@18B(S)-A4	MEI	Area 2	0.013	<0.0062	<0.0062	
SV-151@15B(E)-A2	UC	Area 2	0.24	<0.0047	<0.0047													
SV-151@15B(E)-A2	MEI	Area 2	0.4	0.0023	0.0086													

Labeling: "SV##" = "soil verification" chronologic sample #. @2E-A3 = collected at 2' depth, E wall, Area 3. Example: SV-24@5N-A15 = SV - 24th sample, 5' depth, N wall, Area 15.

Data fm Tables 7 and 8 in UC's 06-2008 PPCSR.

TABLE 22
Soil Remediation Excavation - Verification Sample Analytical Results
Fountain Oaks Shopping Center
(Data Tabulated from Tables 7 and 8 in UC's 06-10-2008 CSR)

Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	First Re-Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	Second Re-Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	Comments
	EPD-Approved TYPE 4 RRS		1.18	0.7	1.84		EPD-Approved TYPE 4 RRS		1.18	0.7	1.84		EPD-Approved TYPE 4 RRS		1.18	0.7	1.84	
SV-164@5N-A4	UC	Area 4	0.22	<0.0046	0.015													
SV-164@5N-A4	MEI	Area 4	0.076	0.0014	0.0077													
SV-165@8N-A4	UC	Area 4	0.59	0.0045	0.015													
SV-165@8N-A4	MEI	Area 4	0.11	<0.0012	0.0082													
SV-166@13N-A4	UC	Area 4	0.24	<0.0047	0.0079													
SV-166@13N-A4	MEI	Area 4	0.072	<0.0012	0.0055													
SV-167@5W-A4	UC	Area 4	0.71	0.0045	0.0081													
SV-167@5W-A4	MEI	Area 4	0.43	0.0035	0.0047													
SV-168@6W-A4	UC	Area 4	**3.9**	0.022	0.066	←Excavation Expanded Into Adjacent Area												
SV-168@6W-A4	MEI	Area 4	0.54	0.0076	0.032	←Excavation Expanded Into Adjacent Area												
SV-169@13W-A4	UC	Area 4	0.26	0.0067	0.051													
SV-169@13W-A4	MEI	Area 4	0.065	0.0018	0.023													
SV-170@5S-A4	UC	Area 4	0.036	0.007	0.0046													
SV-170@5S-A4	MEI	Area 4	0.035	0.0033	0.0035													
SV-171@6S-A4	UC	Area 4	0.023	<0.0044	0.0045													
SV-171@6S-A4	MEI	Area 4	0.016	<0.0011	0.044													
SV-172@13S-A4	UC	Area 4	0.04	<0.0045	0.0054													
SV-172@13S-A4	MEI	Area 4	0.3	0.0044	0.014													
SV-173@16B(N)-A4	UC	Area 4	0.28	<0.0047	0.03													
SV-173@16B(N)-A4	MEI	Area 4	0.08	0.0014	0.012													
SV-174@16B(S)-A4	UC	Area 4	0.26	0.0075	0.055													
SV-174@16B(S)-A4	MEI	Area 4	0.11	0.0018	0.017													
SV-177@5W-A1	UC	Area 1	**1.2**	0.017	0.052	←Excavation Expanded Into Adjacent Area												
SV-177@5W-A1	MEI	Area 1	**1.8**	0.036	0.1	←Excavation Expanded Into Adjacent Area												
SV-178@11W-A1	UC	Area 1	0.018	<0.0042	<0.0042													
SV-178@11W-A1	MEI	Area 1	0.09	0.0016	0.0095													
SV-179@5S-A1	UC	Area 1	**1.3**	0.057	0.034	SV-185@5S-A1	UC	Area 1	**3.9**	0.078	0.033	SV-186@5S-A1	UC	Area 1	**1.4**	0.023	0.012	←Excavation Expanded Into
SV-179@5S-A1	MEI	Area 1	**1.8**	0.035	0.027	SV-185@5S-A1	MEI	Area 1	0.095	<0.0074	<0.0074	SV-186@5S-A1	MEI	Area 1	0.72	0.012	0.0079	←Excavation Expanded Into
SV-180@11S-A1	UC	Area 1	0.0054	<0.0043	<0.0043													
SV-180@11S-A1	MEI	Area 1	0.023	<0.0012	<0.0012													
SV-181@5E-A1	UC	Area 1	0.32	<0.0043	0.0072													
SV-181@5E-A1	MEI	Area 1	0.35	0.0081	0.016													
SV-182@11E-A1	UC	Area 1	0.11	<0.0046	0.0079													
SV-182@11E-A1	MEI	Area 1	0.13	0.0025	0.0094													
SV-183@14B(N)-A1	UC	Area 1	0.18	<0.0056	0.023													
SV-183@14B(N)-A1	MEI	Area 1	0.12	0.0024	0.015													
SV-184@14B(S)-A1	UC	Area 1	0.24	<0.0044	0.011													
SV-184@14B(S)-A1	MEI	Area 1	0.26	0.0018	0.0074													
SV-191@5S-A6	UC	Area 6	<0.0043	0.015	<0.0043													
SV-191@5S-A6	MEI	Area 6	0.0029	0.0079	<0.0013													
SV-192@10S-A6	UC	Area 6	**2.3**	0.065	0.46	SV-202@12S-A6	UC	Area 6	0.036	<0.0051	<0.0051							
SV-192@10S-A6	MEI	Area 6	**2.9**	0.064	0.42	SV-202@12S-A6	MEI	Area 6	0.043	<0.0012	0.0019							
SV-193@5E-A6	UC	Area 6	<0.004	<0.004	<0.004													
SV-193@5E-A6	MEI	Area 6	0.015	0.0044	<0.0012													
SV-194@10E-A6	UC	Area 6	0.54	0.0087	0.021													
SV-194@10E-A6	MEI	Area 6	0.7	0.018	0.061													

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Data fm Tables 7 and 8 in UC's 06-2008 PPCSR.

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Soil Remediation Excavation - Verification Sample Analytical Results
Fountain Oaks Shopping Center
(Data Tabulated from Tables 7 and 8 in UC's 06-10-2008 CSR)

Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	First Re-Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	Second Re-Verification Sample Description	Consultant	Excavation Area	PCE (mg/kg)	TCE (mg/kg)	cDCE (mg/kg)	Comments
	EPD-Approved TYPE 4 RRS		**1.18**	**0.7**	**1.84**		**EPD-Approved TYPE 4 RRS**		**1.18**	**0.7**	**1.84**		**EPD-Approved TYPE 4 RRS**		**1.18**	**0.7**	**1.84**	
SV-195@5S-A6	UC	Area 6	0.050	0.037	0.013													
SV-195@5S-A6	MEI	Area 6	0.079	0.057	0.029													
SV-196@10S-A6	UC	Area 6	0.077	<0.0048	0.0051													
SV-196@10S-A6	MEI	Area 6	0.870	0.019	0.06													
SV-197@5E-A6	UC	Area 6	0.61	0.18	0.033													
SV-197@5E-A6	MEI	Area 6	0.89	0.38	0.099													
SV-198@10E-A6	UC	Area 6	**1.9**	0.018	0.001	SV-203@12E-A6	UC	Area 6	0.028	<0.005	<0.005							
SV-198@10E-A6	MEI	Area 6	**6.9**	0.098	0.52	SV-203@12E-A6	MEI	Area 6	0.24	0.0041	0.015							
SV-199@12B(SW)-A6	UC	Area 6	**2.3**	0.07	0.19	SV-201@14B-A6	UC	Area 6	0.36	0.0095	0.034							
SV-199@12B(SW)-A6	MEI	Area 6	**2**	0.12	0.22	SV-201@14B-A6	MEI	Area 6	0.77	0.023	0.14							
SV-200@12B(NE)-A6	UC	Area 6	0.14	<0.0036	0.0063													
SV-200@12B(NE)-A6	MEI	Area 6	0.11	0.002	0.01													
SV-204@20W-A6A	UC	Area 6	**4.6**	0.035	0.063	SV-207@22N-A6A	UC	Area 6	0.66	0.02	0.070	**< Excavated to Rock**						
SV-204@20W-A6A	MEI	Area 6	**1.5**	0.071	0.12	SV-207@22N-A6A	MEI	Area 6	**1.3**	0.021	0.062	**< Excavated to Rock**						
SV-205@20E-A6A	UC	Area 6	0.6	<0.0043	0.011	SV-208@22SE-A6A	UC	Area 6	0.39	<0.0045	0.0071							
SV-205@20E-A6A	MEI	Area 6	0.14	0.0021	0.01	SV-208@22SE-A6A	MEI	Area 6	0.22	0.0023	0.008							
						SV-209@22SW-A6A	UC	Area 6	0.79	0.0093	0.023							
						SV-209@22SW-A6A	MEI	Area 6	0.48	0.0066	0.02							
SV-206@21B-A6A	UC	Area 6	**2100**	3.3	0.013	**< Excavated to Rock**												
SV-206@21B-A6A	MEI	Area 6	**160**	0.29	0.096	**< Excavated to Rock**												
SV-210@31E-A6A	UC	Area 6	0.63	0.0087	0.019													
SV-210@31E-A6A	MEI	Area 6	0.0017	<0.0011	<0.0011													
SV-211@31SE-A6A	UC	Area 6	1.1	0.011	0.014													
SV-211@31SE-A6A	MEI	Area 6	0.27	0.0035	0.01													
SV-212@31SW-A6A	UC	Area 6	1.1	0.015	0.023													
SV-212@31SW-A6A	MEI	Area 6	0.56	0.0092	0.017													
SV-213@22N-A6A	UC	Area 6	0.19	<0.0048	0.03													
SV-213@22N-A6A	MEI	Area 6	0.14	0.0035	0.038													

Labeling: "SV##" = "soil verification" chronologic sample #. @2E-A3 = collected at 2' depth, E wall, Area 3. Example: SV-24@5N-A15 = SV - 24th sample, 5' depth, N wall, Area 15.

Appendix C

Soil to Groundwater Leaching Calculations

Table C1
Soil to Groundwater Leaching Calculations - Type 2 RRS
Acetone - Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching*						
W	Width of Source	**32.4**		ft	Site-specific	MEI CSR, 12-2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2$*0.009	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$* 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 12-2015, Figure 17
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat}$ * i	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenutation Factor	**2.124**	DAF = 1 + $(U_{gw}*\delta_{gw})$/(I*W)	dimensionless	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenutation Factor	**20**	DAF = 20	dimensionless	Default	
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**2.364**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**8.46E-02**	$K_d = K_{oc}$ * f_{oc}	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
ρ_b	Soil Particle Density	**2.65**		g-S/cm^3-S	Default	EPD Rule 391-3-19 App. III, Table 3
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**1.43E-03**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**0.228**	$K_{sw} = [\Theta_w + (K_d*\rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.219**	$LF_{sw} = 1/(K_{sw}$ * DAF)	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**0.016**		mg/kg	Site-specific	MEI CSR, 12-2015, Tables 7, 8 & 22
$C_{target, Soil}$	**Soil Conc. Causing Leachate to Exceed Higher of Type 1 or 2 GW RRS**	**3.7E+01**		**mg/kg**		
$C_{RRS\ 1,2-GW}$	Higher of Type 1 or Type 2 RRS: GROUNDWATER	8.0E+00		mg/L		
C_{leach}	Conc. in GW by leaching	**8.0E+00**	$C_{leach} = C_{target, soil}$ * LF_{sw}	mg/L	Calculated	ASTM E2081-00 (2015)
$C_{target, GW}$ - C_{leach}		**0.0E+00**	$C_{target, GW}$ - C_{leach}			

*Soil to Groundwater Leaching calculations performed in accordance with procedures and equations detailed in US EPA Publication 9355.4-24 "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites" and ASTM Standard E2081-00 (2015), "Standard Guide for Risk-Based Corrective Action", Section X3.9 and Table X3.4

Table C2
Soil to Groundwater Leaching Calculations - Type 2 RRS
Benzene - Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching*						
W	Width of Source	**32.4**		ft	Site-specific	MEI CSR, 12-2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft} * 30.48$ cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in} * 2.54$ cm/in	cm/yr	Calculated	
k_i	Infiltration Factor	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2 * 0.009$	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft} * 30.48$ cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)} * 86{,}400$ sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	$i = \Delta head / \Delta distance$ (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 12-2015, Figure 17
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat} * i$	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenutation Factor	**2.124**	$DAF = 1 + (U_{gw} * \delta_{gw})/(I * W)$	dimensionless	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenutation Factor	**20**	DAF = 20	dimensionless	Default	
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**145.8**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**5.22E+00**	$K_d = K_{oc} * f_{oc}$	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
ρ_b	Soil Particle Density	**2.65**		g-S/cm^3-S	Default	EPD Rule 391-3-19 App. III, Table 3
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**0.23**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**5.396**	$K_{sw} = [\Theta_w + (K_d * \rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.009**	$LF_{sw} = 1/(K_{sw} * DAF)$	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**0.016**		mg/kg	Site-specific	MEI CSR, 12-2015, Tables 7, 8 & 22
$\mathbf{C_{target, Soil}}$	**Soil Conc. Causing Leachate to Exceed Higher of Type 1 or 2 GW RRS**	**5.8E-01**		**mg/kg**		
$C_{RRS\ 1,2\text{-}GW}$	Higher of Type 1 or Type 2 RRS: GROUNDWATER	5.4E-03		mg/L		
C_{leach}	Conc. in GW by leaching	**5.4E-03**	$C_{leach} = C_{target, soil} * LF_{sw}$	mg/L	Calculated	ASTM E2081-00 (2015)
$C_{target, GW} - C_{leach}$		**0.0E+00**	$C_{target, GW} - C_{leach}$			

*Soil to Groundwater Leaching calculations performed in accordance with procedures and equations detailed in US EPA Publication 9355.4-24 "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites" and ASTM Standard E2081-00 (2015), "Standard Guide for Risk-Based Corrective Action", Section X3.9 and Table X3.4

Table C3
Soil to Groundwater Leaching Calculations - Type 2 RRS
Chloroform - Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching*						
W	Width of Source	32.4		ft	Site-specific	MEI CSR, 12-2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor/Coefficient	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2*0.009$	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$* 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 12-2015, Figure 17
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat} * i$	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenutation Factor	**2.124**	$DAF = 1 + (U_{gw}*\delta_{gw})/(I*W)$	dimensionless	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenutation Factor	**20**	DAF = 20	dimensionless	Default	
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**31.82**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**1.14E+00**	$K_d = K_{oc} * f_{oc}$	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
ρ_b	Soil Particle Density	**2.65**		g-S/cm^3-S	Default	EPD Rule 391-3-19 App. III, Table 3
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**0.15**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**1.304**	$K_{sw} = [\Theta_w + (K_d*\rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.038**	$LF_{sw} = 1/(K_{sw} * DAF)$	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**0.031**		mg/kg	Site-specific	MEI CSR, 2015, Tables 7, 8 & 22
$\mathbf{C_{target, Soil}}$	**Soil Conc. Causing Leachate to Exceed Higher of Type 1 or 2 GW RRS**	**2.09E+00**		**mg/kg**		
$C_{RRS\ 1,2\text{-}GW}$	Higher of Type 1 or Type 2 RRS: GROUNDWATER	8.00E-02		mg/L		
C_{leach}	Conc. in GW by leaching	**8.0E-02**		mg/L	Calculated	ASTM E2081-00 (2015)
$C_{target, GW} - C_{leach}$		**0.0E+00**	$C_{target, GW} - C_{leach}$			

*Soil to Groundwater Leaching calculations performed in accordance with procedures and equations detailed in US EPA Publication 9355.4-23 "Soil Screening Guidance: User's Guide" and ASTM Standard E2081-00 (2015), "Standard Guide for Risk-Based Corrective Action", Section X3.9 and Table X3.4

Table C4
Soil to Groundwater Leaching Calculations - Type 2 RRS
Cumene (Isopropylbenzene) - Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching*						
W	Width of Source	32.4		ft	Site-specific	MEI CSR, 12-2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor/Coefficient	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2$*0.009	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$* 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 12-2015, Figure 17
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat}$ * i	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenutation Factor	**2.124**	DAF = 1 + (U_{gw}*δ_{gw})/(I*W)	dimensionless	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenutation Factor	**20**	DAF = 20	dimensionless	Default	
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**697.8**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**2.50E+01**	$K_d = K_{oc}$ * f_{oc}	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
ρ_b	Soil Particle Density	**2.65**		g-S/cm^3-S	Default	EPD Rule 391-3-19 App. III, Table 3
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**0.47**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**25.192**	$K_{sw} = [\Theta_w + (K_d*\rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.002**	$LF_{sw} = 1/(K_{sw}$ * DAF)	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**0**	Not Detected	mg/kg	Site-specific	MEI CSR, 12-2015, Tables 7, 8 & 22
$C_{target, Soil}$	**Soil Conc. Causing Leachate to Exceed Higher of Type 1 or 2 GW RRS**	**1.0E+02**		**mg/kg**		
$C_{RRS 1,2-GW}$	Higher of Type 1 or Type 2 RRS: GROUNDWATER	2.1E-01		mg/L		
C_{leach}	Conc. in GW by leaching	**2.1E-01**	$C_{leach} = C_{target, soil}$ * LF_{sw}	mg/L	Calculated	ASTM E2081-00 (2015)
$C_{target, GW}$ - C_{leach}		**0.0E+00**	$C_{target, GW}$ - C_{leach}			

*Soil to Groundwater Leaching calculations performed in accordance with procedures and equations detailed in US EPA Publication 9355.4-24 "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites" and ASTM Standard E2081-00 (2015), "Standard Guide for Risk-Based Corrective Action", Section X3.9 and Table X3.4

Table C5
Soil to Groundwater Leaching Calculations - Type 2 RRS
cis-1,2-Dichloroethene (cDCE) - Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching*						
W	Width of Source	32.4		ft	Site-specific	MEI CSR, 12-2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor/Coefficient	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2 * 0.009$	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw,\ cm} = \delta_{gw,\ ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$ * 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 12-2015, Figure 17
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat}$ * i	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenuation Factor	**2.124**	$DAF = 1 + (U_{gw} * \delta_{gw})/(I * W)$	dimensionless	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenuation Factor	**20**	DAF = 20	dimensionless	Default	
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**39.6**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**1.42E+00**	$K_d = K_{oc} * f_{oc}$	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
ρ_b	Soil Particle Density	**2.65**		g-S/cm^3-S	Default	EPD Rule 391-3-19 App. III, Table 3
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**0.17**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**1.585**	$K_{sw} = [\Theta_w + (K_d * \rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.032**	$LF_{sw} = 1/(K_{sw} * DAF)$	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max,\ soil}$	Max soil concentration on-site	**0.3**		mg/kg	Site-specific	MEI CSR, 12-2015, Tables 7, 8 & 22
$\mathbf{C_{target,\ Soil}}$	**Soil Conc. Causing Leachate to Exceed Higher of Type 1 or 2 GW RRS**	**2.2E+00**		**mg/kg**		
$C_{RRS\ 1,2\text{-}GW}$	Higher of Type 1 or Type 2 RRS: GROUNDWATER	7.0E-02		mg/L		
C_{leach}	Conc. in GW by leaching	**7.0E-02**	$C_{leach} = C_{target,\ soil} * LF_{sw}$	mg/L	Calculated	ASTM E2081-00 (2015)
$C_{target,\ GW} - C_{leach}$		**0.0E+00**	$C_{target,\ GW} - C_{leach}$			

*Soil to Groundwater Leaching calculations performed in accordance with procedures and equations detailed in US EPA Publication 9355.4-24 "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites" and ASTM Standard E2081-00 (2015), "Standard Guide for Risk-Based Corrective Action", Section X3.9 and Table X3.4

Table C6
Soil to Groundwater Leaching Calculations - Type 2 RRS
trans-1,2-Dichloroethene (cDCE) - Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching*						
W	Width of Source	32.4		ft	Site-specific	MEI CSR, 12-2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor/Coefficient	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2 * 0.009$	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$ * 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 12-2015, Figure 17
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat}$ * i	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenutation Factor	**2.124**	$DAF = 1 + (U_{gw} * \delta_{gw})/(I * W)$	dimensionless	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenutation Factor	**20**	DAF = 20	dimensionless	Default	
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**39.6**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**1.42E+00**	$K_d = K_{oc} * f_{oc}$	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
ρ_b	Soil Particle Density	**2.65**		g-S/cm^3-S	Default	EPD Rule 391-3-19 App. III, Table 3
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**0.38**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**1.616**	$K_{sw} = [\Theta_w + (K_d * \rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.031**	$LF_{sw} = 1/(K_{sw} * DAF)$	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**0.3**		mg/kg	Site-specific	MEI CSR, 12-2015, Tables 7, 8 & 22
$\mathbf{C_{target, Soil}}$	**Soil Conc. Causing Leachate to Exceed Higher of Type 1 or 2 GW RRS**	**3.2E+00**		**mg/kg**		
$C_{RRS\ 1,2\text{-}GW}$	Higher of Type 1 or Type 2 RRS: GROUNDWATER	1.0E-01		mg/L		
C_{leach}	Conc. in GW by leaching	**1.0E-01**	$C_{leach} = C_{target, soil} * LF_{sw}$	mg/L	Calculated	ASTM E2081-00 (2015)
$C_{target, GW} - C_{leach}$		**0.0E+00**	$C_{target, GW} - C_{leach}$			

*Soil to Groundwater Leaching calculations performed in accordance with procedures and equations detailed in US EPA Publication 9355.4-24 "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites" and ASTM Standard E2081-00 (2015), "Standard Guide for Risk-Based Corrective Action", Section X3.9 and Table X3.4

Table C7
Soil to Groundwater Leaching Calculations - Type 2 RRS
Methyl Ethyl Ketone (MEK) - Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching*						
W	Width of Source	32.4		ft	Site-specific	MEI CSR, 12-2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor/Coefficient	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2 * 0.009$	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$ * 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 12-2015, Figure 17
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat}$ * i	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenutation Factor	**2.124**	$DAF = 1 + (U_{gw} * \delta_{gw})/(I * W)$	dimensionless	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenutation Factor	**20**	DAF = 20	dimensionless	Default	
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**4.51**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**1.61E-01**	$K_d = K_{oc} * f_{oc}$	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
ρ_b	Soil Particle Density	**2.65**		g-S/cm^3-S	Default	EPD Rule 391-3-19 App. III, Table 3
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**2.33E-03**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**0.305**	$K_{sw} = [\Theta_w + (K_d * \rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.164**	$LF_{sw} = 1/(K_{sw} * DAF)$	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**0.3**		mg/kg	Site-specific	MEI CSR, 12-2015, Tables 7, 8 & 22
$\mathbf{C_{target, Soil}}$	**Soil Conc. Causing Leachate to Exceed Higher of Type 1 or 2 GW RRS**	**1.4E+01**		**mg/kg**		
$C_{RRS\ 1,2\text{-}GW}$	Higher of Type 1 or Type 2 RRS: GROUNDWATER	2.3E+00		mg/L		
C_{leach}	Conc. in GW by leaching	**2.3E+00**	$C_{leach} = C_{target, soil} * LF_{sw}$	mg/L	Calculated	ASTM E2081-00 (2015)
$C_{target, GW} - C_{leach}$		**0.0E+00**	$C_{target, GW} - C_{leach}$			

*Soil to Groundwater Leaching calculations performed in accordance with procedures and equations detailed in US EPA Publication 9355.4-24 "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites" and ASTM Standard E2081-00 (2015), "Standard Guide for Risk-Based Corrective Action", Section X3.9 and Table X3.4

Table C8
Soil to Groundwater Leaching Calculations - Type 2 RRS
Tetrachloroethene - Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching*						
W	Width of Source	32.4		ft	Site-specific	MEI CSR, 12-2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2*0.009$	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$* 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 12-2015, Figure 17
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat}$ * i	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenutation Factor	**2.124**	$DAF = 1 + (U_{gw}*\delta_{gw})/(I*W)$	dimensionless	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenutation Factor	**20**	DAF = 20	dimensionless	Default	
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**94.94**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**3.40E+00**	$K_d = K_{oc} * f_{oc}$	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
ρ_b	Soil Particle Density	**2.65**		g-S/cm^3-S	Default	EPD Rule 391-3-19 App. III, Table 3
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**0.724**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**3.647**	$K_{sw} = [\Theta_w + (K_d*\rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.014**	$LF_{sw} = 1/(K_{sw} * DAF)$	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**1.1**		mg/kg	Site-specific	MEI CSR, 12-2015, Tables 7, 8 & 22
$C_{target, Soil}$	**Soil Conc. Causing Leachate to Exceed Higher of Type 1 or 2 GW RRS**	**1.4E+00**		**mg/kg**		
$C_{RRS\ 1,2\text{-}GW}$	Higher of Type 1 or Type 2 RRS: GROUNDWATER	1.9E-02		mg/L		
C_{leach}	Conc. in GW by leaching	**1.9E-02**	$C_{leach} = C_{target, soil} * LF_{sw}$	mg/L	Calculated	ASTM E2081-00 (2015)
$C_{target, GW} - C_{leach}$		**0.0E+00**	$C_{target, GW} - C_{leach}$			

*Soil to Groundwater Leaching calculations performed in accordance with procedures and equations detailed in US EPA Publication 9355.4-24 "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites" and ASTM Standard E2081-00 (2015), "Standard Guide for Risk-Based Corrective Action", Section X3.9 and Table X3.4

Table C9
Soil to Groundwater Leaching Calculations - Type 2 RRS
Trichloroethene - Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching*						
W	Width of Source	32.4		ft	Site-specific	MEI CSR, 12-2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2 * 0.009$	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$ * 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 12-2015, Figure 17
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat}$ * i	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenutation Factor	**2.124**	$DAF = 1 + (U_{gw} * \delta_{gw})/(I*W)$	dimensionless	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenutation Factor	**20**	DAF = 20	dimensionless	Default	
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**60.7**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**2.17E+00**	$K_d = K_{oc} * f_{oc}$	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
ρ_b	Soil Particle Density	**2.65**		g-S/cm^3-S	Default	EPD Rule 391-3-19 App. III, Table 3
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**0.403**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**2.375**	$K_{sw} = [\Theta_w + (K_d * \rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.021**	$LF_{sw} = 1/(K_{sw}$ * DAF)	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**0.18**		mg/kg	Site-specific	MEI CSR, 12-2015, Tables 7, 8 & 22
$C_{target, Soil}$	**Soil Conc. Causing Leachate to Exceed Higher of Type 1 or 2 GW RRS**	**2.4E-01**		**mg/kg**		
$C_{RRS\ 1,2\text{-}GW}$	Higher of Type 1 or Type 2 RRS: GROUNDWATER	5.0E-03		mg/L		
C_{leach}	Conc. in GW by leaching	**5.0E-03**	$C_{leach} = C_{target, soil} * LF_{sw}$	mg/L	Calculated	ASTM E2081-00 (2015)
$C_{target, GW} - C_{leach}$		**0.0E+00**	$C_{target, GW} - C_{leach}$			

*Soil to Groundwater Leaching calculations performed in accordance with procedures and equations detailed in US EPA Publication 9355.4-24 "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites" and ASTM Standard E2081-00 (2015), "Standard Guide for Risk-Based Corrective Action", Section X3.9 and Table X3.4

Table C10
Soil to Groundwater Leaching Calculations - Type 2 RRS
Vinyl Chloride - Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching*						
W	Width of Source	32.4		ft	Site-specific	MEI CSR, 12-2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2 * 0.009$	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$ * 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 12-2015, Figure 17
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat} * i$	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenutation Factor	**2.124**	$DAF = 1 + (U_{gw} * \delta_{gw})/(I * W)$	dimensionless	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenutation Factor	**20**	DAF = 20	dimensionless	Default	
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**21.73**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**7.78E-01**	$K_d = K_{oc} * f_{oc}$	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
ρ_b	Soil Particle Density	**2.65**		g-S/cm^3-S	Default	EPD Rule 391-3-19 App. III, Table 3
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**1.14**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**1.085**	$K_{sw} = [\Theta_w + (K_d * \rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.046**	$LF_{sw} = 1/(K_{sw} * DAF)$	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**0**	Not Detected	mg/kg	Site-specific	MEI CSR, 12-2015, Tables 7, 8 & 22
$\mathbf{C_{target, Soil}}$	**Soil Conc. Causing Leachate to Exceed Higher of Type 1 or 2 GW RRS**	**3.4E-02**		**mg/kg**		
$C_{RRS\ 1,2\text{-}GW}$	Higher of Type 1 or Type 2 RRS: GROUNDWATER	2.0E-03		mg/L		
C_{leach}	Conc. in GW by leaching	**1.6E-03**	$C_{leach} = C_{target, soil} * LF_{sw}$	mg/L	Calculated	ASTM E2081-00 (2015)
$C_{target, GW} - C_{leach}$		**4.5E-04**	$C_{target, GW} - C_{leach}$			

*Soil to Groundwater Leaching calculations performed in accordance with procedures and equations detailed in US EPA Publication 9355.4-24 "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites" and ASTM Standard E2081-00 (2015), "Standard Guide for Risk-Based Corrective Action", Section X3.9 and Table X3.4

Table C11
Soil to Groundwater Leaching Calculations - Type 4 RRS
Acetone - Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching*						
W	Width of Source	**32.4**		ft	Site-specific	MEI CSR, 2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft} * 30.48$ cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in} * 2.54$ cm/in	cm/yr	Calculated	
k_i	Infiltration Factor	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2 * 0.009$	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft} * 30.48$ cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)} * 86,400$ sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	$i = \Delta head/\Delta distance$ (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 12-2015, Figure 17
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat} * i$	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenuation Factor	**2.124**	$DAF = 1 + (U_{gw} * \delta_{gw})/(I * W)$	dimensionless	Calculated	ASTM E2081-00 (2015)
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**2.364**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**0.0846312**	$K_d = K_{oc} * f_{oc}$	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**1.43E-03**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**0.228**	$K_{sw} = [\Theta_w + (K_d * \rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**2.063**	$LF_{sw} = 1/(K_{sw} * DAF)$	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**0.29**		mg/kg	Site-specific	MEI CSR, 2015, Tables 7, 8 & 22
$C_{target, Soil}$	Soil Conc. Causing Leachate to Exceed Higher of Type 3 or 4 GW RRS	**2.2E+01**		**mg/kg**		
$C_{RRS\ 3,4\text{-}GW}$	Higher of Type 3 or Type 4 RRS: GROUNDWATER	4.6E+01		mg/L		
C_{leach}	Conc. in GW by leaching	**4.6E+01**	$C_{leach} = C_{max, soil} * LF_{sw}$	mg/L	Calculated	ASTM E2081-00 (2015)
$C_{target, GW} - C_{leach}$		**0.00E+00**	$C_{target, GW} - C_{leach}$			
*Soil to Groundwater Leaching calculations performed in accordance with procedures and equations detailed in US EPA Publication 9355.4-24 "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites" and ASTM Standard E2081-00 (2015), "Standard Guide for Risk-Based Corrective Action", Section X3.9 and Table X3.4						

Table C12
Soil to Groundwater Leaching Calculations - Type 4 RRS
Benzene - Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching*						
W	Width of Source	32.4		ft	Site-specific	MEI CSR, 2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2$*0.009	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$* 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 12-2015, Figure 17
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat}$ * i	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenuation Factor	**2.124**	DAF = 1 + (U_{gw}*δ_{gw})/(I*W)	dimensionless	Calculated	ASTM E2081-00 (2015)
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**145.8**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**5.21964**	$K_d = K_{oc}$ * f_{oc}	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**0.23**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**5.396**	$K_{sw} = [\Theta_w + (K_d*\rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.087**	$LF_{sw} = 1/(K_{sw}$ * DAF)	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**0.016**		mg/kg	Site-specific	MEI CSR, 2015, Tables 7, 8 & 22
$\mathbf{C_{target, Soil}}$	Soil Conc. Causing Leachate to Exceed Higher of Type 3 or 4 GW RRS	**1.0E-01**		mg/kg		
$C_{RRS\ 3,4\text{-}GW}$	Higher of Type 3 or Type 4 RRS: GROUNDWATER	8.7E-03		mg/L		
C_{leach}	Conc. in GW by leaching	**8.7E-03**	$C_{leach} = C_{max, soil}$ * LF_{sw}	mg/L	Calculated	ASTM E2081-00 (2015)
$C_{target, GW}$ - C_{leach}		**0.0E+00**	$C_{target, GW}$ - C_{leach}			

*Soil to Groundwater Leaching calculations performed in accordance with procedures and equations detailed in US EPA Publication 9355.4-24 "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites" and ASTM Standard E2081-00 (2015), "Standard Guide for Risk-Based Corrective Action", Section X3.9 and Table X3.4

Table C13
Soil to Groundwater Leaching Calculations - Type 4 RRS
Chloroform - Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching*						
W	Width of Source	**32.4**		ft	Site-specific	MEI CSR, 2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor/Coefficient	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2 * 0.009$	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$ * 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 12-2015, Figure 17
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat}$ * i	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenuation Factor	**2.124**	$DAF = 1 + (U_{gw} * \delta_{gw})/(I * W)$	dimensionless	Calculated	ASTM E2081-00 (2015)
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**31.82**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**1.139156**	$K_d = K_{oc} * f_{oc}$	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**0.15**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**1.304**	$K_{sw} = [\Theta_w + (K_d * \rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.361**	$LF_{sw} = 1/(K_{sw} * DAF)$	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max,\ soil}$	Max soil concentration on-site	**0.031**		mg/kg	Site-specific	MEI CSR, 2015, Tables 7, 8 & 22
$C_{target,\ Soil}$	Soil Conc. Causing Leachate to Exceed Higher of Type 3 or 4 GW RRS	**2.2E-01**		mg/kg		
$C_{RRS\ 3,4\text{-}GW}$	Higher of Type 3 or Type 4 RRS: GROUNDWATER	8.0E-02		mg/L		
C_{leach}	Conc. in GW by leaching	**8.0E-02**		mg/L	Calculated	ASTM E2081-00 (2015)
$C_{target,\ GW} - C_{leach}$		**0.0E+00**	$C_{target,\ GW} - C_{leach}$			

*Soil to Groundwater Leaching calculations performed in accordance with procedures and equations detailed in US EPA Publication 9355.4-24 "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites" and ASTM Standard E2081-00 (2015), "Standard Guide for Risk-Based Corrective Action", Section X3.9 and Table X3.4

Table C14
Soil to Groundwater Leaching Calculations - Type 4 RRS
Cumene (Isopropylbenzene) - Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
			Soil to Ground Water Leaching*			
W	Width of Source	32.4		ft	Site-specific	MEI CSR, 2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor/Coefficient	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2$*0.009	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$* 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 12-2015, Figure 17
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat}$ * i	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenuation Factor	**2.124**	DAF = 1 + (U_{gw}*δ_{gw})/(I*W)	dimensionless	Calculated	ASTM E2081-00 (2015)
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**697.8**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**24.98124**	$K_d = K_{oc}$ * f_{oc}	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**0.47**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**25.192**	$K_{sw} = [\Theta_w + (K_d*\rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.019**	$LF_{sw} = 1/(K_{sw}$ * DAF)	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**0.3**		mg/kg	Site-specific	MEI CSR, 2015, Tables 7, 8 & 22
$\mathbf{C_{target, Soil}}$	Soil Conc. Causing Leachate to Exceed Higher of Type 3 or 4 GW RRS	**5.4E+01**		mg/kg		
$C_{RRS\ 3,4\text{-}GW}$	Higher of Type 3 or Type 4 RRS: GROUNDWATER	1.0E+00		mg/L		
C_{leach}	Conc. in GW by leaching	**1.0E+00**		mg/L	Calculated	ASTM E2081-00 (2015)
$C_{target, GW}$ - C_{leach}		**0.0E+00**	$C_{target, GW}$ - C_{leach}			

*Soil to Groundwater Leaching calculations performed in accordance with procedures and equations detailed in US EPA Publication 9355.4-24 "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites" and ASTM Standard E2081-00 (2015), "Standard Guide for Risk-Based Corrective Action", Section X3.9 and Table X3.4

Table C15
Soil to Groundwater Leaching Calculations - Type 4 RRS
cis-1,2-Dichloroethene (cDCE) - Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching*						
W	Width of Source	**32.4**		ft	Site-specific	MEI CSR, 2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor/Coefficient	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2$*0.009	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$* 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 12-2015, Figure 17
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat}$ * i	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenuation Factor	**2.124**	DAF = 1 + (U_{gw}*δ_{gw})/(I*W)	dimensionless	Calculated	ASTM E2081-00 (2015)
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**39.6**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**1.41768**	$K_d = K_{oc}$ * f_{oc}	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**0.17**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**1.585**	$K_{sw} = [\Theta_w + (K_d*\rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.297**	$LF_{sw} = 1/(K_{sw}$ * DAF)	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**0.3**		mg/kg	Site-specific	MEI CSR, 2015, Tables 7, 8 & 22
$\mathbf{C_{target, Soil}}$	Soil Conc. Causing Leachate to Exceed Higher of Type 3 or 4 GW RRS	**2.4E-01**		mg/kg		
$C_{RRS\ 3,4\text{-}GW}$	Higher of Type 3 or Type 4 RRS: GROUNDWATER	7.0E-02		mg/L		
C_{leach}	Conc. in GW by leaching	**7.0E-02**		mg/L	Calculated	ASTM E2081-00 (2015)
$C_{target, GW}$ - C_{leach}		**0.0E+00**	$C_{target, GW}$ - C_{leach}			

*Soil to Groundwater Leaching calculations performed in accordance with procedures and equations detailed in US EPA Publication 9355.4-24 "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites" and ASTM Standard E2081-00 (2015), "Standard Guide for Risk-Based Corrective Action", Section X3.9 and Table X3.4

Table C16
Soil to Groundwater Leaching Calculations - Type 4 RRS
trans-1,2-Dichloroethene (cDCE) - Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching*						
W	Width of Source	32.4		ft	Site-specific	MEI CSR, 2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft} * 30.48$ cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in} * 2.54$ cm/in	cm/yr	Calculated	
k_i	Infiltration Factor/Coefficient	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2*0.009$	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft} * 30.48$ cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)} * 86,400$ sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 12-2015, Figure 17
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat} * i$	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenuation Factor	**2.124**	$DAF = 1 + (U_{gw}*\delta_{gw})/(I*W)$	dimensionless	Calculated	ASTM E2081-00 (2015)
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**39.6**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**1.41768**	$K_d = K_{oc} * f_{oc}$	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**0.38**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**1.616**	$K_{sw} = [\Theta_w + (K_d*\rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.291**	$LF_{sw} = 1/(K_{sw} * DAF)$	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**0.3**		mg/kg	Site-specific	MEI CSR, 2015, Tables 7, 8 & 22
$\mathbf{C_{target, Soil}}$	Soil Conc. Causing Leachate to Exceed Higher of Type 3 or 4 GW RRS	**3.4E-01**		mg/kg		
$C_{RRS\ 3,4\text{-}GW}$	Higher of Type 3 or Type 4 RRS: GROUNDWATER	1.0E-01		mg/L		
C_{leach}	Conc. in GW by leaching	**1.0E-01**		mg/L	Calculated	ASTM E2081-00 (2015)
$C_{target, GW} - C_{leach}$		**1.0E-04**	$C_{target, GW} - C_{leach}$			

*Soil to Groundwater Leaching calculations performed in accordance with procedures and equations detailed in US EPA Publication 9355.4-24 "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites" and ASTM Standard E2081-00 (2015), "Standard Guide for Risk-Based Corrective Action", Section X3.9 and Table X3.4

Table C17
Soil to Groundwater Leaching Calculations - Type 4 RRS
Methyl Ethyl Ketone (MEK) - Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching*						
W	Width of Source	32.4		ft	Site-specific	MEI CSR, 2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor/Coefficient	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2 * 0.009$	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$ * 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 12-2015, Figure 17
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat} * i$	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenuation Factor	**2.124**	$DAF = 1 + (U_{gw} * \delta_{gw})/(I * W)$	dimensionless	Calculated	ASTM E2081-00 (2015)
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**4.51**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**0.161458**	$K_d = K_{oc} * f_{oc}$	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**2.33E-03**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**0.305**	$K_{sw} = [\Theta_w + (K_d * \rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**1.543**	$LF_{sw} = 1/(K_{sw} * DAF)$	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**0.3**		mg/kg	Site-specific	MEI CSR, 2015, Tables 7, 8 & 22
$\mathbf{C_{target, Soil}}$	Soil Conc. Causing Leachate to Exceed Higher of Type 3 or 4 GW RRS	**7.8E+00**		mg/kg		
$C_{RRS\ 3,4\text{-}GW}$	Higher of Type 3 or Type 4 RRS: GROUNDWATER	1.2E+01		mg/L		
C_{leach}	Conc. in GW by leaching	**1.2E+01**		mg/L	Calculated	ASTM E2081-00 (2015)
$C_{target, GW} - C_{leach}$		**0.0E+00**	$C_{target, GW} - C_{leach}$			

*Soil to Groundwater Leaching calculations performed in accordance with procedures and equations detailed in US EPA Publication 9355.4-24 "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites" and ASTM Standard E2081-00 (2015), "Standard Guide for Risk-Based Corrective Action", Section X3.9 and Table X3.4

Table C18
Soil to Groundwater Leaching Calculations - Type 4 RRS
Tetrachloroethene - Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching*						
W	Width of Source	32.4		ft	Site-specific	MEI CSR, 2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2*0.009$	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$* 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 12-2015, Figure 17
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat} * i$	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenuation Factor	**2.124**	$DAF = 1 + (U_{gw}*\delta_{gw})/(I*W)$	dimensionless	Calculated	ASTM E2081-00 (2015)
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**94.94**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**3.398852**	$K_d = K_{oc} * f_{oc}$	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**0.724**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**3.647**	$K_{sw} = [\Theta_w + (K_d*\rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.129**	$LF_{sw} = 1/(K_{sw} * DAF)$	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**1.1**		mg/kg	Site-specific	MEI CSR, 2015, Tables 7, 8 & 22
$\mathbf{C_{target, Soil}}$	Soil Conc. Causing Leachate to Exceed Higher of Type 3 or 4 GW RRS	**7.6E-01**		mg/kg		
$C_{RRS\ 3,4-GW}$	Higher of Type 3 or Type 4 RRS: GROUNDWATER	9.8E-02		mg/L		
C_{leach}	Conc. in GW by leaching	**9.8E-02**	$C_{leach} = C_{max, soil} * LF_{sw}$	mg/L	Calculated	ASTM E2081-00 (2015)
$C_{target, GW} - C_{leach}$		**0.0E+00**	$C_{target, GW} - C_{leach}$			

*Soil to Groundwater Leaching calculations performed in accordance with procedures and equations detailed in US EPA Publication 9355.4-24 "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites" and ASTM Standard E2081-00 (2015), "Standard Guide for Risk-Based Corrective Action", Section X3.9 and Table X3.4

Table C19
Soil to Groundwater Leaching Calculations - Type 4 RRS
Trichloroethene - Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching*						
W	Width of Source	32.4		ft	Site-specific	MEI CSR, 2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft} * 30.48$ cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in} * 2.54$ cm/in	cm/yr	Calculated	
k_i	Infiltration Factor	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2 * 0.009$	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft} * 30.48$ cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)} * 86,400$ sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 12-2015, Figure 17
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat} * i$	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenuation Factor	**2.124**	$DAF = 1 + (U_{gw} * \delta_{gw})/(I * W)$	dimensionless	Calculated	ASTM E2081-00 (2015)
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**60.7**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**2.17306**	$K_d = K_{oc} * f_{oc}$	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**0.403**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**2.375**	$K_{sw} = [\Theta_w + (K_d * \rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.198**	$LF_{sw} = 1/(K_{sw} * DAF)$	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**0.18**		mg/kg	Site-specific	MEI CSR, 2015, Tables 7, 8 & 22
$C_{target, Soil}$	Soil Conc. Causing Leachate to Exceed Higher of Type 3 or 4 GW RRS	**2.6E-02**		mg/kg		
$C_{RRS\ 3,4\text{-}GW}$	Higher of Type 3 or Type 4 RRS: GROUNDWATER	5.2E-03		mg/L		
C_{leach}	Conc. in GW by leaching	**5.2E-03**	$C_{leach} = C_{max, soil} * LF_{sw}$	mg/L	Calculated	ASTM E2081-00 (2015)
$C_{target, GW} - C_{leach}$		**1.7E-06**	$C_{target, GW} - C_{leach}$			

*Soil to Groundwater Leaching calculations performed in accordance with procedures and equations detailed in US EPA Publication 9355.4-24 "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites" and ASTM Standard E2081-00 (2015), "Standard Guide for Risk-Based Corrective Action", Section X3.9 and Table X3.4

Table C20
Soil to Groundwater Leaching Calculations - Type 4 RRS
Vinyl Chloride - Fountain Oaks Shopping Center

Variable	Variable Definition	Value	Formula	Units	Parameter Type	Data Source
Soil to Ground Water Leaching*						
W	Width of Source	32.4		ft	Site-specific	MEI CSR, 2015, Sect. 3.4.4.4.1
W	Width of Source	**988**	$W_{cm} = W_{ft}$ * 30.48 cm/ft	cm	Site-specific	
P	Avg. Annual Precipitation	**49.71**		in/yr	Site-specific	Natl. Weather Svc, Peachtree City
P	Avg. Annual Precipitation	**126**	$P_{cm} = P_{in}$ * 2.54 cm/in	cm/yr	Calculated	
k_i	Infiltration Factor	**0.0009**		dimensionless	Specific to Silty Soil	Weidemeier, et al., 1999, p. 52
I	Infiltration Rate	**14.3**	$I = P^2 * 0.009$	cm/year	Calculated	
δ_{gw}	GW Mixing Zone Thickness	**7.1**		ft	Site-specific	MEI CSR, 12-2015, Table 2
δ_{gw}	GW Mixing Zone Thickness	**216**	$\delta_{gw, cm} = \delta_{gw, ft}$ * 30.48 cm/ft	cm	Site-specific	
K_{sat}	Hydraulic conductivity (saturated)	**7.78E-05**		cm/sec	Site-specific	UC PPCAP, Pg 23
K_{sat}	Hydraulic conductivity (saturated)	**6.72E+00**	$K_{sat,(cm/day)} = K_{sat,(cm/s)}$ * 86,400 sec/day	cm/day		
i	Groundwater Hydraulic Gradient	**0.03**	i = Δhead/Δdistance (along flow path)	cm/cm	Site-specific, Avg.	MEI CSR, 12-2015, Figure 17
U_{gw}	GW Darcy velocity	**73.61**	$U_{gw} = K_{sat} * i$	cm/year	Calculated	ASTM E2081-00 (2015)
DAF	Dilution Attenuation Factor	**2.124**	$DAF = 1 + (U_{gw} * \delta_{gw})/(I*W)$	dimensionless	Calculated	ASTM E2081-00 (2015)
K_{oc}	Soil Organic Carbon-Water Partition Coefficient	**21.73**		cm^3-W/g-C	Compound-Specific	EPA RSL Table, 2015
f_{oc}	Fractional Org. Carbon	**3.58%**		%	Site-specific	UC PPCAP, Table 1
K_d	Soil-Water Partition/Sorption Coeff.	**0.777934**	$K_d = K_{oc} * f_{oc}$	g-W/g-soil	Calculated	ASTM E2081-00 (2015)
ρ_s	Soil Bulk Density	**1.80**		g-S/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_w	Soil Volumetric Water Content	**0.258**		cm^3-W/cm^3-S	Site-specific	UC PPCAP, Table 1
Θ_a	Soil Volumetric Air Content	**0.26**		cm^3-A/cm^3-S	default	ASTM E2081-00 (2015)
H'	Henry's Law Constant	**1.14**		dimensionless	Compound-Specific	EPA RSL Table, 2015
K_{sw}	Soil to Leachate Partition Coeff.	**1.085**	$K_{sw} = [\Theta_w + (K_d * \rho_s) + (H_{eff} * \Theta_a)] / \rho_s$	mg/L-wtr/mg/kg-soil	Calculated	ASTM E2081-00 (2015)
LF_{sw}	Leaching Factor - Soil to Groundwater	**0.434**	$LF_{sw} = 1/(K_{sw} * DAF)$	ppm/ppm	Calculated	ASTM E2081-00 (2015)
$C_{max, soil}$	Max soil concentration on-site	**0.0012**	NOT DETECTED - Subst. MDL	mg/kg	Site-specific	MEI CSR, 2015, Tables 7, 8 & 22
$\mathbf{C_{target, Soil}}$	Soil Conc. Causing Leachate to Exceed Higher of Type 3 or 4 GW RRS	**7.6E-03**		mg/kg		
$C_{RRS\ 3,4\text{-}GW}$	Higher of Type 3 or Type 4 RRS: GROUNDWATER	3.3E-03		mg/L		
C_{leach}	Conc. in GW by leaching	**3.3E-03**	$C_{leach} = C_{max, soil} * LF_{sw}$	mg/L	Calculated	ASTM E2081-00 (2015)
$C_{target, GW} - C_{leach}$		**3.5E-06**	$C_{target, GW} - C_{leach}$			

*Soil to Groundwater Leaching calculations performed in accordance with procedures and equations detailed in US EPA Publication 9355.4-24 "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites" and ASTM Standard E2081-00 (2015), "Standard Guide for Risk-Based Corrective Action", Section X3.9 and Table X3.4

Appendix D

Draft Uniform Environmental Covenant

After Recording Return to:

Gerald L. Pouncey, Esq.
Morris, Manning & Martin LLP
1600 Atlanta Financial Center
3343 Peachtree Road NE
Atlanta, GA 30326

Environmental Covenant

This instrument is an Environmental Covenant executed pursuant to the Georgia Uniform Environmental Covenants Act, O.C.G.A. § 44-16-1 *et seq*, for the property identified below (hereinafter the "Property") as part of an environmental response project to address regulated substances released into the environment. This Environmental Covenant restricts the use of groundwater on the Property to prevent humans from coming into contact with regulated substances.

Fee Owner of Property/Grantor:
AMREIT Fountain Oaks, LP
1221 Main Street
Suite #1000
Columbia, SC 29201

Grantee/Holder:
AMREIT Fountain Oaks, LP
1221 Main Street
Suite #1000
Columbia, SC 29201

Grantee/Entity with express power to enforce:
State of Georgia
Department of Natural Resources
Environmental Protection Division (hereinafter, "EPD")
2 Martin Luther King Jr. Drive, SE
Suite 1456 East Tower
Atlanta, GA 30334

Parties with interest in the Property:
AMREIT Fountain Oaks, LP
1221 Main Street
Suite #1000
Columbia, SC 29201

Property:

The property subject to this Environmental Covenant is the Fountain Oaks Shopping Center located at 4920 Roswell Road and 115 W. Belle Isle Road in Atlanta, Fulton County, Georgia (hereinafter "Property"). A complete legal description of the Property is attached as Exhibit A. A map of the Property is attached as Exhibit B. **[Include Exhibit A & B attachments]**

The Property is approximately 13.77 acres and consists of the following tax parcels, which are subject to this Environmental Covenant:

17 009300061319
17 009300021073

Name and Location of Administrative Record:

The administrative record for the environmental response project is identified as HSI File 10807. This record is available for review at the following location:

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 was previously listed on the state's hazardous site inventory and was designated as needing corrective action due to the presence of hazardous wastes, hazardous constituents, or hazardous substances regulated under state law. 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 AMREIT Fountain Oaks, LP, its successors and assigns, and the State of Georgia, Department of Natural Resources, Environmental Protection Division (hereinafter "EPD"), its successors and assigns. This Environmental Covenant is required in accordance with the approved Voluntary Remediation Program Application and Compliance Status Report and the documented release of acetone, benzene, chloroform, tetrachloroethylene, trichloroethylene, cis-1,2 dichloroethylene, trans-1,2-dichloroethene, methyl ethyl ketone, and vinyl chloride on the Property. These 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 consisted of soil excavation and institutional controls including the restriction of groundwater use to protect human health and the environment.

Grantor, AMREIT Fountain Oaks, LP, hereby binds Grantor, 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 AMREIT Fountain Oaks, LP 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.

AMREIT Fountain Oaks, LP 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 AMREIT Fountain Oaks, LP and EPD and their respective successors and assigns and shall be enforceable by the Director or his agents or assigns or AMREIT Fountain Oaks, LP or its successors 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

<u>Real Property Use Limitation.</u> The Property shall be used only for non-residential uses, as defined in Section 391-3-19-.02 of the Rules as of the date of this Environmental Covenant. Any residential use on the Property shall be prohibited. Any activity on the Property that may result in the release or exposure to the regulated substances that were addressed as part of the Corrective Action, or create a new exposure pathway, is prohibited.

<u>Groundwater Use Limitation.</u> The use or extraction of groundwater beneath the Property for drinking water or other potable uses shall be prohibited. The use or extraction of groundwater for any other purpose besides site characterization is prohibited unless conducted under a plan approved in writing by EPD.

<u>Periodic Reporting</u>. Annually, by no later than July 30 following the effective date of this Environmental Covenant, the Owner shall submit to EPD an Annual Report in the format attached hereto as Exhibit C stating whether or not the activity and use limitations in this Environmental Covenant are being abided by. **[Exhibit C template is attached for reference]**

General Provisions

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

<u>Notice to EPD of Future Conveyances.</u> Within thirty (30) days after each conveyance of a fee simple interest in the Property or any portion thereof, a notice shall be sent to EPD and AMREIT Fountain Oaks, LP. The notice shall include the new owner's name, address, telephone number and other pertinent contact information, the date of the conveyance and the location (County, Deed Book and Page) where the conveyance is recorded, and, if the conveyance is a portion of the Property, a survey map showing the boundaries of the real property conveyed.

<u>Notice of Change in Use.</u> The owner of the Property must provide to EPD thirty (30) days' advance written notice the owner's intent to change the use of the Property, to apply for a building permit for construction at the Property, or to perform an site work that will materially affect any required monitoring or maintenance of any institutional or engineering controls described herein.

<u>Access</u>. Grantor shall provide reasonable access to Grantee/Holder or its assigns to verify compliance with established activity and/or use limitations identified herein.

<u>Effective Date</u>. 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).

<u>Benefit.</u> This Environmental Covenant shall inure to the benefit of Grantee/Holder, EPD, and their respective successors and assigns and shall be enforceable by the Director or his agents or assigns, Grantee/Holder or its successors and assigns, and other party(ies) as provided for in O.C.G.A. § 44-16-11 in a court of competent jurisdiction.

<u>Termination or Modification.</u> This Environmental Covenant shall remain in full force and effect in accordance with O.C.G.A. § 44-16-5, unless and until the Director determines that the Property is in compliance with the Type 1 or 2 Risk Reduction Standards, as defined in Section 391-3-19-.07 of the Georgia Rules of Hazardous Site Response, whereupon the Environmental Covenant may be amended or terminated, as appropriate, in accordance with O.C.G.A. § 44-16-1 *et seq*.

<u>Severability.</u> 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.

<u>Warranty.</u> Grantor hereby represents and warrants to the other signatories hereto 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 and in accordance with O.C.G.A. § 44-16-1 *et seq*.

<u>No EPD Interest in Property Created</u>. 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).

<u>EPD's Environmental Covenants Registry.</u> This Environmental Covenant and any amendment thereto or termination thereof may be included in EPD's registry for environmental covenants.

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 at least thirty (30) days prior to presenting this Environmental Covenant to EPD for execution, the Grantor has served each of the people or entities referenced in O.C.G.A. § 44-16-7(a) with an identical copy of this Environmental Covenant in accordance with O.C.G.A. § 44-16-7(a).
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
Response and Remediation Program
Land Protection Branch
2 Martin Luther King Jr. Drive SE
Suite 1054 East Tower
Atlanta, GA 30334

AMREIT Fountain Oaks, LP
1221 Main Street
Suite #1000
Columbia, SC 29201

Grantor has caused this Environmental Covenant to be executed pursuant to The Georgia Uniform Environmental Covenants Act, on the _______day of ______________, 2016.

Signed, sealed, and delivered in the presence of:	**For the Grantor:**
____________________________	____________________________
Unofficial Witness (*Signature*)	Name of Grantor (*Print*)
____________________________	____________________________ (Seal)
Unofficial Witness Name (*Print*)	Grantor's Authorized Representative (*Signature*)
____________________________	____________________________
____________________________	Authorized Representative Name (*Print*)
Unofficial Witness Address (*Print*)	____________________________
____________________________	Title of Authorized Representative (*Print*)
Notary Public (*Signature*)	Dated:________________
My Commission Expires:________________	(NOTARY SEAL)

Signed, sealed, and delivered in the presence of:

____
Unofficial Witness (*Signature*)

____
Unofficial Witness Name (*Print*)

____

____
Unofficial Witness Address (*Print*)

____
Notary Public (*Signature*)

My Commission Expires:____________

For the State of Georgia
Environmental Protection Division:

______________________________ (Seal)
(*Signature*)

Richard E. Dunn
Director

Dated:______________________
(NOTARY SEAL)

Exhibit A
Legal Description

Exhibit B
Map

Appendix E

Additional Evaluation of Vapor Intrusion Pathway

APPENDIX E

ADDITIONAL EVALUATION OF THE VAPOR INTRUSION PATHWAY

Background

The potential sources for vapor intrusion from the subsurface at the Fountain Oaks Shopping Center (FOSC) have been thoroughly investigated and defined. The extent of volatile organic compounds (VOCs) have previously been characterized using indoor air, soil vapor, soil, and groundwater sampling, and three potential sources identified: a former dry cleaner that was located on the northern portion of the FOSC, another dry cleaner (Chastain Cleaners) located to the northeast and off-site with migration of constituents of potential concern (COPCs) onto the FOSC property, and a gas station located off site, northeast of the FOSC. Thus, COPCs include VOCs associated with dry cleaning and petroleum-based fuels.

Soil excavations have been completed and soil exceeding risk reduction standards (RRS) have been removed. In 2008, a vapor intrusion mitigation system (VISM) was installed and was in operation until late 2011. To evaluate the post-remediation conditions, a focused site investigation was completed for soil gas and indoor air in May 2013. Sub-slab and near-slab soil gas samples were collected from six locations using laboratory-supplied Summa® canisters within and adjacent to the northern portion of the shopping center buildings. In addition, six indoor air sampling canisters (laboratory-supplied Summa® canisters) were placed within the Kroger store and four of the suites to the north of Kroger for indoor air sampling (Property Solutions, 2013). Canister samples were analyzed by Method TO-15. A summary of these data, which are used as lines of evidence in the vapor intrusion risk evaluation, are provided in Table E-1 and Table E-2.

In March 2015, remaining groundwater monitoring wells were sampled for COPCs. These data were presented in the December 2015 Compliance Status Report and VRP Application (Marion Environmental Inc., 2015). Figure 20 from that report is presented for reference herein. Additionally, the March 2015 groundwater analytical results are presented in ATTACHMENT Table 1. In the December 2015 CSR and VRP Application, these data were used to address the potential of vapor intrusion in the USEPA's Johnson and Ettinger Model (J&E Model, USEPA, 2004). Per current USEPA guidance, quantitative fate and transport modeling is a valuable tool in the evaluation of current and future human health risk from vapor intrusion (USEPA, 2015a). The results of the J&E Modeling additionally support a conclusion that the potential for vapor intrusion on the north portion of FOSC had been substantially reduced and the residual concentrations in groundwater would not pose a risk to current and future site receptors.

In November 2016, EPD provided comments that indicated that the J&E Model results would not be accepted as a line of evidence to demonstrate that vapor intrusion risks are in the acceptable range. The same comment requested that the Vapor Intrusion Screening Level (VISL) calculator should be used to evaluate risk for this pathway. Although current USEPA guidance (USEPA, 2015) supports the continuing use of the J&E Model, which was reissued as an update in September 2017, an alternative risk evaluation has been completed using VISL. In addition, per EPD's comments, the groundwater concentrations associated with the northeastern portion of the FOSC have also been evaluated. The groundwater monitoring wells within each area have been evaluated and wells with positive detections for the COPCs of interest are included in the estimation of the exposure point concentrations (EPCs). The grouping of the monitoring wells is indicated by color coding in ATTACHMENT Table 1. When there are four or more detections of a COPC, USEPA's ProUCL software version 5.1 (USEPA, 2015b) has been used to calculate representative EPCs. This approach is consistent with guidance for risk assessment issued by USEPA Region 4 (USEPA, 2014) and the Georgia VRP. The EPCs used to address risk for groundwater are listed in Table E-3 (FOSC north portion) and Table E-4 (northeastern portion that includes off-site source concentrations and petroleum-related COPCs). The calculated ProUCL EPCs are presented in ATTACHMENT Tables 2 through 5.

Risk Characterization – Vapor Intrusion Modeling

The online VISL Calculator was used to estimate risks and hazards associated with indoor air concentrations from residual soil vapor impacts from groundwater for the north portion of the FOSC. The maximum detected soil vapor concentrations detected in May 2013 for constituents exceeding commercial sub-slab VISLs were used in the calculations. Two constituents, benzene and tetrachloroethene, had maximum reported concentrations that exceeded the VISLs based on a target risk of 10^{-6} and hazard index of 0.1 (Table E-1). These two compounds were carried forward to the VISL risk calculations. Table E-5 shows the cumulative risks and hazards estimated using the VISL calculator and soil vapor concentrations. Incremental cancer risk was estimated at 3×10^{-6} and the hazard index at 0.2. Estimated risks are less than the HSRA target risk level of 1×10^{-5}; the hazard index is less than the HSRA target HI of 1. This first line of evidence supports the conclusion that the vapor intrusion pathway does not pose a risk to current or future commercial receptors because soil vapor exposures do not exceed the risk goals set forth in HSRA.

Table E-2 summarizes the results of the indoor air sampling event completed in May 2013. The maximum reported detections for the site COPCs plus other detected constituents that were not detected in soil vapor or in groundwater were compared to commercial indoor air VISLs. The VISLs were based on a target risk of 10^{-6} and target hazard index of 0.1. One of the constituents, chloroform, had a maximum concentration of 1.1 $\mu g/m^3$ that exceeded the screening VISL of 0.53 $\mu g/m^3$. Under a commercial scenario, the maximum concentration of chloroform would be associated with an estimated risk of 2.1×10^{-6}. This estimated risk is less than the HSRA target risk level of 1×10^{-5}. In addition, chloroform is commonly found in ambient air and is associated with chlorinated water and may not be due to vapor intrusion from groundwater. This second line of evidence supports the conclusion that the vapor intrusion pathway does not pose a risk to current or future commercial receptors.

The online VISL Calculator was used to estimate risks and hazards associated with indoor air concentrations from residual groundwater impacts for the north portion of the FOSC. The COPCs and EPCs are summarized on Table E-3 and the estimated risks and hazards are shown on Table E-6. Incremental cancer risk was estimated at 9×10^{-6} and the hazard index at 2. Estimated risks are less than the HSRA target risk level of 1×10^{-5}; the hazard index is slightly greater than the HSRA target HI of 1. The HI is primarily associated with trichloroethene (TCE). Please note that calculations completed with the J&E Model indicate a much higher degree of attenuation between groundwater and the building foundations. The higher degree of attenuation was supported by the depth to groundwater (27 to 33 feet below ground surface) and the 2013 soil vapor results discussed above. Therefore, the attenuation factor in the VISL was adjusted to 0.0005, which is allowed under USEPA guidance. Based on these site-specific considerations, the third line of evidence also supports the conclusion that the vapor intrusion pathway does not pose a risk to current or future commercial receptors.

The online VISL Calculator was used to estimate risks and hazards associated with indoor air concentrations from residual groundwater impacts for the northeastern and eastern portion of the FOSC. These concentrations are associated with an off-site dry cleaning site and a former gas station. The COPCs and EPCs are summarized on Table E-4 and the estimated risks and hazards are shown on Table E-7. For the reasons stated above, the attenuation factor was adjusted to 0.0005. Incremental cancer risk was estimated at 6×10^{-6} and the hazard index at 0.7. Estimated risks are less than the HSRA target risk level of 1×10^{-5}; the hazard index is less than the HSRA target HI of 1. This line of evidence supports the conclusion that the vapor intrusion pathway does not pose a risk to current or future commercial receptors located on the northeastern and eastern portion of the FOSC.

This approach assumes the structure of a building is located above the subsurface impacts and volatile emissions will enter through the floor slab and does not incorporate dispersion, dilution, or bioattenuation. However, in actuality, the concentrations of volatile compounds may naturally attenuate over time. In fact, concentrations at the FOSC monitoring wells exhibit a downward trend in concentrations with time (Figure 20 attached). This approach also assumes an infinite subsurface contamination source, while the distribution across the site is not homogeneous. In fact, the groundwater concentrations used to estimate vapor intrusion are not located underneath site buildings and are located underneath hard cover, which serves as a vapor barrier. In general, the assumptions used to estimate indoor air exposures and risks would tend to overestimate indoor air concentrations. The results obtained with the J&E Model also support the conclusion that risk and hazards calculated with the VISL are overestimates.

In summary, indoor air sample concentrations collected in May 2013 were less than commercial indoor air VISLs with one exception, chloroform. However, estimated risk associated with chloroform is less than the HSRA target risk level of 10^{-5}. Risk calculations were completed using the May 2013 soil vapor sampling results and the March 2015 groundwater sampling results in the online VISL Calculator in order to estimate the indoor air concentrations and risks and hazards for detected constituents in soil vapor and groundwater. When site-specific conditions are included in the calculations, the resulting estimated cumulative hazards and risks indicate no unacceptable risk or hazards for commercial receptors potentially exposed via indoor air vapor emissions based on maintaining the current hard cover and current building parameters. Therefore, the site is compliant with requirements under HSRA and the VRP for delisting.

References

Marion Environmental Inc., 2015. Compliance Status Report and Voluntary Remediation Program Application, Fountain Oaks Shopping Center, December 2015.

Property Solutions Inc., 2013. Limited Subsurface Investigation of Shoppes at Fountain Oaks, Atlanta, Fulton County, Georgia. June 6, 2013.

USEPA, 2004. Johnson and Ettinger Model and User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings, Office of Emergency and Remedial Response, February 2004.

USEPA, 2014. Region 4 Human Health Risk Assessment Supplemental Guidance, January 2014.

USEPA, 2015a. OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air, OSWER Publication 9200.2-154, June 2015.

USEPA, 2015b. ProUCL Version 5.1, Statistical Software for Environmental Applications for Data Sets with and without Non-Detect Observation, October 2015.

USEPA, 2018. Online Vapor Intrusion Screening Level (VISL) Calculator, https://epa-visl.ornl.gov/cgi-bin/visl_search.

TABLES

Table E-1
Fountain Oaks Dry Cleaning Site - Fountain Oaks Shopping Center
Summa Cannister Soil Gas Data Summary- 2013

Parameter	**May 2013 Maximum Reported Concentration, ug/m^3 (a)**	**Soil Gas VISL (Target Risk of 10^{-6} and Hazard Index of 0.1), ug/m^3 (b)**
1,2,4-Trimethylbenzene	34	880
1,3,5-Trimethylbenzene	11	880
2-Butanone	43	73000
4-Ethyltoluene	10	NA
Acetone	250	450000
Benzene	140	52
Carbon disulfide	8.0	10000
Chlorobenzene	20	730
Chloroform	8.6	18
Dichlorodifluoromethane	31	1500
Ethylbenzene	32	160
Methyl isobutyl ketone	36	44000
Tetrachloroethene	1200	580
Toluene	170	73000
Trichloroethene	7.2	29
Trichlorofluoromethane	58	NA
Xylenes	91	1500

ug/m^3 = micrograms per cubic meter
NA Screening level not available
(a) Limited Subsurface Investigation of Shoppes at Fountain Oaks, Property Solutions Inc., June 2013
(b) Commercial Soil Gas Vapor Intrusion Screening Level (VISL), USEPA, May 2016
(c) 1,2,4-Trimethylbenzene used as a surrogate
Bolded parameter had maximum reported concentrations greater than the VISL.
Compounds in italics were not detected in groundwater.

Prepared by: LMS 5/2/17
Checked by: LWC 5/4/17

Table E-2
Fountain Oaks Dry Cleaning Site - Fountain Oaks Shopping Center
Indoor Air Data Summary- 2013

Parameter	**May 2013 Maximum Reported Concentration, ug/m^3 (a)**	**Indoor Air VISL (Target Risk of 10^{-6} and Hazard Index of 0.1), ug/m^3 (b)**
1,2,4-Trimethylbenzene	0.73	26
1,3,5-Trimethylbenzene	<0.5	26
2-Butanone	3.6	2200
4-Ethyltoluene	<0.5	NA
Acetone	250	14000
Benzene	1.0	1.6
Carbon disulfide	3.0	310
Carbon tetrachloride	0.59	2.0
Chlorobenzene	<0.47	22
Chloromethane	1.6	39
Chloroform	1.1	0.53
Dichlorodifluoromethane	3.4	44
Ethylbenzene	0.92	4.9
Methyl isobutyl ketone	<0.83	1300
Methylene chloride	0.72	260
Styrene	2.0	440
Tetrachloroethene	3.1	18
Toluene	4.5	2200
1,1,1-Trichloroethane	3.1	2200
Trichloroethene	<0.55	0.88
Trichlorofluoromethane	23	NA
1,1,2-Trichlorotrifluoroethane	16	13000
Xylenes	2.6	44

ug/m^3 = micrograms per cubic meter
ND Not Detected in Indoor Air
NA Screening level not available
(a) Limited Subsurface Investigation of Shoppes at Fountain Oaks, Property Solutions Inc., June 2013
(b) Commercial Indoor Air Screening Level (VISL), USEPA, May 2016

Bolded parameter had maximum reported concentrations greater than the VISL.
Compounds in italics were not detected in groundwater.

Prepared by: LMS 5/2/17
Checked by: LWC 5/4/17

Table E-3
Fountain Oaks Dry Cleaning Site - Fountain Oaks Shopping Center
Groundwater Data Summary- March 2015

Parameter	Frequency of Detection	Maximum Reported Concentration, ug/L (a)	Exposure Point Concentration	Basis
Chloroform	6/10	14	10.5	95% KM (t) UCL
cis 1,2-Dichloroethene	10/10	210	NA	
trans 1,2-Dichloroethene	1/10	1.2	NA	
Di-isopropyl ether	1/10	1	1	Maximum
Methyl tert butyl ether	3/10	15	15	Maximum
Tetrachloroethene	8/10	810	447	95% KM (Chebyshev) UCL
Trichloroethene	8/10	120	104	97.5% KM (Chebyshev) UCL

Source: Compliance Status Report and Voluntary Remediation Program Application, Fountain Oaks Shopping Center, Marion Environmental Inc., December 2015
(a) Table 9 Data for wells within plume with detections of COPCs: MW-2, MW-3, MW-4, MW-9, MW-13S, MW-14, MW-26, MW-27, MW-29, and MW-30
NA No inhalation toxicity data available for this constituent.
% percent
UCL Upper Confidence Limit of the Arithmetic Mean
KM Kaplan Meier
UCLs calculated using ProUCL Version 5.1

Prepared by: LMS 12/29/16
Checked by: LWC 12/30/16

Table E-4
Northeastern Area (Chastain Cleaners Source) - Fountain Oaks Shopping Center
Groundwater Data Summary- March 2015

Parameter	Frequency of Detection	Maximum Reported Concentration, ug/L (a)	Exposure Point Concentration, ug/L	Basis
Acetone	2/13	86	86	Maximum
Benzene	5/13	140	48.7	95% Hall's Bootstrap
sec-Butylbenzene	1/13	1.9	NA	
Chloroform	4/13	11	7.56	95% KM (t) UCL
Cumene	1/13	3.2	3.2	Maximum
cis 1,2-Dichloroethene	12/13	100	NA	
Di-isopropyl ether	4/13	46	12.6	95% KM (t) UCL
Methyl tert butyl ether	6/13	2500	661	95% KM (t) UCL
Tetrachloroethene	11/13	520	282	95% KM Adj Gamma UCL
Trichloroethene	10/13	35	16.4	95% KM Adj Gamma UCL
Vinyl chloride	4/13	11	3.77	95% KM (t) UCL

Source: Compliance Status Report and Voluntary Remediation Program Application, Fountain Oaks Shopping Center, Marion Environmental Inc., December 2015
(a) Table 9 Data for wells within plume with detections of COPCs: MW-5, MW-6, MW-8, MW-15, MW-16, MW-18, MW-19, MW-20, MW-21, MW-22, MW-23, MW-28, and MW-33
NA No inhalation toxicity data available for this constituent.
% percent
UCL Upper Confidence Limit of the Arithmetic Mean
KM Kaplan Meier
Adj Adjusted
UCLs calculated using ProUCL Version 5.1

Prepared by: LMS 12/29/16
Checked by: LWC 12/30/16

Site-specific VISL Results
Commercial Equation Inputs

*** Inputted values different from Commercial defaults are highlighted.**
Output generated 06MAR2018:17:20:18

Variable	Commercial Air Default Value	Value
AF_{gw} (Attenuation Factor Groundwater) unitless	0.001	0.001
AF_{ss} (Attenuation Factor Sub-Slab) unitless	0.03	0.03
AT_{w} (averaging time - composite worker)	365	365
ED_{w} (exposure duration - composite worker) yr	25	25
EF_{w} (exposure frequency - composite worker) day/yr	250	250
ET_{w} (exposure time - composite worker) hr	8	8
THQ (target hazard quotient) unitless	0.1	1
LT (lifetime) yr	70	70
TR (target risk) unitless	1.0E-06	1.0E-05

TABLE E-5 - FOUNTAINS OAKS FORMER DRYCLEANING AREA - SOIL GAS RISK EVALUATION

Commercial Vapor Intrusion Screening Levels (VISL)
<a href= \/guide.html#Table1 ⮚ User's Guide Variable References

Output generated 06MAR2018:17:20:18

Chemical	CAS Number	Does the chemical meet the definition for volatility? (HLC>1E-5 or VP>1)	Does the chemical have inhalation toxicity data? (IUR and/or RfC)	Is Chemical Sufficiently Volatile and Toxic to Pose Inhalation Risk Via Vapor Intrusion from Soil Source? ($C_{vp} > C_{ia,target}$?)	Is Chemical Sufficiently Volatile and Toxic to Pose Inhalation Risk Via Vapor Intrusion from Groundwater Source? ($C_{hc} > C_{ia,target}$?)	Target Indoor Air Concentration (TCR=1E-05 or THQ=1) MIN($C_{ia,c}$,$C_{ia,nc}$) (µg/m³)	Toxicity Basis	Target Sub-Slab and Exterior Soil Gas Concentration (TCR=1E-05 or THQ=1) C_{sg} (µg/m³)
Benzene	71-43-2	Yes	Yes	Yes	Yes	1.57E+01	CA	5.24E+02
Tetrachloroethylene	127-18-4	Yes	Yes	Yes	Yes	1.75E+02	NC	5.84E+03

Chemical	Target Groundwater Concentration (TCR=1E-05 or THQ=1) C_{gw} (µg/L)	Is Target Groundwater Concentration < MCL? (C_{gw} < MCL?)	Pure Phase Vapor Concentration C_{vp} (25 ° C) (\µg/m³)	Maximum Groundwater Vapor Concentration C_{hc} (\µg/m³)	Temperature for Maximum Groundwater Vapor Concentration (° C)	Lower Explosive Limit LEL (% by volume)	LEL Ref
Benzene	6.93E+01	No (5)	3.98E+08	4.06E+08	25	1.20	CRC89
Tetrachloroethylene	2.42E+02	No (5)	1.65E+08	1.49E+08	25		

Chemical	Inhalation Unit Risk (ug/m³)⁻¹	IUR Ref	Chronic RfC (mg/m³)	Chronic RfC Ref	Mutagenic Indicator	Carcinogenic VISL TCR=1E-05 $C_{ia,c}$ (µg/m³)	Noncarcinogenic VISL THQ=1 $C_{ia,nc}$ (µg/m³)
Benzene	7.80E-06	I	3.00E-02	I		1.57E+01	1.31E+02
Tetrachloroethylene	2.60E-07	I	4.00E-02	I		4.72E+02	1.75E+02

TABLE E-5 - FOUNTAINS OAKS FORMER DRYCLEANING AREA - SOIL GAS RISK EVALUATION

Commercial Vapor Intrusion Risk
Output generated 06MAR2018:17:20:18

Chemical	CAS Number	Site Sub-Slab and Exterior Soil Gas Concentration C_{sg} (µg/m^3)	Site Indoor Air Concentration $C_{i,a}$ (µg/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk $(ug/m^3)^{-1}$	IUR Ref
Benzene	71-43-2	140	4.20E+00	2.67E-06	3.20E-02	7.80E-06	I
Tetrachloroethylene	127-18-4	1200	3.60E+01	7.63E-07	2.05E-01	2.60E-07	I
**Sum*				*3.43E-06*	*2.37E-01*		

Chemical	Chronic RfC (mg/m^3)	RfC Ref	Temperature (° C) for Groundwater Vapor Concentration	Mutagen?
Benzene	3.00E-02	IRIS	25	
Tetrachloroethylene	4.00E-02	IRIS	25	
**Sum*				

TABLE E-5 - FOUNTAINS OAKS FORMER DRYCLEANING AREA - SOIL GAS RISK EVALUATION

Chemical Properties
Output generated 06MAR2018:17:20:18

Chemical	CAS Number	Does the chemical meet the definition for volatility? (HLC>1E-5 or VP>1)	Does the chemical have inhalation toxicity data? (IUR and/or RfC)	MW (g/mol)	MW Ref	Vapor Pressure VP (mm Hg)	VP Ref	Pure Component Water Solubility S (mg/L)	S Ref
Benzene	71-43-2	Yes	Yes	78.12	PHYSPROP	9.48E+01	PHYSPROP	1.79E+03	PHYSPROP
Tetrachloroethylene	127-18-4	Yes	Yes	165.83	PHYSPROP	1.85E+01	PHYSPROP	2.06E+02	PHYSPROP

Chemical	MCL (ug/L)	Henry's Law Constant @25° C (atm-m^3/mole)	Henry's Law Constant (unitless)	H`& HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Air Diffusivity D_{ia} (cm^2/s)	D_{ia} Ref	Water Diffusivity D_{iw} (cm^2/s)	D_{iw} Ref	Normal Boiling Point T_{boil} (K)
Benzene	5	5.55E-03	2.27E-01	PHYSPROP	2.27E-01	8.95E-02	WATER9 (U.S. EPA, 2001)	1.03E-05	WATER9 (U.S. EPA, 2001)	353.15
Tetrachloroethylene	5	1.77E-02	7.24E-01	PHYSPROP	7.24E-01	5.05E-02	WATER9 (U.S. EPA, 2001)	9.46E-06	WATER9 (U.S. EPA, 2001)	394.45

Chemical	BP Ref	Critical Temperature T_{crit} (K)	T_{crit} Ref	Enthalpy of vaporization at the normal boiling point Δ$H_{v,b}$ (cal/mol)	Δ$H_{v,b}$ Ref	Organic Carbon Partition Coefficient K_{oc} (cm3/g)	K_{oc} Ref	Lower Explosive Limit LEL (% by volume)	LEL Ref
Benzene	PHYSPROP	5.62E+02	CRC89	7342.26	CRC89	145.8	EPI	1.20	CRC89
Tetrachloroethylene	PHYSPROP	6.20E+02	YAWS	8288.00	Weast	94.94	EPI		

Site-specific VISL Results
Commercial Equation Inputs

*** Inputted values different from Commercial defaults are highlighted.**
Output generated 06MAR2018:17:00:48

Variable	Commercial Air Default Value	Value
AF_{gw} (Attenuation Factor Groundwater) unitless	0.001	0.0005
AF_{ss} (Attenuation Factor Sub-Slab) unitless	0.03	0.03
AT_{w} (averaging time - composite worker)	365	365
ED_{w} (exposure duration - composite worker) yr	25	25
EF_{w} (exposure frequency - composite worker) day/yr	250	250
ET_{w} (exposure time - composite worker) hr	8	8
THQ (target hazard quotient) unitless	0.1	1
LT (lifetime) yr	70	70
TR (target risk) unitless	1.0E-06	1.0E-05

Commercial Vapor Intrusion Screening Levels (VISL)

<a href= \/guide.html#Table1 ⇨ User's Guide Variable References

Output generated 06MAR2018:17:00:48

Chemical	CAS Number	Does the chemical meet the definition for volatility? (HLC>1E-5 or VP>1)	Does the chemical have inhalation toxicity data? (IUR and/or RfC)	Is Chemical Sufficiently Volatile and Toxic to Pose Inhalation Risk Via Vapor Intrusion from Soil Source? ($C_{vp} > C_{ia,target}$?)	Is Chemical Sufficiently Volatile and Toxic to Pose Inhalation Risk Via Vapor Intrusion from Groundwater Source? ($C_{hc} > C_{ia,target}$?)	Target Indoor Air Concentration (TCR=1E-05 or THQ=1) MIN($C_{ia,c}$,$C_{ia,nc}$) (µg/m³)	Toxicity Basis	Target Sub-Slab and Exterior Soil Gas Concentration (TCR=1E-05 or THQ=1) C_{sg} (µg/m³)
Chloroform	67-66-3	Yes	Yes	Yes	Yes	5.33E+00	CA	1.78E+02
Diisopropyl Ether	108-20-3	Yes	Yes	Yes	Yes	3.07E+03	NC	1.02E+05
Methyl tert-Butyl Ether (MTBE)	1634-04-4	Yes	Yes	Yes	Yes	4.72E+02	CA	1.57E+04
Tetrachloroethylene	127-18-4	Yes	Yes	Yes	Yes	1.75E+02	NC	5.84E+03
Trichloroethylene	79-01-6	Yes	Yes	Yes	Yes	8.76E+00	NC	2.92E+02

Chemical	Target Groundwater Concentration (TCR=1E-05 or THQ=1) C_{gw} (µg/L)	Is Target Groundwater Concentration < MCL? (C_{gw} < MCL?)	Pure Phase Vapor Concentration C_{vp} (17.8 ° C) (\µg/m³)	Maximum Groundwater Vapor Concentration C_{hc} (\µg/m³)	Temperature for Maximum Groundwater Vapor Concentration (° C)	Lower Explosive Limit LEL (% by volume)	LEL Ref	Inhalation Unit Risk (ug/m³)⁻¹
Chloroform	9.48E+01	No (80)	1.26E+09	8.94E+08	17.8			2.30E-05
Diisopropyl Ether	7.90E+04	--	8.19E+08	6.83E+08	17.8	1.40	CRC89	
Methyl tert-Butyl Ether (MTBE)	5.18E+04	--	1.19E+09	9.29E+08	17.8	2.00	YAWS	2.60E-07
Tetrachloroethylene	7.02E+02	No (5)	1.65E+08	1.03E+08	17.8			2.60E-07
Trichloroethylene	6.00E+01	No (5)	4.88E+08	3.74E+08	17.8	8.00	CRC89	4.10E-06

Chemical	IUR Ref	Chronic RfC (mg/m³)	Chronic RfC Ref	Mutagenic Indicator	Carcinogenic VISL TCR=1E-05 $C_{ia,c}$ (µg/m³)	Noncarcinogenic VISL THQ=1 $C_{ia,nc}$ (µg/m³)
Chloroform	I	9.77E-02	A		5.33E+00	4.28E+02
Diisopropyl Ether		7.00E-01	P			3.07E+03
Methyl tert-Butyl Ether (MTBE)	C	3.00E+00	I		4.72E+02	1.31E+04
Tetrachloroethylene	I	4.00E-02	I		4.72E+02	1.75E+02
Trichloroethylene	I	2.00E-03	I	Mut	2.99E+01	8.76E+00

TABLE E-6 GROUNDWATER INVESTIGATION ON NORTHSIDE - FOUNTAIN OAKS FORMER DRYCLEANING AREA

Commercial Vapor Intrusion Risk
Output generated 06MAR2018:17:00:48

Chemical	CAS Number	Site Groundwater Concentration C_{gw} (µg/L)	Site Indoor Air Concentration $C_{i,a}$ (µg/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ
Chloroform	67-66-3	10.5	5.91E-01	1.11E-06	1.38E-03
Diisopropyl Ether	108-20-3	1	3.88E-02		1.27E-05
Methyl tert-Butyl Ether (MTBE)	1634-04-4	15	1.37E-01	2.90E-09	1.04E-05
Tetrachloroethylene	127-18-4	447	1.12E+02	2.36E-06	6.37E-01
Trichloroethylene	79-01-6	104	1.52E+01	5.07E-06	1.73E+00
**Sum*				*8.55E-06*	*2.37E+00*

Chemical	Inhalation Unit Risk $(ug/m^3)^{-1}$	IUR Ref	Chronic RfC (mg/m^3)	RfC Ref	Temperature (° C) for Groundwater Vapor Concentration	Mutagen?
Chloroform	2.30E-05	I	9.77E-02	ATSDR	17.8	
Diisopropyl Ether			7.00E-01	PPRTV	17.8	
Methyl tert-Butyl Ether (MTBE)	2.60E-07	C	3.00E+00	IRIS	17.8	
Tetrachloroethylene	2.60E-07	I	4.00E-02	IRIS	17.8	
Trichloroethylene	4.10E-06	I	2.00E-03	IRIS	17.8	Mut
**Sum*						

Chemical Properties

Output generated 06MAR2018:17:00:48

Chemical	CAS Number	Does the chemical meet the definition for volatility? (HLC>1E-5 or VP>1)	Does the chemical have inhalation toxicity data? (IUR and/or RfC)	MW (g/mol)	MW Ref	Vapor Pressure VP (mm Hg)	VP Ref	Pure Component Water Solubility S (mg/L)	S Ref
Chloroform	67-66-3	Yes	Yes	119.38	PHYSPROP	1.97E+02	PHYSPROP	7.95E+03	PHYSPROP
Diisopropyl Ether	108-20-3	Yes	Yes	102.18	PHYSPROP	1.49E+02	PHYSPROP	8.80E+03	PHYSPROP
Methyl tert-Butyl Ether (MTBE)	1634-04-4	Yes	Yes	88.15	PHYSPROP	2.50E+02	PHYSPROP	5.10E+04	PHYSPROP
Tetrachloroethylene	127-18-4	Yes	Yes	165.83	PHYSPROP	1.85E+01	PHYSPROP	2.06E+02	PHYSPROP
Trichloroethylene	79-01-6	Yes	Yes	131.39	PHYSPROP	6.90E+01	PHYSPROP	1.28E+03	PHYSPROP

TABLE E-6 GROUNDWATER INVESTIGATION ON NORTHSIDE - FOUNTAIN OAKS FORMER DRYCLEANING AREA

Chemical Properties
Output generated 06MAR2018:17:00:48

Chemical	MCL (ug/L)	Henry's Law Constant @25° C (atm-m^3/mole)	Henry's Law Constant (unitless)	Henry's Law Constant (17.8 ° C)	Henry's Law Constant Used in Calcs (unitless)	H`& HLC Ref	Enthalpy of vaporization @ groundwater temperature \Δ$H_{v,gw}$ (cal/mol)	Exponent for \Δ$H_{v,gw}$	Vapor Pressure VP (17.8 ° C) (mm Hg)
Chloroform	80	3.67E-03	1.50E-01	1.13E-01	1.13E-01	PHYSPROP	-3760.82	0.35	9.48E+08
Diisopropyl Ether		2.56E-03	1.05E-01	7.76E-02	7.76E-02	PHYSPROP	-3899.30	0.39	6.07E+08
Methyl tert-Butyl Ether (MTBE)		5.87E-04	2.40E-02	1.82E-02	1.82E-02	PHYSPROP	-3619.19	0.37	8.99E+08
Tetrachloroethylene	5	1.77E-02	7.24E-01	4.99E-01	4.99E-01	PHYSPROP	-4768.71	0.35	1.14E+08
Trichloroethylene	5	9.85E-03	4.03E-01	2.92E-01	2.92E-01	PHYSPROP	-4173.68	0.35	3.53E+08

TABLE E-6 GROUNDWATER INVESTIGATION ON NORTHSIDE - FOUNTAIN OAKS FORMER DRYCLEANING AREA

Chemical Properties

Output generated 06MAR2018:17:00:48

Chemical	Air Diffusivity D_{ia} (cm^2/s)	D_{ia} (17.8 ° C) (cm^2/s)	D_{ia} Used in Calcs (cm^2/s)	D_{ia} Ref	Water Diffusivity D_{iw} (cm^2/s)	D_{iw} (17.8 ° C) (cm^2/s)	D_{iw} Used in Calcs (cm^2/s)	D_{iw} Ref	Normal Boiling Point T_{boil} (K)
Chloroform	7.69E-02	0.0741465	0.0741465	WATER9 (U.S. EPA, 2001)	1.09E-05	0.0000106	0.0000106	WATER9 (U.S. EPA, 2001)	334.25
Diisopropyl Ether	6.54E-02	0.063064	0.063064	WATER9 (U.S. EPA, 2001)	7.76E-06	7.5706E-6	7.5706E-6	WATER9 (U.S. EPA, 2001)	341.65
Methyl tert-Butyl Ether (MTBE)	7.53E-02	0.0725536	0.0725536	WATER9 (U.S. EPA, 2001)	8.59E-06	8.3827E-6	8.3827E-6	WATER9 (U.S. EPA, 2001)	328.15
Tetrachloroethylene	5.05E-02	0.0486469	0.0486469	WATER9 (U.S. EPA, 2001)	9.46E-06	9.2264E-6	9.2264E-6	WATER9 (U.S. EPA, 2001)	394.45
Trichloroethylene	6.87E-02	0.0661864	0.0661864	WATER9 (U.S. EPA, 2001)	1.02E-05	9.9739E-6	9.9739E-6	WATER9 (U.S. EPA, 2001)	360.35

TABLE E-6 GROUNDWATER INVESTIGATION ON NORTHSIDE - FOUNTAIN OAKS FORMER DRYCLEANING AREA

Chemical Properties

Output generated 06MAR2018:17:00:48

Chemical	BP Ref	Critical Temperature T_{crit} (K)	T_{crit} Ref	Enthalpy of vaporization at the normal boiling point Δ$H_{v,b}$ (cal/mol)	Δ$H_{v,b}$ Ref	Organic Carbon Partition Coefficient K_{oc} (cm3/g)	K_{oc} Ref	Lower Explosive Limit LEL (% by volume)	LEL Ref
Chloroform	PHYSPROP	5.36E+02	CRC89	6988.00	Weast	31.82	EPI		
Diisopropyl Ether	PHYSPROP	5.00E+02	CRC89	6955.07	CRC89	22.79	EPI	1.40	CRC89
Methyl tert-Butyl Ether (MTBE)	PHYSPROP	4.97E+02	CRC89	6677.82	CRC89	11.56	EPI	2.00	YAWS
Tetrachloroethylene	PHYSPROP	6.20E+02	YAWS	8288.00	Weast	94.94	EPI		
Trichloroethylene	PHYSPROP	5.71E+02	YAWS	7505.00	Weast	60.7	EPI	8.00	CRC89

Site-specific VISL Results
Commercial Equation Inputs

*** Inputted values different from Commercial defaults are highlighted.**
Output generated 06MAR2018:17:15:08

Variable	Commercial Air Default Value	Value
AF_{gw} (Attenuation Factor Groundwater) unitless	0.001	0.0005
AF_{ss} (Attenuation Factor Sub-Slab) unitless	0.03	0.03
AT_{w} (averaging time - composite worker)	365	365
ED_{w} (exposure duration - composite worker) yr	25	25
EF_{w} (exposure frequency - composite worker) day/yr	250	250
ET_{w} (exposure time - composite worker) hr	8	8
THQ (target hazard quotient) unitless	0.1	1
LT (lifetime) yr	70	70
TR (target risk) unitless	1.0E-06	1.0E-05

Commercial Vapor Intrusion Screening Levels (VISL)
<a href= \/guide.html#Table1 ⍈ User's Guide Variable References

Output generated 06MAR2018:17:15:08

Chemical	CAS Number	Does the chemical meet the definition for volatility? (HLC>1E-5 or VP>1)	Does the chemical have inhalation toxicity data? (IUR and/or RfC)	Is Chemical Sufficiently Volatile and Toxic to Pose Inhalation Risk Via Vapor Intrusion from Soil Source? ($C_{vp} > C_{ia,target}$?)	Is Chemical Sufficiently Volatile and Toxic to Pose Inhalation Risk Via Vapor Intrusion from Groundwater Source? ($C_{hc} > C_{ia,target}$?)	Target Indoor Air Concentration (TCR=1E-05 or THQ=1) MIN($C_{ia,c}$,$C_{ia,nc}$) (µg/m³)	Toxicity Basis	Target Sub-Slab and Exterior Soil Gas Concentration (TCR=1E-05 or THQ=1) C_{sg} (µg/m³)
Acetone	67-64-1	Yes	Yes	Yes	Yes	1.35E+05	NC	4.51E+06
Benzene	71-43-2	Yes	Yes	Yes	Yes	1.57E+01	CA	5.24E+02
Chloroform	67-66-3	Yes	Yes	Yes	Yes	5.33E+00	CA	1.78E+02
Cumene	98-82-8	Yes	Yes	Yes	Yes	1.75E+03	NC	5.84E+04
Diisopropyl Ether	108-20-3	Yes	Yes	Yes	Yes	3.07E+03	NC	1.02E+05
Methyl tert-Butyl Ether (MTBE)	1634-04-4	Yes	Yes	Yes	Yes	4.72E+02	CA	1.57E+04
Tetrachloroethylene	127-18-4	Yes	Yes	Yes	Yes	1.75E+02	NC	5.84E+03
Trichloroethylene	79-01-6	Yes	Yes	Yes	Yes	8.76E+00	NC	2.92E+02
Vinyl Chloride	75-01-4	Yes	Yes	Yes	Yes	2.79E+01	CA	9.29E+02

Commercial Vapor Intrusion Screening Levels (VISL)
<a href= \/guide.html#Table1 ⍈ User's Guide Variable References

Output generated 06MAR2018:17:15:08

Chemical	Target Groundwater Concentration (TCR=1E-05 or THQ=1) C_{gw} (µg/L)	Is Target Groundwater Concentration < MCL? (C_{gw} < MCL?)	Pure Phase Vapor Concentration C_{vp} (17.8 ° C) (\µg/m^3)	Maximum Groundwater Vapor Concentration C_{hc} (\µg/m^3)	Temperature for Maximum Groundwater Vapor Concentration (° C)	Lower Explosive Limit LEL (% by volume)	LEL Ref	Inhalation Unit Risk (ug/m^3)$^{-1}$
Acetone	2.52E+08	--	7.23E+08	1.07E+09	17.8	2.50	CRC89	
Benzene	1.89E+02	No (5)	3.98E+08	2.97E+08	17.8	1.20	CRC89	7.80E-06
Chloroform	9.48E+01	No (80)	1.26E+09	8.94E+08	17.8			2.30E-05
Cumene	1.23E+04	--	2.91E+07	1.75E+07	17.8	0.90	CRC89	
Diisopropyl Ether	7.90E+04	--	8.19E+08	6.83E+08	17.8	1.40	CRC89	
Methyl tert-Butyl Ether (MTBE)	5.18E+04	--	1.19E+09	9.29E+08	17.8	2.00	YAWS	2.60E-07
Tetrachloroethylene	7.02E+02	No (5)	1.65E+08	1.03E+08	17.8			2.60E-07
Trichloroethylene	6.00E+01	No (5)	4.88E+08	3.74E+08	17.8	8.00	CRC89	4.10E-06
Vinyl Chloride	5.81E+01	No (2)	1.00E+10	8.44E+09	17.8	3.60	CRC89	4.40E-06

Commercial Vapor Intrusion Screening Levels (VISL)

<a href= \/guide.html#Table1 ⍈ User's Guide Variable References

Output generated 06MAR2018:17:15:08

Chemical	IUR Ref	Chronic RfC (mg/m³)	Chronic RfC Ref	Mutagenic Indicator	Carcinogenic VISL TCR=1E-05 $C_{ia,c}$ (µg/m³)	Noncarcinogenic VISL THQ=1 $C_{ia,nc}$ (µg/m³)
Acetone		3.09E+01	A			1.35E+05
Benzene	I	3.00E-02	I		1.57E+01	1.31E+02
Chloroform	I	9.77E-02	A		5.33E+00	4.28E+02
Cumene		4.00E-01	I			1.75E+03
Diisopropyl Ether		7.00E-01	P			3.07E+03
Methyl tert-Butyl Ether (MTBE)	C	3.00E+00	I		4.72E+02	1.31E+04
Tetrachloroethylene	I	4.00E-02	I		4.72E+02	1.75E+02
Trichloroethylene	I	2.00E-03	I	Mut	2.99E+01	8.76E+00
Vinyl Chloride	I	1.00E-01	I	Mut	2.79E+01	4.38E+02

Commercial Vapor Intrusion Risk
Output generated 06MAR2018:17:15:08

Chemical	CAS Number	Site Groundwater Concentration C_{gw} (µg/L)	Site Indoor Air Concentration $C_{i,a}$ (µg/m³)	VI Carcinogenic Risk CR	VI Hazard HQ
Acetone	67-64-1	86	4.62E-02		3.41E-07
Benzene	71-43-2	48.7	4.05E+00	2.57E-06	3.08E-02
Chloroform	67-66-3	7.56	4.25E-01	7.98E-07	9.94E-04
Cumene	98-82-8	3.2	4.57E-01		2.61E-04
Diisopropyl Ether	108-20-3	12.6	4.89E-01		1.59E-04
Methyl tert-Butyl Ether (MTBE)	1634-04-4	661	6.02E+00	1.28E-07	4.58E-04
Tetrachloroethylene	127-18-4	282	7.04E+01	1.49E-06	4.02E-01
Trichloroethylene	79-01-6	16.4	2.39E+00	8.00E-07	2.73E-01
Vinyl Chloride	75-01-4	3.77	1.81E+00	6.49E-07	4.13E-03
Sum				*6.44E-06*	*7.12E-01*

Chemical	Inhalation Unit Risk (ug/m³)⁻¹	IUR Ref	Chronic RfC (mg/m³)	RfC Ref	Temperature (° C) for Groundwater Vapor Concentration	Mutagen?
Acetone			3.09E+01	ATSDR	17.8	
Benzene	7.80E-06	I	3.00E-02	IRIS	17.8	
Chloroform	2.30E-05	I	9.77E-02	ATSDR	17.8	
Cumene			4.00E-01	IRIS	17.8	
Diisopropyl Ether			7.00E-01	PPRTV	17.8	
Methyl tert-Butyl Ether (MTBE)	2.60E-07	C	3.00E+00	IRIS	17.8	
Tetrachloroethylene	2.60E-07	I	4.00E-02	IRIS	17.8	
Trichloroethylene	4.10E-06	I	2.00E-03	IRIS	17.8	Mut
Vinyl Chloride	4.40E-06	I	1.00E-01	IRIS	17.8	Mut
Sum						

Chemical Properties

Output generated 06MAR2018:17:15:08

Chemical	CAS Number	Does the chemical meet the definition for volatility? (HLC>1E-5 or VP>1)	Does the chemical have inhalation toxicity data? (IUR and/or RfC)	MW (g/mol)	MW Ref	Vapor Pressure VP (mm Hg)	VP Ref	Pure Component Water Solubility S (mg/L)	S Ref
Acetone	67-64-1	Yes	Yes	58.08	PHYSPROP	2.32E+02	PHYSPROP	1.00E+06	PHYSPROP
Benzene	71-43-2	Yes	Yes	78.12	PHYSPROP	9.48E+01	PHYSPROP	1.79E+03	PHYSPROP
Chloroform	67-66-3	Yes	Yes	119.38	PHYSPROP	1.97E+02	PHYSPROP	7.95E+03	PHYSPROP
Cumene	98-82-8	Yes	Yes	120.20	PHYSPROP	4.50E+00	PHYSPROP	6.13E+01	PHYSPROP
Diisopropyl Ether	108-20-3	Yes	Yes	102.18	PHYSPROP	1.49E+02	PHYSPROP	8.80E+03	PHYSPROP
Methyl tert-Butyl Ether (MTBE)	1634-04-4	Yes	Yes	88.15	PHYSPROP	2.50E+02	PHYSPROP	5.10E+04	PHYSPROP
Tetrachloroethylene	127-18-4	Yes	Yes	165.83	PHYSPROP	1.85E+01	PHYSPROP	2.06E+02	PHYSPROP
Trichloroethylene	79-01-6	Yes	Yes	131.39	PHYSPROP	6.90E+01	PHYSPROP	1.28E+03	PHYSPROP
Vinyl Chloride	75-01-4	Yes	Yes	62.50	PHYSPROP	2.98E+03	EPI	8.80E+03	PHYSPROP

TABLE E-7 GROUNDWATER INVESTIGATION, NORTHWESTERN AREA (CHASTAIN CLEANERS SOURCE)

Chemical Properties

Output generated 06MAR2018:17:15:08

Chemical	MCL (ug/L)	Henry's Law Constant @25° C (atm-m^3/mole)	Henry's Law Constant (unitless)	Henry's Law Constant (17.8 ° C)	Henry's Law Constant Used in Calcs (unitless)	H`& HLC Ref	Enthalpy of vaporization @ groundwater temperature \ΔH$_{v,gw}$ (cal/mol)	Exponent for \ΔH$_{v,gw}$	Vapor Pressure VP (17.8 ° C) (mm Hg)
Acetone		3.50E-05	1.43E-03	1.07E-03	1.07E-03	PHYSPROP	-3754.86	0.36	5.43E+08
Benzene	5	5.55E-03	2.27E-01	1.66E-01	1.66E-01	PHYSPROP	-4046.69	0.35	2.92E+08
Chloroform	80	3.67E-03	1.50E-01	1.13E-01	1.13E-01	PHYSPROP	-3760.82	0.35	9.48E+08
Cumene		1.15E-02	4.70E-01	2.85E-01	2.85E-01	PHYSPROP	-6308.25	0.38	1.77E+07
Diisopropyl Ether		2.56E-03	1.05E-01	7.76E-02	7.76E-02	PHYSPROP	-3899.30	0.39	6.07E+08
Methyl tert-Butyl Ether (MTBE)		5.87E-04	2.40E-02	1.82E-02	1.82E-02	PHYSPROP	-3619.19	0.37	8.99E+08
Tetrachloroethylene	5	1.77E-02	7.24E-01	4.99E-01	4.99E-01	PHYSPROP	-4768.71	0.35	1.14E+08
Trichloroethylene	5	9.85E-03	4.03E-01	2.92E-01	2.92E-01	PHYSPROP	-4173.68	0.35	3.53E+08
Vinyl Chloride	2	2.78E-02	1.14E+00	9.60E-01	9.60E-01	PHYSPROP	-2332.08	0.34	8.46E+09

Chemical Properties

Output generated 06MAR2018:17:15:08

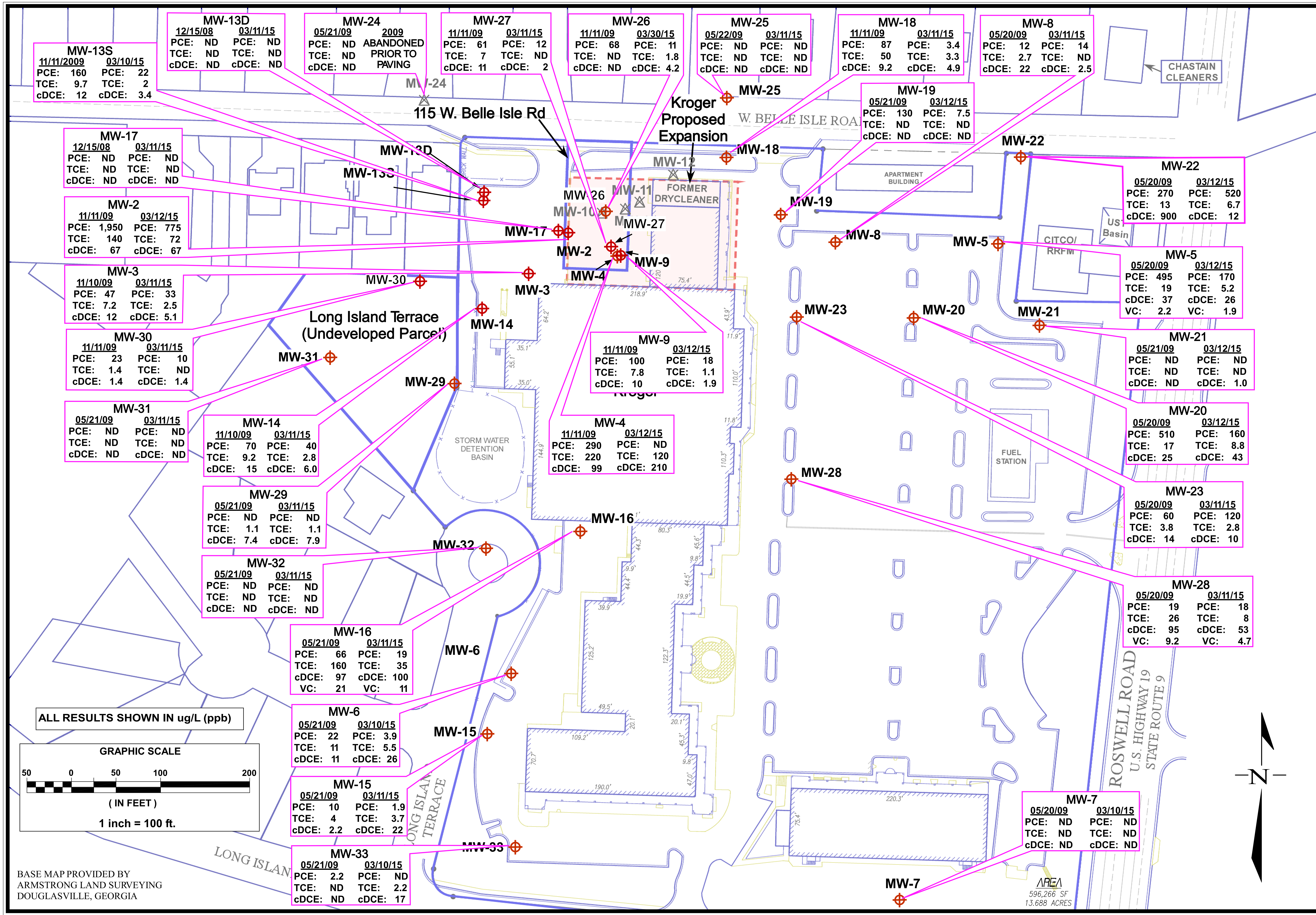
Chemical	Air Diffusivity D_{ia} (cm^2/s)	D_{ia} (17.8 ° C) (cm^2/s)	D_{ia} Used in Calcs (cm^2/s)	D_{ia} Ref	Water Diffusivity D_{iw} (cm^2/s)	D_{iw} (17.8 ° C) (cm^2/s)	D_{iw} Used in Calcs (cm^2/s)	D_{iw} Ref	Normal Boiling Point T_{boil} (K)
Acetone	1.06E-01	0.1021028	0.1021028	WATER9 (U.S. EPA, 2001)	1.15E-05	0.0000112	0.0000112	WATER9 (U.S. EPA, 2001)	329.15
Benzene	8.95E-02	0.0863061	0.0863061	WATER9 (U.S. EPA, 2001)	1.03E-05	0.00001	0.00001	WATER9 (U.S. EPA, 2001)	353.15
Chloroform	7.69E-02	0.0741465	0.0741465	WATER9 (U.S. EPA, 2001)	1.09E-05	0.0000106	0.0000106	WATER9 (U.S. EPA, 2001)	334.25
Cumene	6.03E-02	0.0581303	0.0581303	WATER9 (U.S. EPA, 2001)	7.86E-06	7.6667E-6	7.6667E-6	WATER9 (U.S. EPA, 2001)	425.55
Diisopropyl Ether	6.54E-02	0.063064	0.063064	WATER9 (U.S. EPA, 2001)	7.76E-06	7.5706E-6	7.5706E-6	WATER9 (U.S. EPA, 2001)	341.65
Methyl tert-Butyl Ether (MTBE)	7.53E-02	0.0725536	0.0725536	WATER9 (U.S. EPA, 2001)	8.59E-06	8.3827E-6	8.3827E-6	WATER9 (U.S. EPA, 2001)	328.15
Tetrachloroethylene	5.05E-02	0.0486469	0.0486469	WATER9 (U.S. EPA, 2001)	9.46E-06	9.2264E-6	9.2264E-6	WATER9 (U.S. EPA, 2001)	394.45
Trichloroethylene	6.87E-02	0.0661864	0.0661864	WATER9 (U.S. EPA, 2001)	1.02E-05	9.9739E-6	9.9739E-6	WATER9 (U.S. EPA, 2001)	360.35
Vinyl Chloride	1.07E-01	0.1032582	0.1032582	WATER9 (U.S. EPA, 2001)	1.20E-05	0.0000117	0.0000117	WATER9 (U.S. EPA, 2001)	259.85

Chemical Properties

Output generated 06MAR2018:17:15:08

Chemical	BP Ref	Critical Temperature T_{crit} (K)	T_{crit} Ref	Enthalpy of vaporization at the normal boiling point Δ$H_{v,b}$ (cal/mol)	Δ$H_{v,b}$ Ref	Organic Carbon Partition Coefficient K_{oc} (cm3/g)	K_{oc} Ref	Lower Explosive Limit LEL (% by volume)	LEL Ref
Acetone	PHYSPROP	5.08E+02	CRC89	6955.07	CRC89	2.364	EPI	2.50	CRC89
Benzene	PHYSPROP	5.62E+02	CRC89	7342.26	CRC89	145.8	EPI	1.20	CRC89
Chloroform	PHYSPROP	5.36E+02	CRC89	6988.00	Weast	31.82	EPI		
Cumene	PHYSPROP	6.31E+02	CRC89	10335.30	TOXNET	697.8	EPI	0.90	CRC89
Diisopropyl Ether	PHYSPROP	5.00E+02	CRC89	6955.07	CRC89	22.79	EPI	1.40	CRC89
Methyl tert-Butyl Ether (MTBE)	PHYSPROP	4.97E+02	CRC89	6677.82	CRC89	11.56	EPI	2.00	YAWS
Tetrachloroethylene	PHYSPROP	6.20E+02	YAWS	8288.00	Weast	94.94	EPI		
Trichloroethylene	PHYSPROP	5.71E+02	YAWS	7505.00	Weast	60.7	EPI	8.00	CRC89
Vinyl Chloride	PHYSPROP	4.25E+02	CRC89	4971.32	CRC89	21.73	EPI	3.60	CRC89

FIGURE 20



GROUNDWATER QUALITY MAP
MARCH 2015 & MOST RECENT PREVIOUS RESULTS

FOUNTAIN OAKS SHOPPING CENTER
4920 ROSWELL ROAD, SANDY SPRINGS, GA

PROJECT: 15513	FACILITY: HSI No. 10807
DATE REVISED: 10/19/15	DATE: 03/31/2015
SCALE: 1" = 100'	APPROVED:

MARION ENVIRONMENTAL, INC.
115 PARMENAS LANE
CHATTANOOGA, TN
423-499-4919
www.marionenv.com

FIGURE 20

ATTACHMENT

2015 GROUNDWATER DATA AND PROUCL INPUTS AND OUTPUTS

ATTACHMENT Table 1
Fountain Oaks Shopping Center
Groundwater Analytical Results - March 2015
(Originally Table 9 from the December 2015 CSR and VRP Application)

Well ID	Date	Acetone	Benzene	sec-Butylbenzene	Chloroform	Cumene (Isopropylbenzene)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Di-isopropyl ether	Methyl Ethyl Ketone (2-Butanone)	Methyl tert Butyl Ether	Tetrachloroethene	Trichloroethene	Vinyl chloride
MW-2	3/12/2015	<50	<1	<1	5.6	<1	65	<1	<1	<10	1.0	740	70	<1
(Dup.)	3/12/2015	<50	<1	<1	6.1	<1	68	<1	<1	<10	<1	810	73	<1
MW-3	3/11/2015	<50	<1	<1	10	<1	5.1	<1	<1	<10	1.0	33	2.5	<1
MW-4	3/12/2015	<50	<1	<1	<5	<1	210	1.2	<1	<10	<1	<10	120	<1
MW-5	3/12/2015	<50	1.5	<1	<5	<1	26	<1	<1	<10	<1	170	5.2	1.9
MW-6	3/10/2015	<50	<1	<1	<5	<1	26	<1	1.7	<10	45	3.9	5.5	<1
MW-7	3/10/2015	<50	<1	<1	<5	<1	<1	<1	<1	<10	<1	<1	<1	<1
MW-8	3/11/2015	<50	<1	<1	11	<1	2.5	<1	<1	<50	<1	14	<1	<1
MW-9	3/12/2015	<50	<1	<1	14	<1	1.9	<1	<1	<10	<1	18	1.1	<1
MW-13D	3/11/2015	89	<1	<1	<5	<1	<1	<1	<1	11	<1	<1	<1	<1
MW-13S	3/10/2015	<50	<1	<1	12	<1	3.0	<1	<1	<10	<1	21	1.8	<1
(Dup.)	3/10/2015	<50	<1	<1	11	<1	3.7	<1	<1	<10	<1	23	2.1	<1
MW-14	3/11/2015	<50	<1	<1	9.7	<1	6.0	<1	<1	<10	<1	40	2.8	<1
MW-15	3/11/2015	<50	<1	<1	<5	<1	22	<1	<1	<10	<1	1.9	3.7	<1
MW-16	3/11/2015	54	2.2	<1	<5	<1	100	<1	5.7	<10	340	19	35	11
MW-17	3/11/2015	<50	<1	<1	<5	<1	<1	<1	<1	<10	<1	<1	<1	<1
MW-18	3/11/2015	<50	<1	<1	<5	<1	4.9	<1	<1	<1	<1	3.4	3.3	<1
MW-19	3/12/2015	<50	<1	<1	11	<1	<1	<1	<1	<10	<1	7.5	<1	<1
MW-20	3/12/2015	<50	15	<1	<5	<1	43	<1	<1	<10	2.5	160	8.8	2.2
MW-21	3/12/2015	<50	24	<1	<5	<1	1.0	<1	46	<10	2500	<1	<1	<1
MW-22	3/12/2015	<50	<1	<1	8.9	<1	12	<1	<1	<10	<1	520	6.7	<1
MW-23	3/11/2015	<50	<1	<1	5.6	<1	10	<1	<1	<10	<1	120	2.8	<1
MW-25	3/11/2015	<50	<1	<10	<5	<1	<1	<1	<1	<10	<1	<1	<1	<1
MW-26	3/30/2015	<50	<1	<10	<5	<1	4.2	<1	<1	<10	<1	11	1.8	<1
MW-27	3/11/2015	<50	<1	<1	12	<1	2.0	<1	<1	<10	<1	12	<1	<1
MW-28	3/11/2015	86	130	1.5	<5	2.6	48	<1	11	<10	820	16	7.0	3.9
(Dup.)	3/11/2015	<50	140	1.9	<5	3.2	58	<1	12	<10	890	20	8.9	4.7
MW-29	3/11/2015	<50	<1	<10	<5	<1	7.9	<1	1.0	<10	15	<1	1.1	<1
MW-30	3/11/2015	<50	<1	<10	<5	<1	1.4	<1	<1	<10	<1	10	<1	<1
MW-31	3/11/2015	<50	<1	<10	<5	<1	<1	<1	<1	<10	<1	<1	<1	<1
MW-32	3/11/2015	<50	<1	<10	<5	<1	<1	<1	<1	<10	1.9	<1	<1	<1
MW-33	3/10/2015	<50	<1	<10	<5	<1	17	<1	<1	<10	3.3	<1	2.2	<1

NOTES: (1) Well #'s 1, 10, 11 & 12 abandoned/destroyed during 2007-2008 soil remediation. Well #24 abandoned/destroyed during 2009 road paving. (2) The "less than" symbol (<) indicates that the analyte was not detected above the given numerical method detection limit (MDL).

[Blue] Monitoring wells within Northeastern Area (upgradient source) with detections of COPCs: MW-5, MW-6, MW-8, MW-15, MW-16, MW-18, MW-19, MW-20, MW-21, MW-22, MW-23, MW-28, and MW-33

[Green] Monitoring wells within Fountain Oaks Dry Cleaning Area with detections of COPCs: MW-2, MW-3, MW-4, MW-9, MW-13S, MW-14, MW-26, MW-27, MW-29, and MW-30

ATTACHMENT Table 2
Groundwater Analytical Data for ProUCL
Fountain Oaks Dry Cleaning Site

Well ID	Chloroform	D_Chloroform	cis-1,2-DCE	trans-1,2-DCE	Di-isoproyl ether	MTBE	PCE	D_PCE	TCE	D_TCE
MW-2	6.1	1	68	1	1	1	810	1	73	1
MW-3	10	1	5.1	1	1	1	33	1	2.5	1
MW-4	5	0	210	1.2	1	1	10	0	120	1
MW-9	14	1	1.9	1	1	1	18	1	1.1	1
MW-13S	12	1	3.7	1	1	1	23	1	2.1	1
MW-14	9.7	1	6	1	1	1	40	1	2.8	1
MW-26	5	0	4.2	1	1	1	11	1	1.8	1
MW-27	12	1	2	1	1	1	12	1	1	0
MW-29	5	0	7.9	1	1	15	1	0	1.1	1
MW-30	5	0	1.4	1	1	1	10	1	1	0

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.112/29/2016 1:48:50 PM
From File	Table 9 GW 2015 Data_b.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operation	2000

Chloroform

General Statistics

Total Number of Observations	10	Number of Distinct Observations	6
Number of Detects	6	Number of Non-Detects	4
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	6.1	Minimum Non-Detect	5
Maximum Detect	14	Maximum Non-Detect	5
Variance Detects	7.379	Percent Non-Detects	40%
Mean Detects	10.63	SD Detects	2.716
Median Detects	11	CV Detects	0.255
Skewness Detects	-0.763	Kurtosis Detects	0.933
Mean of Logged Detects	2.332	SD of Logged Detects	0.29

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.944	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.199	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	8.38	KM Standard Error of Mean	1.165
KM SD	3.362	95% KM (BCA) UCL	10.1
95% KM (t) UCL	10.52	95% KM (Percentile Bootstrap) UCL	10.17
95% KM (z) UCL	10.3	95% KM Bootstrap t UCL	10.24
90% KM Chebyshev UCL	11.87	95% KM Chebyshev UCL	13.46
97.5% KM Chebyshev UCL	15.65	99% KM Chebyshev UCL	19.97

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.38	Anderson-Darling GOF Test	
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.225	Kolmogorov-Smirnov GOF	
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	15.78	k star (bias corrected MLE)	8.002
Theta hat (MLE)	0.674	Theta star (bias corrected MLE)	1.329
nu hat (MLE)	189.4	nu star (bias corrected)	96.03
Mean (detects)	10.63		

Gamma ROS Statistics using Imputed Non-Detects
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	2.458	Mean	8.104
Maximum	14	Median	7.9
SD	3.936	CV	0.486
k hat (MLE)	4.032	k star (bias corrected MLE)	2.889
Theta hat (MLE)	2.01	Theta star (bias corrected MLE)	2.805
nu hat (MLE)	80.64	nu star (bias corrected)	57.78
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (57.78, α)	41.31	Adjusted Chi Square Value (57.78, β)	38.9
95% Gamma Approximate UCL (use when n>=50)	11.34	95% Gamma Adjusted UCL (use when n<50)	12.04

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	8.38	SD (KM)	3.362
Variance (KM)	11.31	SE of Mean (KM)	1.165
k hat (KM)	6.211	k star (KM)	4.415
nu hat (KM)	124.2	nu star (KM)	88.29
theta hat (KM)	1.349	theta star (KM)	1.898
80% gamma percentile (KM)	11.42	90% gamma percentile (KM)	13.72
95% gamma percentile (KM)	15.83	99% gamma percentile (KM)	20.31

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (88.29, α)	67.63	Adjusted Chi Square Value (88.29, β)	64.5
95% Gamma Approximate KM-UCL (use when n>=	10.94	95% Gamma Adjusted KM-UCL (use when n<50)	11.47

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.886	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.252	Lilliefors GOF Test
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	8.385	Mean in Log Scale	2.038
SD in Original Scale	3.583	SD in Log Scale	0.452
95% t UCL (assumes normality of ROS data)	10.46	95% Percentile Bootstrap UCL	10.13
95% BCA Bootstrap UCL	10.23	95% Bootstrap t UCL	10.56
95% H-UCL (Log ROS)	11.76		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.043	KM Geo Mean	7.713
KM SD (logged)	0.409	95% Critical H Value (KM-Log)	2.1
KM Standard Error of Mean (logged)	0.142	95% H-UCL (KM -Log)	11.17
KM SD (logged)	0.409	95% Critical H Value (KM-Log)	2.1
KM Standard Error of Mean (logged)	0.142		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	7.38	Mean in Log Scale	1.766
SD in Original Scale	4.663	SD in Log Scale	0.762
95% t UCL (Assumes normality)	10.08	95% H-Stat UCL	15.29

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use
95% KM (t) UCL **10.52**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PCE

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
Number of Detects	8	Number of Non-Detects	2
Number of Distinct Detects	8	Number of Distinct Non-Detects	2
Minimum Detect	10	Minimum Non-Detect	1
Maximum Detect	810	Maximum Non-Detect	10
Variance Detects	77932	Percent Non-Detects	20%
Mean Detects	119.6	SD Detects	279.2
Median Detects	20.5	CV Detects	2.334
Skewness Detects	2.82	Kurtosis Detects	7.964
Mean of Logged Detects	3.387	SD of Logged Detects	1.431

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.453	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.487	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.283	Detected Data Not Normal at 5% Significance Level	
Detected Data Not Normal at 5% Significance Level			
Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs			
KM Mean	95.9	KM Standard Error of Mean	80.57
KM SD	238.3	95% KM (BCA) UCL	257.2
95% KM (t) UCL	243.6	95% KM (Percentile Bootstrap) UCL	252.8
95% KM (z) UCL	228.4	95% KM Bootstrap t UCL	2257
90% KM Chebyshev UCL	337.6	95% KM Chebyshev UCL	447.1
97.5% KM Chebyshev UCL	599.1	99% KM Chebyshev UCL	897.6
Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	1.55	Anderson-Darling GOF Test	
5% A-D Critical Value	0.769	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.42	Kolmogorov-Smirnov GOF	
5% K-S Critical Value	0.311	Detected Data Not Gamma Distributed at 5% Significance Level	
Detected Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics on Detected Data Only			
k hat (MLE)	0.46	k star (bias corrected MLE)	0.371
Theta hat (MLE)	259.8	Theta star (bias corrected MLE)	322.4
nu hat (MLE)	7.366	nu star (bias corrected)	5.937
Mean (detects)	119.6		
Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	0.01	Mean	95.7
Maximum	810	Median	15
SD	251.3	CV	2.626
k hat (MLE)	0.255	k star (bias corrected MLE)	0.245
Theta hat (MLE)	374.9	Theta star (bias corrected MLE)	390
nu hat (MLE)	5.106	nu star (bias corrected)	4.907
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (4.91, α)	1.11	Adjusted Chi Square Value (4.91, β)	0.832
95% Gamma Approximate UCL (use when n>=50)	423.2	95% Gamma Adjusted UCL (use when n<50)	564.7
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	95.9	SD (KM)	238.3
Variance (KM)	56804	SE of Mean (KM)	80.57
k hat (KM)	0.162	k star (KM)	0.18
nu hat (KM)	3.238	nu star (KM)	3.6
theta hat (KM)	592.3	theta star (KM)	532.8
80% gamma percentile (KM)	119	90% gamma percentile (KM)	289.2
95% gamma percentile (KM)	507.3	99% gamma percentile (KM)	1119
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (3.60, α)	0.57	Adjusted Chi Square Value (3.60, β)	0.401
95% Gamma Approximate KM-UCL (use when n>=	605.3	95% Gamma Adjusted KM-UCL (use when n<50)	860.3
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Test Statistic	0.74	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.291	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.283	Detected Data Not Lognormal at 5% Significance Level	
Detected Data Not Lognormal at 5% Significance Level			
Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	95.96	Mean in Log Scale	2.765
SD in Original Scale	251.2	SD in Log Scale	1.82
95% t UCL (assumes normality of ROS data)	241.6	95% Percentile Bootstrap UCL	253.2
95% BCA Bootstrap UCL	334.7	95% Bootstrap t UCL	2277

95% H-UCL (Log ROS)	1689		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.709	KM Geo Mean	15.02
KM SD (logged)	1.808	95% Critical H Value (KM-Log)	4.933
KM Standard Error of Mean (logged)	0.611	95% H-UCL (KM -Log)	1506
KM SD (logged)	1.808	95% Critical H Value (KM-Log)	4.933
KM Standard Error of Mean (logged)	0.611		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	96.25	Mean in Log Scale	2.801
SD in Original Scale	251.1	SD in Log Scale	1.847
95% t UCL (Assumes normality)	241.8	95% H-Stat UCL	2003

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	**447.1**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TCE

General Statistics

Total Number of Observations	10	Number of Distinct Observations	8
Number of Detects	8	Number of Non-Detects	2
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	1.1	Minimum Non-Detect	1
Maximum Detect	120	Maximum Non-Detect	1
Variance Detects	2076	Percent Non-Detects	20%
Mean Detects	25.55	SD Detects	45.56
Median Detects	2.3	CV Detects	1.783
Skewness Detects	1.752	Kurtosis Detects	1.985
Mean of Logged Detects	1.568	SD of Logged Detects	1.87

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.62	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.441	Lilliefors GOF Test
5% Lilliefors Critical Value	0.283	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	20.64	KM Standard Error of Mean	13.31
KM SD	39.36	95% KM (BCA) UCL	44.65
95% KM (t) UCL	45.03	95% KM (Percentile Bootstrap) UCL	44.24
95% KM (z) UCL	42.53	95% KM Bootstrap t UCL	1163
90% KM Chebyshev UCL	60.56	95% KM Chebyshev UCL	78.65
97.5% KM Chebyshev UCL	103.7	99% KM Chebyshev UCL	153

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.32	Anderson-Darling GOF Test
5% A-D Critical Value	0.781	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.428	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.313	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.394	k star (bias corrected MLE)	0.33
Theta hat (MLE)	64.79	Theta star (bias corrected MLE)	77.47
nu hat (MLE)	6.309	nu star (bias corrected)	5.277
Mean (detects)	25.55		

Gamma ROS Statistics using Imputed Non-Detects
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	20.44
Maximum	120	Median	1.95
SD	41.6	CV	2.035
k hat (MLE)	0.263	k star (bias corrected MLE)	0.25
Theta hat (MLE)	77.86	Theta star (bias corrected MLE)	81.62
nu hat (MLE)	5.251	nu star (bias corrected)	5.009
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (5.01, α)	1.156	Adjusted Chi Square Value (5.01, β)	0.87
95% Gamma Approximate UCL (use when n>=50)	88.55	95% Gamma Adjusted UCL (use when n<50)	117.7

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	20.64	SD (KM)	39.36
Variance (KM)	1550	SE of Mean (KM)	13.31
k hat (KM)	0.275	k star (KM)	0.259
nu hat (KM)	5.499	nu star (KM)	5.182
theta hat (KM)	75.07	theta star (KM)	79.65
80% gamma percentile (KM)	30.35	90% gamma percentile (KM)	61.78
95% gamma percentile (KM)	98.84	99% gamma percentile (KM)	197

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.18, α)	1.237	Adjusted Chi Square Value (5.18, β)	0.937
95% Gamma Approximate KM-UCL (use when n>=	86.44	95% Gamma Adjusted KM-UCL (use when n<50)	114.1

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.739	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.363	Lilliefors GOF Test
5% Lilliefors Critical Value	0.283	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	20.46	Mean in Log Scale	0.725
SD in Original Scale	41.59	SD in Log Scale	2.437
95% t UCL (assumes normality of ROS data)	44.57	95% Percentile Bootstrap UCL	44.14
95% BCA Bootstrap UCL	51.22	95% Bootstrap t UCL	889.5
95% H-UCL (Log ROS)	7676		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.254	KM Geo Mean	3.506
KM SD (logged)	1.685	95% Critical H Value (KM-Log)	4.641
KM Standard Error of Mean (logged)	0.57	95% H-UCL (KM -Log)	196.8
KM SD (logged)	1.685	95% Critical H Value (KM-Log)	4.641
KM Standard Error of Mean (logged)	0.57		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	20.54	Mean in Log Scale	1.116
SD in Original Scale	41.55	SD in Log Scale	1.905
95% t UCL (Assumes normality)	44.62	95% H-Stat UCL	497.5

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use
975% KM (Chebyshev) UCL **103.7**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ATTACHMENT Table 4
Groundwater Analytical Data for ProUCL
Northeastern Portion Fountain Oaks Shopping Center

Well ID	**Benzene**	D_Benzene	**Chloroform**	**D_Chloroform**	**Di-isoproyl ether**	D_Di-isoproyl ether	**MTBE**	D_MTBE	**PCE**	**D_PCE**	**TCE**	D_TCE	**VC**	D_VC
MW-5	1.5	1	5	0	1	0	1	0	170	1	5.2	1	1.9	1
MW-6	1	0	5	0	1.7	1	45	1	3.9	1	5.5	1	1	0
MW-8	1	0	11	1	1	0	1	0	14	1	1	0	1	0
MW-15	1	0	5	0	1	0	1	0	1.9	1	3.7	1	1	0
MW-16	2.2	1	5	0	5.7	1	340	1	19	1	35	1	11	1
MW-18	1	0	5	0	1	0	1	0	3.4	1	3.3	1	1	0
MW-19	1	0	11	1	1	0	1	0	7.5	1	1	0	1	0
MW-20	15	1	5	0	1	0	2.5	1	160	1	8.8	1	2.2	1
MW-21	24	1	5	0	46	1	2500	1	1	0	1	0	1	0
MW-22	1	0	8.9	1	1	0	1	0	520	1	6.7	1	1	0
MW-23	1	0	5.6	1	1	0	1	0	120	1	2.8	1	1	0
MW-28	140	1	5	0	12	1	890	1	20	1	8.9	1	4.7	1
MW-33	1	0	5	0	1	0	3.3	1	1	0	2.2	1	1	0

UCL Statistics for Data Sets with Non-Detects

User Selected Options			
Date/Time of Computation	ProUCL 5.112/29/2016 12:22:21 PM		
From File	Table 9 GW 2015 Data_c.xls		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operation	2000		

Benzene

General Statistics			
Total Number of Observations	13	Number of Distinct Observations	6
Number of Detects	5	Number of Non-Detects	8
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	1.5	Minimum Non-Detect	1
Maximum Detect	140	Maximum Non-Detect	1
Variance Detects	3433	Percent Non-Detects	61.54%
Mean Detects	36.54	SD Detects	58.59
Median Detects	15	CV Detects	1.604
Skewness Detects	2.096	Kurtosis Detects	4.485
Mean of Logged Detects	2.404	SD of Logged Detects	1.853
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.69	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.385	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.343	Detected Data Not Normal at 5% Significance Level	
Detected Data Not Normal at 5% Significance Level			
Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs			
KM Mean	14.67	KM Standard Error of Mean	11.42
KM SD	36.81	95% KM (BCA) UCL	36.11
95% KM (t) UCL	35.02	95% KM (Percentile Bootstrap) UCL	34.96
95% KM (z) UCL	33.45	95% KM Bootstrap t UCL	98.24
90% KM Chebyshev UCL	48.92	95% KM Chebyshev UCL	64.43
97.5% KM Chebyshev UCL	85.96	99% KM Chebyshev UCL	128.3
Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	0.351	Anderson-Darling GOF Test	
5% A-D Critical Value	0.71	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.225	Kolmogorov-Smirnov GOF	
5% K-S Critical Value	0.371	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics on Detected Data Only			
k hat (MLE)	0.528	k star (bias corrected MLE)	0.344
Theta hat (MLE)	69.26	Theta star (bias corrected MLE)	106.1
nu hat (MLE)	5.276	nu star (bias corrected)	3.444
Mean (detects)	36.54		
Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	0.01	Mean	14.06
Maximum	140	Median	0.01
SD	38.56	CV	2.742
k hat (MLE)	0.166	k star (bias corrected MLE)	0.179
Theta hat (MLE)	84.56	Theta star (bias corrected MLE)	78.46
nu hat (MLE)	4.323	nu star (bias corrected)	4.659
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (4.66, α)	0.998	Adjusted Chi Square Value (4.66, β)	0.783
95% Gamma Approximate UCL (use when n>=50)	65.64	95% Gamma Adjusted UCL (use when n<50)	83.71
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	14.67	SD (KM)	36.81
Variance (KM)	1355	SE of Mean (KM)	11.42
k hat (KM)	0.159	k star (KM)	0.173
nu hat (KM)	4.128	nu star (KM)	4.509
theta hat (KM)	92.39	theta star (KM)	84.59
80% gamma percentile (KM)	17.77	90% gamma percentile (KM)	44.14
95% gamma percentile (KM)	78.28	99% gamma percentile (KM)	174.6
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (4.51, α)	0.932	Adjusted Chi Square Value (4.51, β)	0.727
95% Gamma Approximate KM-UCL (use when n>=	70.93	95% Gamma Adjusted KM-UCL (use when n<50)	90.97
Lognormal GOF Test on Detected Observations Only			

Shapiro Wilk Test Statistic	0.939	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.208	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	
Detected Data appear Lognormal at 5% Significance Level			

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	14.1	Mean in Log Scale	-1.652
SD in Original Scale	38.54	SD in Log Scale	3.951
95% t UCL (assumes normality of ROS data)	33.15	95% Percentile Bootstrap UCL	32.97
95% BCA Bootstrap UCL	46.82	95% Bootstrap t UCL	132.1
95% H-UCL (Log ROS)	13966591		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.925	KM Geo Mean	2.521
KM SD (logged)	1.557	95% Critical H Value (KM-Log)	3.889
KM Standard Error of Mean (logged)	0.483	95% H-UCL (KM -Log)	48.68
KM SD (logged)	1.557	95% Critical H Value (KM-Log)	3.889
KM Standard Error of Mean (logged)	0.483		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	14.36	Mean in Log Scale	0.498
SD in Original Scale	38.44	SD in Log Scale	1.899
95% t UCL (Assumes normality)	33.36	95% H-Stat UCL	121.2

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	95.73	**95% Hall's Bootstrap**	**48.68**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chloroform

General Statistics

Total Number of Observations	13	Number of Distinct Observations	4
Number of Detects	4	Number of Non-Detects	9
Number of Distinct Detects	3	Number of Distinct Non-Detects	1
Minimum Detect	5.6	Minimum Non-Detect	5
Maximum Detect	11	Maximum Non-Detect	5
Variance Detects	6.503	Percent Non-Detects	69.23%
Mean Detects	9.125	SD Detects	2.55
Median Detects	9.95	CV Detects	0.279
Skewness Detects	-1.231	Kurtosis Detects	0.621
Mean of Logged Detects	2.176	SD of Logged Detects	0.318

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.846	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.269	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level	
Detected Data appear Normal at 5% Significance Level			

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	6.269	KM Standard Error of Mean	0.725
KM SD	2.264	95% KM (BCA) UCL	N/A
95% KM (t) UCL	7.561	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	7.462	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	8.444	95% KM Chebyshev UCL	9.43
97.5% KM Chebyshev UCL	10.8	99% KM Chebyshev UCL	13.48

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.489	Anderson-Darling GOF Test	
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.294	Kolmogorov-Smirnov GOF	
5% K-S Critical Value	0.395	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			

Gamma Statistics on Detected Data Only

k hat (MLE)	14.51	k star (bias corrected MLE)	3.793
Theta hat (MLE)	0.629	Theta star (bias corrected MLE)	2.406
nu hat (MLE)	116	nu star (bias corrected)	30.34
Mean (detects)	9.125		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	4.057
Maximum	11	Median	3.113
SD	4.035	CV	0.995
k hat (MLE)	0.45	k star (bias corrected MLE)	0.398
Theta hat (MLE)	9.014	Theta star (bias corrected MLE)	10.21
nu hat (MLE)	11.7	nu star (bias corrected)	10.34
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (10.34, α)	4.153	Adjusted Chi Square Value (10.34, β)	3.611
95% Gamma Approximate UCL (use when n>=50)	10.1	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	6.269	SD (KM)	2.264
Variance (KM)	5.125	SE of Mean (KM)	0.725
k hat (KM)	7.669	k star (KM)	5.95
nu hat (KM)	199.4	nu star (KM)	154.7
theta hat (KM)	0.818	theta star (KM)	1.054
80% gamma percentile (KM)	8.268	90% gamma percentile (KM)	9.705
95% gamma percentile (KM)	11.01	99% gamma percentile (KM)	13.73

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (154.71, α)	127	Adjusted Chi Square Value (154.71, β)	123.4
95% Gamma Approximate KM-UCL (use when n>=	7.64	95% Gamma Adjusted KM-UCL (use when n<50)	7.861

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.821	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.262	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	4.961	Mean in Log Scale	1.402
SD in Original Scale	3.314	SD in Log Scale	0.661
95% t UCL (assumes normality of ROS data)	6.6	95% Percentile Bootstrap UCL	6.527
95% BCA Bootstrap UCL	6.612	95% Bootstrap t UCL	7.087
95% H-UCL (Log ROS)	7.862		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.784	KM Geo Mean	5.953
KM SD (logged)	0.303	95% Critical H Value (KM-Log)	1.912
KM Standard Error of Mean (logged)	0.097	95% H-UCL (KM -Log)	7.366
KM SD (logged)	0.303	95% Critical H Value (KM-Log)	1.912
KM Standard Error of Mean (logged)	0.097		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	4.538	Mean in Log Scale	1.304
SD in Original Scale	3.428	SD in Log Scale	0.626
95% t UCL (Assumes normality)	6.233	95% H-Stat UCL	6.751

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use
95% KM (t) UCL **7.561**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Di-isoproyl ether

General Statistics

Total Number of Observations	13	Number of Distinct Observations	5
Number of Detects	4	Number of Non-Detects	9
Number of Distinct Detects	4	Number of Distinct Non-Detects	1
Minimum Detect	1.7	Minimum Non-Detect	1
Maximum Detect	46	Maximum Non-Detect	1
Variance Detects	408.7	Percent Non-Detects	69.23%
Mean Detects	16.35	SD Detects	20.22
Median Detects	8.85	CV Detects	1.236
Skewness Detects	1.745	Kurtosis Detects	3.106
Mean of Logged Detects	2.146	SD of Logged Detects	1.381

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.809	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.335	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	5.723	KM Standard Error of Mean	3.85
KM SD	12.02	95% KM (BCA) UCL	N/A
95% KM (t) UCL	12.58	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	12.06	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	17.27	95% KM Chebyshev UCL	22.5
97.5% KM Chebyshev UCL	29.77	99% KM Chebyshev UCL	44.03

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.25	Anderson-Darling GOF Test	
5% A-D Critical Value	0.668	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.217	Kolmogorov-Smirnov GOF	
5% K-S Critical Value	0.403	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.902	k star (bias corrected MLE)	0.392
Theta hat (MLE)	18.13	Theta star (bias corrected MLE)	41.7
nu hat (MLE)	7.215	nu star (bias corrected)	3.137
Mean (detects)	16.35		

Gamma ROS Statistics using Imputed Non-Detects
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	5.038
Maximum	46	Median	0.01
SD	12.8	CV	2.54
k hat (MLE)	0.18	k star (bias corrected MLE)	0.19
Theta hat (MLE)	27.92	Theta star (bias corrected MLE)	26.51
nu hat (MLE)	4.69	nu star (bias corrected)	4.941
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (4.94, α)	1.125	Adjusted Chi Square Value (4.94, β)	0.891
95% Gamma Approximate UCL (use when n>=50)	22.12	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	5.723	SD (KM)	12.02
Variance (KM)	144.5	SE of Mean (KM)	3.85
k hat (KM)	0.227	k star (KM)	0.226
nu hat (KM)	5.893	nu star (KM)	5.867
theta hat (KM)	25.25	theta star (KM)	25.36
80% gamma percentile (KM)	7.986	90% gamma percentile (KM)	17.27
95% gamma percentile (KM)	28.54	99% gamma percentile (KM)	58.97

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.87, α)	1.572	Adjusted Chi Square Value (5.87, β)	1.278
95% Gamma Approximate KM-UCL (use when n>=	21.36	95% Gamma Adjusted KM-UCL (use when n<50)	26.27

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	1	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.153	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	5.112	Mean in Log Scale	-1.803
SD in Original Scale	12.77	SD in Log Scale	3.344
95% t UCL (assumes normality of ROS data)	11.42	95% Percentile Bootstrap UCL	11.69
95% BCA Bootstrap UCL	15.26	95% Bootstrap t UCL	41.08
95% H-UCL (Log ROS)	74211		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.66	KM Geo Mean	1.935
KM SD (logged)	1.192	95% Critical H Value (KM-Log)	3.192
KM Standard Error of Mean (logged)	0.382	95% H-UCL (KM -Log)	11.81
KM SD (logged)	1.192	95% Critical H Value (KM-Log)	3.192
KM Standard Error of Mean (logged)	0.382		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	5.377	Mean in Log Scale	0.18

SD in Original Scale	12.65	SD in Log Scale	1.529
95% t UCL (Assumes normality)	11.63	95% H-Stat UCL	20.95

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	**12.58**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

MTBE

General Statistics

Total Number of Observations	13	Number of Distinct Observations	7
Number of Detects	6	Number of Non-Detects	7
Number of Distinct Detects	6	Number of Distinct Non-Detects	1
Minimum Detect	2.5	Minimum Non-Detect	1
Maximum Detect	2500	Maximum Non-Detect	1
Variance Detects	955467	Percent Non-Detects	53.85%
Mean Detects	630.1	SD Detects	977.5
Median Detects	192.5	CV Detects	1.551
Skewness Detects	1.875	Kurtosis Detects	3.46
Mean of Logged Detects	4.394	SD of Logged Detects	2.907

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.74	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.283	Lilliefors GOF Test
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	291.4	KM Standard Error of Mean	207.4
KM SD	682.5	95% KM (BCA) UCL	607.6
95% KM (t) UCL	661	95% KM (Percentile Bootstrap) UCL	630
95% KM (z) UCL	632.5	95% KM Bootstrap t UCL	2166
90% KM Chebyshev UCL	913.5	95% KM Chebyshev UCL	1195
97.5% KM Chebyshev UCL	1586	99% KM Chebyshev UCL	2355

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.276	Anderson-Darling GOF Test
5% A-D Critical Value	0.762	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.197	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.356	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.331	k star (bias corrected MLE)	0.276
Theta hat (MLE)	1906	Theta star (bias corrected MLE)	2279
nu hat (MLE)	3.968	nu star (bias corrected)	3.317
Mean (detects)	630.1		

Gamma ROS Statistics using Imputed Non-Detects
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	290.8
Maximum	2500	Median	0.01
SD	710.6	CV	2.443
k hat (MLE)	0.128	k star (bias corrected MLE)	0.15
Theta hat (MLE)	2267	Theta star (bias corrected MLE)	1939
nu hat (MLE)	3.336	nu star (bias corrected)	3.899
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (3.90, α)	0.682	Adjusted Chi Square Value (3.90, β)	0.519
95% Gamma Approximate UCL (use when n>=50)	1662	95% Gamma Adjusted UCL (use when n<50)	2185

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	291.4	SD (KM)	682.5
Variance (KM)	465854	SE of Mean (KM)	207.4
k hat (KM)	0.182	k star (KM)	0.191
nu hat (KM)	4.738	nu star (KM)	4.978
theta hat (KM)	1599	theta star (KM)	1522
80% gamma percentile (KM)	374.9	90% gamma percentile (KM)	880.7
95% gamma percentile (KM)	1518	99% gamma percentile (KM)	3286

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.98, α)	1.142	Adjusted Chi Square Value (4.98, β)	0.905
95% Gamma Approximate KM-UCL (use when n>=	1270	95% Gamma Adjusted KM-UCL (use when n<50)	1602

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.907	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.198	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	290.9	Mean in Log Scale	-0.474
SD in Original Scale	710.6	SD in Log Scale	5.49
95% t UCL (assumes normality of ROS data)	642.2	95% Percentile Bootstrap UCL	629.7
95% BCA Bootstrap UCL	906.6	95% Bootstrap t UCL	2264
95% H-UCL (Log ROS)	8.03E+14		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.028	KM Geo Mean	7.597
KM SD (logged)	2.837	95% Critical H Value (KM-Log)	6.592
KM Standard Error of Mean (logged)	0.862	95% H-UCL (KM -Log)	93858
KM SD (logged)	2.837	95% Critical H Value (KM-Log)	6.592
KM Standard Error of Mean (logged)	0.862		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	291.1	Mean in Log Scale	1.655
SD in Original Scale	710.5	SD in Log Scale	3.238
95% t UCL (Assumes normality)	642.3	95% H-Stat UCL	1064210

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use
95% KM (t) UCL **661**

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

PCE

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
Number of Detects	11	Number of Non-Detects	2
Number of Distinct Detects	11	Number of Distinct Non-Detects	1
Minimum Detect	1.9	Minimum Non-Detect	1
Maximum Detect	520	Maximum Non-Detect	1
Variance Detects	24207	Percent Non-Detects	15.38%
Mean Detects	94.52	SD Detects	155.6
Median Detects	19	CV Detects	1.646
Skewness Detects	2.383	Kurtosis Detects	6.219
Mean of Logged Detects	3.188	SD of Logged Detects	1.865

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.652	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.32	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.251	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	80.13	KM Standard Error of Mean	40.89
KM SD	140.6	95% KM (BCA) UCL	151.5
95% KM (t) UCL	153	95% KM (Percentile Bootstrap) UCL	150.1
95% KM (z) UCL	147.4	95% KM Bootstrap t UCL	232.7
90% KM Chebyshev UCL	202.8	95% KM Chebyshev UCL	258.4
97.5% KM Chebyshev UCL	335.5	99% KM Chebyshev UCL	487

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.587	Anderson-Darling GOF Test	
5% A-D Critical Value	0.787	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.267	Kolmogorov-Smirnov GOF	
5% K-S Critical Value	0.27	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.471	k star (bias corrected MLE)	0.403
Theta hat (MLE)	200.6	Theta star (bias corrected MLE)	234.3
nu hat (MLE)	10.37	nu star (bias corrected)	8.874
Mean (detects)	94.52		

Gamma ROS Statistics using Imputed Non-Detects
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	79.98
Maximum	520	Median	14
SD	146.4	CV	1.83
k hat (MLE)	0.29	k star (bias corrected MLE)	0.274
Theta hat (MLE)	275.9	Theta star (bias corrected MLE)	291.6
nu hat (MLE)	7.536	nu star (bias corrected)	7.131
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (7.13, α)	2.242	Adjusted Chi Square Value (7.13, β)	1.873
95% Gamma Approximate UCL (use when n>=50)	254.3	95% Gamma Adjusted UCL (use when n<50)	304.5

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	80.13	SD (KM)	140.6
Variance (KM)	19759	SE of Mean (KM)	40.89
k hat (KM)	0.325	k star (KM)	0.301
nu hat (KM)	8.449	nu star (KM)	7.832
theta hat (KM)	246.6	theta star (KM)	266
80% gamma percentile (KM)	123	90% gamma percentile (KM)	236.2
95% gamma percentile (KM)	366.1	99% gamma percentile (KM)	703.4

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.83, α)	2.638	Adjusted Chi Square Value (7.83, β)	2.229
95% Gamma Approximate KM-UCL (use when n>=	237.9	**95% Gamma Adjusted KM-UCL (use when n<50**	**281.6**

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.935	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.85	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.178	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.251	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	80.02	Mean in Log Scale	2.5
SD in Original Scale	146.4	SD in Log Scale	2.4
95% t UCL (assumes normality of ROS data)	152.4	95% Percentile Bootstrap UCL	149.1
95% BCA Bootstrap UCL	188.2	95% Bootstrap t UCL	233.6
95% H-UCL (Log ROS)	10997		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.698	KM Geo Mean	14.85
KM SD (logged)	1.999	95% Critical H Value (KM-Log)	4.804
KM Standard Error of Mean (logged)	0.582	95% H-UCL (KM -Log)	1753
KM SD (logged)	1.999	95% Critical H Value (KM-Log)	4.804
KM Standard Error of Mean (logged)	0.582		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	80.05	Mean in Log Scale	2.591
SD in Original Scale	146.4	SD in Log Scale	2.241
95% t UCL (Assumes normality)	152.4	95% H-Stat UCL	5175

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	265.7	95% Hall's Bootstrap	1753

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TCE

General Statistics

Total Number of Observations	13	Number of Distinct Observations	11
Number of Detects	10	Number of Non-Detects	3

Number of Distinct Detects	10	Number of Distinct Non-Detects	1
Minimum Detect	2.2	Minimum Non-Detect	1
Maximum Detect	35	Maximum Non-Detect	1
Variance Detects	94.12	Percent Non-Detects	23.08%
Mean Detects	8.21	SD Detects	9.701
Median Detects	5.35	CV Detects	1.182
Skewness Detects	2.828	Kurtosis Detects	8.434
Mean of Logged Detects	1.749	SD of Logged Detects	0.79
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.592	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.372	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.262	Detected Data Not Normal at 5% Significance Level	
Detected Data Not Normal at 5% Significance Level			
Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs			
KM Mean	6.546	KM Standard Error of Mean	2.521
KM SD	8.625	95% KM (BCA) UCL	11.37
95% KM (t) UCL	11.04	95% KM (Percentile Bootstrap) UCL	10.97
95% KM (z) UCL	10.69	95% KM Bootstrap t UCL	18.36
90% KM Chebyshev UCL	14.11	95% KM Chebyshev UCL	17.54
97.5% KM Chebyshev UCL	22.29	99% KM Chebyshev UCL	31.63
Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	0.78	Anderson-Darling GOF Test	
5% A-D Critical Value	0.739	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.255	Kolmogorov-Smirnov GOF	
5% K-S Critical Value	0.271	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data follow Appr. Gamma Distribution at 5% Significance Level			
Gamma Statistics on Detected Data Only			
k hat (MLE)	1.55	k star (bias corrected MLE)	1.151
Theta hat (MLE)	5.298	Theta star (bias corrected MLE)	7.131
nu hat (MLE)	30.99	nu star (bias corrected)	23.03
Mean (detects)	8.21		
Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	0.01	Mean	6.318
Maximum	35	Median	3.7
SD	9.139	CV	1.447
k hat (MLE)	0.419	k star (bias corrected MLE)	0.373
Theta hat (MLE)	15.09	Theta star (bias corrected MLE)	16.92
nu hat (MLE)	10.88	nu star (bias corrected)	9.705
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (9.71, α)	3.758	Adjusted Chi Square Value (9.71, β)	3.249
95% Gamma Approximate UCL (use when n>=50)	16.31	95% Gamma Adjusted UCL (use when n<50)	18.87
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	6.546	SD (KM)	8.625
Variance (KM)	74.39	SE of Mean (KM)	2.521
k hat (KM)	0.576	k star (KM)	0.494
nu hat (KM)	14.98	nu star (KM)	12.85
theta hat (KM)	11.36	theta star (KM)	13.24
80% gamma percentile (KM)	10.75	90% gamma percentile (KM)	17.75
95% gamma percentile (KM)	25.25	99% gamma percentile (KM)	43.7
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (12.85, α)	5.795	Adjusted Chi Square Value (12.85, β)	5.135
95% Gamma Approximate KM-UCL (use when n>=5(	14.52	95% Gamma Adjusted KM-UCL (use when n<50)	16.39
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Test Statistic	0.905	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.19	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level	
Detected Data appear Lognormal at 5% Significance Level			
Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	6.525	Mean in Log Scale	1.313
SD in Original Scale	8.992	SD in Log Scale	1.085
95% t UCL (assumes normality of ROS data)	10.97	95% Percentile Bootstrap UCL	10.87
95% BCA Bootstrap UCL	13.4	95% Bootstrap t UCL	18.46
95% H-UCL (Log ROS)	17.13		
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			

KM Mean (logged)	1.346	KM Geo Mean	3.84
KM SD (logged)	0.987	95% Critical H Value (KM-Log)	2.826
KM Standard Error of Mean (logged)	0.289	95% H-UCL (KM -Log)	13.99
KM SD (logged)	0.987	95% Critical H Value (KM-Log)	2.826
KM Standard Error of Mean (logged)	0.289		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	6.431	Mean in Log Scale	1.186
SD in Original Scale	9.056	SD in Log Scale	1.271
95% t UCL (Assumes normality)	10.91	95% H-Stat UCL	24.98

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	**16.39**	95% GROS Adjusted Gamma UCL	18.87

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

VC

General Statistics

Total Number of Observations	13	Number of Distinct Observations	5
Number of Detects	4	Number of Non-Detects	9
Number of Distinct Detects	4	Number of Distinct Non-Detects	1
Minimum Detect	1.9	Minimum Non-Detect	1
Maximum Detect	11	Maximum Non-Detect	1
Variance Detects	17.84	Percent Non-Detects	69.23%
Mean Detects	4.95	SD Detects	4.224
Median Detects	3.45	CV Detects	0.853
Skewness Detects	1.524	Kurtosis Detects	2.031
Mean of Logged Detects	1.344	SD of Logged Detects	0.807

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.832	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.274	Lilliefors GOF Test
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2.215	KM Standard Error of Mean	0.874
KM SD	2.728	95% KM (BCA) UCL	N/A
95% KM (t) UCL	3.772	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	3.652	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	4.836	95% KM Chebyshev UCL	6.023
97.5% KM Chebyshev UCL	7.671	99% KM Chebyshev UCL	10.91

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.377	Anderson-Darling GOF Test
5% A-D Critical Value	0.66	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.286	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.398	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.109	k star (bias corrected MLE)	0.694
Theta hat (MLE)	2.347	Theta star (bias corrected MLE)	7.134
nu hat (MLE)	16.87	nu star (bias corrected)	5.551
Mean (detects)	4.95		

Gamma ROS Statistics using Imputed Non-Detects
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.53
Maximum	11	Median	0.01
SD	3.177	CV	2.076
k hat (MLE)	0.226	k star (bias corrected MLE)	0.225
Theta hat (MLE)	6.781	Theta star (bias corrected MLE)	6.804
nu hat (MLE)	5.867	nu star (bias corrected)	5.846

Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (5.85, α)	1.562	Adjusted Chi Square Value (5.85, β)	1.269
95% Gamma Approximate UCL (use when n>=50)	5.727	95% Gamma Adjusted UCL (use when n<50)	N/A
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	2.215	SD (KM)	2.728
Variance (KM)	7.441	SE of Mean (KM)	0.874
k hat (KM)	0.66	k star (KM)	0.559
nu hat (KM)	17.15	nu star (KM)	14.52
theta hat (KM)	3.359	theta star (KM)	3.966
80% gamma percentile (KM)	3.65	90% gamma percentile (KM)	5.854
95% gamma percentile (KM)	8.179	99% gamma percentile (KM)	13.84
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (14.52, α)	6.932	Adjusted Chi Square Value (14.52, β)	6.199
95% Gamma Approximate KM-UCL (use when n>=	4.642	95% Gamma Adjusted KM-UCL (use when n<50)	5.191
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Test Statistic	0.911	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.254	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	
Detected Data appear Lognormal at 5% Significance Level			
Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	1.694	Mean in Log Scale	-0.953
SD in Original Scale	3.099	SD in Log Scale	1.945
95% t UCL (assumes normality of ROS data)	3.226	95% Percentile Bootstrap UCL	3.188
95% BCA Bootstrap UCL	3.918	95% Bootstrap t UCL	6.771
95% H-UCL (Log ROS)	35.15		
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	0.414	KM Geo Mean	1.512
KM SD (logged)	0.731	95% Critical H Value (KM-Log)	2.416
KM Standard Error of Mean (logged)	0.234	95% H-UCL (KM -Log)	3.291
KM SD (logged)	0.731	95% Critical H Value (KM-Log)	2.416
KM Standard Error of Mean (logged)	0.234		
DL/2 Statistics			
DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	1.869	Mean in Log Scale	-0.0664
SD in Original Scale	3.005	SD in Log Scale	1.059
95% t UCL (Assumes normality)	3.355	95% H-Stat UCL	4.036
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Detected Data appear Normal Distributed at 5% Significance Level			
Suggested UCL to Use			
95% KM (t) UCL	**3.772**		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Appendix F

Milestone Schedule
Gantt Chart

Milestone Schedule Gantt Chart

TASK	Time to Accomplish Task (Months from Acceptance by EPD)									
	0-6	6 - 12	12 - 18	18 - 24	24 - 30	30 - 36	36 - 42	42 - 48	48 - 54	54 - 60
Abandon 13 Monitor Wells										
Horizontal Delineation of Release Site - COMPLETED										
Horizontal Delineation of Release Off Site- COMPLETED										
Update CSM - COMPLETED										
Submit Compliance Status Reoprt (CSR) - COMPLETED										

Appendix G

Johnson & Ettinger
Vapor Intrusion Modeling Results

Model Input — **Site Name/Run Number:** PCE & Multi-Chem

Note:
-Yellow highlighted cells indicate parameters that typically are changed or must be inputted by the user.
-Dotted outline cells indicate default values that may be changed with justification.
-Toxicity values are taken from Regional Screening Level tables. These tables are updated semi-annually and may not reflect the most current toxicity information.

Source Characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Source medium		Source	Groundwater					
Groundwater concentration	(ug/L)	Cmedium	810		NA			Max. PCE 03-2015 @ MW-2
Depth below grade to water table	(m)	Ls	9.90		Vary - 50	NA		Avg. DTW on FOSC site 03-2015
Average groundwater temperature	(^oC)	Ts	17.6	25	3 - 25			EPA shallow GW temp map.
Calc: Source vapor concentration	(ug/m3)	Cs	400027					
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.242%					

Chemical:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Chemical Name		Chem	Tetrachloroethylene					
CAS No.		CAS	127-18-4					
Toxicity Factors								
Unit risk factor	$(ug/m^3)^{-1}$	IUR	2.60E-07	2.60E-07	NA	NA		
Mutagenic compound		Mut	No	NA	NA	NA		
Reference concentration	(mg/m^3)	RfC	4.00E-02	4.00E-02	NA	NA		

Chemical Properties:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Pure component water solubility	(mg/L)	S	2.06E+02	2.06E+02	NA	NA		
Henry's Law Constant @ 25^oC	(atm-m^3/mol)	Hc	1.77E-02	1.77E-02	NA	NA		
Calc: Henry's Law Constant @ 25^oC	(dimensionless)	Hr	7.24E-01	7.24E-01				
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	4.94E-01	7.42E-01				
Diffusivity in air	(cm2/s)	Dair	5.05E-02	5.05E-02	NA	NA		
Diffusivity in water	(cm2/s)	Dwater	9.46E-06	9.46E-06	NA	NA		

Building Characteristics:

	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Building setting		Bldg_Setting	Residential	Residential				
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade				
Depth below grade to base of foundation	(m)	Lb	0.15	0.10	0.1 - 2.44	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Foundation thickness	(m)	Lf	0.15	0.10	0.1 - 0.25	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00		
Enclosed space floor area	(m2)	Abf	139.40	150.00	80 - 200	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Enclosed space mixing height	(m)	Hb	4.67	2.44	2.13 - 3.05	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Indoor air exchange rate	(1 / hr)	ach	0.43	0.45	.15-1.26	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24		
Calc: Building ventilation rate	(m3/hr)	Qb	279.93	164.70	NA	0.30		
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	0.84	0.49	NA	NA		

Model Input **Site Name/Run Number:** PCE & Multi-Chem

Chemical Name: Tetrachloroethylene CAS No. 127-18-4

Depth below grade to water table: 9.90 meters

Vadose zone characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Stratum A (Top of soil profile):								
Stratum A SCS soil type		SCS_A	Silt Loam					
Stratum A thickness (from surface)	(m)	hSA	9.90					
Stratum A total porosity	(-)	nSA	0.386	0.439	NA	0.20	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A water-filled porosity	(-)	nwSA	0.315	0.180	0.065 - 0.3	0.25	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A bulk density	(g/cm^3)	rhoSA	1.520	1.490	NA	0.05	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum B (Soil layer below Stratum A):								
Stratum B SCS soil type		SCS_B	Not Present					
Stratum B thickness	(m)	hSB						
Stratum B total porosity	(-)	nSB			NA	NA		
Stratum B water-filled porosity	(-)	nwSB			NA	NA		
Stratum B bulk density	(g/cm^3)	rhoSB			NA	NA		
Stratum C (Soil layer below Stratum B):								
Stratum C SCS soil type		SCS_C	Not Present					
Stratum C thickness	(m)	hSC	0.00					
Stratum C total porosity	(-)	nSC			NA	NA		
Stratum C water-filled porosity	(-)	nwSC			NA	NA		
Stratum C bulk density	(g/cm^3)	rhoSC			NA	NA		
Stratum directly above the water table								
Stratum A, B, or C		src_soil	Stratum A					
Height of capillary fringe	(m)	hcz	0.682	0.682	NA	NA		
Capillary zone total porosity	(-)	ncz	0.439	0.439	NA	0.20		
Capillary zone water filled porosity	(-)	nwcz	0.349	0.349	NA	0.18		

Exposure Parameters:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Target risk for carcinogens	(-)	Target_CR	1.00E-05	1.00E-06	NA	NA	WARNING	EPD Target Value
Target hazard quotient for non-carcinogens	(-)	Target_HQ	1	1	NA	NA		
Exposure Scenario		Scenario	Commercial	Commercial				
Averaging time for carcinogens	(yrs)	ATc	70	70	NA	NA		
Averaging time for non-carcinogens	(yrs)	ATnc	25	25	NA	NA		
Exposure duration	(yrs)	ED	25	25	NA	NA		
Exposure frequency	(days/yr)	EF	250	250	NA	NA		
Exposure time	(hrs/24 hrs)	ET	8	8	NA	NA		
Mutagenic mode-of-action factor	(yrs)	MMOAF	72	72	NA	NA	NOTE	MMOAF not relevant for non-mutagenic compounds

Model Output **Site Name/Run Number:** PCE & Multi-Chem

Chemical Name: Tetrachloroethylene CAS No. 127-18-4

Range is based on the reasonable range of Qsoil/Qbuilding values, as reported in the literature.

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**1.1E-06**	1.1E-06 - 1.1E-06	**3.1E-05**	2.4E-05 - 3.1E-05	WARNING	Please review warning messages

Predicted Indoor Air Concentration	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**4.2E-01**	4.2E-01 - 4.2E-01	**1.2E+01**	9.6E+00 - 1.3E+01		
	(ppbv)		**6.3E-02**	6.2E-02 - 6.3E-02	**1.8E+00**	1.4E+00 - 1.9E+00	WARNING	Please review warning messages **SEE MEI COMMENTS ABOVE**

Predicted Vapor Conc. Beneath Foundation	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Subslab vapor concentration	(ug/m3)	**Css**	**1.4E+02**	8.5E+00 - 4.2E+03	**4.1E+03**	9.6E+04 - 1.3E+05		
	(ppbv)		**2.1E+01**	1.3E+00 - 6.2E+02	**6.1E+02**	1.4E+04 - 1.9E+04		

Diffusive Transport Upward Through Vadose Zone	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	5.3E-05	-	2.9E-03	-		
Effective diffusion coefficient through Stratum B	(cm2/sec)	DeffB		-		-		
Effective diffusion coefficient through Stratum C	(cm2/sec)	DeffC		-		-		
Effective diffusion coefficient through capillary zone	(cm2/sec)	DeffCZ	9.0E-05	-	8.9E-05	-		
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	5.5E-05	-	9.1E-04	-		

Critical Parameters		Symbol	Value	Range	Default	Default Range	Flag
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	1.1E-06	-	3.1E-05		
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	4.5E+04	1.5E+03 - 7.5E+05	3.0E+02	1.0E+01 - 5.1E+03	
α for convective transport from subslab to building	(-)	C_Param	3.0E-03	1.0E-04 - 5.0E-02	3.0E-03	1.0E-04 - 5.0E-02	

Interpretation

Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

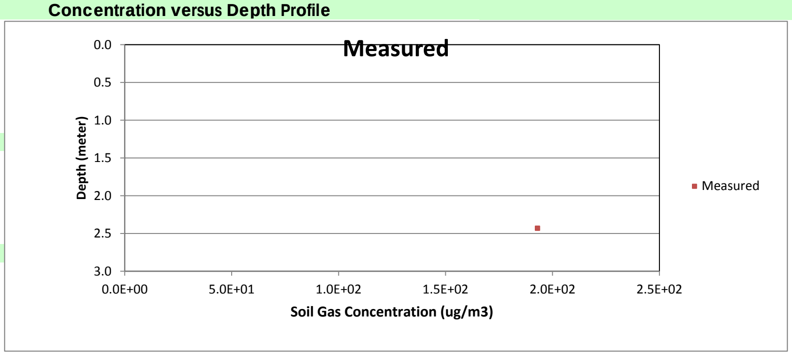
Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Qsoil_Qb, Lf, DeffA, eta

Concentration versus Depth Profile



Please check WARNING or ERROR flags

Model Output Site Name/Run Number: PCE & Multi-Chem

Chemical Name: Tetrachloroethylene CAS No. 127-18-4

Risk Calculations	Units	Symbol	Value	Range	Default	Range	Flag	Comment
Risk-Based Target Screening Levels Scenario: Commercial								
Target risk for carcinogens	(-)	Target_CR	1E-05	-	1E-06	-		
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-		
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**1.75E+02**	-	**4.72E+01**	-	Target indoor air concentration based on non-cancer toxicity (reference concentration)	
	(ppbv)		**2.58E+01**	-	**6.96E+00**	-		
Target groundwater concentration	**(ug/L)**	**Target_GW**	**3.34E+05**	**3.3E+05 - 3.4E+05**	**2.04E+03**	**3.0E+03 - 4.0E+03**		
Incremental Risk Estimates								
Incremental cancer risk from vapor intrusion	**(-)**	**Cancer_Risk**	**9.00E-09**	**8.9E-09 - 9.0E-09**	**2.64E-07**	**2.0E-07 - 2.7E-07**		
Hazard quotient from vapor intrusion	**(-)**	**HQ**	**2.42E-03**	**2.4E-03 - 2.4E-03**	**7.10E-02**	**5.5E-02 - 7.2E-02**		

Table of Inputs and Outputs for Multiple Chemicals

Note: Parameters other than the chemical concentration must be entered in the MODEL sheet and must be the same for all chemicals. Warnings and errors are displayed in only on the MODEL sheet.

			Acetone	Benzene	Chloroform	Cumene	Dichloroethylene, 1,2-cis-	Dichloroethylene, 1,2	Methyl Ethyl Ketone (	Tetrachloroethylene	Trichloroethylene	Vinyl Chloride
Source Characteristics:	**Units**	**Symbol**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**
Source medium		Source	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Groundwater concentration	(ug/L)	Cmedium	89	140	14	3.2	210	1.2	11	810	120	11
Depth below grade to water table	(m)	Ls	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90
Average groundwater temperature	(°C)	Ts	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6
Calc: Source vapor concentration	(ug/m3)	Cs	95	23058	1562	900	25935	347	18	400027	34450	10379
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.000%	0.006%	0.000%	0.003%	0.002%	0.000%	0.000%	0.242%	0.007%	0.000%
Chemical:	**Units**	**Symbol**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**
Chemical Name		Chem	Acetone	Benzene	Chloroform	Cumene	Dichloroethylene, 1,2-cis-	Dichloroethylene, 1,2-trans-	Methyl Ethyl Ketone (2-Butanone)	Tetrachloroethylene	Trichloroethylene	Vinyl Chloride
CAS No.		CAS	67-64-1	71-43-2	67-66-3	98-82-8	156-59-2	156-60-5	78-93-3	127-18-4	79-01-6	75-01-4
Toxicity Factors												
Unit risk factor	$(ug/m^3)^{-1}$	IUR	Not Available	7.80E-06	2.30E-05	Not Available	Not Available	Not Available	Not Available	2.60E-07	see note	4.40E-06
Mutagenic compound		Mut	No	No	No	No	No	No	No	No	Yes	VC
Reference concentration	(ug/m^3)	RfC	3.10E+01	3.00E-02	9.80E-02	4.00E-01	Not Available	Not Available	5.00E+00	4.00E-02	2.00E-03	1.00E-01
Chemical Properties:	**Units**	**Symbol**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**
Pure component water solubility	(mg/L)	S	1.00E+06	1.79E+03	7.95E+03	6.13E+01	6.41E+03	4.52E+03	2.23E+05	2.06E+02	1.28E+03	8.80E+03
Henry's Law Constant @ 25°C	$(atm\text{-}m^3/mol)$	Hc	3.50E-05	5.55E-03	3.67E-03	1.15E-02	4.08E-03	9.38E-03	5.69E-05	1.77E-02	9.85E-03	2.78E-02
Calc: Henry's Law Constant @ 25°C	(dimensionless)	Hr	1.43E-03	2.27E-01	1.50E-01	4.70E-01	1.67E-01	3.84E-01	2.33E-03	7.24E-01	4.03E-01	1.14E+00
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	1.07E-03	1.65E-01	1.12E-01	2.81E-01	1.23E-01	2.89E-01	1.67E-03	4.94E-01	2.87E-01	9.44E-01
Diffusivity in air	(cm2/s)	Dair	1.06E-01	8.95E-02	7.69E-02	6.03E-02	8.84E-02	8.76E-02	9.14E-02	5.05E-02	6.87E-02	1.07E-01
Diffusivity in water	(cm2/s)	Dwater	1.15E-05	1.03E-05	1.09E-05	7.86E-06	1.13E-05	1.12E-05	1.02E-05	9.46E-06	1.02E-05	1.20E-05
Building Characteristics:	**Units**	**Symbol**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**
Building setting		Bldg_Setting	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential	Residential
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade	Slab-on-grade	Slab-on-grade	Slab-on-grade	Slab-on-grade	Slab-on-grade	Slab-on-grade	Slab-on-grade	Slab-on-grade
Depth below grade to base of foundation	(m)	Lb	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Foundation thickness	(m)	Lf	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Enclosed space floor area	(m2)	Ab	139.40	139.40	139.40	139.40	139.40	139.40	139.40	139.40	139.40	139.40
Enclosed space mixing height	(m)	Hb	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67	4.67
Indoor air exchange rate	(1/hr)	ach	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030
Calc: Building ventilation rate	(m3/hr)	Qb	279.93	279.93	279.93	279.93	279.93	279.93	279.93	279.93	279.93	279.93
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Vadose zone characteristics:	**Units**	**Symbol**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**
Stratum A (Top of soil profile):												
Stratum A SCS soil type		SCS_A	Silt Loam	Silt Loam	Silt Loam	Silt Loam	Silt Loam	Silt Loam	Silt Loam	Silt Loam	Silt Loam	Silt Loam
Stratum A thickness (from surface)	(m)	hSA	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90
Stratum A total porosity	(-)	nSA	0.386	0.386	0.386	0.386	0.386	0.386	0.386	0.386	0.386	0.386
Stratum A water-filled porosity	(-)	nwSA	0.315	0.315	0.315	0.315	0.315	0.315	0.315	0.315	0.315	0.315
Stratum A bulk density	(g/cm^3)	rhoSA	1.520	1.520	1.520	1.520	1.520	1.520	1.520	1.520	1.520	1.520
Stratum B (Soil layer below Stratum A):												
Stratum B SCS soil type		SCS_B	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present
Stratum B thickness	(m)	hSB										
Stratum B total porosity	(-)	nSB										
Stratum B water-filled porosity	(-)	nwSB										
Stratum B bulk density	(g/cm^3)	rhoSB										
Stratum C (Soil layer below Stratum B):												
Stratum C SCS soil type		SCS_C	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present
Stratum C thickness	(m)	hSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stratum C total porosity	(-)	nSC										
Stratum C water-filled porosity	(-)	nwSC										
Stratum C bulk density	(g/cm^3)	rhoSC										
Stratum directly above the water table												
Stratum A, B, or C		src_soil	Stratum A	Stratum A	Stratum A	Stratum A	Stratum A	Stratum A	Stratum A	Stratum A	Stratum A	Stratum A
Height of capillary fringe	(m)	hcz	0.682	0.682	0.682	0.682	0.682	0.682	0.682	0.682	0.682	0.682
Capillary zone total porosity	(-)	ncz	0.439	0.439	0.439	0.439	0.439	0.439	0.439	0.439	0.439	0.439
Capillary zone water filled porosity	(-)	nwcz	0.349	0.349	0.349	0.349	0.349	0.349	0.349	0.349	0.349	0.349

Exposure Parameters:	Units	Symbol	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value
Target risk for carcinogens	(-)	Target_CR	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05	1.00E-05
Target hazard quotient for non-carcinogens	(-)	Target_HQ	1	1	1	1	1	1	1	1	1	1
Exposure Scenario		Scenario	Commercial	Commercial	Commercial	Commercial	Commercial	Commercial	Commercial	Commercial	Commercial	Commercial
Averaging time for carcinogens	(yrs)	ATc	70	70	70	70	70	70	70	70	70	70
Averaging time for non-carcinogens	(yrs)	ATnc	25	25	25	25	25	25	25	25	25	25
Exposure duration	(yrs)	ED	25	25	25	25	25	25	25	25	25	25
Exposure frequency	(days/yr)	EF	250	250	250	250	250	250	250	250	250	250
Exposure time	(hrs/24 hrs)	ET	8	8	8	8	8	8	8	8	8	8
Mutagenic mode-of-action factor	(yrs)	MMOAF	72	72	72	72	72	72	72	72	72	72

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value
Groundwater to indoor air attenuation coefficient	(-)	alpha	**3.2E-05**	**2.0E-06**	**1.8E-06**	**1.3E-06**	**2.0E-06**	**1.9E-06**	**1.9E-05**	**1.1E-06**	**1.5E-06**	**2.2E-06**
		Range	2.4E-05 - 3.2E-05	1.9E-06 - 2.0E-06	1.8E-06 - 1.8E-06	1.3E-06 - 1.3E-06	2.0E-06 - 2.0E-06	1.8E-06 - 1.9E-06	1.6E-05 - 1.9E-05	1.1E-06 - 1.1E-06	1.4E-06 - 1.5E-06	2.1E-06 - 2.2E-06
Predicted Indoor Air Concentration			Value	Value	Value	Value	Value	Value	Value	Value	Value	Value
Indoor air concentration due to vapor intrusion	(ug/m3)	Cia	**3.0E-03**	**4.5E-02**	**2.8E-03**	**1.2E-03**	**5.2E-02**	**6.4E-04**	**3.4E-04**	**4.2E-01**	**5.1E-02**	**2.3E-02**
		Range	2.3E-03 - 3.1E-03	4.4E-02 - 4.5E-02	2.8E-03 - 2.8E-03	1.1E-03 - 1.2E-03	5.1E-02 - 5.2E-02	6.3E-04 - 6.4E-04	2.9E-04 - 3.5E-04	4.2E-01 - 4.2E-01	5.0E-02 - 5.1E-02	2.2E-02 - 2.3E-02
	(ppbv)	Cia	**1.3E-03**	**1.4E-02**	**5.8E-04**	**2.3E-04**	**1.3E-02**	**1.6E-04**	**1.2E-04**	**6.3E-02**	**9.4E-03**	**8.8E-03**
		Range	9.7E-04 - 1.3E-03	1.4E-02 - 1.4E-02	5.7E-04 - 5.8E-04	2.3E-04 - 2.4E-04	1.3E-02 - 1.3E-02	1.6E-04 - 1.6E-04	9.9E-05 - 1.2E-04	6.2E-02 - 6.3E-02	9.3E-03 - 9.4E-03	8.6E-03 - 8.8E-03
Predicted Vapor Concentration Beneath the Foundation			Value	Value	Value	Value	Value	Value	Value	Value	Value	Value
Subslab vapor concentration	(ug/m3)	Css	**1.0E+00**	**1.5E+01**	**9.4E-01**	**3.8E-01**	**1.7E+01**	**2.1E-01**	**1.1E-01**	**1.4E+02**	**1.7E+01**	**7.5E+00**
		Range	6.1E-02 - 2.3E+01	9.1E-01 - 4.4E+02	5.7E-02 - 2.8E+01	2.3E-02 - 1.1E+01	1.0E+00 - 5.1E+02	1.3E-02 - 6.3E+00	6.9E-03 - 2.9E+00	8.5E+00 - 4.2E+03	1.0E+00 - 5.0E+02	4.5E-01 - 2.2E+02
	(ppbv)	Css	**4.2E-01**	**4.7E+00**	**1.9E-01**	**7.8E-02**	**4.4E+00**	**5.4E-02**	**3.9E-02**	**2.1E+01**	**3.1E+00**	**2.9E+00**
		Range	2.6E-02 - 9.7E+00	2.8E-01 - 1.4E+02	1.2E-02 - 5.7E+00	4.7E-03 - 2.3E+00	2.6E-01 - 1.3E+02	3.3E-03 - 1.6E+00	2.3E-03 - 9.9E-01	1.3E+00 - 6.2E+02	1.9E-01 - 9.3E+01	1.8E-01 - 8.6E+01

Diffusive Transport Upward Through Vadose Zone			Value	Value	Value	Value	Value	Value	Value	Value	Value	Value
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	1.7E-03	9.9E-05	9.1E-05	6.5E-05	1.0E-04	9.3E-05	9.7E-04	5.3E-05	7.4E-05	1.1E-04
Effective diffusion coefficient through Stratum B	(cm2/sec)	DeffB										
Effective diffusion coefficient through Stratum C	(cm2/sec)	DeffC										
Effective diffusion coefficient through capillary zone	(cm2/sec)	DeffCZ	1.9E-03	1.6E-04	1.5E-04	1.1E-04	1.7E-04	1.6E-04	1.1E-03	9.0E-05	1.2E-04	1.9E-04
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	1.7E-03	1.0E-04	9.4E-05	6.6E-05	1.0E-04	9.6E-05	9.8E-04	5.5E-05	7.6E-05	1.1E-04

Critical Parameters			Value	Value	Value	Value	Value	Value	Value	Value	Value	Value
α for diffusive transport from source to building with	(-)	A_Param	3.2E-05	2.0E-06	1.8E-06	1.3E-06	2.0E-06	1.9E-06	1.9E-05	1.1E-06	1.5E-06	2.2E-06
Pe (Peclet Number) for transport through the foundation	(-)	B_Param	1.4E+03	2.4E+04	2.6E+04	3.7E+04	2.3E+04	2.6E+04	2.5E+03	4.5E+04	3.2E+04	2.2E+04
α for convective transport from subslab to building	(-)	C_Param	3.0E-03	3.0E-03	3.0E-03	3.0E-03	3.0E-03	3.0E-03	3.0E-03	3.0E-03	3.0E-03	3.0E-03
			9.6E+02	1.6E+04	1.7E+04	2.5E+04	1.6E+04	1.7E+04	1.6E+03	3.0E+04	2.2E+04	1.5E+04
Interpretation			Advection is the domina Diffusion through soil is tl	Advection is the domi Diffusion through soil is	Advection is the domi Diffusion through soil i	Advection is the domi Diffusion through soil is	Advection is the domin Diffusion through soil is	Advection is the do Diffusion through so	Advection is the do Diffusion through so	Advection is the do Diffusion through so	Advection is the do Diffusion through so	Advection is the dominant mechanism a Diffusion through soil is the overall rate lin
Critical Parameters			Hb, Ls, DeffT, ach	Hb, Ls, DeffT, ach	Hb, Ls, DeffT, ach	Hb, Ls, DeffT, ach	Hb, Ls, DeffT, ach	Hb, Ls, DeffT, ach	Hb, Ls, DeffT, ach	Hb, Ls, DeffT, ach	Hb, Ls, DeffT, ach	Hb, Ls, DeffT, ach
Non-Critical Parameters			Qsoil_Qb, Lf, DeffA, eta	Qsoil_Qb, Lf, DeffA, et	Qsoil_Qb, Lf, DeffA, et	Qsoil_Qb, Lf, DeffA, et	Qsoil_Qb, Lf, DeffA, eta	Qsoil_Qb, Lf, DeffA,	Qsoil_Qb, Lf, DeffA,	Qsoil_Qb, Lf, DeffA,	Qsoil_Qb, Lf, DeffA,	Qsoil_Qb, Lf, DeffA, eta

Risk Calculations	Units	Symbol	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	
Risk-Based Target Screening Levels													
Target risk for carcinogens	(-)	Target_CR	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	1E-05	
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	1	1	1	1	1	1	1	1	1	
Target indoor air concentration	(ug/m3)	Target_IA	**1.36E+05**	**1.57E+01**	**5.33E+00**	**1.75E+03**	**No tox data available**	**No tox data availabl**	**2.19E+04**	**1.75E+02**	**2.05E+01**	**2.10E+00**	
	(ppbv)	Target_IA	**5.72E+04**	**4.92E+00**	**1.09E+00**	**3.57E+02**	**No tox data available**	**No tox data availabl**	**7.43E+03**	**2.58E+01**	**3.82E+00**	**8.22E-01**	
Target groundwater concentration	(ug/L)	Target_GW	**4.00E+09**	**4.86E+04**	**2.64E+04**	**4.86E+06**	**No tox data available**	**No tox data availabl**	**7.00E+08**	**3.34E+05**	**4.86E+04**	**1.02E+03**	
Incremental Risk Estimates													**TOTALS**
Incremental cancer risk from vapor intrusion	(-)	Cancer_Risk	**No IUR**	**2.88E-08**	**5.30E-09**	**No IUR**	**No IUR**	**No IUR**	**No IUR**	**9.00E-09**	**6.57E-08**	**8.09E-09**	**1.17E-07**
		Range	-	2.8E-08 - 2.9E-08	5.2E-09 - 5.3E-09	-	-	-	-	8.9E-09 - 9.0E-09	6.5E-08 - 6.6E-08	7.9E-09 - 8.1E-09	
Hazard quotient from vapor intrusion	(-)	HQ	**2.22391E-08**	**0.00034441**	**6.58622E-06**	**6.58936E-07**	**No RfC Available**	**No RfC Available**	**1.57103E-08**	**0.002423502**	**0.005783034**	**5.15115E-05**	**8.61E-03**
		Range	1.7E-08 - 2.2E-08	3.4E-04 - 3.4E-04	6.5E-06 - 6.6E-06	6.5E-07 - 6.6E-07	: Available - No RfC Av	Available - No RfC A	1.3E-08 - 1.6E-08	2.4E-03 - 2.4E-03	5.7E-03 - 5.8E-03	5.0E-05 - 5.2E-05	
			1.7E-08 - 2.2E-08	3.4E-04 - 3.4E-04	6.5E-06 - 6.6E-06	6.5E-07 - 6.6E-07	fC Available - No RfC Ava	Available - No RfC A	1.3E-08 - 1.6E-08	3.6E-03 - 3.6E-03	5.7E-03 - 5.8E-03	5.0E-05 - 5.2E-05	

Model Input

Site Name/Run Number: Acetone

Note:
-Yellow highlighted cells indicate parameters that typically are changed or must be inputted by the user.
-Dotted outline cells indicate default values that may be changed with justification.
-Toxicity values are taken from Regional Screening Level tables. These tables are updated semi-annually and may not reflect the most current toxicity information.

Use English / Metric Converter

Source Characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Source medium		Source	Groundwater					
Groundwater concentration	(ug/L)	Cmedium	89		NA			Max. Acetone 03-2015 @ MW-13D
Depth below grade to water table	(m)	Ls	9.90		Vary - 50	NA		Avg. DTW on FOSC site 03-2015
Average groundwater temperature	(°C)	Ts	17.6	25	3 - 25			EPA shallow GW temp map.
Calc: Source vapor concentration	(ug/m3)	Cs	95					
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.000%					

Chemical:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Chemical Name		Chem	Acetone					
CAS No.		CAS	67-64-1					
Toxicity Factors								
Unit risk factor	$(ug/m^3)^{-1}$	IUR	Not Available	Not Available	NA	NA		No IUR available for this compound.
Mutagenic compound		Mut	No	NA	NA	NA		
Reference concentration	(mg/m^3)	RfC	3.10E+01	3.10E+01	NA	NA		

Chemical Properties:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Pure component water solubility	(mg/L)	S	1.00E+06	1.00E+06	NA	NA		
Henry's Law Constant @ 25°C	$(atm\text{-}m^3/mol)$	Hc	3.50E-05	3.50E-05	NA	NA		
Calc: Henry's Law Constant @ 25°C	(dimensionless)	Hr	1.43E-03	1.43E-03				
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	1.07E-03	1.47E-03				
Diffusivity in air	(cm2/s)	Dair	1.06E-01	1.06E-01	NA	NA		
Diffusivity in water	(cm2/s)	Dwater	1.15E-05	1.15E-05	NA	NA		

Building Characteristics:

Select Building Assumptions
- (●) Use ratio for Qsoil/Qbuilding (recommended if no site specific data available)
- ( ) Specify Qsoil and Qbuilding separately; calculate ratio

	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Building setting		Bldg_Setting	Residential	Residential				
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade				
Depth below grade to base of foundation	(m)	Lb	0.15	0.10	0.1 - 2.44	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Foundation thickness	(m)	Lf	0.15	0.10	0.1 - 0.25	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00		
Enclosed space floor area	(m2)	Abf	139.40	150.00	80 - 200	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Enclosed space mixing height	(m)	Hb	4.67	2.44	2.13 - 3.05	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Indoor air exchange rate	(1 / hr)	ach	0.43	0.45	.15-1.26	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24		
Calc: Building ventilation rate	(m3/hr)	Qb	279.93	164.70	NA	0.30		
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	0.84	0.49	NA	NA		

Model Input Site Name/Run Number: Acetone

Chemical Name: Acetone CAS No. 67-64-1

Depth below grade to water table: 9.90 meters

Vadose zone characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Stratum A (Top of soil profile):								
Stratum A SCS soil type		SCS_A	Silt Loam					
Stratum A thickness (from surface)	(m)	hSA	9.90					
Stratum A total porosity	(-)	nSA	0.386	0.439	NA	0.20	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A water-filled porosity	(-)	nwSA	0.315	0.180	0.065 - 0.3	0.25	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A bulk density	(g/cm^3)	rhoSA	1.520	1.490	NA	0.05	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum B (Soil layer below Stratum A):								
Stratum B SCS soil type		SCS_B	Not Present					
Stratum B thickness	(m)	hSB						
Stratum B total porosity	(-)	nSB			NA	NA		
Stratum B water-filled porosity	(-)	nwSB			NA	NA		
Stratum B bulk density	(g/cm^3)	rhoSB			NA	NA		
Stratum C (Soil layer below Stratum B):								
Stratum C SCS soil type		SCS_C	Not Present					
Stratum C thickness	(m)	hSC	0.00					
Stratum C total porosity	(-)	nSC			NA	NA		
Stratum C water-filled porosity	(-)	nwSC			NA	NA		
Stratum C bulk density	(g/cm^3)	rhoSC			NA	NA		
Stratum directly above the water table								
Stratum A, B, or C		src_soil	Stratum A					
Height of capillary fringe	(m)	hcz	0.682	0.682	NA	NA		
Capillary zone total porosity	(-)	ncz	0.439	0.439	NA	0.20		
Capillary zone water filled porosity	(-)	nwcz	0.349	0.349	NA	0.18		

Exposure Parameters:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Target risk for carcinogens	(-)	Target_CR	1.00E-05	1.00E-06	NA	NA	WARNING	EPD Target Value
Target hazard quotient for non-carcinogens	(-)	Target_HQ	1	1	NA	NA		
Exposure Scenario		Scenario	Commercial	Commercial				
Averaging time for carcinogens	(yrs)	ATc	70	70	NA	NA		
Averaging time for non-carcinogens	(yrs)	ATnc	25	25	NA	NA		
Exposure duration	(yrs)	ED	25	25	NA	NA		
Exposure frequency	(days/yr)	EF	250	250	NA	NA		
Exposure time	(hrs/24 hrs)	ET	8	8	NA	NA		
Mutagenic mode-of-action factor	(yrs)	MMOAF	72	72	NA	NA	NOTE	MMOAF not relevant for non-mutagenic compounds

Model Output **Site Name/Run Number:** Acetone

Chemical Name: Acetone CAS No. 67-64-1

Range is based on the reasonable range of Qsoil/Qbuilding values, as reported in the literature.

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**3.2E-05**	2.4E-05 - 3.2E-05	**1.6E-04**	6.4E-05 - 1.7E-04	WARNING	Please review warning messages

Predicted Indoor Air Concentration	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**3.0E-03**	2.3E-03 - 3.1E-03	**1.6E-02**	6.1E-03 - 1.6E-02		
	(ppbv)		**1.3E-03**	9.7E-04 - 1.3E-03	**6.6E-03**	2.5E-03 - 6.9E-03	WARNING	Please review warning messages **SEE MEI COMMENTS ABOVE**

Predicted Vapor Conc. Beneath Foundation	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Subslab vapor concentration	(ug/m3)	**Css**	**1.0E+00**	6.1E-02 - 2.3E+01	**5.2E+00**	6.1E+01 - 1.6E+02		
	(ppbv)		**4.2E-01**	2.6E-02 - 9.7E+00	**2.2E+00**	2.5E+01 - 6.9E+01		

Diffusive Transport Upward Through Vadose Zone	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	1.7E-03	-	6.2E-03	-		
Effective diffusion coefficient through Stratum B	(cm2/sec)	DeffB		-		-		
Effective diffusion coefficient through Stratum C	(cm2/sec)	DeffC		-		-		
Effective diffusion coefficient through capillary zone	(cm2/sec)	DeffCZ	1.9E-03	-	1.4E-03	-		
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	1.7E-03	-	5.0E-03	-		

Critical Parameters		Symbol	Value	Range	Default	Default Range	Flag
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	3.2E-05	-	1.7E-04		
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	1.4E+03	4.8E+01 - 2.4E+04	1.4E+02	4.7E+00 - 2.4E+03	
α for convective transport from subslab to building	(-)	C_Param	3.0E-03	1.0E-04 - 5.0E-02	3.0E-03	1.0E-04 - 5.0E-02	

Interpretation

Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

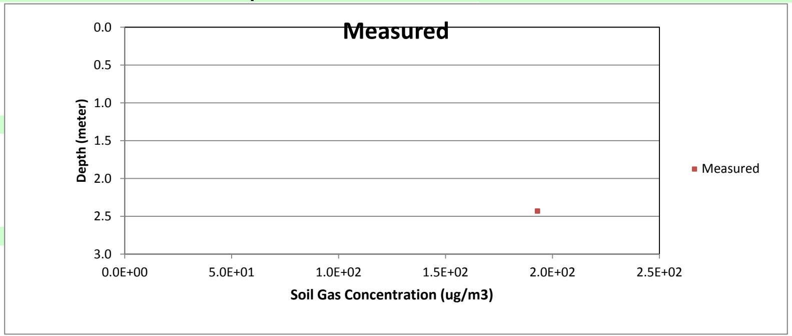
Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Qsoil_Qb, Lf, DeffA, eta

Concentration versus Depth Profile



Please check WARNING or ERROR flags

Model Output Site Name/Run Number: Acetone

Chemical Name: Acetone CAS No. 67-64-1

Risk Calculations	Units	Symbol	Value	Range	Default	Range	Flag	Comment
Risk-Based Target Screening Levels Scenario: Commercial								
Target risk for carcinogens	(-)	Target_CR	1E-05	-	1E-06	-		
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-		
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**1.36E+05**	-	**1.36E+05**	-	Target indoor air concentration based on non-cancer toxicity (reference concentration)	
	(ppbv)		**5.72E+04**	-	**5.72E+04**	-		
Target groundwater concentration	**(ug/L)**	**Target_GW**	**4.00E+09**	**4.0E+09 - 5.2E+09**	**5.63E+08**	**7.4E+08 - 2.0E+09**		
Incremental Risk Estimates								
Incremental cancer risk from vapor intrusion	**(-)**	**Cancer_Risk**	**No IUR**	**-**	**No IUR**	**No IUR - No IUR**		
Hazard quotient from vapor intrusion	**(-)**	**HQ**	**2.22E-08**	**1.7E-08 - 2.2E-08**	**1.15E-07**	**4.5E-08 - 1.2E-07**		

Model Input

Site Name/Run Number: Benzene

Note:
-Yellow highlighted cells indicate parameters that typically are changed or must be inputted by the user.
-Dotted outline cells indicate default values that may be changed with justification.
-Toxicity values are taken from Regional Screening Level tables. These tables are updated semi-annually and may not reflect the most current toxicity information.

Use English / Metric Converter

Source Characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Source medium		Source	Groundwater					
Groundwater concentration	(ug/L)	Cmedium	140		NA			Max. Benzene 03-2015 @ MW-28
Depth below grade to water table	(m)	Ls	9.90		Vary - 50	NA		Avg. DTW on FOSC site 03-2015
Average groundwater temperature	(^oC)	Ts	17.6	25	3 - 25			EPA shallow GW temp map.
Calc: Source vapor concentration	(ug/m3)	Cs	23058					
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.006%					

Chemical:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Chemical Name		Chem	Benzene					
CAS No.		CAS	71-43-2					
Toxicity Factors								
Unit risk factor	$(ug/m^3)^{-1}$	IUR	7.80E-06	7.80E-06	NA	NA		
Mutagenic compound		Mut	No	NA	NA	NA		
Reference concentration	(mg/m^3)	RfC	3.00E-02	3.00E-02	NA	NA		

Chemical Properties:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Pure component water solubility	(mg/L)	S	1.79E+03	1.79E+03	NA	NA		
Henry's Law Constant @ 25^oC	(atm-m^3/mol)	Hc	5.55E-03	5.55E-03	NA	NA		
Calc: Henry's Law Constant @ 25^oC	(dimensionless)	Hr	2.27E-01	2.27E-01				
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	1.65E-01	2.33E-01				
Diffusivity in air	(cm2/s)	Dair	8.95E-02	8.95E-02	NA	NA		
Diffusivity in water	(cm2/s)	Dwater	1.03E-05	1.03E-05	NA	NA		

Building Characteristics:

Select Building Assumptions
- (●) Use ratio for Qsoil/Qbuilding (recommended if no site specific data available)
- ( ) Specify Qsoil and Qbuilding separately; calculate ratio

	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Building setting		Bldg_Setting	Residential	Residential				
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade				
Depth below grade to base of foundation	(m)	Lb	0.15	0.10	0.1 - 2.44	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Foundation thickness	(m)	Lf	0.15	0.10	0.1 - 0.25	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00		
Enclosed space floor area	(m2)	Abf	139.40	150.00	80 - 200	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Enclosed space mixing height	(m)	Hb	4.67	2.44	2.13 - 3.05	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Indoor air exchange rate	(1 / hr)	ach	0.43	0.45	.15-1.26	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24		
Calc: Building ventilation rate	(m3/hr)	Qb	279.93	164.70	NA	0.30		
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	0.84	0.49	NA	NA		

Model Input Site Name/Run Number: Benzene

Chemical Name: Benzene CAS No. 71-43-2

Depth below grade to water table: 9.90 meters

Vadose zone characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Stratum A (Top of soil profile):								
Stratum A SCS soil type		SCS_A	Silt Loam					
Stratum A thickness (from surface)	(m)	hSA	9.90					
Stratum A total porosity	(-)	nSA	0.386	0.439	NA	0.20	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A water-filled porosity	(-)	nwSA	0.315	0.180	0.065 - 0.3	0.25	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A bulk density	(g/cm^3)	rhoSA	1.520	1.490	NA	0.05	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum B (Soil layer below Stratum A):								
Stratum B SCS soil type		SCS_B	Not Present					
Stratum B thickness	(m)	hSB						
Stratum B total porosity	(-)	nSB			NA	NA		
Stratum B water-filled porosity	(-)	nwSB			NA	NA		
Stratum B bulk density	(g/cm^3)	rhoSB			NA	NA		
Stratum C (Soil layer below Stratum B):								
Stratum C SCS soil type		SCS_C	Not Present					
Stratum C thickness	(m)	hSC	0.00					
Stratum C total porosity	(-)	nSC			NA	NA		
Stratum C water-filled porosity	(-)	nwSC			NA	NA		
Stratum C bulk density	(g/cm^3)	rhoSC			NA	NA		
Stratum directly above the water table								
Stratum A, B, or C		src_soil	Stratum A					
Height of capillary fringe	(m)	hcz	0.682	0.682	NA	NA		
Capillary zone total porosity	(-)	ncz	0.439	0.439	NA	0.20		
Capillary zone water filled porosity	(-)	nwcz	0.349	0.349	NA	0.18		

Exposure Parameters:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Target risk for carcinogens	(-)	Target_CR	1.00E-05	1.00E-06	NA	NA	WARNING	EPD Target Value
Target hazard quotient for non-carcinogens	(-)	Target_HQ	1	1	NA	NA		
Exposure Scenario		Scenario	Commercial	Commercial				
Averaging time for carcinogens	(yrs)	ATc	70	70	NA	NA		
Averaging time for non-carcinogens	(yrs)	ATnc	25	25	NA	NA		
Exposure duration	(yrs)	ED	25	25	NA	NA		
Exposure frequency	(days/yr)	EF	250	250	NA	NA		
Exposure time	(hrs/24 hrs)	ET	8	8	NA	NA		
Mutagenic mode-of-action factor	(yrs)	MMOAF	72	72	NA	NA	NOTE	MMOAF not relevant for non-mutagenic compounds

Model Output **Site Name/Run Number:** Benzene

Chemical Name: Benzene CAS No. 71-43-2

Range is based on the reasonable range of Qsoil/Qbuilding values, as reported in the literature.

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**2.0E-06**	1.9E-06 - 2.0E-06	**5.6E-05**	3.6E-05 - 5.7E-05	WARNING	Please review warning messages

Predicted Indoor Air Concentration	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**4.5E-02**	4.4E-02 - 4.5E-02	**1.3E+00**	8.3E-01 - 1.3E+00		
	(ppbv)		**1.4E-02**	1.4E-02 - 1.4E-02	**4.0E-01**	2.6E-01 - 4.1E-01	WARNING	Please review warning messages **SEE MEI COMMENTS ABOVE**

Predicted Vapor Conc. Beneath Foundation	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Subslab vapor concentration	(ug/m3)	**Css**	**1.5E+01**	9.1E-01 - 4.4E+02	**4.3E+02**	8.3E+03 - 1.3E+04		
	(ppbv)		**4.7E+00**	2.8E-01 - 1.4E+02	**1.3E+02**	2.6E+03 - 4.1E+03		

Diffusive Transport Upward Through Vadose Zone	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	9.9E-05	-	5.2E-03	-		
Effective diffusion coefficient through Stratum B	(cm2/sec)	DeffB		-		-		
Effective diffusion coefficient through Stratum C	(cm2/sec)	DeffC		-		-		
Effective diffusion coefficient through capillary zone	(cm2/sec)	DeffCZ	1.6E-04	-	1.6E-04	-		
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	1.0E-04	-	1.6E-03	-		

Critical Parameters		Symbol	Value	Range	Default	Default Range	Flag
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	2.0E-06	-	5.7E-05		
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	2.4E+04	8.1E+02 - 4.0E+05	1.7E+02	5.7E+00 - 2.9E+03	
α for convective transport from subslab to building	(-)	C_Param	3.0E-03	1.0E-04 - 5.0E-02	3.0E-03	1.0E-04 - 5.0E-02	

Interpretation

Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

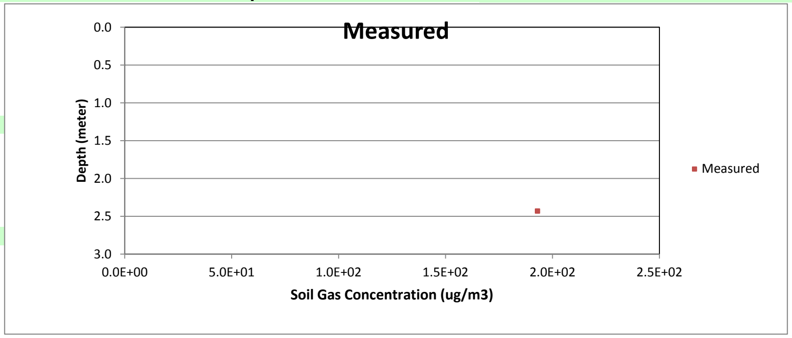
Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Qsoil_Qb, Lf, DeffA, eta

Concentration versus Depth Profile



Please check WARNING or ERROR flags

Model Output Site Name/Run Number: Benzene

Chemical Name: Benzene CAS No. 71-43-2

Risk Calculations	Units	Symbol	Value	Range	Default	Range	Flag	Comment
Risk-Based Target Screening Levels Scenario: Commercial								
Target risk for carcinogens	(-)	Target_CR	1E-05	-	1E-06	-		
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-		
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**1.57E+01**	-	**1.57E+00**	-	Target indoor air concentration based on cancer risk (unit risk factor)	
	(ppbv)		**4.92E+00**	-	**4.92E-01**	-		
Target groundwater concentration	**(ug/L)**	**Target_GW**	**4.86E+04**	**4.9E+04 - 5.0E+04**	**1.22E+02**	**1.7E+02 - 2.6E+02**		
Incremental Risk Estimates								
Incremental cancer risk from vapor intrusion	**(-)**	**Cancer_Risk**	**2.88E-08**	**2.8E-08 - 2.9E-08**	**8.15E-07**	**5.3E-07 - 8.3E-07**		
Hazard quotient from vapor intrusion	**(-)**	**HQ**	**3.44E-04**	**3.4E-04 - 3.4E-04**	**9.75E-03**	**6.3E-03 - 9.9E-03**		

Model Input

Site Name/Run Number: Chloroform

Note:
-Yellow highlighted cells indicate parameters that typically are changed or must be inputted by the user.
-Dotted outline cells indicate default values that may be changed with justification.
-Toxicity values are taken from Regional Screening Level tables. These tables are updated semi-annually and may not reflect the most current toxicity information.

Use English / Metric Converter

Source Characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Source medium		Source	Groundwater					
Groundwater concentration	(ug/L)	Cmedium	14		NA			Max. Chloroform 03-2015 @ MW-9
Depth below grade to water table	(m)	Ls	9.90		Vary - 50	NA		Avg. DTW on FOSC site 03-2015
Average groundwater temperature	(^oC)	Ts	17.6	25	3 - 25			EPA shallow GW temp map.
Calc: Source vapor concentration	(ug/m3)	Cs	1562					
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.000%					

Chemical:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Chemical Name		Chem	Chloroform					
CAS No.		CAS	67-66-3					
Toxicity Factors								
Unit risk factor	$(ug/m^3)^{-1}$	IUR	2.30E-05	2.30E-05	NA	NA		
Mutagenic compound		Mut	No	NA	NA	NA		
Reference concentration	(mg/m^3)	RfC	9.80E-02	9.80E-02	NA	NA		

Chemical Properties:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Pure component water solubility	(mg/L)	S	7.95E+03	7.95E+03	NA	NA		
Henry's Law Constant @ 25^{o}C	(atm-m^3/mol)	Hc	3.67E-03	3.67E-03	NA	NA		
Calc: Henry's Law Constant @ 25^{o}C	(dimensionless)	Hr	1.50E-01	1.50E-01				
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	1.12E-01	1.54E-01				
Diffusivity in air	(cm2/s)	Dair	7.69E-02	7.69E-02	NA	NA		
Diffusivity in water	(cm2/s)	Dwater	1.09E-05	1.09E-05	NA	NA		

Building Characteristics:

Select Building Assumptions
- (●) Use ratio for Qsoil/Qbuilding (recommended if no site specific data available)
- ( ) Specify Qsoil and Qbuilding separately; calculate ratio

	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Building setting		Bldg_Setting	Residential	Residential				
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade				
Depth below grade to base of foundation	(m)	Lb	0.15	0.10	0.1 - 2.44	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Foundation thickness	(m)	Lf	0.15	0.10	0.1 - 0.25	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00		
Enclosed space floor area	(m2)	Abf	139.40	150.00	80 - 200	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Enclosed space mixing height	(m)	Hb	4.67	2.44	2.13 - 3.05	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Indoor air exchange rate	(1 / hr)	ach	0.43	0.45	.15-1.26	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24		
Calc: Building ventilation rate	(m3/hr)	Qb	279.93	164.70	NA	0.30		
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	0.84	0.49	NA	NA		

Model Input Site Name/Run Number: Chloroform

Chemical Name: Chloroform CAS No. 67-66-3

Depth below grade to water table: 9.90 meters

Vadose zone characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Stratum A (Top of soil profile):								
Stratum A SCS soil type		SCS_A	Silt Loam					
Stratum A thickness (from surface)	(m)	hSA	9.90					
Stratum A total porosity	(-)	nSA	0.386	0.439	NA	0.20	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A water-filled porosity	(-)	nwSA	0.315	0.180	0.065 - 0.3	0.25	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A bulk density	(g/cm^3)	rhoSA	1.520	1.490	NA	0.05	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum B (Soil layer below Stratum A):								
Stratum B SCS soil type		SCS_B	Not Present					
Stratum B thickness	(m)	hSB						
Stratum B total porosity	(-)	nSB			NA	NA		
Stratum B water-filled porosity	(-)	nwSB			NA	NA		
Stratum B bulk density	(g/cm^3)	rhoSB			NA	NA		
Stratum C (Soil layer below Stratum B):								
Stratum C SCS soil type		SCS_C	Not Present					
Stratum C thickness	(m)	hSC	0.00					
Stratum C total porosity	(-)	nSC			NA	NA		
Stratum C water-filled porosity	(-)	nwSC			NA	NA		
Stratum C bulk density	(g/cm^3)	rhoSC			NA	NA		
Stratum directly above the water table								
Stratum A, B, or C		src_soil	Stratum A					
Height of capillary fringe	(m)	hcz	0.682	0.682	NA	NA		
Capillary zone total porosity	(-)	ncz	0.439	0.439	NA	0.20		
Capillary zone water filled porosity	(-)	nwcz	0.349	0.349	NA	0.18		

Exposure Parameters:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Target risk for carcinogens	(-)	Target_CR	1.00E-05	1.00E-06	NA	NA	WARNING	EPD Target Value
Target hazard quotient for non-carcinogens	(-)	Target_HQ	1	1	NA	NA		
Exposure Scenario		Scenario	Commercial	Commercial				
Averaging time for carcinogens	(yrs)	ATc	70	70	NA	NA		
Averaging time for non-carcinogens	(yrs)	ATnc	25	25	NA	NA		
Exposure duration	(yrs)	ED	25	25	NA	NA		
Exposure frequency	(days/yr)	EF	250	250	NA	NA		
Exposure time	(hrs/24 hrs)	ET	8	8	NA	NA		
Mutagenic mode-of-action factor	(yrs)	MMOAF	72	72	NA	NA	NOTE	MMOAF not relevant for non-mutagenic compounds

Model Output **Site Name/Run Number:** Chloroform

Chemical Name: Chloroform CAS No. 67-66-3

Range is based on the reasonable range of Qsoil/Qbuilding values, as reported in the literature.

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**1.8E-06**	1.8E-06 - 1.8E-06	**4.9E-05**	3.3E-05 - 5.0E-05	WARNING	Please review warning messages

Predicted Indoor Air Concentration	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**2.8E-03**	2.8E-03 - 2.8E-03	**7.7E-02**	5.2E-02 - 7.8E-02		
	(ppbv)		**5.8E-04**	5.7E-04 - 5.8E-04	**1.6E-02**	1.1E-02 - 1.6E-02	WARNING	Please review warning messages **SEE MEI COMMENTS ABOVE**

Predicted Vapor Conc. Beneath Foundation	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Subslab vapor concentration	(ug/m3)	**Css**	**9.4E-01**	5.7E-02 - 2.8E+01	**2.6E+01**	5.2E+02 - 7.8E+02		
	(ppbv)		**1.9E-01**	1.2E-02 - 5.7E+00	**5.2E+00**	1.1E+02 - 1.6E+02		

Diffusive Transport Upward Through Vadose Zone	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	9.1E-05	-	4.4E-03	-		
Effective diffusion coefficient through Stratum B	(cm2/sec)	DeffB		-		-		
Effective diffusion coefficient through Stratum C	(cm2/sec)	DeffC		-		-		
Effective diffusion coefficient through capillary zone	(cm2/sec)	DeffCZ	1.5E-04	-	1.4E-04	-		
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	9.4E-05	-	1.4E-03	-		

Critical Parameters		Symbol	Value	Range	Default	Default Range	Flag
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	1.8E-06	-	5.0E-05		
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	2.6E+04	8.7E+02 - 4.4E+05	2.0E+02	6.7E+00 - 3.3E+03	
α for convective transport from subslab to building	(-)	C_Param	3.0E-03	1.0E-04 - 5.0E-02	3.0E-03	1.0E-04 - 5.0E-02	

Interpretation

Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

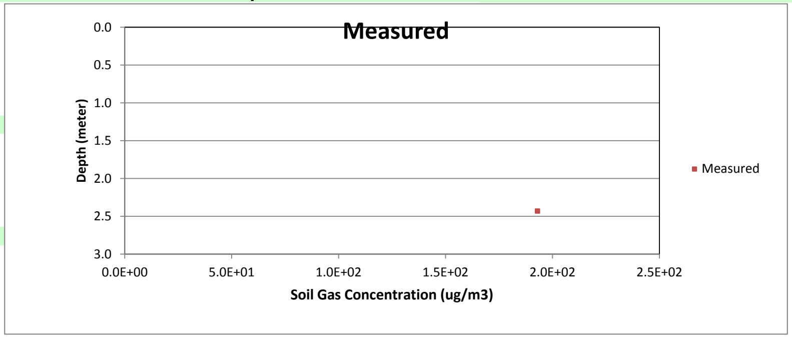
Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Qsoil_Qb, Lf, DeffA, eta

Concentration versus Depth Profile



Please check WARNING or ERROR flags

Model Output Site Name/Run Number: Chloroform

Chemical Name: Chloroform CAS No. 67-66-3

Risk Calculations	Units	Symbol	Value	Range	Default	Range	Flag	Comment
Risk-Based Target Screening Levels **Scenario: Commercial**								
Target risk for carcinogens	(-)	Target_CR	1E-05	-	1E-06	-		
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-		
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**5.33E+00**	-	**5.33E-01**	-	Target indoor air concentration based on cancer risk (unit risk factor)	
	(ppbv)		**1.09E+00**	-	**1.09E-01**	-		
Target groundwater concentration	**(ug/L)**	**Target_GW**	**2.64E+04**	**2.6E+04 - 2.7E+04**	**7.06E+01**	**9.6E+01 - 1.4E+02**		
Incremental Risk Estimates								
Incremental cancer risk from vapor intrusion	**(-)**	**Cancer_Risk**	**5.30E-09**	**5.2E-09 - 5.3E-09**	**1.44E-07**	**9.8E-08 - 1.5E-07**		
Hazard quotient from vapor intrusion	**(-)**	**HQ**	**6.59E-06**	**6.5E-06 - 6.6E-06**	**1.79E-04**	**1.2E-04 - 1.8E-04**		

Model Input

Site Name/Run Number: cDCE

Note:
-Yellow highlighted cells indicate parameters that typically are changed or must be inputted by the user.
-Dotted outline cells indicate default values that may be changed with justification.
-Toxicity values are taken from Regional Screening Level tables. These tables are updated semi-annually and may not reflect the most current toxicity information.

Use English / Metric Converter

Source Characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Source medium		Source	Groundwater					
Groundwater concentration	(ug/L)	Cmedium	210		NA			Max. cDCE 03-2015 @ MW-4
Depth below grade to water table	(m)	Ls	9.90		Vary - 50	NA		Avg. DTW on FOSC site 03-2015
Average groundwater temperature	(^{o}C)	Ts	17.6	25	3 - 25			EPA shallow GW temp map.
Calc: Source vapor concentration	(ug/m3)	Cs	25935					
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.002%					

Chemical:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Chemical Name		Chem	Dichloroethylene, 1,2-cis-					
CAS No.		CAS	156-59-2					
Toxicity Factors								
Unit risk factor	(ug/m^{3})$^{-1}$	IUR	Not Available	Not Available	NA	NA		No IUR available for this compound.
Mutagenic compound		Mut	No	NA	NA	NA		
Reference concentration	(mg/m^{3})	RfC	Not Available	Not Available	NA	NA		No RfC available for this compound.

Chemical Properties:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Pure component water solubility	(mg/L)	S	6.41E+03	6.41E+03	NA	NA		
Henry's Law Constant @ 25^{o}C	(atm-m^{3}/mol)	Hc	4.08E-03	4.08E-03	NA	NA		
Calc: Henry's Law Constant @ 25^{o}C	(dimensionless)	Hr	1.67E-01	1.67E-01				
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	1.23E-01	1.71E-01				
Diffusivity in air	(cm2/s)	Dair	8.84E-02	8.84E-02	NA	NA		
Diffusivity in water	(cm2/s)	Dwater	1.13E-05	1.13E-05	NA	NA		

Building Characteristics:

Select Building Assumptions
- (●) Use ratio for Qsoil/Qbuilding (recommended if no site specific data available)
- ( ) Specify Qsoil and Qbuilding separately; calculate ratio

	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Building setting		Bldg_Setting	Residential	Residential				
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade				
Depth below grade to base of foundation	(m)	Lb	0.15	0.10	0.1 - 2.44	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Foundation thickness	(m)	Lf	0.15	0.10	0.1 - 0.25	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00		
Enclosed space floor area	(m2)	Abf	139.40	150.00	80 - 200	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Enclosed space mixing height	(m)	Hb	4.67	2.44	2.13 - 3.05	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Indoor air exchange rate	(1 / hr)	ach	0.43	0.45	.15-1.26	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24		
Calc: Building ventilation rate	(m3/hr)	Qb	279.93	164.70	NA	0.30		
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	0.84	0.49	NA	NA		

Model Input **Site Name/Run Number:** cDCE

Chemical Name: Dichloroethylene, 1,2-cis- CAS No. 156-59-2

Depth below grade to water table: 9.90 meters

Vadose zone characteristics:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**	**Comment**
Stratum A (Top of soil profile):								
Stratum A SCS soil type		SCS_A	Silt Loam					
Stratum A thickness (from surface)	(m)	hSA	9.90					
Stratum A total porosity	(-)	nSA	0.386	0.439	NA	0.20	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A water-filled porosity	(-)	nwSA	0.315	0.180	0.065 - 0.3	0.25	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A bulk density	(g/cm^3)	rhoSA	1.520	1.490	NA	0.05	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum B (Soil layer below Stratum A):								
Stratum B SCS soil type		SCS_B	Not Present					
Stratum B thickness	(m)	hSB						
Stratum B total porosity	(-)	nSB			NA	NA		
Stratum B water-filled porosity	(-)	nwSB			NA	NA		
Stratum B bulk density	(g/cm^3)	rhoSB			NA	NA		
Stratum C (Soil layer below Stratum B):								
Stratum C SCS soil type		SCS_C	Not Present					
Stratum C thickness	(m)	hSC	0.00					
Stratum C total porosity	(-)	nSC			NA	NA		
Stratum C water-filled porosity	(-)	nwSC			NA	NA		
Stratum C bulk density	(g/cm^3)	rhoSC			NA	NA		
Stratum directly above the water table								
Stratum A, B, or C		src_soil	Stratum A					
Height of capillary fringe	(m)	hcz	0.682	0.682	NA	NA		
Capillary zone total porosity	(-)	ncz	0.439	0.439	NA	0.20		
Capillary zone water filled porosity	(-)	nwcz	0.349	0.349	NA	0.18		

Exposure Parameters:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**	**Comment**
Target risk for carcinogens	(-)	Target_CR	1.00E-05	1.00E-06	NA	NA	WARNING	EPD Target Value
Target hazard quotient for non-carcinogens	(-)	Target_HQ	1	1	NA	NA		
Exposure Scenario		Scenario	Commercial	Commercial				
Averaging time for carcinogens	(yrs)	ATc	70	70	NA	NA		
Averaging time for non-carcinogens	(yrs)	ATnc	25	25	NA	NA		
Exposure duration	(yrs)	ED	25	25	NA	NA		
Exposure frequency	(days/yr)	EF	250	250	NA	NA		
Exposure time	(hrs/24 hrs)	ET	8	8	NA	NA		
Mutagenic mode-of-action factor	(yrs)	MMOAF	72	72	NA	NA	NOTE	MMOAF not relevant for non-mutagenic compounds

Range is based on the reasonable range of Qsoil/Qbuilding values, as reported in the literature.

Model Output **Site Name/Run Number:** cDCE

Chemical Name: Dichloroethylene, 1,2-cis- CAS No. 156-59-2

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**2.0E-06**	2.0E-06 - 2.0E-06	**5.6E-05**	3.6E-05 - 5.7E-05	WARNING	Please review warning messages

Predicted Indoor Air Concentration	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**5.2E-02**	5.1E-02 - 5.2E-02	**1.4E+00**	9.4E-01 - 1.5E+00		
	(ppbv)		**1.3E-02**	1.3E-02 - 1.3E-02	**3.6E-01**	2.4E-01 - 3.7E-01	WARNING	Please review warning messages **SEE MEI COMMENTS ABOVE**

Predicted Vapor Conc. Beneath Foundation	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Subslab vapor concentration	(ug/m3)	**Css**	**1.7E+01**	1.0E+00 - 5.1E+02	**4.8E+02**	9.4E+03 - 1.5E+04		
	(ppbv)		**4.4E+00**	2.6E-01 - 1.3E+02	**1.2E+02**	2.4E+03 - 3.7E+03		

Diffusive Transport Upward Through Vadose Zone	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	1.0E-04	-	5.1E-03	-		
Effective diffusion coefficient through Stratum B	(cm2/sec)	DeffB		-		-		
Effective diffusion coefficient through Stratum C	(cm2/sec)	DeffC		-		-		
Effective diffusion coefficient through capillary zone	(cm2/sec)	DeffCZ	1.7E-04	-	1.6E-04	-		
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	1.0E-04	-	1.6E-03	-		

Critical Parameters		Symbol	Value	Range	Default	Default Range	Flag
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	2.0E-06	-	5.7E-05		
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	2.3E+04	7.8E+02 - 3.9E+05	1.7E+02	5.8E+00 - 2.9E+03	
α for convective transport from subslab to building	(-)	C_Param	3.0E-03	1.0E-04 - 5.0E-02	3.0E-03	1.0E-04 - 5.0E-02	

Interpretation

Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

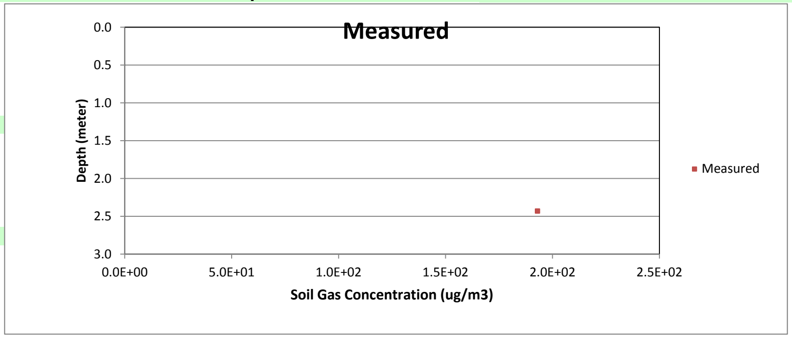
Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Qsoil_Qb, Lf, DeffA, eta

Concentration versus Depth Profile



Please check WARNING or ERROR flags

Model Output Site Name/Run Number: cDCE

Chemical Name: Dichloroethylene, 1,2-cis- CAS No. 156-59-2

Risk Calculations	Units	Symbol	Value	Range	Default	Range	Flag	Comment
Risk-Based Target Screening Levels Scenario: Commercial								
Target risk for carcinogens	(-)	Target_CR	1E-05	-	1E-06	-		
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-		
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**lo tox data availabl**	-	**No tox data available**	-		
	(ppbv)		**No tox data availabl**	-	**NA**	-		
Target groundwater concentration	**(ug/L)**	**Target_GW**	**lo tox data availabl**	**NA - NA**	**No tox data available**	**NA - NA**		
Incremental Risk Estimates								
Incremental cancer risk from vapor intrusion	**(-)**	**Cancer_Risk**	**No IUR**	**-**	**No IUR**	**No IUR - No IUR**		
Hazard quotient from vapor intrusion	**(-)**	**HQ**	**No RfC Available**	**ıvailable - No RfC A**	**No RfC Available**	**Available - No RfC Av**		

Model Input

Site Name/Run Number: tDCE

Note:
-Yellow highlighted cells indicate parameters that typically are changed or must be inputted by the user.
-Dotted outline cells indicate default values that may be changed with justification.
-Toxicity values are taken from Regional Screening Level tables. These tables are updated semi-annually and may not reflect the most current toxicity information.

Use English / Metric Converter

Source Characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Source medium		Source	Groundwater					
Groundwater concentration	(ug/L)	Cmedium	1.2		NA			Max. tDCE 03-2015 @ MW-4
Depth below grade to water table	(m)	Ls	9.90		Vary - 50	NA		Avg. DTW on FOSC site 03-2015
Average groundwater temperature	(^oC)	Ts	17.6	25	3 - 25			EPA shallow GW temp map.
Calc: Source vapor concentration	(ug/m3)	Cs	347					
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.000%					

Chemical:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Chemical Name		Chem	Dichloroethylene, 1,2-trans-					
CAS No.		CAS	156-60-5					
Toxicity Factors								
Unit risk factor	$(ug/m^3)^{-1}$	IUR	Not Available	Not Available	NA	NA		No IUR available for this compound.
Mutagenic compound		Mut	No	NA	NA	NA		
Reference concentration	(mg/m^3)	RfC	Not Available	Not Available	NA	NA		No RfC available for this compound.

Chemical Properties:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Pure component water solubility	(mg/L)	S	4.52E+03	4.52E+03	NA	NA		
Henry's Law Constant @ 25°C	$(atm\text{-}m^3/mol)$	Hc	9.38E-03	9.38E-03	NA	NA		
Calc: Henry's Law Constant @ 25°C	(dimensionless)	Hr	3.84E-01	3.84E-01				
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	2.89E-01	3.93E-01				
Diffusivity in air	(cm2/s)	Dair	8.76E-02	8.76E-02	NA	NA		
Diffusivity in water	(cm2/s)	Dwater	1.12E-05	1.12E-05	NA	NA		

Building Characteristics:

Select Building Assumptions
- (●) Use ratio for Qsoil/Qbuilding (recommended if no site specific data available)
- ( ) Specify Qsoil and Qbuilding separately; calculate ratio

	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Building setting		Bldg_Setting	Residential	Residential				
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade				
Depth below grade to base of foundation	(m)	Lb	0.15	0.10	0.1 - 2.44	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Foundation thickness	(m)	Lf	0.15	0.10	0.1 - 0.25	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00		
Enclosed space floor area	(m2)	Abf	139.40	150.00	80 - 200	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Enclosed space mixing height	(m)	Hb	4.67	2.44	2.13 - 3.05	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Indoor air exchange rate	(1 / hr)	ach	0.43	0.45	.15-1.26	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24		
Calc: Building ventilation rate	(m3/hr)	Qb	279.93	164.70	NA	0.30		
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	0.84	0.49	NA	NA		

Model Input

Site Name/Run Number: tDCE

Chemical Name: Dichloroethylene, 1,2-trans- **CAS No.** 156-60-5

Depth below grade to water table: 9.90 meters

Vadose zone characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Stratum A (Top of soil profile):								
Stratum A SCS soil type		SCS_A	Silt Loam					
Stratum A thickness (from surface)	(m)	hSA	9.90					
Stratum A total porosity	(-)	nSA	0.386	0.439	NA	0.20	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A water-filled porosity	(-)	nwSA	0.315	0.180	0.065 - 0.3	0.25	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A bulk density	(g/cm^3)	rhoSA	1.520	1.490	NA	0.05	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum B (Soil layer below Stratum A):								
Stratum B SCS soil type		SCS_B	Not Present					
Stratum B thickness	(m)	hSB						
Stratum B total porosity	(-)	nSB			NA	NA		
Stratum B water-filled porosity	(-)	nwSB			NA	NA		
Stratum B bulk density	(g/cm^3)	rhoSB			NA	NA		
Stratum C (Soil layer below Stratum B):								
Stratum C SCS soil type		SCS_C	Not Present					
Stratum C thickness	(m)	hSC	0.00					
Stratum C total porosity	(-)	nSC			NA	NA		
Stratum C water-filled porosity	(-)	nwSC			NA	NA		
Stratum C bulk density	(g/cm^3)	rhoSC			NA	NA		
Stratum directly above the water table								
Stratum A, B, or C		src_soil	Stratum A					
Height of capillary fringe	(m)	hcz	0.682	0.682	NA	NA		
Capillary zone total porosity	(-)	ncz	0.439	0.439	NA	0.20		
Capillary zone water filled porosity	(-)	nwcz	0.349	0.349	NA	0.18		

Exposure Parameters:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Target risk for carcinogens	(-)	Target_CR	1.00E-05	1.00E-06	NA	NA	WARNING	EPD Target Value
Target hazard quotient for non-carcinogens	(-)	Target_HQ	1	1	NA	NA		
Exposure Scenario		Scenario	Commercial	Commercial				
Averaging time for carcinogens	(yrs)	ATc	70	70	NA	NA		
Averaging time for non-carcinogens	(yrs)	ATnc	25	25	NA	NA		
Exposure duration	(yrs)	ED	25	25	NA	NA		
Exposure frequency	(days/yr)	EF	250	250	NA	NA		
Exposure time	(hrs/24 hrs)	ET	8	8	NA	NA		
Mutagenic mode-of-action factor	(yrs)	MMOAF	72	72	NA	NA	NOTE	MMOAF not relevant for non-mutagenic compounds

Model Output **Site Name/Run Number:** tDCE

Range is based on the reasonable range of Qsoil/Qbuilding values, as reported in the literature.

Chemical Name: Dichloroethylene, 1,2-trans- CAS No. 156-60-5

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**1.9E-06**	1.8E-06 - 1.9E-06	**5.4E-05**	3.5E-05 - 5.5E-05	WARNING	Please review warning messages

Predicted Indoor Air Concentration	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**6.4E-04**	6.3E-04 - 6.4E-04	**1.9E-02**	1.2E-02 - 1.9E-02		
	(ppbv)		**1.6E-04**	1.6E-04 - 1.6E-04	**4.7E-03**	3.1E-03 - 4.8E-03	WARNING	Please review warning messages **SEE MEI COMMENTS ABOVE**

Predicted Vapor Conc. Beneath Foundation	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Subslab vapor concentration	(ug/m3)	**Css**	**2.1E-01**	1.3E-02 - 6.3E+00	**6.2E+00**	1.2E+02 - 1.9E+02		
	(ppbv)		**5.4E-02**	3.3E-03 - 1.6E+00	**1.6E+00**	3.1E+01 - 4.8E+01		

Diffusive Transport Upward Through Vadose Zone	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	9.3E-05	-	5.1E-03	-		
Effective diffusion coefficient through Stratum B	(cm2/sec)	DeffB		-		-		
Effective diffusion coefficient through Stratum C	(cm2/sec)	DeffC		-		-		
Effective diffusion coefficient through capillary zone	(cm2/sec)	DeffCZ	1.6E-04	-	1.6E-04	-		
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	9.6E-05	-	1.6E-03	-		

Critical Parameters		Symbol	Value	Range	Default	Default Range	Flag
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	1.9E-06	-	5.5E-05		
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	2.6E+04	8.5E+02 - 4.3E+05	1.8E+02	5.8E+00 - 2.9E+03	
α for convective transport from subslab to building	(-)	C_Param	3.0E-03	1.0E-04 - 5.0E-02	3.0E-03	1.0E-04 - 5.0E-02	

Interpretation

Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

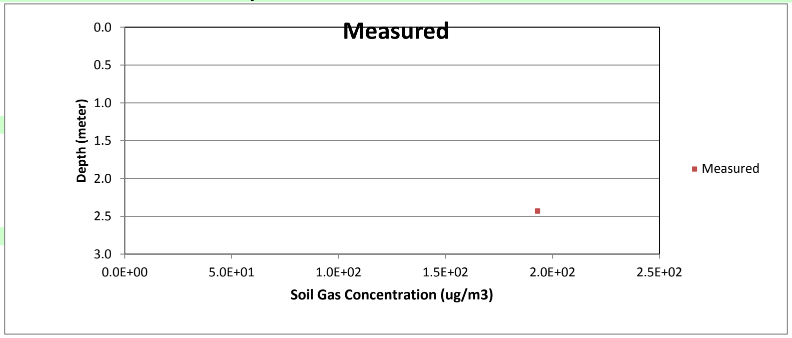
Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Qsoil_Qb, Lf, DeffA, eta

Concentration versus Depth Profile



Please check WARNING or ERROR flags

Model Output Site Name/Run Number: tDCE

Chemical Name: Dichloroethylene, 1,2-trans- CAS No. 156-60-5

Risk Calculations	Units	Symbol	Value	Range	Default	Range	Flag	Comment
Risk-Based Target Screening Levels Scenario: Commercial								
Target risk for carcinogens	(-)	Target_CR	1E-05	-	1E-06	-		
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-		
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**lo tox data availabl**	-	**No tox data available**	-		
	(ppbv)		**No tox data availabl**	-	**NA**	-		
Target groundwater concentration	**(ug/L)**	**Target_GW**	**lo tox data availabl**	**NA - NA**	**No tox data available**	**NA - NA**		
Incremental Risk Estimates								
Incremental cancer risk from vapor intrusion	**(-)**	**Cancer_Risk**	**No IUR**	**-**	**No IUR**	**No IUR - No IUR**		
Hazard quotient from vapor intrusion	**(-)**	**HQ**	**No RfC Available**	**ıvailable - No RfC A**	**No RfC Available**	**Available - No RfC Av**		

Model Input

Site Name/Run Number: Cumene

Note:
-Yellow highlighted cells indicate parameters that typically are changed or must be inputted by the user.
-Dotted outline cells indicate default values that may be changed with justification.
-Toxicity values are taken from Regional Screening Level tables. These tables are updated semi-annually and may not reflect the most current toxicity information.

Use English / Metric Converter

Source Characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Source medium		Source	Groundwater					
Groundwater concentration	(ug/L)	Cmedium	3.2		NA			Max. Cumene 03-2015 @ MW-28
Depth below grade to water table	(m)	Ls	9.90		Vary - 50	NA		Avg. DTW on FOSC site 03-2015
Average groundwater temperature	(^oC)	Ts	17.6	25	3 - 25			EPA shallow GW temp map.
Calc: Source vapor concentration	(ug/m3)	Cs	900					
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.003%					

Chemical:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Chemical Name		Chem	Cumene					
CAS No.		CAS	98-82-8					
Toxicity Factors								
Unit risk factor	$(ug/m^3)^{-1}$	IUR	Not Available	Not Available	NA	NA		No IUR available for this compound.
Mutagenic compound		Mut	No	NA	NA	NA		
Reference concentration	(mg/m^3)	RfC	4.00E-01	4.00E-01	NA	NA		

Chemical Properties:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Pure component water solubility	(mg/L)	S	6.13E+01	6.13E+01	NA	NA		
Henry's Law Constant @ 25^oC	$(atm-m^3/mol)$	Hc	1.15E-02	1.15E-02	NA	NA		
Calc: Henry's Law Constant @ 25^oC	(dimensionless)	Hr	4.70E-01	4.70E-01				
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	2.81E-01	4.82E-01				
Diffusivity in air	(cm2/s)	Dair	6.03E-02	6.03E-02	NA	NA		
Diffusivity in water	(cm2/s)	Dwater	7.86E-06	7.86E-06	NA	NA		

Building Characteristics:

Select Building Assumptions
- (●) Use ratio for Qsoil/Qbuilding (recommended if no site specific data available)
- ( ) Specify Qsoil and Qbuilding separately; calculate ratio

	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Building setting		Bldg_Setting	Residential	Residential				
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade				
Depth below grade to base of foundation	(m)	Lb	0.15	0.10	0.1 - 2.44	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Foundation thickness	(m)	Lf	0.15	0.10	0.1 - 0.25	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00		
Enclosed space floor area	(m2)	Abf	139.40	150.00	80 - 200	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Enclosed space mixing height	(m)	Hb	4.67	2.44	2.13 - 3.05	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Indoor air exchange rate	(1 / hr)	ach	0.43	0.45	.15-1.26	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24		
Calc: Building ventilation rate	(m3/hr)	Qb	279.93	164.70	NA	0.30		
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	0.84	0.49	NA	NA		

Model Input Site Name/Run Number: Cumene

Chemical Name: Cumene CAS No. 98-82-8

Depth below grade to water table: 9.90 meters

Vadose zone characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Stratum A (Top of soil profile):								
Stratum A SCS soil type		SCS_A	Silt Loam					
Stratum A thickness (from surface)	(m)	hSA	9.90					
Stratum A total porosity	(-)	nSA	0.386	0.439	NA	0.20	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A water-filled porosity	(-)	nwSA	0.315	0.180	0.065 - 0.3	0.25	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A bulk density	(g/cm^3)	rhoSA	1.520	1.490	NA	0.05	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum B (Soil layer below Stratum A):								
Stratum B SCS soil type		SCS_B	Not Present					
Stratum B thickness	(m)	hSB						
Stratum B total porosity	(-)	nSB			NA	NA		
Stratum B water-filled porosity	(-)	nwSB			NA	NA		
Stratum B bulk density	(g/cm^3)	rhoSB			NA	NA		
Stratum C (Soil layer below Stratum B):								
Stratum C SCS soil type		SCS_C	Not Present					
Stratum C thickness	(m)	hSC	0.00					
Stratum C total porosity	(-)	nSC			NA	NA		
Stratum C water-filled porosity	(-)	nwSC			NA	NA		
Stratum C bulk density	(g/cm^3)	rhoSC			NA	NA		
Stratum directly above the water table								
Stratum A, B, or C		src_soil	Stratum A					
Height of capillary fringe	(m)	hcz	0.682	0.682	NA	NA		
Capillary zone total porosity	(-)	ncz	0.439	0.439	NA	0.20		
Capillary zone water filled porosity	(-)	nwcz	0.349	0.349	NA	0.18		

Exposure Parameters:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Target risk for carcinogens	(-)	Target_CR	1.00E-05	1.00E-06	NA	NA	WARNING	EPD Target Value
Target hazard quotient for non-carcinogens	(-)	Target_HQ	1	1	NA	NA		
Exposure Scenario		Scenario	Commercial	Commercial				
Averaging time for carcinogens	(yrs)	ATc	70	70	NA	NA		
Averaging time for non-carcinogens	(yrs)	ATnc	25	25	NA	NA		
Exposure duration	(yrs)	ED	25	25	NA	NA		
Exposure frequency	(days/yr)	EF	250	250	NA	NA		
Exposure time	(hrs/24 hrs)	ET	8	8	NA	NA		
Mutagenic mode-of-action factor	(yrs)	MMOAF	72	72	NA	NA	NOTE	MMOAF not relevant for non-mutagenic compounds

Model Output Site Name/Run Number: Cumene

Chemical Name: Cumene CAS No. 98-82-8

Range is based on the reasonable range of Qsoil/Qbuilding values, as reported in the literature.

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**1.3E-06**	1.3E-06 - 1.3E-06	**3.7E-05**	2.7E-05 - 3.8E-05	WARNING	Please review warning messages

Predicted Indoor Air Concentration	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**1.2E-03**	1.1E-03 - 1.2E-03	**3.3E-02**	2.5E-02 - 3.4E-02		
	(ppbv)		**2.3E-04**	2.3E-04 - 2.4E-04	**6.8E-03**	5.0E-03 - 6.9E-03	WARNING	Please review warning messages **SEE MEI COMMENTS ABOVE**

Predicted Vapor Conc. Beneath Foundation	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Subslab vapor concentration	(ug/m3)	**Css**	**3.8E-01**	2.3E-02 - 1.1E+01	**1.1E+01**	2.5E+02 - 3.4E+02		
	(ppbv)		**7.8E-02**	4.7E-03 - 2.3E+00	**2.3E+00**	5.0E+01 - 6.9E+01		

Diffusive Transport Upward Through Vadose Zone	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	6.5E-05	-	3.5E-03	-		
Effective diffusion coefficient through Stratum B	(cm2/sec)	DeffB		-		-		
Effective diffusion coefficient through Stratum C	(cm2/sec)	DeffC		-		-		
Effective diffusion coefficient through capillary zone	(cm2/sec)	DeffCZ	1.1E-04	-	1.1E-04	-		
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	6.6E-05	-	1.1E-03	-		

Critical Parameters		Symbol	Value	Range	Default	Default Range	Flag
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	1.3E-06	-	3.8E-05		
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	3.7E+04	1.2E+03 - 6.2E+05	2.5E+02	8.5E+00 - 4.2E+03	
α for convective transport from subslab to building	(-)	C_Param	3.0E-03	1.0E-04 - 5.0E-02	3.0E-03	1.0E-04 - 5.0E-02	

Interpretation

Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

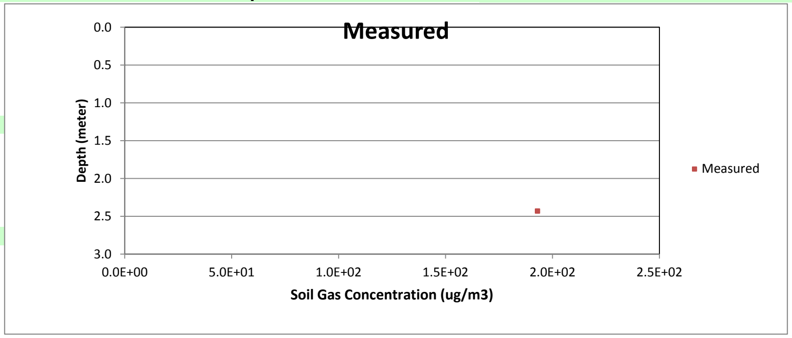
Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Qsoil_Qb, Lf, DeffA, eta

Concentration versus Depth Profile



Please check WARNING or ERROR flags

Model Output Site Name/Run Number: Cumene

Chemical Name: Cumene CAS No. 98-82-8

Risk Calculations	Units	Symbol	Value	Range	Default	Range	Flag	Comment
Risk-Based Target Screening Levels Scenario: Commercial								
Target risk for carcinogens	(-)	Target_CR	1E-05	-	1E-06	-		
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-		
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**1.75E+03**	-	**1.75E+03**	-	Target indoor air concentration based on non-cancer toxicity (reference concentration)	
	(ppbv)		**3.57E+02**	-	**3.57E+02**	-		
Target groundwater concentration	**(ug/L)**	**Target_GW**	**4.86E+06**	**4.9E+06 - 4.9E+06**	**9.78E+04**	**1.7E+05 - 2.3E+05**		
Incremental Risk Estimates								
Incremental cancer risk from vapor intrusion	**(-)**	**Cancer_Risk**	**No IUR**	**-**	**No IUR**	**No IUR - No IUR**		
Hazard quotient from vapor intrusion	**(-)**	**HQ**	**6.59E-07**	**6.5E-07 - 6.6E-07**	**1.91E-05**	**1.4E-05 - 1.9E-05**		

Model Input **Site Name/Run Number:** MEK

Note:
-Yellow highlighted cells indicate parameters that typically are changed or must be inputted by the user.
-Dotted outline cells indicate default values that may be changed with justification.
-Toxicity values are taken from Regional Screening Level tables. These tables are updated semi-annually and may not reflect the most current toxicity information.

Use English / Metric Converter

Source Characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Source medium		Source	Groundwater					
Groundwater concentration	(ug/L)	Cmedium	11		NA			Max. MEK 03-2015 @ MW-13D
Depth below grade to water table	(m)	Ls	9.90		Vary - 50	NA		Avg. DTW on FOSC site 03-2015
Average groundwater temperature	(^oC)	Ts	17.6	25	3 - 25			EPA shallow GW temp map.
Calc: Source vapor concentration	(ug/m3)	Cs	18					
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.000%					

Chemical:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Chemical Name		Chem	Methyl Ethyl Ketone (2-Butanone)					
CAS No.		CAS	78-93-3					
Toxicity Factors								
Unit risk factor	$(ug/m^3)^{-1}$	IUR	Not Available	Not Available	NA	NA		No IUR available for this compound.
Mutagenic compound		Mut	No	NA	NA	NA		
Reference concentration	(mg/m^3)	RfC	5.00E+00	5.00E+00	NA	NA		

Chemical Properties:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Pure component water solubility	(mg/L)	S	2.23E+05	2.23E+05	NA	NA		
Henry's Law Constant @ 25°C	$(atm\text{-}m^3/mol)$	Hc	5.69E-05	5.69E-05	NA	NA		
Calc: Henry's Law Constant @ 25°C	(dimensionless)	Hr	2.33E-03	2.33E-03				
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	1.67E-03	2.39E-03				
Diffusivity in air	(cm2/s)	Dair	9.14E-02	9.14E-02	NA	NA		
Diffusivity in water	(cm2/s)	Dwater	1.02E-05	1.02E-05	NA	NA		

Building Characteristics:

Select Building Assumptions
- (●) Use ratio for Qsoil/Qbuilding (recommended if no site specific data available)
- ( ) Specify Qsoil and Qbuilding separately; calculate ratio

	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Building setting		Bldg_Setting	Residential	Residential				
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade				
Depth below grade to base of foundation	(m)	Lb	0.15	0.10	0.1 - 2.44	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Foundation thickness	(m)	Lf	0.15	0.10	0.1 - 0.25	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00		
Enclosed space floor area	(m2)	Abf	139.40	150.00	80 - 200	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Enclosed space mixing height	(m)	Hb	4.67	2.44	2.13 - 3.05	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Indoor air exchange rate	(1 / hr)	ach	0.43	0.45	.15-1.26	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24		
Calc: Building ventilation rate	(m3/hr)	Qb	279.93	164.70	NA	0.30		
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	0.84	0.49	NA	NA		

Model Input Site Name/Run Number: MEK

Chemical Name: Methyl Ethyl Ketone (2-Butanone) CAS No. 78-93-3

Depth below grade to water table: 9.90 meters

Vadose zone characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Stratum A (Top of soil profile):								
Stratum A SCS soil type		SCS_A	Silt Loam					
Stratum A thickness (from surface)	(m)	hSA	9.90					
Stratum A total porosity	(-)	nSA	0.386	0.439	NA	0.20	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A water-filled porosity	(-)	nwSA	0.315	0.180	0.065 - 0.3	0.25	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A bulk density	(g/cm^3)	rhoSA	1.520	1.490	NA	0.05	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum B (Soil layer below Stratum A):								
Stratum B SCS soil type		SCS_B	Not Present					
Stratum B thickness	(m)	hSB						
Stratum B total porosity	(-)	nSB			NA	NA		
Stratum B water-filled porosity	(-)	nwSB			NA	NA		
Stratum B bulk density	(g/cm^3)	rhoSB			NA	NA		
Stratum C (Soil layer below Stratum B):								
Stratum C SCS soil type		SCS_C	Not Present					
Stratum C thickness	(m)	hSC	0.00					
Stratum C total porosity	(-)	nSC			NA	NA		
Stratum C water-filled porosity	(-)	nwSC			NA	NA		
Stratum C bulk density	(g/cm^3)	rhoSC			NA	NA		
Stratum directly above the water table								
Stratum A, B, or C		src_soil	Stratum A					
Height of capillary fringe	(m)	hcz	0.682	0.682	NA	NA		
Capillary zone total porosity	(-)	ncz	0.439	0.439	NA	0.20		
Capillary zone water filled porosity	(-)	nwcz	0.349	0.349	NA	0.18		

Exposure Parameters:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Target risk for carcinogens	(-)	Target_CR	1.00E-05	1.00E-06	NA	NA	WARNING	EPD Target Value
Target hazard quotient for non-carcinogens	(-)	Target_HQ	1	1	NA	NA		
Exposure Scenario		Scenario	Commercial	Commercial				
Averaging time for carcinogens	(yrs)	ATc	70	70	NA	NA		
Averaging time for non-carcinogens	(yrs)	ATnc	25	25	NA	NA		
Exposure duration	(yrs)	ED	25	25	NA	NA		
Exposure frequency	(days/yr)	EF	250	250	NA	NA		
Exposure time	(hrs/24 hrs)	ET	8	8	NA	NA		
Mutagenic mode-of-action factor	(yrs)	MMOAF	72	72	NA	NA	NOTE	MMOAF not relevant for non-mutagenic compounds

Model Output Site Name/Run Number: MEK

Chemical Name: Methyl Ethyl Ketone (2-Butanone) CAS No. 78-93-3

Range is based on the reasonable range of Qsoil/Qbuilding values, as reported in the literature.

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Groundwater to indoor air attenuation coefficient	(-)	alpha	**1.9E-05**	1.6E-05 - 1.9E-05	**1.3E-04**	5.7E-05 - 1.3E-04	WARNING	Please review warning messages

Predicted Indoor Air Concentration	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Indoor air concentration due to vapor intrusion	(ug/m3)	Cia	**3.4E-04**	2.9E-04 - 3.5E-04	**2.3E-03**	1.1E-03 - 2.4E-03		
	(ppbv)		**1.2E-04**	9.9E-05 - 1.2E-04	**8.0E-04**	3.6E-04 - 8.3E-04	WARNING	Please review warning messages **SEE MEI COMMENTS ABOVE**

Predicted Vapor Conc. Beneath Foundation	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Subslab vapor concentration	(ug/m3)	Css	**1.1E-01**	6.9E-03 - 2.9E+00	**7.8E-01**	1.1E+01 - 2.4E+01		
	(ppbv)		**3.9E-02**	2.3E-03 - 9.9E-01	**2.7E-01**	3.6E+00 - 8.3E+00		

Diffusive Transport Upward Through Vadose Zone	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	9.7E-04	-	5.4E-03	-		
Effective diffusion coefficient through Stratum B	(cm2/sec)	DeffB		-		-		
Effective diffusion coefficient through Stratum C	(cm2/sec)	DeffC		-		-		
Effective diffusion coefficient through capillary zone	(cm2/sec)	DeffCZ	1.1E-03	-	8.2E-04	-		
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	9.8E-04	-	3.9E-03	-		

Critical Parameters		Symbol	Value	Range	Default	Default Range	Flag
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	1.9E-05	-	1.3E-04		
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	2.5E+03	8.2E+01 - 4.1E+04	1.7E+02	5.5E+00 - 2.8E+03	
α for convective transport from subslab to building	(-)	C_Param	3.0E-03	1.0E-04 - 5.0E-02	3.0E-03	1.0E-04 - 5.0E-02	

Interpretation

Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

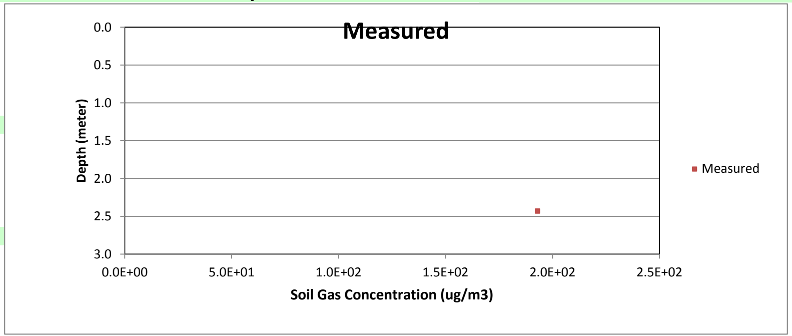
Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Qsoil_Qb, Lf, DeffA, eta

Concentration versus Depth Profile



Please check WARNING or ERROR flags

Model Output Site Name/Run Number: MEK

Chemical Name: Methyl Ethyl Ketone (2-Butanone) CAS No. 78-93-3

Risk Calculations	Units	Symbol	Value	Range	Default	Range	Flag	Comment
Risk-Based Target Screening Levels Scenario: Commercial								
Target risk for carcinogens	(-)	Target_CR	1E-05	-	1E-06	-		
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-		
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**2.19E+04**	-	**2.19E+04**	-		Target indoor air concentration based on non-cancer toxicity (reference concentration)
	(ppbv)		**7.43E+03**	-	**7.43E+03**	-		
Target groundwater concentration	**(ug/L)**	**Target_GW**	**7.00E+08**	**7.0E+08 - 8.3E+08**	**7.17E+07**	**9.8E+07 - 2.3E+08**		
Incremental Risk Estimates								
Incremental cancer risk from vapor intrusion	**(-)**	**Cancer_Risk**	**No IUR**	**-**	**No IUR**	**No IUR - No IUR**		
Hazard quotient from vapor intrusion	**(-)**	**HQ**	**1.57E-08**	**1.3E-08 - 1.6E-08**	**1.07E-07**	**4.8E-08 - 1.1E-07**		

Model Input

Site Name/Run Number: PCE

Note:
-Yellow highlighted cells indicate parameters that typically are changed or must be inputted by the user.
-Dotted outline cells indicate default values that may be changed with justification.
-Toxicity values are taken from Regional Screening Level tables. These tables are updated semi-annually and may not reflect the most current toxicity information.

Use English / Metric Converter

Source Characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Source medium		Source	Groundwater					
Groundwater concentration	(ug/L)	Cmedium	810		NA			Max. PCE 03-2015 @ MW-2
Depth below grade to water table	(m)	Ls	9.90		Vary - 50	NA		Avg. DTW on FOSC site 03-2015
Average groundwater temperature	(^oC)	Ts	17.6	25	3 - 25			EPA shallow GW temp map.
Calc: Source vapor concentration	(ug/m3)	Cs	400027					
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.242%					

Chemical:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Chemical Name		Chem	Tetrachloroethylene					
CAS No.		CAS	127-18-4					
Toxicity Factors								
Unit risk factor	$(ug/m^3)^{-1}$	IUR	2.60E-07	2.60E-07	NA	NA		
Mutagenic compound		Mut	No	NA	NA	NA		
Reference concentration	(mg/m^3)	RfC	4.00E-02	4.00E-02	NA	NA		

Chemical Properties:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Pure component water solubility	(mg/L)	S	2.06E+02	2.06E+02	NA	NA		
Henry's Law Constant @ 25^oC	$(atm\text{-}m^3/mol)$	Hc	1.77E-02	1.77E-02	NA	NA		
Calc: Henry's Law Constant @ 25^oC	(dimensionless)	Hr	7.24E-01	7.24E-01				
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	4.94E-01	7.42E-01				
Diffusivity in air	(cm2/s)	Dair	5.05E-02	5.05E-02	NA	NA		
Diffusivity in water	(cm2/s)	Dwater	9.46E-06	9.46E-06	NA	NA		

Building Characteristics:

Select Building Assumptions
- (●) Use ratio for Qsoil/Qbuilding (recommended if no site specific data available)
- ( ) Specify Qsoil and Qbuilding separately; calculate ratio

	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Building setting		Bldg_Setting	Residential	Residential				
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade				
Depth below grade to base of foundation	(m)	Lb	0.15	0.10	0.1 - 2.44	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Foundation thickness	(m)	Lf	0.15	0.10	0.1 - 0.25	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00		
Enclosed space floor area	(m2)	Abf	139.40	150.00	80 - 200	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Enclosed space mixing height	(m)	Hb	4.67	2.44	2.13 - 3.05	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Indoor air exchange rate	(1 / hr)	ach	0.43	0.45	.15-1.26	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24		
Calc: Building ventilation rate	(m3/hr)	Qb	279.93	164.70	NA	0.30		
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	0.84	0.49	NA	NA		

Model Input Site Name/Run Number: PCE

Chemical Name: Tetrachloroethylene **CAS No. 127-18-4**

Depth below grade to water table: 9.90 meters

Vadose zone characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Stratum A (Top of soil profile):								
Stratum A SCS soil type		SCS_A	Silt Loam					
Stratum A thickness (from surface)	(m)	hSA	9.90					
Stratum A total porosity	(-)	nSA	0.386	0.439	NA	0.20	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A water-filled porosity	(-)	nwSA	0.315	0.180	0.065 - 0.3	0.25	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A bulk density	(g/cm^3)	rhoSA	1.520	1.490	NA	0.05	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum B (Soil layer below Stratum A):								
Stratum B SCS soil type		SCS_B	Not Present					
Stratum B thickness	(m)	hSB						
Stratum B total porosity	(-)	nSB			NA	NA		
Stratum B water-filled porosity	(-)	nwSB			NA	NA		
Stratum B bulk density	(g/cm^3)	rhoSB			NA	NA		
Stratum C (Soil layer below Stratum B):								
Stratum C SCS soil type		SCS_C	Not Present					
Stratum C thickness	(m)	hSC	0.00					
Stratum C total porosity	(-)	nSC			NA	NA		
Stratum C water-filled porosity	(-)	nwSC			NA	NA		
Stratum C bulk density	(g/cm^3)	rhoSC			NA	NA		
Stratum directly above the water table								
Stratum A, B, or C		src_soil	Stratum A					
Height of capillary fringe	(m)	hcz	0.682	0.682	NA	NA		
Capillary zone total porosity	(-)	ncz	0.439	0.439	NA	0.20		
Capillary zone water filled porosity	(-)	nwcz	0.349	0.349	NA	0.18		
Exposure Parameters:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**	**Comment**
Target risk for carcinogens	(-)	Target_CR	1.00E-05	1.00E-06	NA	NA	WARNING	EPD Target Value
Target hazard quotient for non-carcinogens	(-)	Target_HQ	1	1	NA	NA		
Exposure Scenario		Scenario	Commercial	Commercial				
Averaging time for carcinogens	(yrs)	ATc	70	70	NA	NA		
Averaging time for non-carcinogens	(yrs)	ATnc	25	25	NA	NA		
Exposure duration	(yrs)	ED	25	25	NA	NA		
Exposure frequency	(days/yr)	EF	250	250	NA	NA		
Exposure time	(hrs/24 hrs)	ET	8	8	NA	NA		
Mutagenic mode-of-action factor	(yrs)	MMOAF	72	72	NA	NA	NOTE	MMOAF not relevant for non-mutagenic compounds

Range is based on the reasonable range of Qsoil/Qbuilding values, as reported in the literature.

Model Output

Site Name/Run Number: PCE

Chemical Name: Tetrachloroethylene **CAS No. 127-18-4**

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**1.1E-06**	1.1E-06 - 1.1E-06	**3.1E-05**	2.4E-05 - 3.1E-05	WARNING	Please review warning messages

Predicted Indoor Air Concentration	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**4.2E-01**	4.2E-01 - 4.2E-01	**1.2E+01**	9.6E+00 - 1.3E+01		
	(ppbv)		**6.3E-02**	6.2E-02 - 6.3E-02	**1.8E+00**	1.4E+00 - 1.9E+00	WARNING	Please review warning messages **SEE MEI COMMENTS ABOVE**

Predicted Vapor Conc. Beneath Foundation	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Subslab vapor concentration	(ug/m3)	**Css**	**1.4E+02**	8.5E+00 - 4.2E+03	**4.1E+03**	9.6E+04 - 1.3E+05		
	(ppbv)		**2.1E+01**	1.3E+00 - 6.2E+02	**6.1E+02**	1.4E+04 - 1.9E+04		

Diffusive Transport Upward Through Vadose Zone	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	5.3E-05	-	2.9E-03	-		
Effective diffusion coefficient through Stratum B	(cm2/sec)	DeffB		-		-		
Effective diffusion coefficient through Stratum C	(cm2/sec)	DeffC		-		-		
Effective diffusion coefficient through capillary zone	(cm2/sec)	DeffCZ	9.0E-05	-	8.9E-05	-		
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	5.5E-05	-	9.1E-04	-		

Critical Parameters		Symbol	Value	Range	Default	Default Range	Flag
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	1.1E-06	-	3.1E-05		
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	4.5E+04	1.5E+03 - 7.5E+05	3.0E+02	1.0E+01 - 5.1E+03	
α for convective transport from subslab to building	(-)	C_Param	3.0E-03	1.0E-04 - 5.0E-02	3.0E-03	1.0E-04 - 5.0E-02	

Interpretation

Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

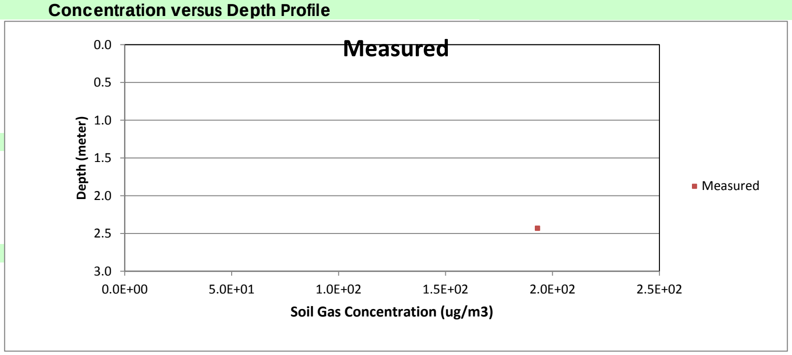
Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Qsoil_Qb, Lf, DeffA, eta

Concentration versus Depth Profile



Please check WARNING or ERROR flags

Model Output Site Name/Run Number: PCE

Chemical Name: Tetrachloroethylene **CAS No. 127-18-4**

Risk Calculations	Units	Symbol	Value	Range	Default	Range	Flag	Comment
Risk-Based Target Screening Levels Scenario: Commercial								
Target risk for carcinogens	(-)	Target_CR	1E-05	-	1E-06	-		
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-		
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**1.75E+02**	-	**4.72E+01**	-	Target indoor air concentration based on non-cancer toxicity (reference concentration)	
	(ppbv)		**2.58E+01**	-	**6.96E+00**	-		
Target groundwater concentration	**(ug/L)**	**Target_GW**	**3.34E+05**	**3.3E+05 - 3.4E+05**	**2.04E+03**	**3.0E+03 - 4.0E+03**		
Incremental Risk Estimates								
Incremental cancer risk from vapor intrusion	**(-)**	**Cancer_Risk**	**9.00E-09**	**8.9E-09 - 9.0E-09**	**2.64E-07**	**2.0E-07 - 2.7E-07**		
Hazard quotient from vapor intrusion	**(-)**	**HQ**	**2.42E-03**	**2.4E-03 - 2.4E-03**	**7.10E-02**	**5.5E-02 - 7.2E-02**		

Model Input

Site Name/Run Number: TCE

Note:
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-Dotted outline cells indicate default values that may be changed with justification.
-Toxicity values are taken from Regional Screening Level tables. These tables are updated semi-annually and may not reflect the most current toxicity information.

Use English / Metric Converter

Source Characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Source medium		Source	Groundwater					
Groundwater concentration	(ug/L)	Cmedium	120		NA			Max. TCE 03-2015 @ MW-4
Depth below grade to water table	(m)	Ls	9.90		Vary - 50	NA		Avg. DTW on FOSC site 03-2015
Average groundwater temperature	(^{o}C)	Ts	17.6	25	3 - 25			EPA shallow GW temp map.
Calc: Source vapor concentration	(ug/m3)	Cs	34450					
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.007%					

Chemical:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Chemical Name		Chem	Trichloroethylene					
CAS No.		CAS	79-01-6					
Toxicity Factors								
Unit risk factor	(ug/m^{3})$^{-1}$	IUR	see note	see note	NA	NA		
Mutagenic compound		Mut	Yes	NA	NA	NA		
Reference concentration	(mg/m^{3})	RfC	2.00E-03	2.00E-03	NA	NA		

Chemical Properties:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Pure component water solubility	(mg/L)	S	1.28E+03	1.28E+03	NA	NA		
Henry's Law Constant @ 25^{o}C	(atm-m^{3}/mol)	Hc	9.85E-03	9.85E-03	NA	NA		
Calc: Henry's Law Constant @ 25^{o}C	(dimensionless)	Hr	4.03E-01	4.03E-01				
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	2.87E-01	4.13E-01				
Diffusivity in air	(cm2/s)	Dair	6.87E-02	6.87E-02	NA	NA		
Diffusivity in water	(cm2/s)	Dwater	1.02E-05	1.02E-05	NA	NA		

Building Characteristics:

Select Building Assumptions
- (●) Use ratio for Qsoil/Qbuilding (recommended if no site specific data available)
- ( ) Specify Qsoil and Qbuilding separately; calculate ratio

	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Building setting		Bldg_Setting	Residential	Residential				
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade				
Depth below grade to base of foundation	(m)	Lb	0.15	0.10	0.1 - 2.44	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Foundation thickness	(m)	Lf	0.15	0.10	0.1 - 0.25	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00		
Enclosed space floor area	(m2)	Abf	139.40	150.00	80 - 200	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Enclosed space mixing height	(m)	Hb	4.67	2.44	2.13 - 3.05	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Indoor air exchange rate	(1 / hr)	ach	0.43	0.45	.15-1.26	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24		
Calc: Building ventilation rate	(m3/hr)	Qb	279.93	164.70	NA	0.30		
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	0.84	0.49	NA	NA		

Model Input **Site Name/Run Number:** TCE

Chemical Name: Trichloroethylene **CAS No. 79-01-6**

Depth below grade to water table: 9.90 meters

Vadose zone characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Stratum A (Top of soil profile):								
Stratum A SCS soil type		SCS_A	Silt Loam					
Stratum A thickness (from surface)	(m)	hSA	9.90					
Stratum A total porosity	(-)	nSA	0.386	0.439	NA	0.20	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A water-filled porosity	(-)	nwSA	0.315	0.180	0.065 - 0.3	0.25	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A bulk density	(g/cm^3)	rhoSA	1.520	1.490	NA	0.05	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum B (Soil layer below Stratum A):								
Stratum B SCS soil type		SCS_B	Not Present					
Stratum B thickness	(m)	hSB						
Stratum B total porosity	(-)	nSB			NA	NA		
Stratum B water-filled porosity	(-)	nwSB			NA	NA		
Stratum B bulk density	(g/cm^3)	rhoSB			NA	NA		
Stratum C (Soil layer below Stratum B):								
Stratum C SCS soil type		SCS_C	Not Present					
Stratum C thickness	(m)	hSC	0.00					
Stratum C total porosity	(-)	nSC			NA	NA		
Stratum C water-filled porosity	(-)	nwSC			NA	NA		
Stratum C bulk density	(g/cm^3)	rhoSC			NA	NA		
Stratum directly above the water table								
Stratum A, B, or C		src_soil	Stratum A					
Height of capillary fringe	(m)	hcz	0.682	0.682	NA	NA		
Capillary zone total porosity	(-)	ncz	0.439	0.439	NA	0.20		
Capillary zone water filled porosity	(-)	nwcz	0.349	0.349	NA	0.18		

Exposure Parameters:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Target risk for carcinogens	(-)	Target_CR	1.00E-05	1.00E-06	NA	NA	WARNING	EPD Target Value
Target hazard quotient for non-carcinogens	(-)	Target_HQ	1	1	NA	NA		
Exposure Scenario		Scenario	Commercial	Commercial				
Averaging time for carcinogens	(yrs)	ATc	70	70	NA	NA		
Averaging time for non-carcinogens	(yrs)	ATnc	25	25	NA	NA		
Exposure duration	(yrs)	ED	25	25	NA	NA		
Exposure frequency	(days/yr)	EF	250	250	NA	NA		
Exposure time	(hrs/24 hrs)	ET	8	8	NA	NA		
Mutagenic mode-of-action factor	(yrs)	MMOAF	72	72	NA	NA		MMOAF used in place of ED in risk calculations

Model Output **Site Name/Run Number:** TCE

Chemical Name: Trichloroethylene **CAS No. 79-01-6**

Range is based on the reasonable range of Qsoil/Qbuilding values, as reported in the literature.

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**1.5E-06**	1.4E-06 - 1.5E-06	**4.2E-05**	3.0E-05 - 4.3E-05	WARNING	Please review warning messages
Predicted Indoor Air Concentration	**Units**	**Symbol**	**Value**	**Range**	**Default**	**Default Range**	**Flag**	**Comment**
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**5.1E-02**	5.0E-02 - 5.1E-02	**1.5E+00**	1.0E+00 - 1.5E+00		
	(ppbv)		**9.4E-03**	9.3E-03 - 9.4E-03	**2.7E-01**	1.9E-01 - 2.8E-01	WARNING	Please review warning messages **SEE MEI COMMENTS ABOVE**
Predicted Vapor Conc. Beneath Foundation	**Units**	**Symbol**	**Value**	**Range**	**Default**	**Default Range**	**Flag**	**Comment**
Subslab vapor concentration	(ug/m3)	**Css**	**1.7E+01**	1.0E+00 - 5.0E+02	**4.9E+02**	1.0E+04 - 1.5E+04		
	(ppbv)		**3.1E+00**	1.9E-01 - 9.3E+01	**9.1E+01**	1.9E+03 - 2.8E+03		
Diffusive Transport Upward Through Vadose Zone	**Units**	**Symbol**	**Value**	**Range**	**Default**	**Default Range**	**Flag**	**Comment**
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	7.4E-05	-	4.0E-03	-		
Effective diffusion coefficient through Stratum B	(cm2/sec)	DeffB		-		-		
Effective diffusion coefficient through Stratum C	(cm2/sec)	DeffC		-		-		
Effective diffusion coefficient through capillary zone	(cm2/sec)	DeffCZ	1.2E-04	-	1.2E-04	-		
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	7.6E-05	-	1.2E-03	-		

Critical Parameters		Symbol	Value	Range	Default	Default Range	Flag
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	1.5E-06	-	4.3E-05		
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	3.2E+04	1.1E+03 - 5.4E+05	2.2E+02	7.5E+00 - 3.7E+03	
α for convective transport from subslab to building	(-)	C_Param	3.0E-03	1.0E-04 - 5.0E-02	3.0E-03	1.0E-04 - 5.0E-02	

Interpretation

Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

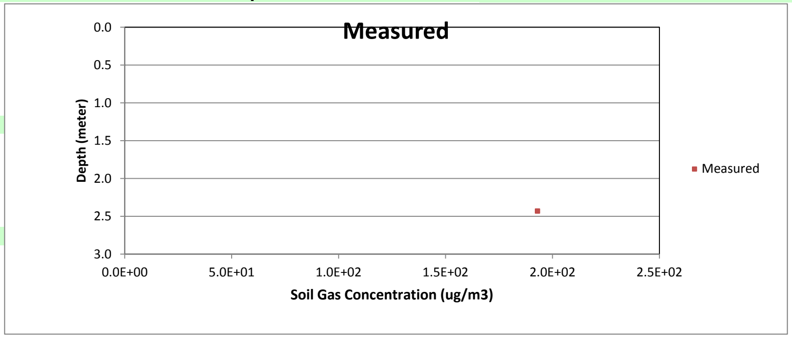
Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Qsoil_Qb, Lf, DeffA, eta

Concentration versus Depth Profile



Please check WARNING or ERROR flags

Model Output Site Name/Run Number: TCE

Chemical Name: Trichloroethylene **CAS No. 79-01-6**

Risk Calculations	Units	Symbol	Value	Range	Default	Range	Flag	Comment
Risk-Based Target Screening Levels Scenario: Commercial								
Target risk for carcinogens	(-)	Target_CR	1E-05	-	1E-06	-		
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-		
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**2.05E+01**	-	**2.05E+00**	-	Target indoor air concentration based on both cancer risk and non-cancer toxicity	
	(ppbv)		**3.82E+00**	-	**3.82E-01**	-		
Target groundwater concentration	**(ug/L)**	**Target_GW**	**4.86E+04**	**4.9E+04 - 4.9E+04**	**1.17E+02**	**1.7E+02 - 2.4E+02**		
Incremental Risk Estimates								
Incremental cancer risk from vapor intrusion	**(-)**	**Cancer_Risk**	**6.57E-08**	**6.5E-08 - 6.6E-08**	**1.90E-06**	**1.3E-06 - 1.9E-06**		
Hazard quotient from vapor intrusion	**(-)**	**HQ**	**5.78E-03**	**5.7E-03 - 5.8E-03**	**1.67E-01**	**1.2E-01 - 1.7E-01**		

Model Input

Site Name/Run Number: Vinyl Chloride

Note:
-Yellow highlighted cells indicate parameters that typically are changed or must be inputted by the user.
-Dotted outline cells indicate default values that may be changed with justification.
-Toxicity values are taken from Regional Screening Level tables. These tables are updated semi-annually and may not reflect the most current toxicity information.

Use English / Metric Converter

Source Characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Source medium		Source	Groundwater					
Groundwater concentration	(ug/L)	Cmedium	11		NA			Max. VC 03-2015 @ MW-16
Depth below grade to water table	(m)	Ls	9.90		Vary - 50	NA		Avg. DTW on FOSC site 03-2015
Average groundwater temperature	(^oC)	Ts	17.6	25	3 - 25			EPA shallow GW temp map.
Calc: Source vapor concentration	(ug/m3)	Cs	3158					
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.001%					

Chemical:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Chemical Name		Chem	Trichloroethylene					
CAS No.		CAS	79-01-6					
Toxicity Factors								
Unit risk factor	$(ug/m^3)^{-1}$	IUR	see note	see note	NA	NA		
Mutagenic compound		Mut	Yes	NA	NA	NA		
Reference concentration	(mg/m^3)	RfC	2.00E-03	2.00E-03	NA	NA		

Chemical Properties:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Pure component water solubility	(mg/L)	S	1.28E+03	1.28E+03	NA	NA		
Henry's Law Constant @ 25^oC	(atm-m^3/mol)	Hc	9.85E-03	9.85E-03	NA	NA		
Calc: Henry's Law Constant @ 25^oC	(dimensionless)	Hr	4.03E-01	4.03E-01				
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	2.87E-01	4.13E-01				
Diffusivity in air	(cm2/s)	Dair	6.87E-02	6.87E-02	NA	NA		
Diffusivity in water	(cm2/s)	Dwater	1.02E-05	1.02E-05	NA	NA		

Building Characteristics:

Select Building Assumptions
- (●) Use ratio for Qsoil/Qbuilding (recommended if no site specific data available)
- ( ) Specify Qsoil and Qbuilding separately; calculate ratio

	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Building setting		Bldg_Setting	Residential	Residential				
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade				
Depth below grade to base of foundation	(m)	Lb	0.15	0.10	0.1 - 2.44	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Foundation thickness	(m)	Lf	0.15	0.10	0.1 - 0.25	NA	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00		
Enclosed space floor area	(m2)	Abf	139.40	150.00	80 - 200	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Enclosed space mixing height	(m)	Hb	4.67	2.44	2.13 - 3.05	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Indoor air exchange rate	(1 / hr)	ach	0.43	0.45	.15-1.26	NA	WARNING	Table 4 - Coin Shop. UC Vapor Sampling & Modeling Rpt 02-2011
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24		
Calc: Building ventilation rate	(m3/hr)	Qb	279.93	164.70	NA	0.30		
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	0.84	0.49	NA	NA		

Model Input **Site Name/Run Number:** Vinyl Chloride

Chemical Name: Trichloroethylene **CAS No. 79-01-6**

Depth below grade to water table: 9.90 meters

Vadose zone characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Stratum A (Top of soil profile):								
Stratum A SCS soil type		SCS_A	Silt Loam					
Stratum A thickness (from surface)	(m)	hSA	9.90					
Stratum A total porosity	(-)	nSA	0.386	0.439	NA	0.20	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A water-filled porosity	(-)	nwSA	0.315	0.180	0.065 - 0.3	0.25	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum A bulk density	(g/cm^3)	rhoSA	1.520	1.490	NA	0.05	WARNING	Table 2 - UC Vapor Sampling & Modeling Rpt 02-2011
Stratum B (Soil layer below Stratum A):								
Stratum B SCS soil type		SCS_B	Not Present					
Stratum B thickness	(m)	hSB						
Stratum B total porosity	(-)	nSB			NA	NA		
Stratum B water-filled porosity	(-)	nwSB			NA	NA		
Stratum B bulk density	(g/cm^3)	rhoSB			NA	NA		
Stratum C (Soil layer below Stratum B):								
Stratum C SCS soil type		SCS_C	Not Present					
Stratum C thickness	(m)	hSC	0.00					
Stratum C total porosity	(-)	nSC			NA	NA		
Stratum C water-filled porosity	(-)	nwSC			NA	NA		
Stratum C bulk density	(g/cm^3)	rhoSC			NA	NA		
Stratum directly above the water table								
Stratum A, B, or C		src_soil	Stratum A					
Height of capillary fringe	(m)	hcz	0.682	0.682	NA	NA		
Capillary zone total porosity	(-)	ncz	0.439	0.439	NA	0.20		
Capillary zone water filled porosity	(-)	nwcz	0.349	0.349	NA	0.18		

Exposure Parameters:	Units	Symbol	Value	Default	Potential Span	CV	Flag	Comment
Target risk for carcinogens	(-)	Target_CR	1.00E-05	1.00E-06	NA	NA	WARNING	EPD Target Value
Target hazard quotient for non-carcinogens	(-)	Target_HQ	1	1	NA	NA		
Exposure Scenario		Scenario	Commercial	Commercial				
Averaging time for carcinogens	(yrs)	ATc	70	70	NA	NA		
Averaging time for non-carcinogens	(yrs)	ATnc	25	25	NA	NA		
Exposure duration	(yrs)	ED	25	25	NA	NA		
Exposure frequency	(days/yr)	EF	250	250	NA	NA		
Exposure time	(hrs/24 hrs)	ET	8	8	NA	NA		
Mutagenic mode-of-action factor	(yrs)	MMOAF	72	72	NA	NA		MMOAF used in place of ED in risk calculations

Model Output **Site Name/Run Number:** Vinyl Chloride

Chemical Name: Trichloroethylene **CAS No. 79-01-6**

Range is based on the reasonable range of Qsoil/Qbuilding values, as reported in the literature.

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**1.5E-06**	1.4E-06 - 1.5E-06	**4.2E-05**	3.0E-05 - 4.3E-05	WARNING	Please review warning messages

Predicted Indoor Air Concentration	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**4.6E-03**	4.6E-03 - 4.6E-03	**1.3E-01**	9.5E-02 - 1.4E-01		
	(ppbv)		**8.6E-04**	8.5E-04 - 8.6E-04	**2.5E-02**	1.8E-02 - 2.5E-02	WARNING	Please review warning messages **SEE MEI COMMENTS ABOVE**

Predicted Vapor Conc. Beneath Foundation	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Subslab vapor concentration	(ug/m3)	**Css**	**1.5E+00**	9.3E-02 - 4.6E+01	**4.5E+01**	9.5E+02 - 1.4E+03		
	(ppbv)		**2.9E-01**	1.7E-02 - 8.5E+00	**8.3E+00**	1.8E+02 - 2.5E+02		

Diffusive Transport Upward Through Vadose Zone	Units	Symbol	Value	Range	Default	Default Range	Flag	Comment
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	7.4E-05	-	4.0E-03	-		
Effective diffusion coefficient through Stratum B	(cm2/sec)	DeffB		-		-		
Effective diffusion coefficient through Stratum C	(cm2/sec)	DeffC		-		-		
Effective diffusion coefficient through capillary zone	(cm2/sec)	DeffCZ	1.2E-04	-	1.2E-04	-		
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	7.6E-05	-	1.2E-03	-		

Critical Parameters		Symbol	Value	Range	Default	Default Range	Flag
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	1.5E-06	-	4.3E-05		
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	3.2E+04	1.1E+03 - 5.4E+05	2.2E+02	7.5E+00 - 3.7E+03	
α for convective transport from subslab to building	(-)	C_Param	3.0E-03	1.0E-04 - 5.0E-02	3.0E-03	1.0E-04 - 5.0E-02	

Interpretation

Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

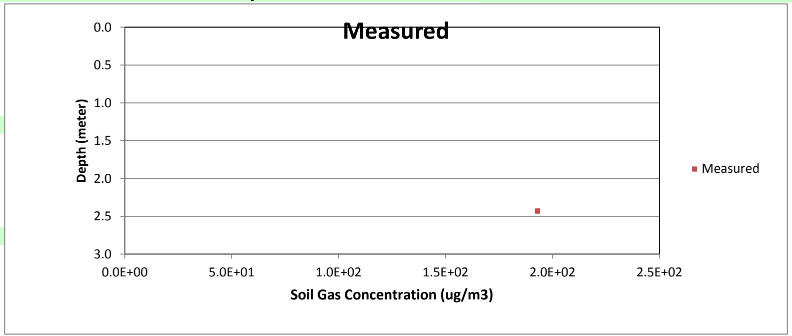
Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Qsoil_Qb, Lf, DeffA, eta

Concentration versus Depth Profile



Please check WARNING or ERROR flags

Model Output Site Name/Run Number: Vinyl Chloride

Chemical Name: Trichloroethylene **CAS No. 79-01-6**

Risk Calculations	Units	Symbol	Value	Range	Default	Range	Flag	Comment
Risk-Based Target Screening Levels Scenario: Commercial								
Target risk for carcinogens	(-)	Target_CR	1E-05	-	1E-06	-		
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-		
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**2.05E+01**	-	**2.05E+00**	-	Target indoor air concentration based on both cancer risk and non-cancer toxicity	
	(ppbv)		**3.82E+00**	-	**3.82E-01**	-		
Target groundwater concentration	**(ug/L)**	**Target_GW**	**4.86E+04**	**4.9E+04 - 4.9E+04**	**1.17E+02**	**1.7E+02 - 2.4E+02**		
Incremental Risk Estimates								
Incremental cancer risk from vapor intrusion	**(-)**	**Cancer_Risk**	**6.02E-09**	**5.9E-09 - 6.0E-09**	**1.74E-07**	**1.2E-07 - 1.8E-07**		
Hazard quotient from vapor intrusion	**(-)**	**HQ**	**5.30E-04**	**5.2E-04 - 5.3E-04**	**1.53E-02**	**1.1E-02 - 1.6E-02**		

Appendix H

Revised Compliance Status Report
&
Progress Report
- Electronic Copy (Compact Disc)