Former Greif Brothers Manufacturing Facility
Cullman Alabama
ADEM VCP Site #: 461-001-134

Fact Sheet

A Voluntary Cleanup Program (VCP) Cleanup Plan has been found to be technically adequate by the Alabama Department of Environmental Management for the Former Greif Brothers Manufacturing Facility site in Cullman, Alabama. The City of Cullman currently owns the facility. This fact sheet has been prepared to briefly advise the public of the principal legal and policy issues of the VCP.

I. VCP PROCESS

The VCP provides a mechanism for the implementation of a cleanup program that encourages applicants to voluntarily assess, remediate, and reuse rural and urban areas of actual or perceived contamination. The program does not relieve any “responsible person” for the liability for administrative, civil, or criminal fines or penalties which are otherwise authorized by law and imposed as a result of the illegal or unpermitted disposal of solid waste, hazardous waste, hazardous constituents, hazardous substances, petroleum products, and/or pollutants to the land, air, or waters of the State on an identified property. The program is designed to expedite the voluntary cleanup process and has been designed for entry at any stage of the cleanup process as long as all applicable criteria have been met up to the point of entry.

II. PROCEDURES FOR REACHING A FINAL DECISION

The Alabama Department of Environmental Management (ADEM) is proposing to issue the City of Cullman a final decision for the site remediation. The Voluntary Cleanup Plan includes plans for institutional and engineering controls which include procedures to install two feet of clean clay material or asphalt on contaminated areas of soil, restrictions on groundwater use, and the site will not be used for residential purposes.

ADEM Admin Code R. 335-15-6-.02 requires that the public be given a 30-day comment period from the date of the notice. The comment period will begin on August 3, 2018 which is the date of publication of the public notice in major local newspaper(s) of general circulation and will end on September 4, 2018.

All persons wishing to comment on any of the conditions of the VCP Remediation should submit their comments in writing to the Alabama Department of Environmental Management, Permits and Services Division, 1400 Coliseum Blvd. (Zip 36110). P.O. Box 301463 (Zip 36130-1463) Montgomery, Alabama, ATTENTION: Mr. Russell Kelly. Written comments on the VCP activities should be submitted to the Alabama Department of Environmental Management and be received by 5:00 p.m. on September 4, 2018.

ADEM will consider all written comments received during the comment period while making a final decision on this issue. When the Department makes its final decision, notice will be given to the applicant and each person who has submitted written comments or requested notice of the final decision.

III. FACILITY DESIGN

Goodwyn, Mills, and Cawood, Inc. has completed Site Investigation activities under the VCP at the Former Greif Brothers Manufacturing Facility site located at 409 Second Avenue NE, Cullman, Cullman County, Alabama. The site was used for a variety of industrial uses from 1917 until 1947. From 1947 until September, 2002, the facility was operated by Greif Brothers Corporation for the production of steel drum containers. In addition, the Cullman Supply Company (CUSCO) owned by Greif Brothers, was a machine shop and parts warehouse and operated several different processes including saw blade manufacturing, a welding shop, a machine shop, and a parts distribution center. Due to the presence of elevated levels of petroleum aromatic hydrocarbons and volatile organic compounds in the groundwater and heavy metals in the soil, and the site's history, institutional and engineering controls will be used at the site to eliminate or minimize potential exposures associated with future use and/or development. These include a restriction on the use of groundwater and areas with elevated soil concentrations will be paved or landscaped.

IV. TECHNICAL CONTACT

Pamela Luckie, Project Manager
Redevelopment Section
Industrial Hazardous Waste Branch
Land Division
Alabama Department of Environmental Management
1400 Coliseum Boulevard (Zip 36110)
P.O. Box 301463 (Zip 36130-1463)
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bullock environmental, llc 2811 crescent avenue, suite 101, birmingham, alabama 35209 t 205.876.1715 f 205.443.9413

March 25, 2019

Mr. Tom Charney
Risk Management Officer
City of Cullman
204 2nd Ave NE
Cullman, AL 35055

Subject: **Modified Voluntary Cleanup Plan & Risk Assessment**
Former Greif Brothers Facility (Parcels A & B)
409 Second Avenue NE
Cullman, Cullman County, Alabama
Alabama Voluntary Cleanup Site #: 461-9496
Bullock Environmental, LLC Project #: 18-CULL01

Dear Mr. Charney:

Bullock Environmental, LLC (Bullock) submits the attached Modified Voluntary Cleanup Plan & Risk Assessment for the above-referenced Site.

If you have any questions or comments regarding the content or recommendations set forth in this report, please call us at (205) 876-1715.

Sincerely,

BULLOCK ENVIRONMENTAL, LLC

Douglas A. Bullock, CHMM
Principal

cc: Alabama Department of Environmental Management-Redevelopment Section

Enclosure

Modified Voluntary Cleanup Plan & Risk Assessment
Former Greif Brothers Facility (Parcels A & B)
409 Second Avenue NE
Cullman, Cullman County, Alabama
Alabama Voluntary Cleanup Site #: 461-9496
Bullock Environmental, LLC Project #: 18-CULL01

Prepared for:

Alabama Department of Environmental Management
Redevelopment Section
Alabama Department of Environmental Management
P.O. Box 301463
Montgomery, Alabama 36130-1463

On Behalf of:
The City of Cullman
204 2nd Ave NE
Cullman, AL 35055

March 25, 2019

BULLOCK ENVIRONMENTAL, LLC

Samuel Smith, AL-P.G. # 1287
Project Geologist
March 25, 2019

Douglas A. Bullock, CHMM
Principal
March 25, 2019

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CERTIFICATION PAGE

I certify under penalty of law that this document and all plans, specifications, and technical data submitted were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiring of the person or persons who directly gathered the enclosed information, the information submitted, to the best of my knowledge and belief, is true, accurate, and complete. I am aware that there are significant penalties for submitting false information.

Signed

Mr. Samuel Smith
Printed

AL-P.G. # 1287
Registration Number

March 25, 2018
Date

1.0 INTRODUCTION

1.1 SITE DESCRIPTION

The Site is located at 409 Second Avenue NE in Cullman, Alabama, and depicted on the United States Geological Survey (USGS) 7.5-Minute Topographic Quadrangle *Cullman, Alabama*, dated 1997. As indicated on **Figure 1**, the Site is approximately located at north latitude 34°10’59.9” and west longitude 86°50’45.8”. A Site plan illustrating structures, approximate boundaries, and sampling locations is included as **Figure 2**.

The Site (Parcels A and B) comprises approximately two city blocks located between 8th Street Northeast (north), 2nd Avenue Northeast (east), Elizabeth Street Northeast (south), and CSX Railroad Right-of-Way and tracks (west). Containing numerous structures, the Site houses the Cullman City Garage, the Cullman Street Department and city storage, and the Cullman Police Department. The remaining portions of the Site consist primarily of paved parking areas and two single-family residences located along the northeastern Site boundary.

Properties surrounding the Site include residential and commercial/light industrial development on all sides

1.2 SITE HISTORY AND PURPOSE

Based on a review of historical information, the Site was developed for industrial use as early as 1917. Over this time the Site accommodated a wide range of operations, which included (among others) Bremen (of Dremen) Manufacturing Company, Standard Industrial Laundry, Porter Knitting Mills Company, Cullman Supply Company (from approximately 1946), Acadia Planning, King Pharr Canning Supply Company, Raible Division Sheet Metal & Stamping Company, and Greif Brothers, Inc. (manufacturers of steel drums). The City of Cullman acquired the Site from Greif Brothers, Inc. in May 2009 and has used it for municipal purposes since that time.

Bullock also reviewed of available Sanborn® Fire Insurance Maps depicting the site, dated 1917, 1926, 1946, and 1959, in the *Certified Sanborn® Map Report* included in **Appendix A**. The following information was obtained from the maps:

- 1917: The portion of the Site visible in this image indicates that Dreher Manufacturing Company housed five structures and a dwelling with a railroad spur along the western boundary. Four “Pickle Tanks” are illustrated on the northern portion of the Site with a pickling plant, dry kiln, lumber shed, a larger rectangular structure with an apparent engine house, and a reinforced concrete structure containing two apparent tanks and storage vats (substance stored is not identified). A freight depot and apparent train station are illustrated immediately west of the Site with portions of the railroad lines present on the area of the Site currently designated as Parcel B.
- 1926: The structural layout of the Site is unchanged from the 1917 image; however, the Site is now identified as the Cullman Heading Company. Surrounding land use appears similar to that represented in the 1917 image.
- 1946: The Cullman Heading Company occupied the northern portion of the Site while Cullman Supply Company comprises the eastern side. A structure on the western portion of the Site (adjacent to the railroad right-of-way) is identified as an electrical shop while a machine shop is located immediately east of the electrical shop. A new road is also present on the Site (Acadia Place) which enters the Site from 2nd Avenue East and turns south, terminating in then northern third of the Site. Three residential dwellings area also illustrated along the north eastern Site boundary with 2nd Avenue East. An office is located on the eastern Site boundary at the apparent entrance to the

Cullman Supply Company property. Structures behind (west of) the office include a series of machine shops and lumber processing buildings. A separate area, designated as "scattered log piles" is present southwest of the office and apparent Site entrance. Surrounding properties include Gulf Refining to the northwest and a steam laundry facility, residential development and a Standard Oil bulk storage terminal to the north, and residential development to the east. A cotton/weaving factory is located south of the Site.
- 1959: The Site configuration is generally unchanged from the 1946 image; however, a gasoline tank is located along the eastern Site boundary adjacent to the office. Additionally, a cupola is shown in the north-central portion of the Site; however, it is listed as "unused."

Bullock notes that certain structures on the Site burned following the 1959 Sanborn Map image. As such, the current structural configuration of the Site differs significantly from that represented in the historical Sanborn Maps.

Considering the information obtained and reviewed to date, Bullock understands that the Site was enrolled into the Alabama Voluntary Cleanup Program (VCP) in 2009 following a series of assessments completed between 2001 and 2007. Subsequent assessment and remedial activities followed the Site's enrollment into the Alabama VCP which included supplemental groundwater monitoring activities, source area remedial efforts (through soil blending/chemical oxidation activities), initiation of phytoremediation efforts, and the placement of passive soil vapor extraction (SVE) wells. In advance of executing the scope of work summarized herein, Bullock reviewed the following documents:

1. 2002 Phase III Site Assessment (ERM, Inc.);
2. 2010 Pre-Remedial Groundwater Report (Goodwyn Mills & Cawood);
3. 2012 Underground Injection Permit Application & Installation of Sodium Permanganate into on onsite soil to address elevated volatile organic compounds (VOCs) noted in groundwater on the west-central portion of the Site;
4. 2015 Cleanup Action Activities for Greif Facility, Cullman, Alabama-Final Report (Goodwyn Mills & Cawood);
5. 2017 Groundwater Monitoring Report (Terracon, Inc.); and
6. 2018 Modified Cleanup Plan (Goodwyn Mills & Cawood).

The purpose of this additional assessment is to obtain a better understanding of the source of onsite soil and groundwater contamination. The following section briefly summarizes the documents Bullock reviewed before commencing with this assessment.

2.0 SUMMARY OF PREVIOUS ASSESSMENTS

Investigations to date identified eleven Areas of Concern (AOCs) identified on the Site. Investigation of these areas (completed in 2001 and 2002 indicated the presence of various volatile organic compounds in soil and groundwater throughout the northern portion of the Site with the highest concentrations noted beneath and surrounding the former hazardous materials storage building and Trichloroethylene (TCE) Degreaser Building (see attached figure for reference). Chlorinated VOCs were noted in soil beneath and surrounding both the hazardous materials storage building and TCE degreaser building at concentrations above applicable screening values established by the Environmental Protection Agency (EPA). Depth of soil contamination ranged from surface soil (0-1 foot below surface) in sample SSR-2 with a TCE concentration of 17.99 milligrams per kilogram (mg/kg), above the EPA screening value of 1.9 mg/kg, to 9.35 mg/kg in the drill cuttings sampled from the installation of monitoring well MW-4. With regard to groundwater, monitoring well MW-4 (installed within the former hazardous materials storage building) contained the maximum TCE concentrations in onsite groundwater with levels ranging from 30.4

milligrams per liter (mg/L) to 88.6 mg/L (Maximum Contaminant Level for TCE in groundwater is 0.005 mg/L). Additional VOCs, including degradation products associated with TCE (cis-1,2-DCE and vinyl chloride) were also detected at elevated concentrations within this monitoring well in all sampling events conducted from 2002 through 2011. Surrounding monitoring wells (MW-3, MW-6, MW-1, MW-9, and MW-10) also contained elevated VOC concentrations, indicating a source area in the area surrounding monitoring well MW-4.

Supplemental sampling events from 2012 through 2017 indicated similar trends of VOC contaminants in onsite groundwater with post-remedial soil samples (limited to four locations surrounding the source area - see subsequent sections further detailing these results) containing low-level TCE concentrations (maximum TCE concentration in post-remedial soil samples was 0.082 mg/kg). Analysis of the 2017 groundwater sampling data (post-remediation) indicated that elevated VOC concentrations remained in onsite groundwater with a likely source area still in place and supporting these concentrations. Finally, review of the groundwater data from the 2017 sampling event alone (which does not include monitoring well MW-4) indicated a potential indoor vapor inhalation exposure pathway exists on the Site.

Considering these data, Bullock concluded that the effectiveness of the remedial actions completed between 2011 and 2014 remained unclear.

ASSESSMENT & CORRECTIVE ACTIONS COMPLETED THROUGH THE ALABAMA VCP

Based on Bullock's review of the 2015 and 2017 documents submitted to ADEM, Bullock understands that Goodwyn Mills & Cawood employed a series of remedial elements to address the VOCs present in onsite soil and groundwater. Those included the placement of at least four phytoremediation plots across certain ares of the Site (located outside known source areas), the use of sodium permanganate and lime with associated soil blending to chemically oxidize the contaminants in soil, and the placement of SVE blowers at numerous monitoring well locations throughout the Site.

Further review of the 2015 and 2017 documents submitted to ADEM revealed that Goodwyn Mills & Cawood concluded that the remedial efforts have reduced the VOC concentrations in soil and groundwater by as much as 99.99%.

Analysis of the data from these documents, however, suggests that elevated VOC concentrations may remain in onsite soil and groundwater. Bullock drew this conclusion based on the following:

1. Monitoring well MW-4 was moved approximately 50 feet east (and upgradient) of its former location. The movement of this well from its former location to its current one provides no empirical data regarding the efficacy of the remedial actions completed between 2011 and 2014;

2. Groundwater analytical results from surrounding monitoring wells in 2014 (MW-3) and 2017 (MW-6) indicated that elevated concentrations of TCE and other VOCs remained in groundwater following the conclusion of remedial efforts;

   A. TCE was present at a concentration of 30 mg/L in monitoring well MW-3 (located adjacent to and downgradient from the soil blending area) during the September 25, 2014, sampling event with PCE, cis-1,2-DCE, and vinyl chloride also present at concentrations significantly exceeding their respective MCLs. The documents submitted to ADEM neither commented upon nor explained these results (which followed the soil blending activities conducted in this area).

B. Results from the May 2017 sampling event indicated that monitoring well MW-6 contained TCE, cis-1,2-DCE, and vinyl chloride at concentrations of 0.429 mg/L, 11.5 mg/L, and 1.57 mg/L, respectively (each COC more than 100 times its associated MCL).

3. Finally, analysis of the analytical results obtained from monitoring well MW-10 indicated consistently elevated levels of TCE and associated break-down products since its installation in 2011. TCE concentrations in groundwater at this location remained at 1.4 mg/L or above with similarly, elevated concentrations of PCE, cis-1,2-DCE, and vinyl chloride (among other VOCs) detected well above their associated MCLs. With the consistently elevated COC concentrations noted in this monitoring well, Bullock concluded that a potential source area (not identified during previous investigations) may be present on the Site.

Taken together, the movement of monitoring well MW-4 from its former location, the dismissal of COC concentrations in monitoring wells MW-3 and MW-6 (at more than 100 times their associated MCLs), and the consistently elevated VOC concentrations in monitoring well MW-10 indicated that a contaminant source may remain in onsite soil which was not addressed during previous remedial efforts. With these questions in mind, Bullock proposed the following scope of work (detailed in subsequent sections). Historical Site assessment and remedial documents, along with relevant regulatory correspondence are included in **Appendix A**.

3.0 SCOPE OF WORK AND REPORT ORGANIZATION

3.1 SCOPE OF WORK

Considering the investigations completed to date, Bullock concluded that additional assessment appeared necessary to obtain a better understanding of the source of onsite soil and groundwater contamination. The assessment included the installation of 35 soil borings and the conversion of 13 soil borings into groundwater monitoring wells for subsequent water level measurement and sampling (in addition to the existing network of onsite monitoring wells). The investigation followed the ADEM Alabama Environmental Investigation & Remediation Guidance (AEIRG), revised February 2017 and comprised (where applicable) the following elements:

1. Background (property description and features, physical setting, site history & land use, surrounding land use, & summary of previous assessments);
2. Supplemental records review (if applicable);
3. Conceptual Site Model and sampling plan;
4. Chemical testing plan;
5. Surrounding public and private well inventory;
6. Utility search and location of subsurface conduit pathways;
7. Discussion of field exploration methods;
8. Evaluation and presentation of soil and groundwater analytical results;
9. Measurement of Groundwater Flow;
10. Discussion of findings and conclusions; and
11. Presentation of data in tabular and graphical form.

In addition to the tasks described above, Bullock also completed an evaluation of vapor intrusion risk based on the data obtained during the October 2018 investigation work. The data from this evaluation was used to better understand the overall risk to current and future occupants to COCs present in the subsurface and develop appropriate land use controls for inclusion in the environmental covenant to follow. Finally, Bullock developed a soil management plan to ensure proper management and handling of subsurface soil during future site redevelopment tasks. The measures outlined in this plan should mitigate potential exposure to future onsite workers while also providing a framework for the management and subsequent disposal of waste materials generated from such activities.

3.2 REPORT ORGANIZATION

Section 4.0 summarizes Site characterization information, which includes the general geology, hydrogeology, and lithology of the Site area and provides Site-specific information regarding COCs in each media evaluated (soil and groundwater). The assessment component of this report summarizes the Site investigation activities conducted by Bullock and presents an analysis of the data. Sections 5.0 and 6.0 summarize the installation of the soil borings and monitoring wells, the collection of groundwater samples for analysis of target COCs, and a comparison of the analytical results to regulatory screening values or MCLs. Section 7.0 provides an analysis of the risk associated with COCs present in onsite soil and groundwater while 8.0 outlines potential vapor mitigation measures associated with the construction of buildings in designated areas of the Site. Section 9.0 summarizes the proposed soil management plan to be employed during future redevelopment efforts. Section 10.0 presents conclusions and recommendations for further action while Section 11.0 lists the references cited throughout this report.

4.0 SITE CHARACTERIZATION AND FIELD INVESTIGATION RESULTS

4.1 SURROUNDING POPULATION

Properties surrounding the Site include a mixture of residential and commercial development to the north and east, commercial properties to the south, and railroad right-of-way followed by commercial/industrial development to the west.

4.2 GEOLOGY AND HYDROGEOLOGY

According to the Geological Survey of Alabama (GSA) *Geologic Map of the Cullman 7.5-Minute Quadrangle, Cullman County, Alabama*, dated 1957 (revised 1983), the Site lies within the Appalachian Plateaus physiographic province and appears to be underlain by the Pennsylvanian-aged Pottsville Formation, Lower Part. This geologic formation consists of light gray thick-bedded to massive pebbly quartzose sandstone, containing varying amounts of interbedded dark gray shale, siltstone, and thin discontinuous coal.

Site topography, which has been altered by development, is generally flat with a slight slope from northeast to southwest. Stormwater is directed away via surface flow and curb and gutter. Various factors can affect groundwater flow direction. In general, for unconfined aquifers, the direction of shallow groundwater movement mirrors surface topography and generally flows from hilltops and uplands (recharge areas) to stream valleys. Based on the interpretation of the *Cullman, Alabama* topographic quadrangle, shallow groundwater beneath the Site is inferred to generally flow to the southeast towards and unnamed tributary to Eight Mile Creek.

As summarized in **Table 1**, shallow groundwater elevations ranged from approximately 802.59 feet above mean sea level (AMSL) (BMW-2) to 794.86 feet AMSL (MW-10). Water table measurements in October 2018 indicated that groundwater generally flows southeast with a southwestern component in the west-central portion of the site (**Figure 3**).

4.3 SITE SOILS

According to the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) Web Soil Survey, the Site is primarily underlain by Albertville Loam, 2 to 6 percent slopes, eroded. The parent material of Albertville loam is clayey residuum weathered from shale; the depth to the restrictive feature is 40 to 60 inches (paralithic bedrock), while the depth to the water table is more than 80 inches.

Soils encountered during drilling operations varied across the Site from silty gravel fill with sand to sandy silty clay and silty sand residuum; Bedrock was encountered at depths ranging from seven feet BLS to 15 feet BLS. Boring logs illustrating the soil strata encountered during this investigation are included as **Appendix B**.

4.4 UNDERGROUND UTILITY SURVEY

Known underground utilities at the Site include water, storm sewer, gas, and sanitary sewer. Bullock personnel observed no evidence that underground utilities are functioning as conduits for potential contaminant transfer. Bullock personnel estimated the depths of onsite, subsurface utility lines to range from two to six feet BLS. A Site Plan with estimated subsurface utility locations is included as **Figure 2**.

4.5 RELEASE CHARACTERIZATION AND DISTRIBUTION OF COCS

This investigation revealed the presence of VOCs and polynuclear aromatic hydrocarbons (PAHs) in onsite soil at concentrations exceeding their associated EPA Regional Screening Levels (RSLs)for a commercial setting (dermal contact and ingestion of particulates assumed). Additionally, numerous VOCs were noted in onsite groundwater at concentrations exceeding their associated drinking water standards (MCLs) or tap water RSLs (See subsequent Sections detailing the compounds and noted concentrations of each).

Table 2A, Table 2B, and **Table 3A** summarize the analytical results for the soil and groundwater samples collected during the assessment activities completed in October 2018. Laboratory analytical reports are included in **Appendix C**. **Figure 4** illustrates the detected COCs in soil while **Figure 5** estimates the extent of COCs noted in groundwater with concentrations exceeding MCLs or tap water RSLs.

5.0 DISCUSSION OF FIELD EXPLORATION METHODS

5.1 SOIL BORING INSTALLATION AND SAMPLE COLLECTION - PHASE II ESA

On October 16 and 17, 2018, Bullock personnel oversaw the installation of 35 soil borings (SB-1 through SB-16, BMW-1 through BMW-13, and PBSB-1 through PBSB-6, **Figure 2**) by Geolab Environmental Drilling Company using a direct-push technology (DPT) drilling rig. Using five-foot long stainless steel core samplers with internal acetate liners, the drilling rig hydraulically advanced each soil boring in five-foot increments to collect continuous soil samples from the ground surface until reaching groundwater or bedrock refusal, with total depths ranging from one foot BLS (PBSB-1 through PBSB-6) to approximately 15 feet BLS. Field personnel decontaminated drilling rods and sampling equipment between borings to prevent cross-contamination.

Following sample collection, Bullock personnel split a representative portion of each soil sample for chemical analysis, headspace screening, and lithologic classification. Each soil sample collected for chemical analysis was immediately placed in a pre-cleaned sample container supplied by the laboratory, labeled, and packed in a cooler with ice. The soil samples were then delivered under proper chain-of-custody to Sutherland Environmental Laboratory, for analysis for select COCs. Soil samples collected for headspace screening were placed in re-sealable plastic bags and allowed to equilibrate for a minimum of 10 to 15 minutes, permitting sufficient vapors in the sample containers to accumulate. The containers were then screened with a photoionization detector (PID) and the headspace reading recorded. PID readings for each sample interval are included on the boring logs in **Appendix B**.

Field work, handling of samples, and decontamination of equipment were conducted in accordance with the protocols outlined in the Alabama Environmental Investigation & Remediation Guidance (AEIRG, revised February 2017).

5.2 TEMPORARY MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLE COLLECTION

Bullock converted 13 of the soil borings into temporary monitoring wells (BMW-1 through BMW-13, **Figure 2**). Each monitoring well was constructed with a five- to ten-foot section of one-inch Schedule 40 polyvinyl chloride (PVC), 0.010-inch slotted screen and an appropriate length of PVC riser and completed with a silica sand pack to approximately two feet above the uppermost elevation of the screened well interval. The sand pack was followed by a hydrated bentonite seal to within one foot of the surface to prevent the well from acting as a conduit for surface contamination of the groundwater table. **Appendix B** contains well construction diagrams illustrating the details for each monitoring well installed.

Using a pre-cleaned electronic water level indicator/interface probe (IP) before collecting groundwater samples, Bullock personnel gauged each onsite monitoring well on October 18, 2017, and recorded depths to groundwater ranging from 1.16 feet BLS (BMW-2) to 7.46 feet BLS (BMW-10). Field personnel then collected groundwater samples from each location, dispensing them into appropriate laboratory-prepared sample containers for subsequent analysis. Upon collection, the sample containers were wrapped in bubble pack and placed immediately in a cooler containing ice for delivery under proper chain-of-custody to Sutherland Environmental Laboratory in Birmingham, Alabama for analysis.

6.0 DISCUSSION OF ANALYTICAL RESULTS

6.1 SOIL ANALYTICAL RESULTS

The analytical data for the soil samples collected during this assessment were compared to the RSLs for industrial soil established by the EPA (revised May 2018). TCE was detected above the EPA-established RSL of 1.9 mg/kg in three soil samples (two from boring SB-1 and one sample from SB-3) located in the vicinity of former monitoring well MW-4. Those TCE concentrations ranged from 1.95 mg/kg (SB-1, -0-5’) to 5.57 mg/kg (SB-1, 5-10’). It is notable that the material encountered in each of these locations was primarily gravel (with less surface area than native silty clay material), which could skew the results downward (i.e., surrounding soil may contain equal or higher concentrations).

TCE was also detected in four additional locations at concentrations exceeding the residential RSL of 0.41 mg/kg. Those concentrations were detected in soil borings SB-5, SB-8, SB-14, and BMW-8 with levels ranging from 0.345 mg/kg (SB-5) to 0.79 mg/kg (SB-8). BMW-8 and SB-14 are located adjacent to the former machine shop and TCE mixing tanks while SB-5 and SB-8 are located south of the original position of MW-4 (previously identified as the hazardous material storage area). Naphthalene was also detected in one soil sample (SB-6) at a concentration of 11.5 mg/kg, above the residential screening value (3.8 mg/kg).

Finally, with regard to the shallow soil samples collected on Parcel B, laboratory analytical results yielded the following at concentrations exceeding EPA industrial RSLs:

- Arsenic was detected in five of the six shallow soil samples at concentrations exceeding the EPA RSL of 3.0 mg/kg in five of the six borings advanced in this area with concentrations ranging from 8.3 mg/kg (PBSB-5) to 47 mg/kg (PBSB-6);
- Total chromium was detected in five of the six shallow soil samples at concentrations exceeding the EPA RSL of 6.3 mg/kg in five of the six borings advanced in this area with concentrations ranging from 7.1 mg/kg (PBSB-5) to 117 mg/kg (PBSB-4); and
- Benzo(a)pyrene was detected above its associated RSL of 2.1 mg/kg in one soil sample (PBSB-1) at a concentration of 3.72 mg/kg.

Bullock notes that numerous additional compounds were present above their associated residential RSLs in the soil samples collected from Parcel B. These included chromium (PBSB-3), benzo(a)anthracene (PBSB-1, PBSB-4, and PBSB-6), benzo(a)pyrene (PBSB-2 through PBSB-6), benzo(b)fluoranthene (PBSB-1, PBSB-4, and PBSB-6), dibenzofuran (PBSB-1, PBSB-3, and PBSB-4), and indeno(1,2,3-cd)pyrene (PBSB-1).

COCs in soil are summarized in **Tables 2A** and **2B**. A copy of the laboratory analytical report for soil is included in **Appendix C**. **Figure 4** illustrates the location of each soil boring installed at the Site and includes COC concentrations detected above RSLs.

For reference, Bullock also compiled the historical soil sampling data from previous investigations (included as **Table 2C**). Review of those data indicate that TCE was present in the drill cuttings from monitoring well MW-4 (in 2002) at a concentration of 9.35 mg/kg. Additionally, TCE was present in shallow soil along the western boundary (in 2002) of the Site (Sample SSR-2) at a concentration of 17.99 mg/kg. Bullock notes that the remedial efforts summarized in previous documents did not address the area within or surrounding SSR-2. Results from historical Site assessment activities are summarized in **Table 2C**.

6.2 GROUNDWATER ANALYTICAL RESULTS

In addition to the monitoring wells installed during the October 2018 investigation, Bullock also collected groundwater samples from existing locations on the Site (installed by others during previous assessments). With the addition of these sampling locations, field personnel collected groundwater samples from 24 locations across the Site on October 18, 2018.

Of the 24 groundwater samples collected during the October 2018 investigation, similar contaminants (as described in previous assessment documents) were encountered at concentrations exceeding their established MCLs or tap water RSLs as established by EPA (May 2018 revision). Each are listed below.

1,1-DCA: Present in eight of the 24 groundwater samples at concentrations above the screening value of 0.0028 mg/L. Concentrations ranged from 0.006 mg/L (MW-6) to 0.224 mg/L (MW-3).

1,1-DCE: Present in seven of the 24 groundwater samples at concentrations above the MCL of 0.007 mg/L. Concentrations ranged from 0.009 mg/L (BMW-12) to 0.406 mg/L (BMW-8).

cis-1,2-DCE: Present in six of the 24 groundwater samples at concentrations above the MCL of 0.07 mg/L. Concentrations ranged from 0.098 mg/L (MW-9) to 5.9 mg/L (MW-6).

Naphthalene: Present in two of the 24 groundwater samples at concentrations above the tap water RSL of 0.00017 mg/L. Concentrations ranged from 0.071 mg/L (BMW-8) to 0.075 mg/L (BMW-7).

PCE: Present in one of the 24 groundwater samples (BMW-8) at a concentrations of 0.014 mg/L above the MCL of 0.005 mg/L.

1,1,1-TCA: Present in one of the 24 groundwater samples (BMW-8) at a concentrations of 0.239 mg/L above the MCL of 0.2 mg/L.

TCE: Present in 11 of the 24 groundwater samples at concentrations above the MCL of 0.005 mg/L. Concentrations ranged from 0.008 mg/L (BMW-8) to 4.59 mg/L (MW-10).

1,3,5-Trimethylbenzene: Present in one of the 24 groundwater samples at a concentration above the tap water RSL of 0.006 mg/L. Monitoring well BMW-7 contained a concentration of 0.033 mg/L.

1,2,4-Trimethylbenzene: Present in two of the 24 groundwater samples at concentrations above the tap water RSL of 0.0056 mg/L. Concentrations ranged from 0.08 mg/L (BMW-8) to 0.116 mg/L (BMW-7).

Vinyl Chloride: Present in 13 of the 24 groundwater samples at concentrations above the MCL of 0.002 mg/L. Concentrations ranged from 0.003 mg/L (MW-2) to 1.02 mg/L (MW-6).

COCs in groundwater are summarized in **Table 3A** and represented on **Figure 5**. A copy of the laboratory analytical report for the groundwater samples is included in **Appendix C**.

6.3 ANALYSIS OF SOIL & GROUNDWATER ANALYTICAL RESULTS

Review of the results from this investigation indicate that COCs were detected in onsite soil at concentrations more than 60 times higher than those reported in the Voluntary Cleanup Plan submitted to ADEM in July 2018. Those most elevated concentrations were present in the former location of monitoring well MW-4, which previous documents identified as a likely source area for contaminants. However, isolated areas of elevated TCE concentrations were also noted along the northern boundary of the shop building (near monitoring well MW-3).

With regard to groundwater, the results from the October 2018 investigation do not support the conclusions presented in the 2018 Voluntary Cleanup Plan (presented below):

"…with the exception of monitoring well #6, constituents in all wells are below the MCLs or have shown decreasing trends."

The contaminant plume appears to span the width of the Site (from east to west) with elevated concentrations of TCE and vinyl chloride (i.e., more than 100 times the MCL) present in localized areas near the eastern and western boundaries (MW-3, MW-6, MW-10, BMW-5, and BMW-8). Moreover, the **contaminant concentrations in monitoring well MW-10 remain elevated and represent the highest concentrations in onsite groundwater (not a decreasing trend as indicated in previous documents)** relative to historical monitoring events. Analysis of concentrations from 2011 to present indicated that the TCE concentration in monitoring well MW-10 during the October 2018 was more than twice the maximum ever detected in this location.

Table 3B summarizes the COCs detected in onsite groundwater during previous investigations while **Table 3C** presents graphs illustrating the concentration trends of target COCs in monitoring wells MW-1, MW-3, MW-4, MW-4R, MW-6, MW-9, and MW-10 (these wells were selected based on location relative to the treatment areas described in previous documents).

As illustrated in **Table 3C**, COC concentrations in monitoring wells MW-1, MW-3, and MW-6 indicate fluctuating patterns (with noted decreases in TCE levels in monitoring well MW-1) with pre- and post-remedial TCE concentrations in monitoring well MW-3 ranging from 56 mg/L in 2007 to 0.323 mg/L in 2010 (pre-remediation) to 30.0 mg/L in 2014 (post-remediation) and 0.338 mg/L in October 2018. MW-10, however, indicates an increasing trend for TCE, cis-1,2-DCE, and vinyl chloride. Finally, review of concentration trends in monitoring well MW-4 and MW-4R indicate a dramatic reduction of all COC concentrations immediately following its placement approximately 50 feet east of the original location. Comparison of the average TCE concentration in MW-4 from 2002 to 2011 (56.9 mg/L) to the average following its subsequent placement approximately 50 feet upgradient (0.307 mg/L) indicates a reduction of more than 95%. However, comparison of the pre- and post-remediation groundwater concentrations for monitoring wells MW-4/4R, along with MW-6, MW-9, and MW-10 indicate either increasing or statistically unchanged results in monitoring wells surrounding the treatment area (see summary table below).

Well ID	Pre-Remedial TCE (mg/L)	Post-Remedial TCE (mg/L)	Pre-Remedial cis-1,2-DCE (mg/L)	Post-Remedial cis-1,2-DCE (mg/L)	Pre-Remedial Vinyl Chloride (mg/L)	Post-Remedial Vinyl Chloride (mg/L)
MW-4/4R	*56.9*	*0.31*	*14.58*	*0.142*	*0.48*	*ND*
MW-6	0.708	0.362	7.3	6.66	0.893	0.874
MW-9	0.131	**0.137**	0.188	0.179	0.042	0.02
MW-10	2.3	**2.6**	0.599	0.51	0.005	**0.01**

As illustrated above (highlighted cells indicate increased concentrations following remedial activities), while the concentrations in monitoring well MW-4R indicate significant overall reductions in COC concentrations, the decline of those concentrations differs substantially from the pre- and post-remedial concentrations noted in surrounding monitoring wells. TCE concentrations actually rose in monitoring wells MW-9 and MW-10 following remedial activities while vinyl chloride concentrations also rose in monitoring well MW-10. Notably, however, while TCE concentrations in monitoring well MW-6, reduced, pre- and post-remedial cis-1,2-DCE and vinyl chloride levels remained effectively unchanged. Likewise, pre- and post-remedial cis-1,2-DCE concentrations in monitoring wells MW-9 and MW-10 show no evidence of meaningful decline.

Based on the comparisons detailed above, Bullock concluded that the remarkable reductions of COC concentrations in MW-4 appear to be related to its relocation (approximately 50 feet east) rather than the efficacy of remedial activities employed within this area of the Site. These conclusions are supported by the elevated TCE concentrations noted in monitoring well BMW-8 (located southwest and downgradient of former MW-4) as well as the increasing concentrations noted in monitoring well MW-10.

Additionally, with regard to potential exposure risks, soil and groundwater concentrations measured during the October 2018 investigation do not appear to pose an imminent risk to current Site occupants (through the indoor vapor intrusion pathway); however, without an analysis of this risk, it is not possible to assess the degree (if any) that exposure (through viable pathways) could adversely affect current and future occupants, workers (City of Cullman personnel), and/or visitors at the Site (i.e., grading and movement of onsite soil, inhalation in enclosed building spaces, possible exposure following significant rain events which could elevate the shallow groundwater table). **Figure 6** presents a Site Conceptual Exposure Model for current and/or future receptors which could potentially be exposed to onsite COCs.

Finally, **Figure 7** illustrates the estimated locations of affected media relative to the proposed Site Plan provided by The City of Cullman. This plan illustrates The City's intended future use of Site for municipal services, recreational areas, and public spaces. As illustrated on this figure, the area of affected soil and groundwater underlies the proposed open-air pavilion, buffer zone, and playground area.

The following sections summarize the evaluation of indoor vapor intrusion risk (in order to address the uncertainties highlighted above) and outline the recommended measures to manage COC-affected media during future redevelopment efforts contemplated by The City of Cullman.

7.0 DISCUSSION OF COCS IN GROUNDWATER RELATIVE TO VISL THRESHOLDS

7.1 EPA DEFAULT SCREENING VALUES &-RECOMMENDED PROTOCOLS

EPA distinguishes between two distinct levels of assessment for vapor intrusion as follows:

1. *A preliminary analysis, which utilizes available and readily ascertainable information to develop an initial understanding of the potential for human health risks to be posed by vapor intrusion, would typically be performed as part of an* ***initial site assessment****; and*
2. ***A detailed investigation, which is generally recommended when the preliminary analysis indicates that subsurface contamination with vapor-forming chemicals may be present underlying or near buildings****. A detailed investigation of the vapor intrusion pathway is typically performed as part of the site investigation stage.*

> *"The approach for assessing vapor intrusion will vary from site to site because each site will differ in the available data when vapor intrusion is being evaluated. Therefore, EPA's 2015 Vapor Intrusion Guidance document recommends a framework for planning and conducting vapor intrusion investigations rather than a prescriptive step-by-step approach to be applied at every site. "VOC concentrations in soil gas attenuate, or decrease, as the VOCs move from the source through the soil and into indoor air. This reduction in VOC concentration from a measurement point in the subsurface to indoor air is referred to as attenuation and occurs because the VOC emissions into a building are mixed with the natural flow of ambient air through the building (Conceptual Model Scenarios of the Vapor Intrusion Pathway, 02/24/2012, EPA)."*

As summarized in **Appendix D**, Bullock entered the maximum concentration of each COC detected in onsite groundwater into the VISL calculator (based on EPA 2015 Vapor Intrusion Guidance document) to derive predicted indoor air concentrations (and associated risk for each compound). The results obtained from this screening evaluation indicate that the maximum concentrations of 1,1-DCA, naphthalene, TCE, and vinyl chloride represent a potential indoor vapor inhalation risk to current and/or future commercial occupants of the Site. The output from this initial screening evaluation is summarized below and further detailed in **Table 4A**. As indicated in that table, the cumulative risk associated with the maximum onsite concentrations exceeds the ADEM thresholds for cumulative Estimated Increased Lifetime Cancer Risk (EILCR) of 1.0 E^{-5} and the non-cancer risk (Hazard Index) 1.0 as follows:

Cumulative EILCR:	1.05 E^{-3}
Cumulative Hazard Index:	214

However, when accounting for the maximum groundwater concentrations located around the existing structure (used by City of Cullman personnel), the estimated cancer and non-cancer risks associated with the maximum onsite groundwater concentrations surrounding the existing structure (representative of current Site conditions) are reduced, but remain above the established ADEM cancer and non-cancer risk thresholds (See **Table 4B)**. As indicated in **Table 4B**, the cumulative risk associated with this scenario exceed the ADEM thresholds for cumulative EILCR of 1.0 E^{-5} and the Hazard Index 1.0 as follows:

Cumulative EILCR: 3.98 E^{-4}
Cumulative Hazard Index: 31.6

For both scenarios (maximum, Site-wide maximum concentrations and maximum COC concentrations surrounding existing structure), the COCs representing a potential vapor intrusion risk (i.e. estimated indoor air concentration exceeds the EPA screening value for commercial/industrial air) include 1,1-DCA, naphthalene, TCE, and vinyl chloride.

7.2 MEDIA-SPECIFIC AF FOR INDOOR VAPOR INTRUSION RISK

As indicated above, use the default values assumed by EPA for initial screening purposes, the Site-wide maximum COC concentrations as well as the maximum COC concentrations surrounding the existing structure result in an estimated risk which exceed ADEM's accepted risk thresholds. However, the predicted indoor air concentrations noted above do not account for the depth to onsite groundwater or the fine-grained material (clay) noted to be present in the subsurface. In cases where fine-grained material is present, EPA allows for a reduction of the AF from the default value of 0.001 to a 0.0005 to account for the minimized transport of vapors from the subsurface to indoor air (Appendix A.3.2 of the 2015 Vapor Intrusion Guidance document). In this section of the guidance document, EPA recommends the consideration of site-specific data as follows:

> *"A factor that commonly results in greater attenuation (lower attenuation factors) is the presence of laterally extensive, unfractured fine-grained sediment in the vadose zone. Table A-3 (Table 14 in EPA (2012a)) provides selected statistics and Figure A-3 (Figure 29 in EPA (2012a)) shows the box-and-whisker plots for the groundwater attenuation factors for three soil types. Comparing each descriptive statistic (except for the 25th percentile values) indicates that the attenuation factor values for residences overlying soils classified as "very coarse" generally are larger than those for residences overlying soils classified as "coarse," which are larger than those for soils classified as "fine." This pattern is consistent with the conceptual model for vapor intrusion; smaller attenuation factors, which indicate greater reduction in vapor concentration, would be expected in vadose zones with finer-grained soils, when all other factors (e.g., depth to groundwater, biodegradability of the volatile chemicals) are the same. The 95th percentile value of the coarse-grained soil is equal to the generic value, as expected, since coarse-grained soil provide low resistance to vapor transport and thus would be expected to yield high-valued attenuation factors. Where fine-grained sediments underlay buildings, however, more attenuation is expected and observed in the database.* ***Thus, a semi-site-specific attenuation factor of 0.0005 may be used at sites where laterally extensive fine-grained sediment has been demonstrated through site-specific sampling to underlay buildings being investigated for vapor intrusion.****"*

As summarized in **Tables 4A** and **Table 4B**, application of the semi-Site-specific AF of 0.0005 results in an overall reduction of risk as follows; however, the cumulative risk remains above the ADEM thresholds for cumulative EILCR of 1.0 E^{-5} and the Hazard Index 1.0 as follows:

Cumulative EILCR (maximum onsite concentrations): 5.24 E^{-4}
Cumulative Hazard Index(maximum onsite concentrations): 107

Cumulative EILCR (maximum COC concentrations surrounding building): 1.99 E^{-4}
Cumulative Hazard Index(maximum COC concentrations surrounding building): 15.8

Based on the initial screening evaluation, Bullock accounted for site-specific media characteristics to better assess the overall risk related to COCs in the subsurface. The following section summarizes the process employed to account for site-specific soil and groundwater conditions and presents an analysis of the estimated exposure risk when accounting for these variables.

7.3 SITE-SPECIFIC EVALUATION OF INDOOR VAPOR INTRUSION RISK

As indicated in EPA Section 5.5.2 of the 2015 Vapor Intrusion Guidance document, EPA encourages the collection of site-specific information in addressing vapor intrusion risks as follows:

> *"Before performing any comparison of existing sampling data to recommended generic vapor intrusion screening levels (VISLs) (see Section 6.5), it is important to verify that site-specific conditions reflect the conditions and assumptions of the generic model underlying the VISLs, which are summarized in Section 6.5.2. To verify that the generic vapor intrusion model applies, there is a need for basic knowledge of the subsurface source of vapors (e.g., location, form, and extent of site-specific vapor-forming chemicals) and subsurface conditions (e.g., soil type in the vadose zone, depth to groundwater for groundwater sources), which are important elements of the CSM (see Section 5.4).When these subsurface data are not available, EPA recommends they be collected (i.e., initiate a vapor intrusion investigation; see Section 6.3.2, for example) before relying upon risk-based screening using pre-existing sampling data."*

Accounting for the media-specific variables noted above (depth to groundwater, fine-grained soil, moisture content within the fine-grained soil, and estimated dry bulk density of the fine-grained materil), Bullock employed media-specific AFs for 1,1-DCA, naphthalene., TCE, and vinyl chloride based on the analytical solutions of Johnson and Ettinger (1991) for contaminant partitioning and subsurface vapor transport into buildings. These models account for the media-specific variables noted above and derive a median-range AF for each COC to estimate the predicted vapor intrusion risk based on the COC concentration in groundwater.

As demonstrated from these models (attached as **Appendix E**) and summarized in **Table 5A**, use of the site-specific AF for each compound with the maximum concentrations of each COC in groundwater result in a cumulative risk above the ADEM EILCR threshold of 1.0 E^{-5} and the Hazard Index 1.0 as follows:

Cumulative EILCR (maximum onsite COC concentrations): 1.77 E^{-5}
Cumulative Hazard Index(maximum onsite COC concentrations): 1.29

However, use of the maximum COC concentrations in groundwater surrounding the existing structure (**Table 5B**) results in a cumulative risk below both the ADEM EILCR threshold of 1.0 E^{-5} and the Hazard Index 1.0 as follows:

Cumulative EILCR (maximum COC concentrations surrounding building): 4.42 E^{-6}
Cumulative Hazard Index(maximum COC concentrations surrounding building): 0.187

As indicated in the calculations above, application of the media-specific AFs for each COC reduces the predicted vapor intrusion risk to levels below the ADEM cumulative EILCR and Hazard Index thresholds of 1.0 E^{-5} and 1.0 for current conditions (accounting for the existing structure onsite).

Considering the site-specific AFs value derived for each COC from the variables incorporated into the EPA 2015 Vapor Intrusion Guidance document, combined with the maximum COC concentrations detected in groundwater surrounding the existing structure (which presents the most conservative representation of current exposure conditions), there is no indication that an exposure risk to current or future receptors exists at the Site through inhalation of vapors from subsurface sources. However, should The City of Cullman elect to improve the Site with a structure in eastern portion of the Site (within the area surrounding monitoring well MW-10, as illustrated on **Figure 8**), institutional or engineering controls may be required to mitigate potential exposure risk through vapor intrusion. The following section describes the options to be employed to mitigate potential vapor intrusion risks in this area.

8.0 MITIGATION OF VAPOR INTRUSION RISKS

In light of the potential vapor intrusion risk associated with TCE concentrations in monitoring well MW-10, Bullock recommends the inclusion of the following provisions into the environmental covenant for subsequent recordation on the deed (in addition to those already approved by ADEM in the July 26, 2018, correspondence):

1. The City of Cullman will not construct an enclosed building on this portion of the Site (to be legally described and included as an attachment to the covenant) and designated as the “Restricted Property Area” (see attached figure illustrating this area); and
2. Should future redevelopment plans include the construction of an enclosed building in the Restricted Property Area then the inhalation risk due to vapor intrusion will be further evaluated through additional groundwater sampling and/or assessment pursuant to the ADEM Alabama Risk Based Corrective Action Guidance Manual to determine whether vapor intrusion remains a risk. If the groundwater analysis and/or risk assessment shows that vapor intrusion remains a potential inhalation risk then an ADEM approved vapor barrier or other mitigating remedy shall be installed as part of any proposed construction. Any additional groundwater analysis, risk assessment, and/or remedial plan required by this provision shall be submitted to ADEM for approval.

With the addition of these provisions, The City of Cullman can proceed with future redevelopment efforts under specific parameters while ensuring the protection of human health and the environment.

9.0 SOIL MANAGEMENT PLAN FOR FUTURE ONSITE EXCAVATION AND GRADING ACTIVITIES

Considering the areas containing COCs in soil at concentrations exceeding applicable RSLs, Bullock has prepared the following Soil Management Plan to mitigate potential exposure risks during future onsite grading or excavation activities. This plan also outlines the process for management of soil from certain areas of the Site to ensure compliance with applicable Solid Waste regulations. As illustrated on **Figure 7**, the areas known to contain COCs in soil at concentrations exceeding applicable RSLs are located in the western portion of the Site (Parcel B) and within localized areas in the north-central and northwestern portion of the Site (Parcel A). As detailed in **Appendix F**, Bullock proposes the following procedures for the management of soil during future Site redevelopment efforts.

In light of the detected concentrations of COCs in soil at concentrations exceeding applicable RSLs, handling and management of soil during future site preparation activities should be conducted as follows.

Handling

Onsite personnel should don Level D personal protective equipment (PPE) to minimize contact with potentially affected media. Beyond the standard PPE required for construction sites (hard hats, safety glasses, steel-toed boots, etc.), workers who handle the soil should do so with protective gloves, including but not limited to standard work gloves or impermeable material such as latex or nitrile. To minimize potential ingestion of particulates, field personnel should have on hand a water truck to maintain adequate moisture on the ground surface to mitigate fugitive dust.

It is also possible that workers may be exposed to vapors from subsurface soil sources in excavations extending more than one foot below grade in the designated Parcel A areas. Before advancing such excavations, onsite personnel shall measure organic vapors in ambient air with a photo-ionization detector or similar device suitable for the detection of both chlorinated and non-chlorinated VOCs. The excavation workers should also have dedicated personnel onsite to continue the measurement of such vapor concentrations throughout the course of the excavation work.

If vapor concentrations in ambient air exceed the action level of 10 parts per million (ppm) sustained for ten minutes within the designated work zone, field personnel will cease work until a determination is made regarding the need to upgrade PPE to include respiratory protection.

Management

Onsite grading activities which may result in the generation of potentially regulated solid waste should include measures for segregation, analysis, and determination of its character by a representative designated by The City of Cullman. Evaluation of the waste characteristics may require laboratory analysis. In such cases, the representative designated by the City of Cullman will collect appropriate composite waste samples in accordance with ADEM Solid Waste Branch requirements and deliver them under chain-of-custody to an ADEM-approved laboratory for analysis. Upon receipt of the analytical results, the representative for The City of Cullman will make recommendations regarding the management of the material (i.e. retain onsite or transport offsite under an ADEM-approved Solid Waste Profile).

The material, once excavated, should be stockpiled in a designated area on the Site and covered with polyethylene until it is returned to designated excavation areas or managed as a waste in accordance with ADEM Solid Waste regulations. Onsite personnel are to maintain the polyethylene cover on the stockpiled soil and ensure it remains intact through daily inspections. This process should continue until all material is transferred back designated areas (through grading and placement detailed in construction plans) or transported offsite under an ADEM-approved Solid Waste Profile.

10.0 CONCLUSIONS AND RECOMMENDATIONS

Considering the results obtained from this investigation, COCs remain in onsite soil and groundwater at concentrations exceeding applicable screening values published by EPA and endorsed by ADEM. Moreover, the results obtained differ from those represented in previous assessment reports and cleanup plans submitted to ADEM for review and approval. Finally, comparison of pre- and post-remedial groundwater concentrations for monitoring wells located along the periphery of the areas formerly treated with sodium permanganate do not show evidence of decreasing concentrations; in the case of monitoring well MW-10, the COC concentrations remain elevated (TCE concentrations as high as 4.59 mg/L) and represent a potential vapor intrusion risk should The City of Cullman elect to construct an enclosed building within this area.

Based on the findings from the October 2018 investigation activities, Bullock further assessed the vapor intrusion risk associated with the VOC-affected groundwater present on the Site. The results from that analysis indicate that no viable risk is present for commercial workers under current conditions (based on the maximum concentrations of VOCs detected around the City of Cullman structure located along the western Site boundary. However, a potential vapor intrusion risk exists for future enclosed buildings in the eastern portion of the Site (surrounding monitoring well MW-10). As such, Bullock recommends the addition of certain provisions in the environmental covenant which will either restrict the construction of an enclosed building in this area or conduct supplemental evaluation (with ADEM approval) to design a remedy sufficient to mitigate such vapor intrusion risks.

With regard to the COC concentrations remaining in soil at concentrations exceeding applicable RSLs, Bullock has prepared a Soil Management Plan to address handling and management of this material during future site improvement efforts to mitigate potential exposure risks to construction workers or the surrounding population.

Finally, regarding the elevated COC concentrations in monitoring well MW-10, it appears that this condition is limited to a localized area based on the COC concentrations in groundwater in surrounding (and downgradient) monitoring wells. Considering the absence of detectable COC concentrations in the monitoring well installed downgradient from monitoring well MW-10 (BMW-11), it does not appear that the plume of affected groundwater is migrating offsite, nor does it appear to represent a threat to an offsite Point of Exposure (POE).

As such, analysis of the site-wide data (collected during investigations between 2001 and 2018), Bullock presents the following recommendations.

1. No further assessment or remedial measures at this time;
2. Prepare an environmental covenant for review and approval by ADEM and subsequent execution by both parties for recordation on the deed. The proposed provisions of the environmental covenant are as follows:
   A. A restriction of groundwater use for potable purposes;
   B. Soil areas containing COCs at concentrations above applicable RSL are to remain capped with asphalt, concrete, or two feet of clean soil;
   C. The site shall not be used for residential purposes;
   D. The area designated as the "Restricted Property Area" will not contain enclosed buildings; and
   E. Should future redevelopment plans include the construction of an enclosed building in the Restricted Property Area then the inhalation risk due to vapor intrusion will be further evaluated through additional groundwater sampling and/or assessment pursuant to the ADEM ARBCA Guidance Manual to determine whether vapor intrusion remains a risk. If the groundwater analysis and/or risk assessment shows that vapor intrusion remains a potential inhalation risk then an ADEM approved vapor barrier or other mitigating remedy shall be installed as part of any proposed construction. Any additional groundwater analysis, risk assessment, and/or remedial plan required by this provision shall be submitted to ADEM for approval; and
3. During future redevelopment/Site improvements, handle and manage soil in accordance with the Soil Management Plan to mitigate potential exposure risks to construction workers or the surrounding population (subject to modification as needed to accommodate changes in Site development plans).

The data collected during the October 2018 investigation, in addition to the analysis of potential vapor intrusion risks (and resulting recommendations) and recommendations for future soil handling, provide The City of Cullman with the definition and assurance it needs to move ahead with a clear development plan (understood by all parties) while reducing the unknowns during the implementation of future improvements. A Certificate of Compliance is included as **Appendix G**.

11.0 REFERENCE MATERIALS

Bullock referenced the following sources during the preparation of this report.

1. USGS 7.5-minute Topographic Quadrangle *Cullman, Alabama*, dated 1957, revised 1983.
2. Soil Survey Staff, NRCS, USDA. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov.
4. 2002 *Phase III Site Assessment* (ERM, Inc.);
5. 2010 *Pre-Remedial Groundwater Report* (Goodwyn Mills & Cawood);
6. 2012 *Underground Injection Permit Application & Installation of Sodium Permanganate into on onsite soil to address elevated volatile organic compounds (VOCs) noted in groundwater on the west-central portion of the Site*;
7. 2015 *Cleanup Action Activities for Greif Facility, Cullman, Alabama-Final Report* (Goodwyn Mills & Cawood);
8. 2017 *Groundwater Monitoring Report* (Terracon, Inc.); and
9. 2018 *Modified Cleanup Plan* (Goodwyn Mills & Cawood).
10. AEIRG (revised February 2017).
11. EPA Regional Screening Levels (May 2018).
12. U.S EPA Office of Solid Waste & Emergency Response [OSWER] Publication 9200.2-154, *Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air*, June 2015.
13. Analytical Solutions of Johnson & Ettinger, 1991
14. VISL Calculator, 2015

TABLES

FIGURES

APPENDIX A

HISTORICAL SITE ASSESSMENT REPORTS AND REGULATORY CORRESPONDENCE

APPENDIX B

BORING LOGS

APPENDIX C

LABORATORY ANALYTICAL DATA REPORTS

APPENDIX D

VISL CALCULATOR

APPENDIX E

JOHNSON STINGER MODEL
(Using Site-Specific Soil & Groundwater Data)

APPENDIX F

SOIL MANAGEMENT PLAN

TABLES

Table 1
Summary of Groundwater Elevations
Former Greif Brothers
2nd Avenue Southwest
Cullman, Cullman County, Alabama
Bullock Environmental, LLC Project #: 18-CULL01

MW ID	Date	TOC	DTW	WTE
BMW-1	**10/19/18**	**803.29**	**3.21**	**800.08**
BMW-2	**10/19/18**	**803.75**	**1.16**	**802.59**
BMW-3	**10/19/18**	**802.85**	**4.20**	**798.65**
BMW-4	**10/19/18**	**801.88**	**3.98**	**797.90**
BMW-5	**10/19/18**	**802.67**	**4.30**	**798.37**
BMW-6	**10/19/18**	**801.57**	**3.52**	**798.05**
BMW-7	**10/19/18**	**801.40**	**2.55**	**798.85**
BMW-8	**10/19/18**	**801.15**	**3.02**	**798.13**
BMW-9	**10/19/18**	**801.88**	**5.80**	**796.08**
BMW-10	**10/19/18**	**801.12**	**4.98**	**796.14**
BMW-11	**10/19/18**	**801.88**	**7.46**	**794.42**
BMW-12	**10/19/18**	**801.33**	**4.40**	**796.93**
BMW-13	**10/19/18**	**802.14**	**4.80**	**797.34**
MW-1	05/02/02	800.00		800.00
	02/11/10	800.00	1.90	798.10
	05/23/17	800.00	1.40	798.60
	10/19/18	**800.00**	**2.25**	**797.75**
MW-2	05/02/02	800.67		800.67
	02/11/10	800.67	1.17	799.50
	05/23/17	800.67	0.65	800.02
	10/19/18	**800.67**	**2.32**	**798.35**
MW-3	05/02/02	800.80		800.80
	02/11/10	800.80	1.22	799.58
	05/23/17	800.80	1.92	798.88
	10/19/18	**800.80**	**1.37**	**799.43**
MW-3A	**10/19/18**	**801.47**	**3.65**	**797.82**
MW-4R	**10/19/18**	**802.98**	**2.80**	**800.18**
MW-5	05/02/02	791.53		791.53
	02/11/10	791.53	0.94	790.59
	05/23/17	791.53		791.53
	10/19/18	**791.53**	**2.30**	**789.23**
MW-6	05/02/02	803.61		803.61
	02/11/10	803.61	1.85	801.76
	05/23/17	803.61	5.92	797.69
	10/19/18	**803.61**	**5.68**	**797.93**

Table 1
Summary of Groundwater Elevations
Former Greif Brothers
2nd Avenue Southwest
Cullman, Cullman County, Alabama
Bullock Environmental, LLC Project #: 18-CULL01

MW ID	Date	TOC	DTW	WTE
MW-8	**10/19/18**	**801.20**	**47.80**	**753.40**
MW-9	**10/19/18**	**801.44**	**3.10**	**798.34**
MW-10	**10/19/18**	**802.11**	**7.25**	**794.86**
MW-11	**10/19/18**	**789.09**	**24.60**	**764.49**

Notes:
MW ID = Monitoring Well Identification
TOC = Top of Casing Elevation (feet above mean sea level [ft amsl])
DTW = Depth to Water (feet below top of casing [ft btoc])
WTE = Water Table Elevation (ft amsl)

Table 2A
Chemicals of Concern in Soil (October 2018 Assessment)
Former Greif Brothers
2nd Avenue Southwest
Cullman, Cullman County, Alabama
Bullock Environmental, LLC Project #: 18-CULL01

Method	COC	Date Collected			10/16/18	10/16/18	10/16/18	10/16/18	10/16/18	10/16/18	10/16/18	10/16/18	10/16/18	10/16/18	10/16/18	10/16/18	10/16/18
		Sample ID			SB-1	SB-1	SB-2	SB-3	SB-3	SB-4	SB-5	SB-6	SB-6	SB-7	SB-8	SB-8	SB-9
		Sample Depth			'0-5	'5-10	5-7	0-5	5-10	0-5	0-5	0-5	5-10	5-7	0-5	5-10	0-5
		Units	EPA RSL (res)	EPA RSL (ind)	PARCEL A (SOURCE AREA DELINEATION SAMPLES												
8260B	**n-Butylbenzene**	mg/kg	390	5800	<0.005	<0.005	**0.5**	<0.005	**0.006**	<0.005	<0.005	**0.009**	**0.233**	<0.005	<0.005	<0.005	<0.005
8260B	**sec-Butylbenzene**	mg/kg	780	12000	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**Chloromethane**	mg/kg	11	46	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**1,1-DCA**	mg/kg	3.6	16	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**1,1-DCE**	mg/kg	23	100	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**cis-1,2-DCE**	mg/kg	16	230	**0.184**	**0.535**	**0.053**	**0.102**	**1.42**	**0.008**	**0.156**	<0.005	<0.005	<0.005	**0.009**	**0.199**	<0.005
8260B	**trans-1,2-DCE**	mg/kg	160	2300	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**Ethylbenzene**	mg/kg	5.8	25	<0.005	<0.005	**0.157**	**0.196**	<0.005	<0.005	<0.005	<0.005	**0.007**	<0.005	**0.136**	<0.005	<0.005
8260B	**Isopropylbenzene**	mg/kg		990	<0.005	**0.025**	**0.152**	**0.009**	<0.005	<0.005	<0.005	<0.005	**0.118**	<0.005	<0.005	<0.005	<0.005
8260B	**4-Isopropyltoluene**	mg/kg			<0.005	<0.005	**0.065**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**Methylene Chloride**	mg/kg	35	320	<0.005	<0.005	<0.005	**0.122**	**0.137**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**Naphthalane**	mg/kg	3.8	17	<0.005	<0.005	**1.64**	<0.005	**0.025**	<0.005	**0.08**	**0.044**	**11.5**	<0.005	**0.045**	**0.028**	<0.005
8260B	**n-Proplybenzene**	mg/kg	380	2400	<0.005	**0.071**	**0.4**	**0.021**	<0.005	<0.005	<0.005	**0.005**	**0.245**	<0.005	**0.005**	<0.005	<0.005
8260B	**PCE**	mg/kg	24	39	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.048**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**Toluene**	mg/kg	490	4700	<0.005	<0.005	**0.2**	**0.005**	**0.013**	<0.005	<0.005	<0.005	**0.006**	<0.005	<0.005	<0.005	<0.005
8260B	**TCE**	mg/kg	0.41	1.9	**1.95**	**5.57**	<0.005	**0.173**	**3.25**	**0.011**	**0.345**	<0.005	<0.005	<0.005	**0.007**	**0.79**	<0.005
8260B	**1,2,4-TMB**	mg/kg	30	180	<0.005	**0.282**	**2.17**	**0.214**	**0.042**	<0.005	**0.012**	**0.005**	<0.005	<0.005	**0.033**	<0.005	<0.005
8260B	**1,3,5-TMB**	mg/kg	27	150	<0.005	**0.228**	**0.74**	**0.05**	**0.009**	<0.005	<0.005	<0.005	<0.005	<0.005	**0.005**	<0.005	<0.005
8260B	**Vinyl Chloride**	mg/kg	0.059	1.7	<0.005	**0.015**	**0.038**	<0.005	**0.029**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**Total Xylenes**	mg/kg	58	250	<0.005	<0.005	**1.05**	**1.21**	<0.005	<0.005	<0.005	<0.005	**0.018**	<0.005	**0.06**	<0.005	<0.005

Method	COC	Date Collected			10/16/18	10/16/18	10/16/18	10/16/18	10/17/18	10/17/18	10/17/18	10/17/18	10/16/18	10/16/18	10/16/18	10/16/18	10/16/18
		Sample ID			SB-10	SB-11	SB-12	SB-13	SB-14	SB-14	SB-15	SB-16	BMW-1	BMW-2	BMW-3	BMW-4	BMW-5
		Sample Depth			5-10	5-9	5-9	59-10	5-10	10-15	10-15	0-5	5-10	5-8	0-5	5-10	5-10
		Units	EPA RSL (res)	EPA RSL (ind)	PARCEL A (SOURCE AREA DELINEATION SAMPLES												
8260B	**n-Butylbenzene**	mg/kg	390	5800	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**sec-Butylbenzene**	mg/kg	780	12000	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**Chloromethane**	mg/kg	11	46	<0.005	<0.005	<0.005	<0.005	<0.005	**0.012**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**1,1-DCA**	mg/kg	3.6	16	<0.005	<0.005	<0.005	<0.005	**0.051**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**1,1-DCE**	mg/kg	23	100	<0.005	<0.005	<0.005	<0.005	**0.018**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**cis-1,2-DCE**	mg/kg	16	230	<0.005	**0.015**	<0.005	<0.005	**0.085**	<0.005	**0.026**	<0.005	**0.015**	<0.005	<0.005	<0.005	**0.015**
8260B	**trans-1,2-DCE**	mg/kg	160	2300	<0.005	<0.005	<0.005	<0.005	**0.008**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**Ethylbenzene**	mg/kg	5.8	25	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**Isopropylbenzene**	mg/kg		990	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**4-Isopropyltoluene**	mg/kg			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**Methylene Chloride**	mg/kg	35	320	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.139**	<0.005	<0.005	<0.005	<0.005
8260B	**Naphthalane**	mg/kg	3.8	17	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.031**
8260B	**n-Proplybenzene**	mg/kg	380	2400	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**PCE**	mg/kg	24	39	<0.005	<0.005	<0.005	**0.1**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**Toluene**	mg/kg	490	4700	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.007**	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**TCE**	mg/kg	0.41	1.9	<0.005	**0.031**	<0.005	**0.03**	**0.51**	**0.005**	**0.028**	<0.005	**0.02**	<0.005	<0.005	<0.005	**0.23**
8260B	**1,2,4-TMB**	mg/kg	30	180	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.014**
8260B	**1,3,5-TMB**	mg/kg	27	150	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**Vinyl Chloride**	mg/kg	0.059	1.7	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	**Total Xylenes**	mg/kg	58	250	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Table 2A
Chemicals of Concern in Soil (October 2018 Assessment)
Former Greif Brothers
2nd Avenue Southwest
Cullman, Cullman County, Alabama
Bullock Environmental, LLC Project #: 18-CULL01

Method	COC	Date Collected			10/17/18	10/17/18	10/17/18	10/17/18	10/17/18	10/17/18	10/17/18	10/17/18
		Sample ID			BMW-6	BMW-7	BMW-8	BMW-9	BMW-10	BMW-11	BMW-12	BMW-13
		Sample Depth			0-5	5-10	5-10	5-10	0-5	5-7	5-10	5-10
		Units	EPA RSL (res)	EPA RSL (ind)	PARCEL A (SOURCE AREA DELINEATION SAMPLES							
8260B	n-Butylbenzene	mg/kg	390	5800	<0.005	**0.038**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	sec-Butylbenzene	mg/kg	780	12000	<0.005	**0.006**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	Chloromethane	mg/kg	11	46	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	1,1-DCA	mg/kg	3.6	16	<0.005	**0.007**	**0.053**	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	1,1-DCE	mg/kg	23	100	<0.005	<0.005	0.061	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	cis-1,2-DCE	mg/kg	16	230	<0.005	**0.008**	0.127	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	trans-1,2-DCE	mg/kg	160	2300	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	Ethylbenzene	mg/kg	5.8	25	<0.005	**0.52**	**0.005**	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	Isopropylbenzene	mg/kg		990	<0.005	**0.015**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	4-Isopropyltoluene	mg/kg			<0.005	**0.025**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	Methylene Chloride	mg/kg	35	320	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	Naphthalane	mg/kg	3.8	17	<0.005	**0.292**	**0.038**	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	n-Proplybenzene	mg/kg	380	2400	<0.005	**0.026**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	PCE	mg/kg	24	39	<0.005	<0.005	**0.031**	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	Toluene	mg/kg	490	4700	<0.005	**0.011**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	TCE	mg/kg	0.41	1.9	<0.005	<0.005	**0.515**	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	1,2,4-TMB	mg/kg	30	180	**0.026**	**0.128**	**0.005**	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	1,3,5-TMB	mg/kg	27	150	<0.005	**0.018**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	Vinyl Chloride	mg/kg	0.059	1.7	<0.005	<0.005	**0.011**	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	Total Xylenes	mg/kg	58	250	<0.005	**0.365**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Notes:
All concentrations presented in milligrams per kilogram (mg/kg), parts per million equivalent.
EPA RSL = Regional Screening Level for Industrial Soil (THQ 0.1) established by Environmental Protection Agency (EPA) Region 9 (May 2018)
Bolded Cell = Detected concentration but below EPA RSL for Industrial Soil
Highlighted/bolded cells = Concentration exceeds corresponding EPA RSL

Table 2B
Chemicals of Concern in Shallow Soil (Parcel B)
Former Greif Brothers
2nd Avenue Southwest
Cullman, Cullman County, Alabama
Bullock Environmental, LLC Project #: 18-CULL01

Method	COC	Date Collected			10/17/18	10/17/18	10/17/18	10/17/18	10/17/18	10/17/18
		Sample ID			PBSB-1	PBSB-2	PBSB-3	PBSB-4	PBSB-5	PBSB-6
		Sample Depth			0-1	0-1	0-1	0-1	0-1	0-1
		Units	**EPA RSL (res)**	**EPA RSL (ind)**	**PARCEL B (SHALLOW SOIL SAMPLES)**					
6010B	Arsenic	mg/kg	6.8E-01	3.0E+00	**28**	**16**	<1.0	**34**	**8.3**	**47**
6010B	Barium	mg/kg	1.5E+03	2.2E+04	**92**	**90**	**317**	**187**	**90**	**170**
6010B	Cadmium	mg/kg	7.1E+00	9.8E+01	**6.1**	<1.0	**1.2**	<1.0	**1.1**	**1.5**
6010B	Chromium	mg/kg	3.0E-01	6.3E+00	**21**	**50**	**2.5**	**117**	**7.1**	**8.0**
6010B	Lead	mg/kg	4.0E+02	8.0E+02	**195**	**122**	**129**	**173**	**66**	**226**
7471A	Mercury	mg/kg	1.1E+00	4.6E+00	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
6010B	Selenium	mg/kg	3.9E+01	5.8E+02	<1.0	**11**	<1.0	**5.1**	<1.0	<1.0
6010B	Silver	mg/kg	3.9E+01	5.8E+02	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
8260B	Methylene Chloride	mg/kg	35	320	<0.005	<0.005	<0.005	**0.158**	**0.16**	**0.133**
8260B	Toluene	mg/kg	490	4700	<0.005	<0.005	<0.005	<0.005	**0.005**	<0.005
8260B	TCE	mg/kg	0.41	1.9	**0.006**	<0.005	<0.005	<0.005	<0.005	<0.005
8270C-SIM	Anthracene	mg/kg	1.8E+03	2.3E+04	**1.08**	**0.243**	**0.208**	**0.590**	**0.168**	**0.190**
8270C-SIM	Acenaphthene	mg/kg	3.6E+02	4.5E+03	**0.559**	<0.05	<0.05	**0.056**	<0.05	<0.05
8270C-SIM	Acenaphthylene	mg/kg	NE		**1.05**	**0.252**	**0.149**	**0.525**	**0.191**	**0.107**
8270C-SIM	Benzo(a)anthracene	mg/kg	1.1E+00	2.1E+01	**2.52**	**0.244**	**0.735**	**1.30**	**0.390**	**1.27**
8270C-SIM	Benzo(a)pyrene	mg/kg	1.1E-01	2.1E+00	**3.72**	**0.481**	**0.860**	**1.81**	**0.58**	**1.29**
8270C-SIM	Benzo(b)fluoranthene	mg/kg	1.1E+00	2.1E+01	**6.35**	**0.58**	**0.0955**	**1.88**	**0.565**	**1.47**
8270C-SIM	Benzo(g,h,i)perylene	mg/kg	NE		**1.94**	**0.302**	**0.575**	**1.23**	**0.345**	**0.630**
8270C-SIM	Benzo(k)fluoranthene	mg/kg	1.1E+01	2.1E+02	**3.70**	**0.515**	**0.760**	**1.84**	**0.575**	**1.05**
8270C-SIM	Chrysene	mg/kg	1.1E+02	2.1E+03	**3.270**	**0.540**	**0.915**	**1.83**	**0.530**	**1.57**
8270C-SIM	Fluoranthene	mg/kg	2.1E+02	3.0E+03	**2.12**	**0.388**	**1.27**	**1.79**	**0.575**	**1.770**
8270C-SIM	Fluorene	mg/kg	2.1E+02	3.0E+03	**0.113**	<0.05	<0.05	<0.05	<0.05	**0.064**
8270C-SIM	Indeno(1,2,3-cd)pyrene	mg/kg	1.1E+00	2.1E+01	**1.62**	**0.256**	**0.440**	**1.03**	**0.273**	**0.525**
8270C-SIM	Naphthalene	mg/kg	3.8E+00	1.7E+01	**0.355**	**0.194**	**0.147**	**0.810**	**0.075**	**1.06**
8270C-SIM	Phenanthrene	mg/kg	NE		**0.377**	**0.214**	**1.34**	**1.1**	**0.240**	**1.54**
8270C-SIM	Pyrene	mg/kg	1.8E+02	2.3E+03	**2.68**	**0.388**	**1.04**	**1.72**	**0.58**	**1.56**
8270C-SIM	2-Methylnaphthalene	mg/kg	2.4E+01	3.0E+02	**0.223**	**0.123**	**0.398**	**0.895**	**0.074**	**1.06**
8270C-SIM	Bis(2-ethylhexyl)phthalate	mg/kg	3.9E+01	1.6E+02	**0.094**	**0.214**	<0.05	<0.05	<0.05	<0.05
8270C-SIM	Dibenzofuran	mg/kg	7.3E+00	1.0E+02	**0.157**	<0.05	**0.223**	**0.315**	<0.05	<0.05

Notes:

All concentrations presented in milligrams per kilogram (mg/kg), parts per million equivalent.

EPA RSL = Regional Screening Level for Industrial Soil (THQ 0.1) established by Environmental Protection

Bolded Cell = Detected concentration but below EPA RSL for Industrial Soil

Highlighted/bolded cells = Concentration exceeds corresponding EPA RSL

NE= Not Established

Table 2C
Chemicals of Concern in Soil (2001-2014)
Former Greif Brothers
2nd Avenue Southwest
Cullman, Cullman County, Alabama
Bullock Environmental, LLC Project #: 18-CULL01

Client Sample ID	**EPA RSL (Res) (mg/kg)**	**EPA RSL (Comm/Ind) (mg/kg)**	SB-5	SB-5 (dup)	SB-6	SB-7	SB-8	SB-9	SB-10	SB-11	SB-12	MW-4 (CUTTINGS)
Sample Depth			0-4	0-4	4-7	0-4	4-8	4-8	0-4.5	0-4	4-6	9-10
Date Collected			4/8/02	4/8/02	4/8/02	4/8/02	4/8/02	4/8/02	4/8/02	4/8/02	4/8/02	4/8/02
TPH (GRO)	52	220	**14.1**	**9.51**	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**35.6**
TPH (DRO)	250	3300	BDL	BDL	**134**	**20.6**	**93.6**	BDL	BDL	BDL	BDL	**29.4**
2-Methylnaphthalene	24	300	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**0.924**
Naphthalane	3.8	17	BDL	BDL	BDL	**1.05**	BDL	BDL	BDL	BDL	BDL	**2.81**
Acetone	11	46	BDL	BDL	BDL	**0.085**	BDL	BDL	BDL	BDL	BDL	BDL
Benzene	3.6	16	BDL	BDL	BDL	**0.0028**	BDL	BDL	BDL	BDL	BDL	BDL
Carbon Disulfide	77	350	BDL	BDL	BDL	BDL	**0.0029**	BDL	BDL	BDL	BDL	BDL
Chroroethane	35	320	BDL	BDL	BDL	BDL	**0.142**	BDL	BDL	**0.0074**	BDL	BDL
1,1-DCA	3.6	16	BDL	BDL	BDL	BDL	**0.0253**	**0.0057**	BDL	**2.88**	BDL	BDL
1,2-DCA	0.46	2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1-DCE	23	100	BDL	BDL	BDL	BDL	**0.0099**	**0.0034**	BDL	BDL	BDL	**0.0037**
cis-1,2-DCE	16	230	BDL	BDL	BDL	**0.0371**	**2.28**	**0.0362**	**0.194**	**0.0323**	BDL	**1.77**
trans-1,2-DCE	160	2300	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**0.0082**	BDL	BDL
1,1,1-TCA	16	230	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**0.0075**
TCE	0.41	1.9	BDL	BDL	BDL	BDL	BDL	**0.0588**	**0.0125**	**0.0095**	BDL	**9.35**
PCE	24	39	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**0.0059**
Ethylbenzene	5.8	25	**0.0187**	**162**	BDL	**0.362**	**0.0273**	BDL	BDL	BDL	BDL	**0.108**
MIBK	3300	14000	BDL	BDL	BDL	**0.0651**	BDL	BDL	BDL	BDL	BDL	BDL
Toluene	490	4700	BDL	BDL	BDL	**0.35**	BDL	BDL	BDL	**0.0123**	BDL	**0.0061**
Vinyl Chloride	0.059	1.7	BDL	BDL	BDL	**0.02**	**0.16**	BDL	**0.01**	**0.61**	BDL	**0.0084**
Total Xylenes	58	250	**0.446**	**1340**	BDL	**1.26**	**0.0496**	BDL	BDL	BDL	BDL	**7.64**

Notes:
All concentrations presented in milligrams per kilogram (mg/kg), parts per million equivalent.
EPA RSL = Regional Screening Level for Industrial Soil (THQ 0.1) established by Environmental Protection

Bolded Cell = Detected concentration but below EPA RSL for Industrial Soil
Highlighted/bolded cells = Concentration exceeds corresponding EPA RSL

Table 2C
Chemicals of Concern in Soil (2001-2014)
Former Greif Brothers
2nd Avenue Southwest
Cullman, Cullman County, Alabama
Bullock Environmental, LLC Project #: 18-CULL01

Client Sample ID	**EPA RSL (Res) (mg/kg)**	**EPA RSL (Comm/Ind) (mg/kg)**	SB-9	SB-9	SB-5	SSR-1	SSR-2	SSR-2 (DUP	SB-4	SB-2	SB-3
Sample Depth			0-4	4-8	4-8	0-1	0-1	0-1	4-7.5	0-5.5	1-5
Date Collected			7/20/01	7/20/01	7/20/01	7/18/01	7/18/01	7/18/01	7/19/01	7/19/01	7/19/01
TPH (GRO)	52	220	**222**	**46.5**	<5.81	<5.88	<6.10	<6.02	<6.58	<6.02	<6.02
TPH (DRO)	250	3300	**492**	<11.9	**26**	**62**	<12.3	<12.1	**19.2**	<12.1	<12.1
Isophrone	570	2400	<0.384	<0.393	<0.393	<0.393	<0.393	<0.393	<0.393	<0.393	<0.393
2-Methylnaphthalene	24	300	**0.499**	<0.393	<0.393	<0.393	<0.393	<0.393	<0.393	<0.393	<0.393
2-Methylphenol	130	1600	**0.384**	<0.393	<0.393	<0.393	<0.393	<0.393	<0.393	<0.393	<0.393
Naphthalane	3.8	17	**3.69**	<0.393	<0.393	<0.393	<0.393	<0.393	<0.393	<0.393	<0.393
Fluoranthene	240	3000	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	**0.521**	<0.02	<0.02
Bis(2-ethylhexyl)phthalate	39	160	**4.99**	**1.65**	**4.84**	<0.02	<0.02	<0.02	**1.53**	**1.69**	**1.1**
Acetone	11	46	**0.252**	<0.00531	<0.00531	<0.00531	<0.00531	<0.00531	<0.00531	<0.00531	<0.00531
Benzene	3.6	16	**0.0071**	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021
MEK	23	100	**0.0994**	<0.00531	<0.00531	<0.00531	<0.00531	<0.00531	<0.00531	<0.00531	<0.00531
Carbon Disulfide	77	350	**0.0028**	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021
1,1-DCA	3.6	16	<0.002	<0.0021	**0.0085**	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021
1,2-DCA	0.46	2	<0.002	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021
1,1-DCE	23	100	<0.002	<0.0021	<0.0019	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021
cis-1,2-DCE	16	230	**0.355**	**4.762**	**0.0283**	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021
trans-1,2-DCE	160	2300	**0.0084**	**0.0263**	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021
Ethylbenzene	5.8	25	**0.7093**	**0.026**	<0.0122	**0.4118**	<0.0122	<0.1205	<0.0122	<0.0122	<0.0122
MIBK	3300	14000	**0.7201**	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016
Toluene	490	4700	**3.256**	<0.0021	<0.0021	**9.059**	**0.1585**	<0.1205	<0.0021	<0.0021	<0.0021
1,1,1-TCA	810	3600	<0.0019	<0.0019	<0.0019	<0.1176	**17.99**	**0.1446**	<0.0019	<0.0019	<0.0019
PCE	24	39	<0.1176	<0.1176	<0.1176	<0.1176	**0.2744**	<0.1205	<0.1176	<0.1176	<0.1176
TCE	0.41	1.9	<0.1176	<0.1176	**0.0376**	<0.1176	**17.99**	**3.855**	<0.1176	<0.1176	<0.1176
Vinyl Chloride	0.059	1.7	<0.1163	**0.4524**	**0.0071**	<0.1163	<0.1163	<0.1163	<0.1163	<0.1163	<0.1163
Total Xylenes	58	250	**6.59**	**0.1507**	<0.122	**3.488**	<0.122	<0.1205	<0.122	<0.122	<0.122

Notes:
All concentrations presented in milligrams per kilogram (mg/kg), parts per million equivalent.
EPA RSL = Regional Screening Level for Industrial Soil (THQ 0.1) established by Environmental Protection
Bolded Cell = Detected concentration but below EPA RSL for Industrial Soil
Highlighted/bolded cells = Concentration exceeds corresponding EPA RSL

Table 3A
Chemicals of Concern in Groundwater (October 2018 Sampling Event)
Former Greif Brothers
2nd Avenue Southwest
Cullman, Cullman County, Alabama
Bullock Environmental, LLC Project #: 18-CULL01

Client Sample ID				BMW-1	BMW-2	BMW-3	BMW-4	BMW-5	BMW-6	BMW-7	BMW-8	BMW-9	BMW-10	BMW-11	BMW-12	BMW-13
Date Collected				10/18/2018	10/18/2018	10/18/2018	10/18/2018	10/18/2018	10/18/2018	10/18/2018	10/18/2018	10/18/2018	10/18/2018	10/18/2018	10/18/2018	10/18/2018
Method	Analyte	Units	RSL* / MCL	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
8260B	N-BUTYLBENZENE	mg/l	1*	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.017**	**0.013**	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	SEC-BUTYLBENZENE	mg/l	2*	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.006**	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	CHLOROETHANE	mg/l	2.1*	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.007**	**0.169**	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	1,2-DICHLOROBENZENE	mg/l	0.6	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	1,1-DICHLOROETHANE	mg/l	0.0028*	<0.005	<0.005	<0.005	<0.005	**0.008**	<0.005	**0.014**	**0.125**	<0.005	<0.005	<0.005	**0.011**	<0.005
8260B	1,1-DICHLOROETHENE	mg/l	0.007	<0.005	<0.005	<0.005	<0.005	**0.018**	<0.005	<0.005	**0.406**	<0.005	<0.005	<0.005	**0.009**	<0.005
8260B	CIS-1,2-DICHLOROETHENE	mg/l	0.07	<0.005	**0.05**	**0.033**	**0.049**	**0.023**	**0.007**	**0.008**	**0.417**	**0.006**	<0.005	<0.005	**0.028**	<0.005
8260B	TRANS-1,2-DICHLOROETHEN	mg/l	0.1	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.009**	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	ETHYLBENZENE	mg/l	0.7	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.163**	**0.013**	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	ISOPROPYLBENZENE	mg/l	0.045*	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.005**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	4-ISOPROPYLTOLUENE	mg/l	NE	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.006**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	NAPHTHALENE	mg/l	0.00017*	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	**0.075**	**0.071**	<0.010	<0.010	<0.010	<0.010	<0.010
8260B	N-PROPYLBENZENE	mg/l	0.066*	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.008**	**0.007**	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	TETRACHLOROETHENE	mg/l	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.014**	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	TOLUENE	mg/l	1	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.016**	**0.007**	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	1,1,1-TRICHLOROETHANE	mg/l	0.2	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.239**	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	TRICHLOROETHENE	mg/l	0.005	<0.005	**0.143**	<0.005	**0.014**	**0.111**	<0.005	<0.005	**0.599**	**0.008**	<0.005	<0.005	<0.005	<0.005
8260B	1,2,4-TRIMETHYLBENZENE	mg/l	0.0056*	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.116**	**0.08**	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	1,3,5-TRIMETHYLBENZENE	mg/l	0.006*	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.033**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	VINYL CHLORIDE	mg/l	0.002	**0.005**	<0.002	**0.115**	**0.015**	**0.010**	<0.002	**0.005**	**0.757**	<0.002	<0.002	<0.002	**0.003**	<0.002
8260B	XYLENES, TOTAL	mg/l	10	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.894**	**0.025**	<0.005	<0.005	<0.005	<0.005	<0.005

Notes:
All concentrations presented in milligrams per liter (mg/L), parts per million equivalent.
*EPA RSL = Regional Screening Level (RSL) for Tapwater (THQ 0.1) established by Environmental Protection Agency (EPA) Region 9 (May 2018)

EPA MCL = Maximum Contaminant Level (MCL) (THQ 0.1) established by EPA Region 9
Bolded Cell = Detected concentration but below EPA RSL for Tapwater or MCL
Highlighted/bolded cells = Concentration exceeds corresponding EPA RSL/MCL
NA = Not Analyzed

Table 3A
Chemicals of Concern in Groundwater (October 2018 Sampling Event)
Former Greif Brothers
2nd Avenue Southwest
Cullman, Cullman County, Alabama
Bullock Environmental, LLC Project #: 18-CULL01

Client Sample ID				MW-1	MW-2	MW-3	MW-3A	MW-4R	MW-5	MW-6	MW-8	MW-9	MW-10	MW-11
Date Collected				10/18/2018	10/18/2018	10/18/2018	10/18/2018	10/18/2018	10/18/2018	10/18/2018	10/18/2018	10/18/2018	10/18/2018	10/18/2018
Method	Analyte	Units	RSL* / MCL	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
8260B	N-BUTYLBENZENE	mg/l	1*	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	SEC-BUTYLBENZENE	mg/l	2*	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	CHLOROETHANE	mg/l	2.1*	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	1,2-DICHLOROBENZENE	mg/l	0.6	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.008**	<0.005
8260B	1,1-DICHLOROETHANE	mg/l	0.0028*	<0.005	<0.005	**0.224**	**0.076**	<0.005	<0.005	**0.006**	<0.005	<0.005	**0.01**	<0.005
8260B	1,1-DICHLOROETHENE	mg/l	0.007	<0.005	<0.005	**0.11**	**0.098**	<0.005	<0.005	**0.014**	<0.005	<0.005	**0.108**	<0.005
8260B	CIS-1,2-DICHLOROETHENE	mg/l	0.07	**0.023**	**0.025**	**0.581**	**0.828**	<0.005	<0.005	**5.9**	<0.005	**0.098**	**0.8**	<0.005
8260B	TRANS-1,2-DICHLOROETHEN	mg/l	0.1	<0.005	<0.005	**0.008**	**0.008**	<0.005	<0.005	**0.027**	<0.005	<0.005	**0.005**	<0.005
8260B	ETHYLBENZENE	mg/l	0.7	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	ISOPROPYLBENZENE	mg/l	0.045*	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	4-ISOPROPYLTOLUENE	mg/l	NE	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	NAPHTHALENE	mg/l	0.00017*	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
8260B	N-PROPYLBENZENE	mg/l	0.066*	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	TETRACHLOROETHENE	mg/l	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	TOLUENE	mg/l	1	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	1,1,1-TRICHLOROETHANE	mg/l	0.2	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	TRICHLOROETHENE	mg/l	0.005	**0.025**	<0.005	**0.338**	**0.198**	<0.005	<0.005	**0.015**	<0.005	**0.073**	**4.59**	<0.005
8260B	1,2,4-TRIMETHYLBENZENE	mg/l	0.0056*	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	1,3,5-TRIMETHYLBENZENE	mg/l	0.006*	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
8260B	VINYL CHLORIDE	mg/l	0.002	<0.002	**0.003**	**0.249**	**0.017**	<0.002	<0.002	**1.02**	<0.002	**0.011**	**0.024**	<0.002
8260B	XYLENES, TOTAL	mg/l	10	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Notes:
All concentrations presented in milligrams per liter (mg/L), parts per million equivalent.
*EPA RSL = Regional Screening Level (RSL) for Tapwater (THQ 0.1) established by Environmental Protection Agency (EPA) Region 9 (May 2018)

EPA MCL = Maximum Contaminant Level (MCL) (THQ 0.1) established by EPA Region 9
Bolded Cell = Detected concentration but below EPA RSL for Tapwater or MCL
Highlighted/bolded cells = Concentration exceeds corresponding EPA RSL/MCL
NA = Not Analyzed

Table 3B

Chemicals of Concern in Groundwater (Historical Summary)
Former Greif Brothers
2nd Avenue Southwest
Cullman, Cullman County, Alabama
Bullock Environmental, LLC Project #: 18-CULL01

Chemical of Concern			PCE	TCE	cis-1,2-DCE	VC	1,1-DCA	1,1-DCE
MCL/Screening Value	Date	Units	0.005	0.005	0.07	0.002	0.0028	0.007
SB-9 (Adj. to MW-1)	7/20/01	mg/L	**BDL**	**BDL**	**2.44**	**2.98**	BDL	**0.0179**
MW-1	5/2/02	mg/L	BDL	**0.341**	**0.174**	**0.0035**	BDL	**0.0283**
	8/14/07	mg/L	BDL	**0.109**	**0.121**	BDL	BDL	0.007
	1/9/09	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
	2/11/10	mg/L	BDL	**0.197**	**0.196**	**0.002**	BDL	BDL
	9/25/14	mg/L	BDL	**0.067**	**0.078**	**0.002**	**0.341**	0.005
	5/23/17	mg/L	BDL	**0.0427**	**0.0441**	BDL	**0.109**	BDL
	10/18/18	mg/L	BDL	**0.025**	BDL	BDL	BDL	BDL
MW-2	7/20/01	mg/L	BDL	**0.0334**	**0.071**	**0.0161**	**0.197**	BDL
	5/2/02	mg/L	BDL	**0.0075**	0.0312	**0.0058**	**0.067**	BDL
	8/14/07	mg/L	BDL	BDL	0.024	BDL	**0.0427**	BDL
	1/9/09	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
	2/11/10	mg/L	BDL	BDL	0.011	**0.004**	BDL	BDL
	9/25/14	mg/L	BDL	BDL	0.025	**0.006**	BDL	BDL
	5/23/17	mg/L	BDL	BDL	0.0063	BDL	BDL	BDL
	10/18/18	mg/L	BDL	BDL	0.0063	BDL	BDL	**0.003**
MW-3	5/2/02	mg/L	**0.052**	**21.6**	**12.2**	**0.548**	**6.34**	**8.92**
	8/14/07	mg/L	**0.047**	**56.1**	**10.4**	**1.17**	BDL	**19**
	1/9/09	mg/L	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	2/11/10	mg/L	BDL	**0.323**	**0.285**	**0.043**	BDL	BDL
	9/25/14	mg/L	**0.072**	**30**	**1.84**	**0.424**	**0.832**	**6.08**
	5/23/17	mg/L	**BDL**	**0.254**	**0.882**	**0.157**	**0.0732**	**0.105**
	10/18/18	mg/L	**BDL**	**0.338**	**0.581**	**0.249**	**0.224**	**0.11**
Sump-Surface Water	5/2/02	mg/L	**BDL**	**0.185**	**0.317**	**0.0064**	BDL	BDL
MW-3A	10/18/18	mg/L	**BDL**	**0.198**	**0.828**	**0.017**	**0.076**	**0.098**
MW-4	5/2/02	mg/L	**0.098**	**88.6**	**15.8**	**0.048**	BDL	**0.112**
	8/14/07	mg/L	**0.052**	**71.9**	**17.4**	**0.81**	BDL	**0.087**
	1/9/09	mg/L	**0.061**	**54.3**	**15**	**0.429**	BDL	**0.119**
	2/11/10	mg/L	**0.05**	**30.4**	**11.3**	**0.412**	BDL	**0.063**
	3/18/11	mg/L	**0.067**	**42.7**	**13.4**	**0.699**	BDL	**0.099**
MW-4R	3/29/12	mg/L	**0.138**	**0.899**	**0.257**	BDL	BDL	BDL
	8/30/12	mg/L	**0.016**	**0.023**	**0.026**	BDL	BDL	BDL
	9/25/14	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
	5/23/17	mg/L	BDL	**0.0012**	BDL	BDL	BDL	BDL
	10/18/18	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
SB-5	7/20/01	mg/L	BDL	**0.0274**	**0.0651**	**0.0145**	**0.054**	**0.0193**

Table 3B
Chemicals of Concern in Groundwater (Historical Summary)
Former Greif Brothers
2nd Avenue Southwest
Cullman, Cullman County, Alabama
Bullock Environmental, LLC Project #: 18-CULL01

Chemical of Concern			PCE	TCE	cis-1,2-DCE	VC	1,1-DCA	1,1-DCE
MW-5	7/20/01	mg/L	g/L, Chromium=18.3 mg/L					
	5/2/02	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
	8/14/07	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
	1/9/09	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
	2/11/10	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
	9/25/14	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
	5/23/17	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
	10/18/18	mg/L	NS	NS	NS	NS	NS	NS
MW-6	5/2/02	mg/L	BDL	**0.178**	**1.66**	**0.25**	BDL	BDL
	8/14/07	mg/L	BDL	**0.78**	**10.3**	**1.29**	BDL	**0.013**
	1/9/09	mg/L	BDL	**0.815**	**7.15**	**0.81**	BDL	**0.026**
	2/11/10	mg/L	BDL	**1.06**	**10.1**	**1.22**	BDL	**0.032**
	3/18/11	mg/L	BDL	**NS**	**NS**	**NS**	**NS**	**NS**
	3/29/12	mg/L	BDL	**0.833**	**8.0**	**1.05**	BDL	**0.017**
	8/30/12	mg/L	BDL	**0.435**	**6.61**	**0.689**	BDL	**0.009**
	9/25/14	mg/L	BDL	**0.096**	**1.29**	**0.028**	BDL	<0.005
	5/23/17	mg/L	BDL	**0.429**	**11.5**	**1.57**	**0.0107**	**0.0247**
	10/18/18	mg/L	BDL	**0.015**	**5.9**	**1.02**	**0.006**	**0.014**
MW-7	2/11/10	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
MW-8	2/11/10	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
MW-9	2011	mg/L	BDL	**0.036**	**0.076**	**0.034**	BDL	**0.014**
	2012	mg/L	BDL	**0.225**	**0.3**	**0.05**	BDL	BDL
	2013	mg/L	BDL	**NS**	**NS**	**NS**	BDL	BDL
	9/25/14	mg/L	BDL	**0.229**	**0.292**	**0.033**	BDL	BDL
	5/23/17	mg/L	BDL	**0.109**	**0.146**	**0.0148**	BDL	**0.00347**
	10/18/18	mg/L	BDL	**0.073**	**0.098**	**0.011**	BDL	BDL
MW-10	2011	mg/L	**0.068**	**2.3**	**0.599**	**0.005**	BDL	**0.005**
	2012	mg/L	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	2013	mg/L	**0.055**	**1.89**	**0.49**	**0.012**	BDL	**0.01**
	9/25/14	mg/L	**0.039**	**2.51**	**0.366**	**0.006**	BDL	**0.007**
	5/23/17	mg/L	**0.189**	**1.4**	**0.38**	**0.00728**	BDL	**0.0421**
	10/18/18	mg/L	BDL	**4.59**	**0.8**	**0.024**	**0.01**	**0.108**
MW-11	5/23/17	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
	10/18/18		BDL	BDL	BDL	BDL	BDL	BDL

Notes:

All concentrations presented in milligrams per liter (mg/L), parts per million equivalent.

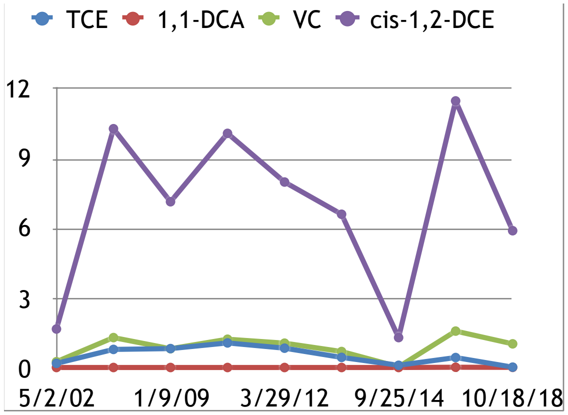
*EPA RSL = Regional Screening Level (RSL) for Tapwater (THQ 0.1) established by Environmental Protection Agency

EPA MCL = Maximum Contaminant Level (MCL) (THQ 0.1) established by EPA Region 9 (May 201

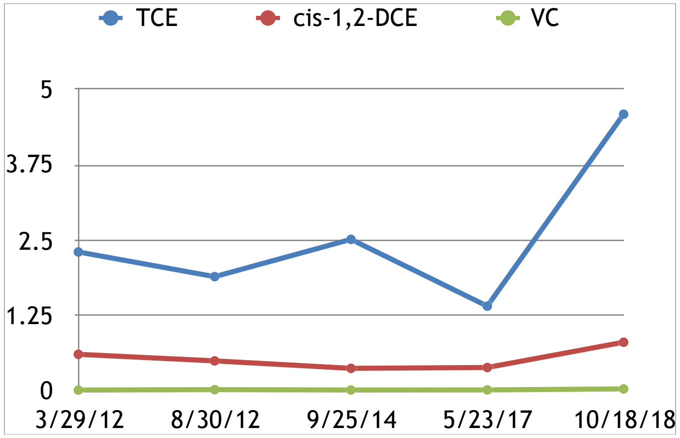
Bolded Cell = Detected concentration but below EPA RSL for Tapwater or MCL

TABLE 3C: COC CONCENTRATIONS OVER TIME

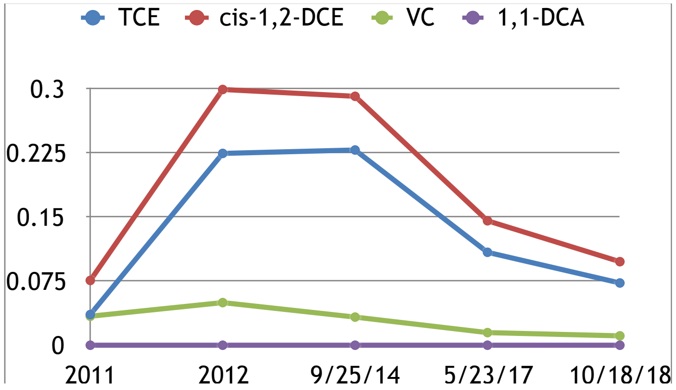
MW-6				
Date	TCE	cis-1,2-DCE	VC	1,1-DCA
5/2/02	0.178	1.66	0.25	0
8/14/07	0.78	10.3	1.29	0
1/9/09	0.815	7.15	0.81	0
2/11/10	1.06	10.1	1.22	0
3/29/12	0.833	8.0	1.05	0
8/30/12	0.435	6.61	0.689	0
9/25/14	0.096	1.29	0.028	0
5/23/17	0.429	11.5	1.57	0.0107
10/18/18	0.015	5.9	1.02	0.006



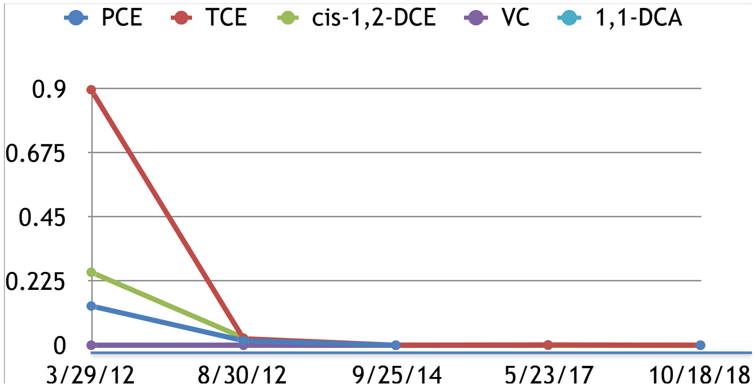
MW-10				
Date	TCE	cis-1,2-DCE	VC	1,1-DCA
3/29/12	2.3	0.599	0.005	NS
8/30/12	1.89	0.49	0.012	0
9/25/14	2.51	0.366	0.006	0
5/23/17	1.4	0.38	0.00728	0
10/18/18	4.59	0.8	0.024	0.01



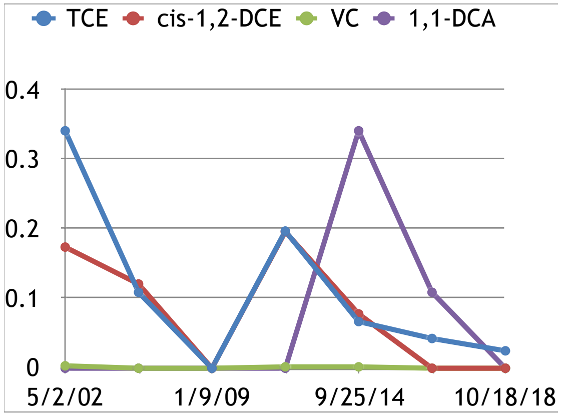
MW-9				
Date	TCE	cis-1,2-DCE	VC	1,1-DCA
2011	0.036	0.076	0.034	0
2012	0.225	0.3	0.05	0
9/25/14	0.229	0.292	0.033	0
5/23/17	0.109	0.146	0.0148	0
10/18/18	0.073	0.098	0.011	0



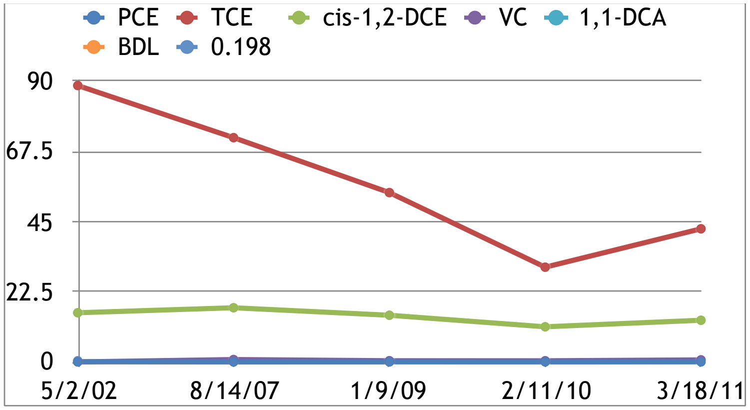
MW-4R					
Date	PCE	TCE	cis-1,2-DCE	VC	1,1-DCA
3/29/12	0.138	0.899	0.257	0	0
8/30/12	0.016	0.023	0.026	0	0
9/25/14	0	0	0BDL	0	0
5/23/17	BDL	0.0012	0	0	0
10/18/18	0	0	0	0	0



MW-1				
Date	TCE	cis-1,2-DCE	VC	1,1-DCA
5/2/02	0.341	0.174	0.0035	0
8/14/07	0.109	0.121	0	0
1/9/09	0	0	0	0
2/11/10	0.197	0.196	0.002	0
9/25/14	0.067	0.078	0.002	0.341
5/23/17	0.0427	0	0	0.109
10/18/18	0.025	0	0	0



MW-4					
Date	PCE	TCE	cis-1,2-DCE	VC	1,1-DCA
5/2/02	0.098	88.6	15.8	0.048	BDL
8/14/07	0.052	71.9	17.4	0.81	BDL
1/9/09	0.061	54.3	15	0.429	BDL
2/11/10	0.05	30.4	11.3	0.412	BDL
3/18/11	0.067	42.7	13.4	0.699	BDL



MW-3					
Date	PCE	TCE	cis-1,2-DCE	VC	1,1-DCA
5/2/02	0.052	21.6	12.2	0.548	6.34
8/14/07	0.047	56.1	10.4	1.17	0
2/11/10	0	0.323	0.285	0.043	0
9/25/14	0.072	30	1.84	0.424	0.832
5/23/17	0	0.254	0.882	0.157	0.0732
10/18/18	0	0.338	0.581	0.249	0.224

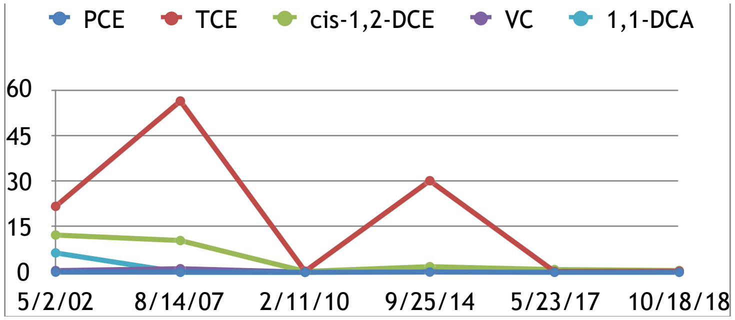


Table 4A

Chemicals of Concern in Groundwater-Vapor Intrusion Evaluation (MAXIMUM CONCENTRATIONS)

Former Greif Brothers
409 2nd Avenue NE
Cullman, Cullman County, Alabama
Bullock Environmental, LLC Project #: 18-CULL01

COMMERCIAL									
Client Sample ID				Maximum Concentration	Well Location	VI EILCR (using EPA default AF)	VI HQ (using EPA default AF)	VI EILCR (using EPA gw AF for fine grain)	VI HQ (using EPA gw AF for fine grain)
Date Collected									
Method	Analyte	Units	**RSL* or MCL**						
8260B	**1,1-DICHLOROETHANE**	**mg/l**	**0.0028***	**0.224**	**MW-3**	**6.70E-06**	**No RfC**	**3.35E-06**	**No RfC**
8260B	**1,1-DICHLOROETHENE**	**mg/l**	**0.007**	**0.406**	**BMW-8**	**No IUR**	**4.90E-01**	**No IUR**	**2.45E-01**
8260B	CIS-1,2-DICHLOROETHENE	mg/l	0.07	5.9	MW-6	Not Applicable		Not Applicable	
8270C-SIM	NAPHTHALENE	mg/l	0.00017*	0.075	BMW-7	3.70E-06	1.00E-01	1.85E-06	5.00E-02
8260B	**TETRACHLOROETHENE**	**mg/l**	**0.005**	**14**	**BMW-8**	**2.15E-07**	**5.80E-02**	**1.08E-07**	**2.90E-02**
8260B	1,1,1-TRICHLOROETHANE	mg/l	0.2	0.239	**BMW-8**	No IUR	7.70E-03	No IUR	3.85E-03
8260B	**TRICHLOROETHENE**	**mg/l**	**0.005**	**4.59**	**MW-10**	**6.20E-04**	**2.10E+02**	**3.10E-04**	**1.05E+02**
8260B	**1,2,4-TRIMETHYLBENZENE**	**mg/l**	**0.0056***	**0.116**	**BMW-7**	**No IUR**	**9.50E-01**	**No IUR**	**4.75E-01**
8260B	1,3,5-TRIMETHYLBENZENE	mg/l	0.006*	**0.033**	**BMW-7**	Not Applicable		Not Applicable	
8260B	**VINYL CHLORIDE**	**mg/l**	**0.002**	**1.02**	**MW-6**	**4.16E-04**	**2.60E+00**	**2.08E-04**	**1.30E+00**
Cumulative Risk for All Compounds						**1.05E-03**	**2.14E+02**	**5.23E-04**	**1.07E+02**

All concentrations presented in milligrams per liter (mg/L), parts per million

EPA RSL = Regional Screening Level (RSL) for Tapwater established by Environmental Protection Agency (EPA) Region 9 (June 2017)

EPA MCL = Maximum Contaminant Level MCL established by Environmental Protection Agency (EPA) Region 9 (June 2017)

* = EPA RSL for Tapwater used

NA = Not analyzed

Bolded/highlighted cells = Concentration exceeds corresponding EPA RSL

Shaded Cell = Detected Concentration but below EPA MCL tap water

NE = Not Established

VI CR Vapor Intrusion Carcinogenic Risk

VI HQ Vapor Intrusion Hazard Quotient (Non-carcinogenic)

AF= Attenuation Factor for vapor from groundwater in fine-grained lithology (EPA 2015)

TCR=Target Cancer Risk of 1 X 10-6

THQ= Target Hazard Quotient of 1.0

NTOX= Insufficient Toxicity for complete pathway

No IUR= No Inhalation Unit Risk Factor

Vapor Risk Using EPA-recommended default exposure factors and Exposure factors (0.001 AF for groundwater)

Table 4B

Chemicals of Concern in Groundwater-Vapor Intrusion Evaluation (CONCENTRATIONS NEAR BUILDING)

Former Greif Brothers

409 2nd Avenue NE

Cullman, Cullman County, Alabama

Bullock Environmental, LLC Project #: 18-CULL01

COMMERCIAL									
Client Sample ID				CONCENTRATION AT STRUCTURE	Well Location	VI EILCR (using EPA default AF)	VI HQ (using EPA default AF)	VI EILCR (using EPA gw AF for fine grain)	VI HQ (using EPA gw AF for fine grain)
Date Collected									
Method	Analyte	Units	RSL* or MCL						
8260B	**1,1-DICHLOROETHANE**	**mg/l**	**0.0028***	**0.224**	**BMW-5, BMW-8, MW-3, MW-3A**	**6.70E-06**	**No RfC**	**3.35E-06**	**No RfC**
8260B	**1,1-DICHLOROETHENE**	**mg/l**	**0.007**	**0.406**		**No IUR**	**4.95E-01**	**No IUR**	**2.48E-01**
8260B	CIS-1,2-DICHLOROETHENE	mg/l	0.07	0.454		Not Applicable		Not Applicable	
8270C-SIM	NAPHTHALENE	mg/l	0.00017*	0.071		3.54E-06	9.72E-02	1.77E-06	4.86E-02
8260B	**TETRACHLOROETHENE**	**mg/l**	**0.005**	**0.014**		**2.15E-07**	**5.80E-02**	**1.08E-07**	**2.90E-02**
8260B	1,1,1-TRICHLOROETHANE	mg/l	0.2	0.239		No IUR	7.70E-03	No IUR	3.85E-03
8260B	**TRICHLOROETHENE**	**mg/l**	**0.005**	**0.599**		**4.19E-05**	**1.43E+01**	**2.10E-05**	**7.15E+00**
8260B	**1,2,4-TRIMETHYLBENZENE**	**mg/l**	**0.0056***	**0.08**		**No IUR**	**7.67E-02**	**No IUR**	**3.84E-02**
8260B	1,3,5-TRIMETHYLBENZENE	mg/l	0.006*	0.033		Not Applicable	4.50E-02	Not Applicable	
8260B	**VINYL CHLORIDE**	**mg/l**	**0.002**	**0.757**		**1.04E-04**	**6.64E-01**	**5.20E-05**	**3.32E-01**
Cumulative Risk for All Compounds						**1.56E-04**	**1.57E+01**	**7.82E-05**	**7.85E+00**

Notes:

All concentrations presented in milligrams per liter (mg/L), parts per million

EPA RSL = Regional Screening Level (RSL) for Tapwater established by Environmental Protection Agency (EPA) Region 9 (June 2017)

EPA MCL = Maximum Contaminant Level MCL established by Environmental Protection Agency (EPA) Region 9 (June 2017)

* = EPA RSL for Tapwater used

NA = Not analyzed

Bolded/highlighted cells = Concentration exceeds corresponding EPA RSL

Shaded Cell = Detected Concentration but below EPA MCL tap water

NE = Not Established

VI CR Vapor Intrusion Carcinogenic Risk

VI HQ Vapor Intrusion Hazard Quotient (Non-carcinogenic)

Vapor Risk Using EPA-recommended default exposure factors and Exposure factors (0.001 AF for groundwater)

AF= Attenuation Factor for vapor from groundwater in fine-grained lithology (EPA 2015)

TCR=Target Cancer Risk of 1 X 10-6

THQ= Target Hazard Quotient of 1.0

NTOX= Insufficient Toxicity for complete pathway

No IUR= No Inhalation Unit Risk Factor

Table 5A
Chemicals of Concern in Groundwater-Vapor Intrusion Evaluation (MAXIMUM CONCENTRATIONS)
(SITE-SPECIFIC PARAMETERS)
Former Greif Brothers
409 2nd Avenue NE
Cullman, Cullman County, Alabama
Bullock Environmental, LLC Project #: 18-CULL01

COMMERCIAL							
Client Sample ID				Maximum Concentration	Well Location	VI EILCR (using J&E Inputs)	VI HQ J&E Inputs)
Date Collected							
Method	Analyte	Units	RSL* or MCL				
8260B	**1,1-DICHLOROETHANE**	**mg/l**	**0.0028***	**0.224**	**MW-3**	**5.66E-08**	**No RfC**
8260B	**1,1-DICHLOROETHENE**	**mg/l**	**0.007**	**0.406**	**BMW-8**	**No IUR**	**3.05E-03**
8260B	CIS-1,2-DICHLOROETHENE	mg/l	0.07	5.9	MW-6	Not Applicable	
8270C-SIM	NAPHTHALENE	mg/l	0.00017*	0.075	BMW-7	1.18E-07	3.23E-03
8260B	**TETRACHLOROETHENE**	**mg/l**	**0.005**	**0.014**	**BMW-8**	**8.49E-10**	**2.29E-04**
8260B	1,1,1-TRICHLOROETHANE	mg/l	0.2	0.239	**BMW-8**	No IUR	3.81E-05
8260B	**TRICHLOROETHENE**	**mg/l**	**0.005**	**4.59**	**MW-10**	**1.43E-05**	**1.26E+00**
8260B	**1,2,4-TRIMETHYLBENZENE**	**mg/l**	**0.0056***	**0.116**	**BMW-7**	**No IUR**	**4.38E-04**
8260B	1,3,5-TRIMETHYLBENZENE	mg/l	0.006*	**0.033**	**BMW-7**	Not Applicable	2.26E-04
8260B	**VINYL CHLORIDE**	**mg/l**	**0.002**	**1.02**	**MW-6**	**3.19E-06**	**2.30E-02**
Cumulative Risk for All Compounds						**1.77E-05**	**1.29E+00**

Notes:
All concentrations presented in milligrams per liter (mg/L), parts per million
EPA RSL = Regional Screening Level (RSL) for Tapwater established by Environmental Protection Agency (EPA) Region 9 (May 2018)
EPA MCL = Maximum Contaminant Level MCL established by Environmental Protection Agency (EPA) Region 9 (May 2018)
* = EPA RSL for Tapwater used
NA = Not analyzed
Bolded/highlighted cells = Concentration exceeds corresponding EPA RSL
Shaded Cell = Detected Concentration but below EPA MCL tap water
NE = Not Established
VI CR Vapor Intrusion Carcinogenic Risk
VI HQ Vapor Intrusion Hazard Quotient (Non-carcinogenic)

AF= Attenuation Factor for vapor from groundwater in fine-grained lithology (
TCR=Target Cancer Risk of 1 X 10-6
THQ= Target Hazard Quotient of 1.0
NTOX= Insufficient Toxicity for complete pathway
No IUR= No Inhalation Unit Risk Factor

Table 5B

Chemicals of Concern in Groundwater-Vapor Intrusion Evaluation (CONCENTRATIONS NEAR BUILDING) (SITE-SPECIFIC PARAMETERS)

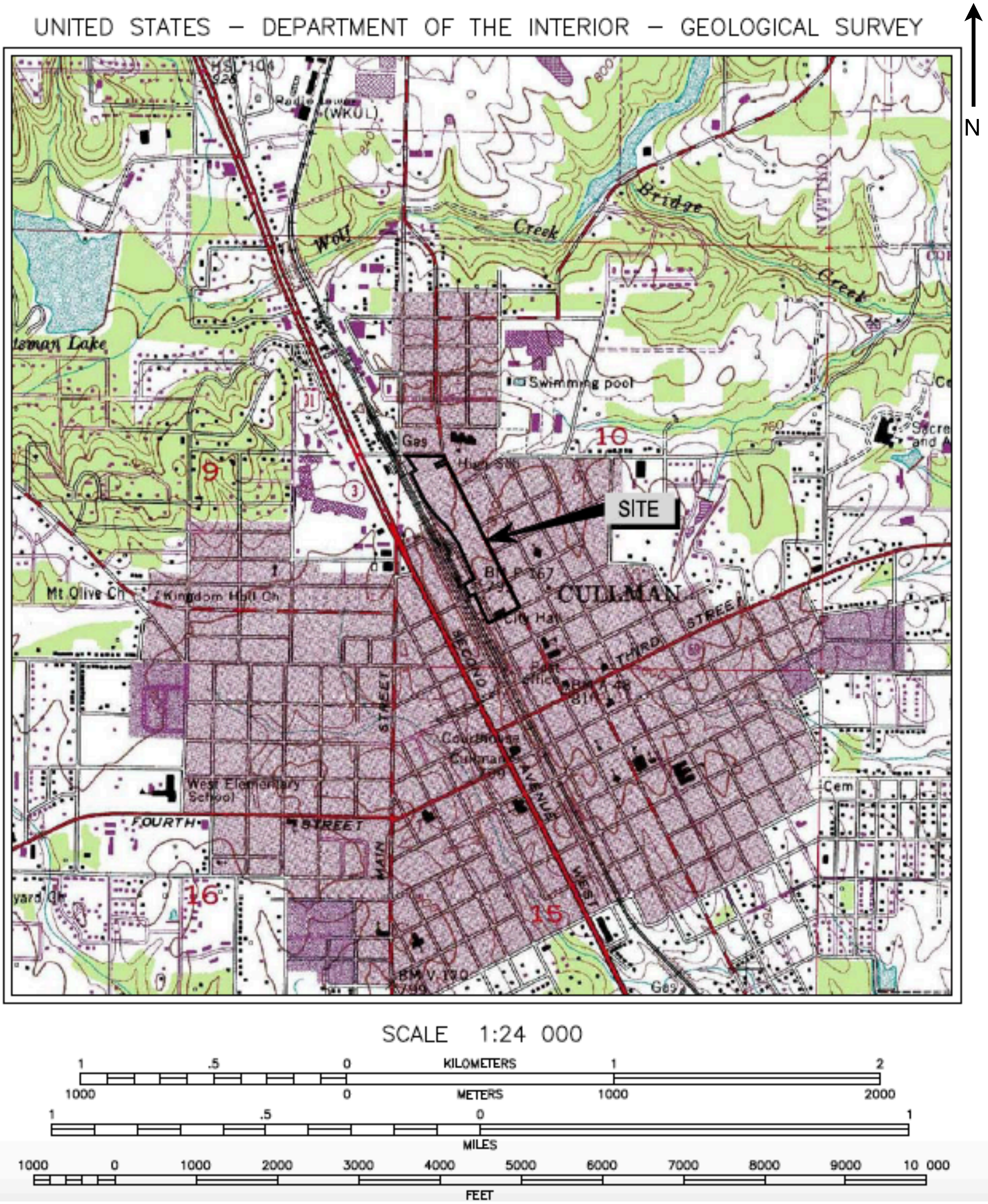
Former Greif Brothers
409 2nd Avenue NE
Cullman, Cullman County, Alabama
Bullock Environmental, LLC Project #: 18-CULL01

COMMERCIAL							
Client Sample ID				CONCENTRATION AT STRUCTURE	Well Location	VI EILCR (using J&E Inputs)	VI HQ J&E Inputs)
Date Collected							
Method	Analyte	Units	**RSL* or MCL**				
8260B	**1,1-DICHLOROETHANE**	**mg/l**	**0.0028***	**0.224**	**MAXIMIUM CONCENTRATION OF WELLS BMW-5, BMW-8, MW-3, MW-3A**	**5.66E-08**	**No RfC**
8260B	**1,1-DICHLOROETHENE**	**mg/l**	**0.007**	**0.406**		**No IUR**	**3.05E-03**
8260B	CIS-1,2-DICHLOROETHENE	mg/l	0.07	0.454		Not Applicable	
8270C-SIM	NAPHTHALENE	mg/l	0.00017*	0.071		1.18E-07	3.23E-03
8260B	**TETRACHLOROETHENE**	**mg/l**	**0.005**	**0.014**		**8.49E-10**	**2.29E-04**
8260B	1,1,1-TRICHLOROETHANE	mg/l	0.2	0.239		No IUR	3.81E-05
8260B	**TRICHLOROETHENE**	**mg/l**	**0.005**	**0.599**		**1.87E-06**	**1.65E-01**
8260B	**1,2,4-TRIMETHYLBENZENE**	**mg/l**	**0.0056***	**0.08**		**No IUR**	**4.38E-04**
8260B	1,3,5-TRIMETHYLBENZENE	mg/l	0.006*	**0.033**		Not Applicable	2.26E-04
8260B	**VINYL CHLORIDE**	**mg/l**	**0.002**	**0.757**		**2.37E-06**	**1.50E-02**
Cumulative Risk for All Compounds						**4.42E-06**	**1.87E-01**

Notes:
All concentrations presented in milligrams per liter (mg/L), parts per million
EPA RSL = Regional Screening Level (RSL) for Tapwater established by Environmental Protection Agency (EPA) Region 9 (May 2018)
EPA MCL = Maximum Contaminant Level MCL established by Environmental Protection Agency (EPA) Region 9 (May 2018)
* = EPA RSL for Tapwater used
NA = Not analyzed
Bolded/highlighted cells = Concentration exceeds corresponding EPA RSL
Shaded Cell = Detected Concentration but below EPA MCL tap water
NE = Not Established
VI CR Vapor Intrusion Carcinogenic Risk
VI HQ Vapor Intrusion Hazard Quotient (Non-carcinogenic)

AF= Attenuation Factor for vapor from groundwater in fine-grained lithology (
TCR=Target Cancer Risk of 1 X 10-6
THQ= Target Hazard Quotient of 1.0
NTOX= Insufficient Toxicity for complete pathway
No IUR= No Inhalation Unit Risk Factor

FIGURES



bullock environmental, llc

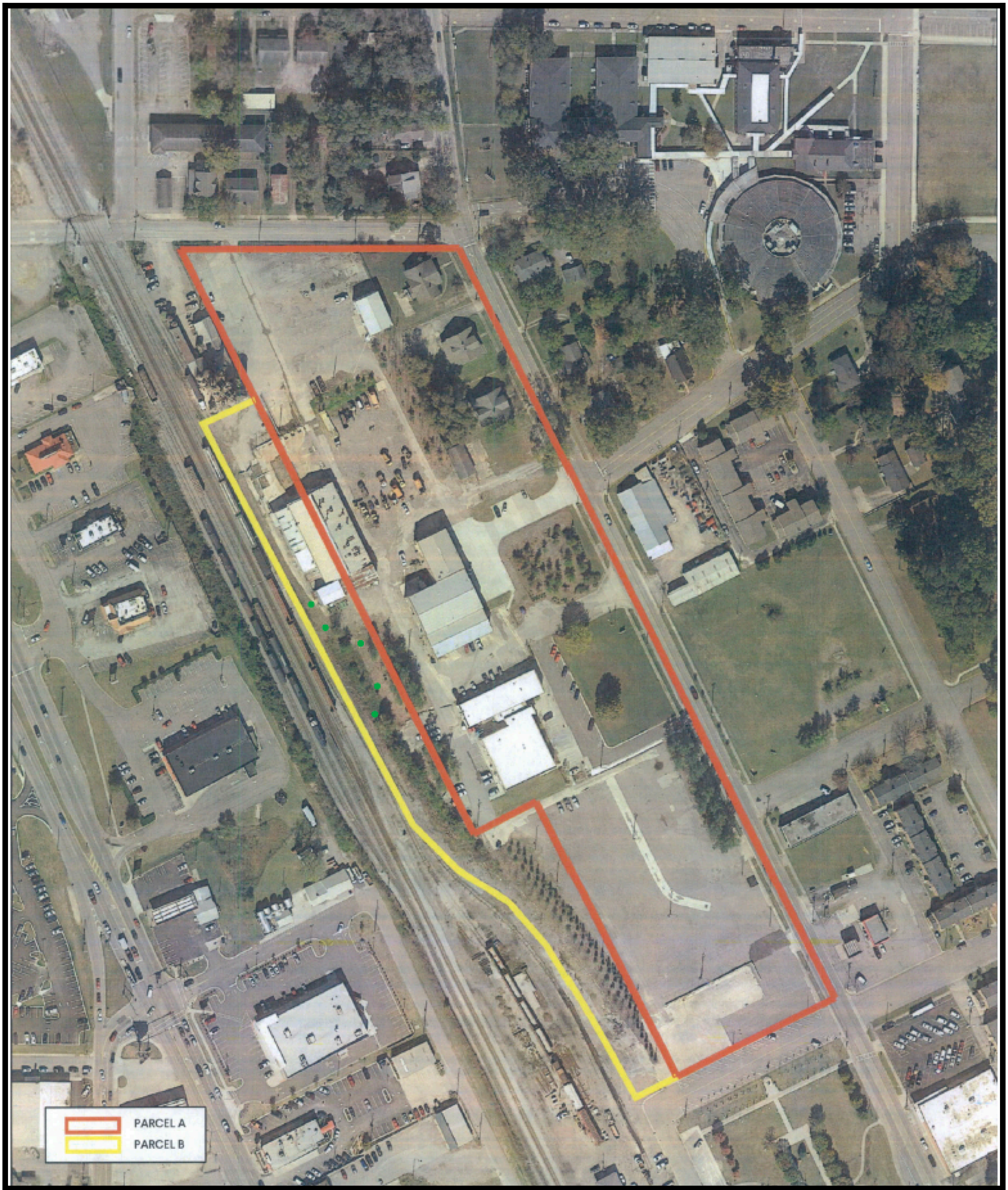
PROJECT

MODIFIED VOLUNTARY CLEANUP PLAN & RISK ASSESSMENT
FORMER GREIF BROTHERS FACILITY (PARCELS A & B)
409 SECOND AVENUE NE
CULLMAN, CULLMAN COUNTY, ALABAMA
ALABAMA VOLUNTARY CLEANUP SITE #: 461-9496
BULLOCK ENVIRONMENTAL, LLC PROJECT #: 18-CULL01

FIGURE 1

SITE LOCATION MAP

USGS 7.5-MINUTE
TOPOGRAPHIC QUADRANGLES
CULLMAN, *ALABAMA*,
DATED 1997



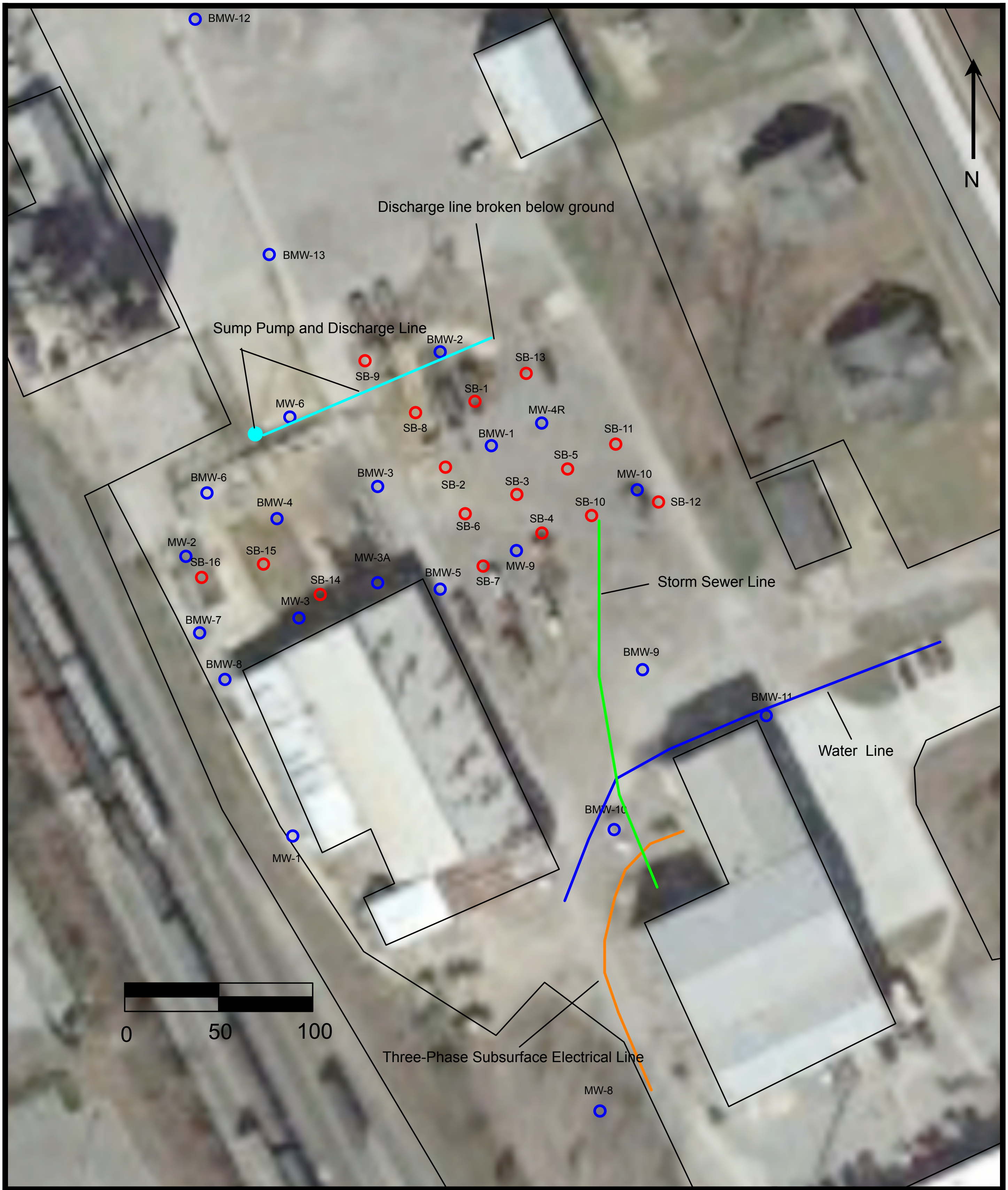
bullock environmental, llc

PROJECT

MODIFIED VOLUNTARY CLEANUP PLAN & RISK ASSESSMENT
FORMER GREIF BROTHERS FACILITY (PARCELS A & B)
409 SECOND AVENUE NE
CULLMAN, CULLMAN COUNTY, ALABAMA
ALABAMA VOLUNTARY CLEANUP SITE #: 461-9496
BULLOCK ENVIRONMENTAL, LLC PROJECT #: 18-CULL01

FIGURE 2A

SITE PLAN



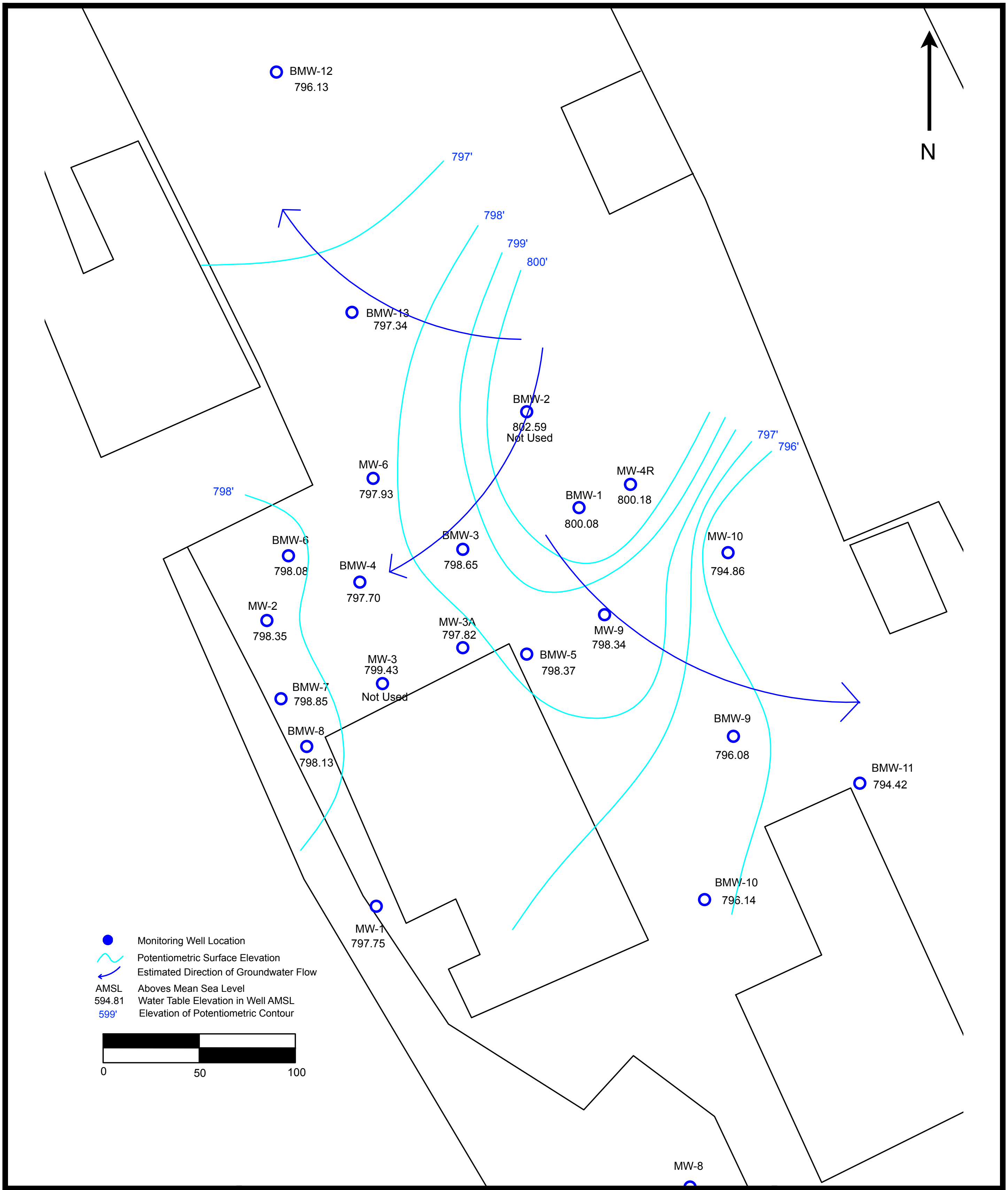
bullock environmental, llc

PROJECT

MODIFIED VOLUNTARY CLEANUP PLAN & RISK ASSESSMENT
FORMER GREIF BROTHERS FACILITY (PARCELS A & B)
409 SECOND AVENUE NE
CULLMAN, CULLMAN COUNTY, ALABAMA
ALABAMA VOLUNTARY CLEANUP SITE #: 461-9496
BULLOCK ENVIRONMENTAL, LLC PROJECT #: 18-CULL01

FIGURE 2B

SITE PLAN WITH UTILITY LOCATIONS AND CONNECTIONS



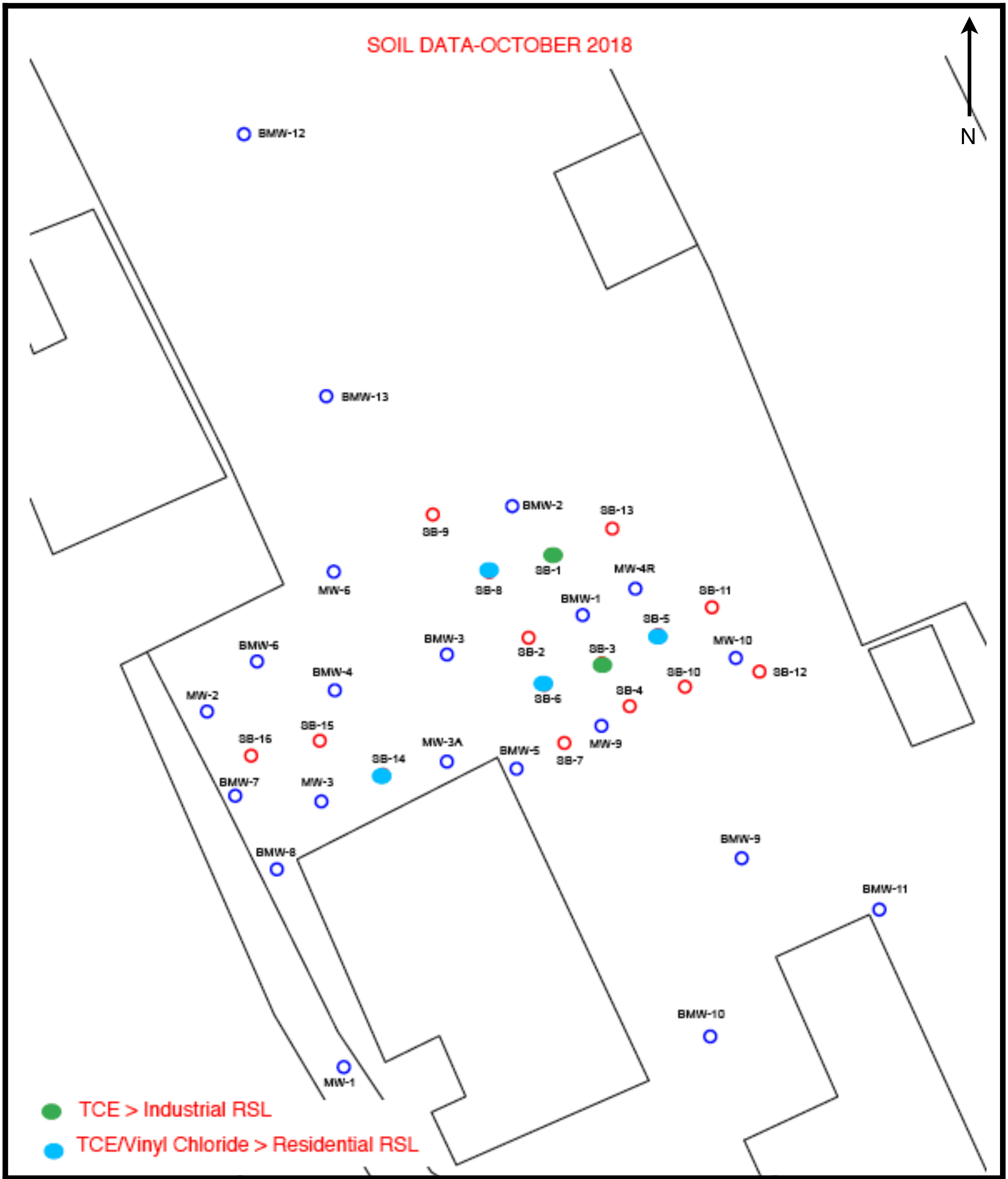
bullock environmental, llc

PROJECT

MODIFIED VOLUNTARY CLEANUP PLAN & RISK ASSESSMENT
FORMER GREIF BROTHERS FACILITY (PARCELS A & B)
409 SECOND AVENUE NE
CULLMAN, CULLMAN COUNTY, ALABAMA
ALABAMA VOLUNTARY CLEANUP SITE #: 461-9496
BULLOCK ENVIRONMENTAL, LLC PROJECT #: 18-CULL01

FIGURE 3

POTENTIOMETRIC
SURFACE MAP
(OCTOBER 2018)



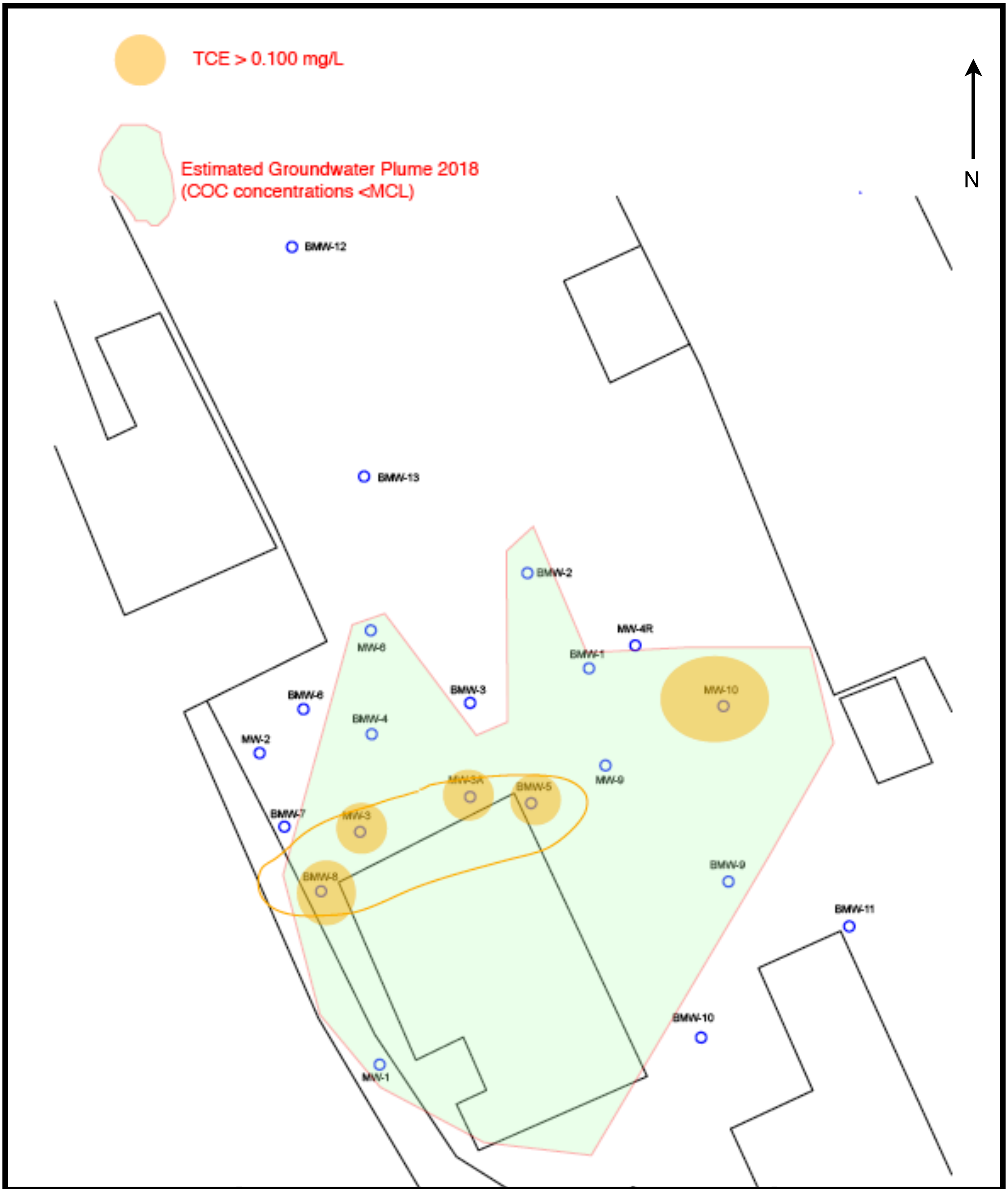
bullock environmental, llc

PROJECT

MODIFIED VOLUNTARY CLEANUP PLAN AND RISK ASSESSMENT
FORMER GREIF BROTHERS FACILITY (PARCELS A & B)
409 SECOND AVENUE NE
CULLMAN, CULLMAN COUNTY, ALABAMA
ALABAMA VOLUNTARY CLEANUP SITE #: 461-9496
BULLOCK ENVIRONMENTAL, LLC PROJECT #: 18-CULL01

FIGURE 4

CHEMICALS OF CONCERN
IN SOIL
(OCTOBER 2018)



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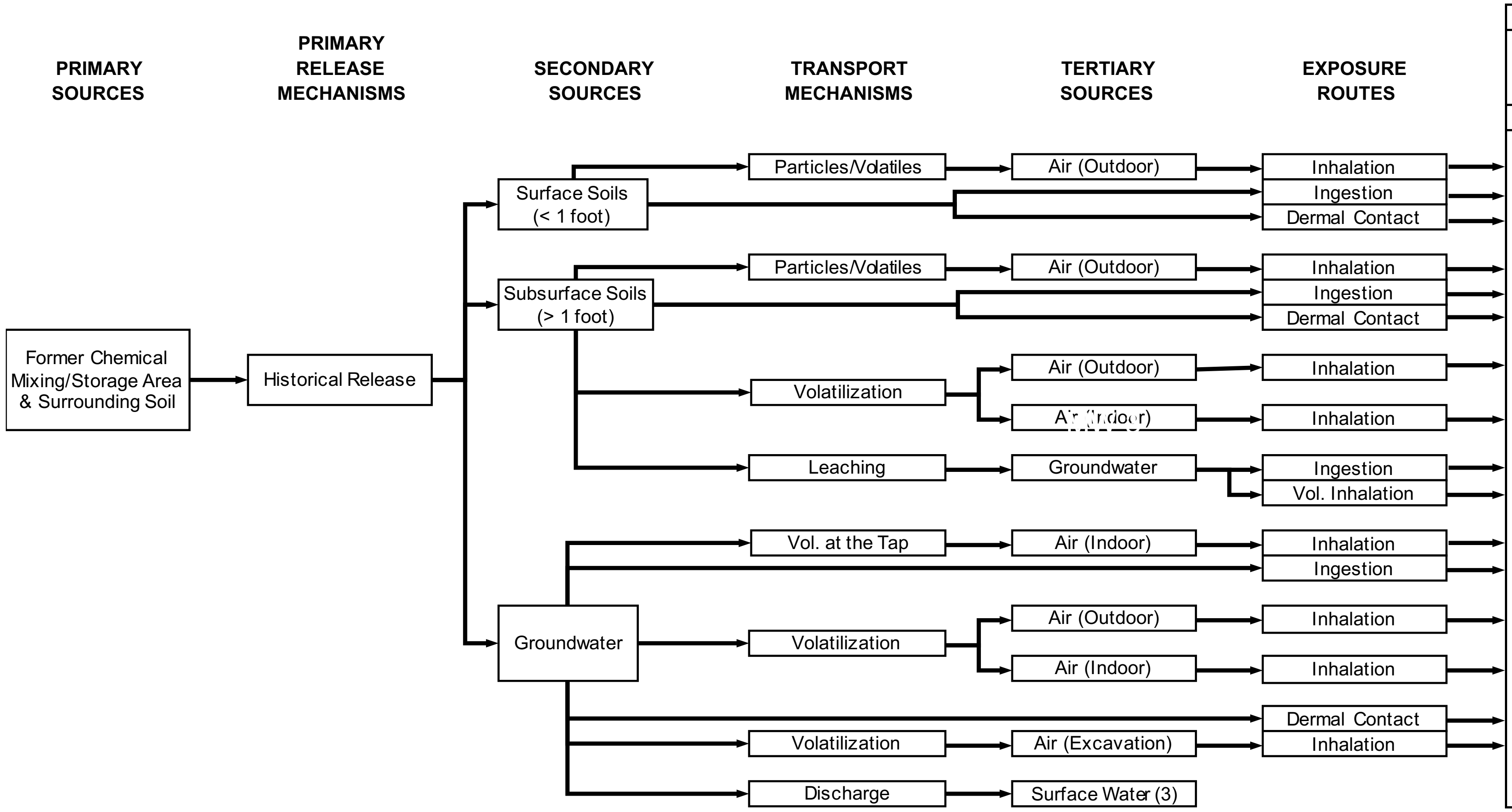
PROJECT

MODIFIED VOLUNTARY CLEANUP PLAN AND RISK ASSESSMENT
FORMER GREIF BROTHERS FACILITY (PARCELS A & B)
409 SECOND AVENUE NE
CULLMAN, CULLMAN COUNTY, ALABAMA
ALABAMA VOLUNTARY CLEANUP SITE #: 461-9496
BULLOCK ENVIRONMENTAL, LLC PROJECT #: 18-CULL01

FIGURE 5

CHEMICALS OF CONCERN
IN GROUNDWATER
(OCTOBER 2018)

Oregon Department of Environmental Quality
RBDM Conceptual Site Model



SECONDARY SOURCES	TRANSPORT MECHANISMS	TERTIARY SOURCES	EXPOSURE ROUTES	POTENTIAL RECEPTORS							
				Residential (1)		Trespasser (1)		Commercial Worker		Construction & Excavation (2)	
				Current	Future	Current	Future	Current	Future	Current	Future
Surface Soils (< 1 foot)	Particles/Volatiles	Air (Outdoor)	Inhalation	NC	NC	C	C	C	C	C	C
			Ingestion	NC	NC	NC	NC	NC	NC	NC	NC
			Dermal Contact	NC	NC	C	C	C	C	C	C
Subsurface Soils (> 1 foot)	Particles/Volatiles	Air (Outdoor)	Inhalation	NC	NC	NC	NC	NC	NC	NC	NC
			Ingestion	NC	NC	NC	NC	NC	NC	NC	NC
			Dermal Contact	NC	NC	NC	NC	NC	NC	NC	NC
	Volatilization	Air (Outdoor)	Inhalation	NC	NC	C	C	C	C	C	C
		Air (Indoor)	Inhalation	NC	NC	NC	NC	C	C	NC	NC
	Leaching	Groundwater	Ingestion	NC	NC	NC	NC	NC	NC	NC	NC
			Vol. Inhalation	NC	NC	NC	NC	C	C	C	C
Groundwater	Vol. at the Tap	Air (Indoor)	Inhalation	NC	NC	NC	NC	NC	NC	NC	NC
			Ingestion	NC	NC	NC	NC	NC	NC	NC	NC
	Volatilization	Air (Outdoor)	Inhalation	NC	NC	C	C	C	C	C	C
		Air (Indoor)	Inhalation	NC	NC	NC	NC	C	C	C	C
			Dermal Contact	NC	NC	NC	NC	NC	NC	NC	NC
	Volatilization	Air (Excavation)	Inhalation	NC	NC	NC	NC	NC	NC	C	C
	Discharge	Surface Water (3)									

Notes:

- \+ This route is a primary source of exposure.
- \- There is no exposure by this route.
- (1) Specify if urban residential or single-family residential. Include separate columns for these exposure scenarios if necessary.
- (2) Include separate columns for these two exposure scenarios if necessary.
- (3) Surface water contamination is not known to be a current or future concern; however, this item is relevant to the GRP pathway (represented below).

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PROJECT
Modified Voluntary Cleanup Plan & Risk Assessment
FORMER GREIF BROTHERS FACILITY (PARCELS A & B)
409 SECOND AVENUE NE
CULLMAN, CULLMAN COUNTY, ALABAMA
ALABAMA VOLUNTARY CLEANUP SITE #: 461-9496
BULLOCK ENVIRONMENTAL, LLC PROJECT #: 18-CULL01

FIGURE 6

SITE CONCEPTUAL EXPOSURE MODEL

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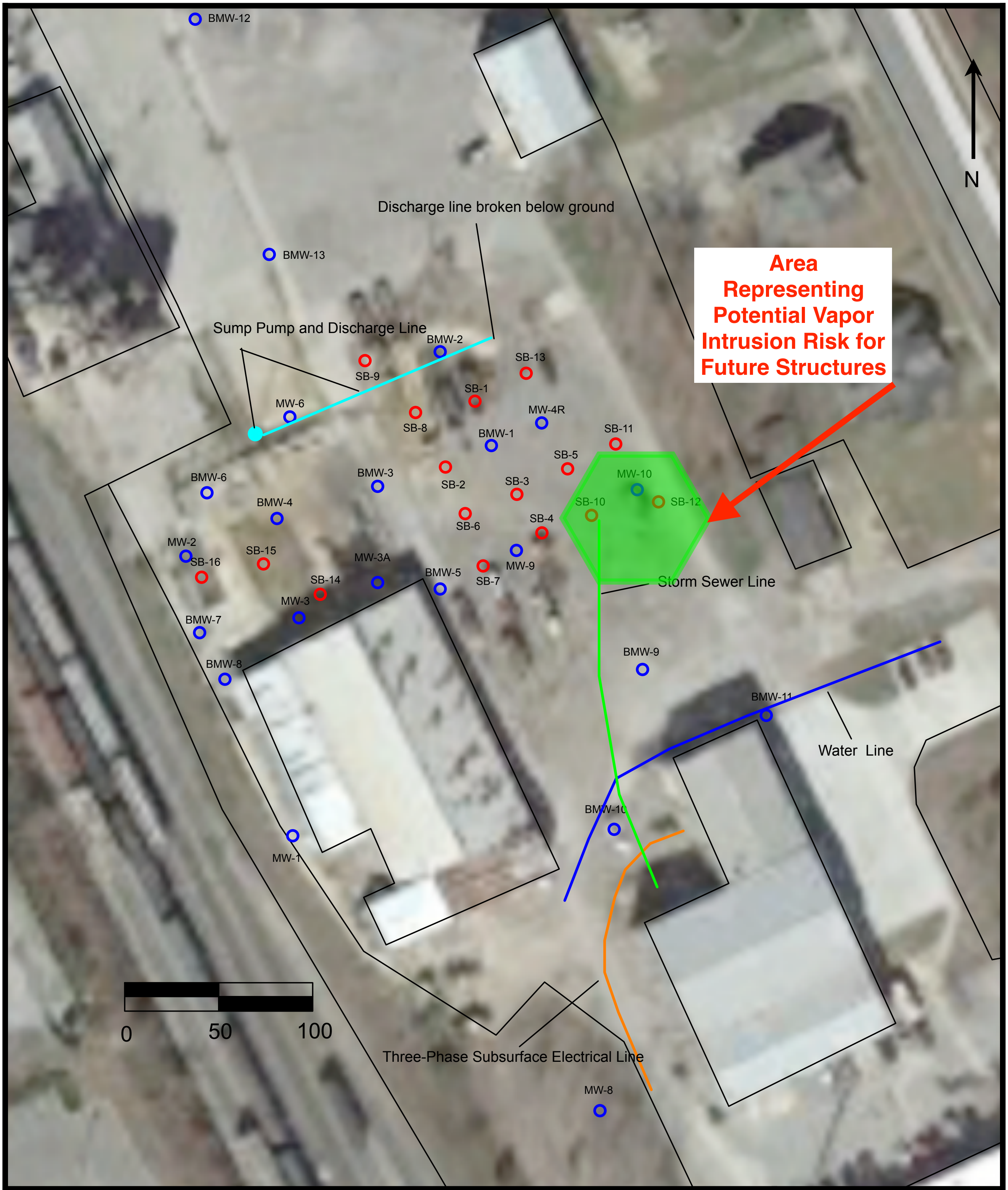
PROJECT

Modified Voluntary Cleanup Plan & Risk Assessment

FORMER GREIF BROTHERS FACILITY (PARCELS A & B)
409 SECOND AVENUE NE
CULLMAN, CULLMAN COUNTY, ALABAMA
ALABAMA VOLUNTARY CLEANUP SITE #: 461-9496

FIGURE 7

PROPOSED SITE PLAN WITH OVERLAY OF KNOWN CONTAMINANT AREAS



bullock environmental, llc

PROJECT

ADDITIONAL PROPERTY ASSESSMENT
FORMER GREIF BROTHERS FACILITY (PARCELS A & B)
409 SECOND AVENUE NE
CULLMAN, CULLMAN COUNTY, ALABAMA
ALABAMA VOLUNTARY CLEANUP SITE #: 461-9496
BULLOCK ENVIRONMENTAL, LLC PROJECT #: 18-CULL01

Figure 8

Onsite Area
Representing Potential
Vapor Intrusion Risk for
Future Structures

APPENDIX A

HISTORICAL SITE ASSESSMENT REPORTS AND REGULATORY CORRESPONDENCE

1. 2002 Phase III Site Assessment (ERM, Inc.);
2. 2010 Pre-Remedial Groundwater Report (Goodwyn Mills & Cawood);
3. 2012 Underground Injection Permit Application & Installation of Sodium Permanganate into on onsite soil to address elevated volatile organic compounds (VOCs) noted in groundwater on the west-central portion of the Site;
4. 2015 Cleanup Action Activities for Greif Facility, Cullman, Alabama-Final Report (Goodwyn Mills & Cawood);
5. 2017 Groundwater Monitoring Report (Terracon, Inc.); and
6. 2018 Modified Cleanup Plan (Goodwyn Mills & Cawood).

Greif Brothers Monitoring Well Results

Aug-07

VOC's (8260B)	Test Result						
	MW 1	MW 2	MW 3	MW 4	MW 5	MW 6	Water (mg/l)
Benzene	bdl	bdl	bdl	bdl	bdl	0.005	0.0
Chloroethane	bdl	bdl	bdl	bdl	bdl	bdl	
1, 2-Dichloroethane	bdl	bdl	0.009	bdl	bdl	bdl	0.005
1, 1-Dichloroethene	0.007	bdl	19	0.087	bdl	0.013	0.007
Cis-1,2-Dichloroethene	0.121	0.024	10.4	17.4	bdl	10.3	0.07
trans-1,2-Dichloroethene	bdl	bdl	0.021	0.015	bdl	0.018	0.1
Ethylbenzene	bdl	bdl	bdl	0.54	bdl	bdl	0.7
Tetrachloroethene	bdl	bdl	0.047	0.052	bdl	bdl	0.005
Toluene	bdl	bdl	0.102	0.008	bdl	bdl	1
1,1,1-Trichloroethane	bdl	bdl	3.2	bdl	bdl	bdl	0.2
Trichloroethene	0.109	bdl	56.1	71.9	bdl	0.78	0.005
Vinyl Chloride	bdl	bdl	1.17	0.81	bdl	1.29	2
Xylenes	bdl	bdl	bdl	2.33	bdl	bdl	

[2] National Primary Drinking Water Standards
Sep-08
Method Detection Limit - .005

Greif Brothers Monitoring Well Results

Aug-07

Metals	Test Result						
	MW 1	MW 2	MW 3	MW 4	MW 5	MW 6	Water (mg/l)
aluminum	bdl	bdl	bdl	bdl	bdl	bdl	0.2
arsenic	bdl	bdl	bdl	bdl	bdl	bdl	0.01
chromium	bdl	bdl	0.009	bdl	bdl	bdl	N
iron	0.74	2.5	5.8	2.1	3.1	0.36	N
magnesium	3.8	10	6.6	3.2	5.2	3.1	N
cyanide	bdl	bdl	bdl	bdl	bdl	bdl	0.2

[2] National Primary Drinking Water Standards

[N] = No Standard

PHASE III REMEDIAL INVESTIGATION REPORT

Greif Bros. Corporation

Phase III Remedial Investigation (RI) Report

Greif Bros. Facilities
Cullman, Alabama

July 2002

Environmental Resources Management

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LIST OF ACRONYMS

ASTM	American Society for Testing and Materials
bgs	Below ground surface
CPT	Cone penetrometer test
DCA	Dichloroethane (1,1- or 1,2-)
DCE	Dichloroethene (1,1- or 1,2-)
DNAPL	Dense non-aqueous phase liquid
DTSC	Department of Toxic Substance Control
ERM	Environmental Resources Management
ft msl	Feet above mean sea level
GC/MS	Gas chromatograph/mass spectrometer
H&S	Health and Safety
HSP	Health and Safety Plan
MCLs	Maximum Contaminant Levels
MDLs	Method detection limits
mg/L	Milligrams per liter
µg/kg	Micrograms per kilogram
µg/L	Microgram per liter
PCE	Tetrachloroethene, or Perchloroethene
PCBs	Polychlorinated biphenyls
PID	Photoionization detector
PRGs	Preliminary remediation goals
PVC	Polyvinyl chloride
QA/QC	Quality assurance/quality control
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
SSLs	Soil screening levels
SOPs	Standard Operating Procedures
SVOCs	Semivolatile organic compounds
TCA	Trichloroethane (1,1,1- or 1,1,2-)
TCE	Trichloroethene, or Trichloroethylene
TDS	Total dissolved solids
TPH-d	Total petroleum hydrocarbons as diesel
TPH	Total petroleum hydrocarbons
USEPA	United States Environmental Protection Agency
USCS	Unified Soil Classification System
VOCs	Volatile organic compounds

EXECUTIVE SUMMARY

As requested by Scott Doran of the Vorys, Sater, Seymour, and Pease, LLP Law Firm, Environmental Resources Management (ERM) conducted a Phase I Environmental Site Assessment (ESA) and Limited Phase II Investigation of the Greif Bros. facility located at 409 Second Avenue, N.E. in Cullman, Alabama and the Cullman Supply Company, also located at this address and owned by Greif Bros. Corporation (Greif). The Phase I ESA was conducted in general accordance with the scope and guidelines of *ASTM Standard E1527-00 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process.* The Phase II investigation was conducted in general accordance with *ASTM Standard E1903-97 Standard Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process.* Ed Ossi, P.G., of ERM's Brentwood, Tennessee office conducted the Phase I ESA site visit on June 12 and June 14, 2001. The Phase II investigation was conducted by ERM on July 18-20, 2001.

Based on the information obtained during the Phase I site visit, the environmental database review, and the interviews with persons familiar with the site and its history, eleven Areas of Concern (recognized environmental conditions) were identified (see Section 6.0 of ERM's report entitled *Phase I Environmental Site Assessment and Limited Phase II Investigation* for a detailed discussion of each Area of Concern):

1. Scrap Metal and Equipment Storage Area
2. Hazardous Material Storage Area
3. Trichloroethylene (TCE) Degreaser Area
4. Oil Stained Soil Along West Property Line, Adjacent to Railroad Track
5. Hazardous Waste Storage Area/ Light Gauge Paint Room
6. Former UST - West Entrance of the Raible Division Heavy Gauge Assembly Area
7. Former UST - Southeast Corner of the Cullman Supply Company Electric Shop
8. Dry Well and Adjacent Solvent Recovery Room
9. Basement Vault
10. Oil Drum Storage Rack-Cullman Supply
11. Former Hazardous Waste Storage Shed

To assess the above Areas of Concern (AOCs), ERM performed a Limited Phase II Investigation to determine whether the surficial and subsurface soils and shallow water-bearing zone were impacted by potential historical releases of chemicals or past activities at the Site. The investigation included the collection of soil, ground water and/or surface water samples for analysis at an Alabama certified laboratory of the parameters deemed most pertinent to the AOC being assessed.

Of the 11 AOCs where Phase II investigation activities (i.e., soil sampling and analysis) were performed, AOCs 1, 2, 3, 4, 5, and 11 had reported concentrations of one or more constituents above potentially applicable regulatory threshold or "level of concern" such as a federal and/or state established maximum contaminant level (MCL). Most notably, aromatic and/or chlorinated solvents (i.e., TCE) were reported to be present in the soils and/or shallow water-bearing zone above their respective levels of concern in AOCs 2, 3, and 4; heavy metals (i.e., chromium) were reported to be present in the soils above their respective levels of concern in AOCs 1, 5, and 11 and total petroleum hydrocarbons (TPHs) were reported to be present in the shallow water-bearing zone above their respective levels of concern in AOC 5.

Of the above, AOC 2 (Hazardous Material Storage Area) appeared to be of the most concern based on the then currently available data. The ground water sample (7918-018), collected from the shallow water-bearing zone, was reported by the laboratory to have concentrations of the TCE degradation constituents cis-1,2-dicholoroethene, 1,2-dicholorethene and vinyl chloride (VC) at concentrations several orders of magnitude above their respective levels of concern.

In the ground water sample (7918-011) collected from the shallow water-bearing zone for AOC 3 (TCE Degreaser Area), TCE and the TCE degradation constituents cis-1,2-dicholoroethene and VC were reported at concentrations well above their respective levels of concern.

In the two soil samples (7918-003 and/or 7918-004) collected for AOC 4 (Oil Stained Soil along the West Property Line), tetrachloroethene and TCE were reported at concentrations well above their respective levels of concern. Lead and chromium (total) were also reported to be present several orders of magnitude above levels of concern.

In the ground water sample (7918-009) collected from the shallow water-bearing zone for AOC 5 (Hazardous Waste Storage Area/Light Gauge Paint Room), lead, cadmium and chromium (total) were reported to be present at concentrations well above their respective levels of concern.

TPH (gasoline range and diesel range) were also reported to be present above the levels of concern.

Based on an Asbestos Containing Materials (ACMs) survey[1] performed by ERM in May 2000, ACMs are reported to be present in the on-site building(s) floor and ceiling tiles. Section 5.0 of ERM's report provides a summary of the identified ACMs.

As requested by Scott Doran of the Vorys, Sater, Seymour, and Pease, LLP Law Firm, ERM prepared a Phase III Remedial Investigation (RI) Work Plan[2] to follow-up the preliminary assessment findings as described in ERM's August 2001 report. This Work Plan was developed in general accordance with the *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (United States Environmental Protection Agency [USEPA], 1988).

The principal objective of the RI was to confirm and, if present, further define the nature and extent of the chemical constituents in the soils and ground water in three of the eleven Areas of Concern (AOC) that were identified and investigated as part of prior site assessments[3] activities. The three AOCs that were the focus of the RI were the:

- Hazardous Material Storage Area (AOC 2);
- TCE Degreaser Area (AOC 3), both of which are located on the northern portion of the Site; and
- Former Hazardous Waste Storage Area/Light Gauge Paint Room (AOC 5), which is located in the central portion of the Site.

An additional potential AOC (not previously identified; hereafter identified as AOC 12) located along the southeast side of the property, near the exterior wall of a former satellite hazardous waste accumulation and paint storage room was also assessed in the RI.

The significant findings of the RI as discussed throughout this report are as follows:

- The soil gas survey indicated that significant concentrations of TCE and other chlorinated solvents, such as tetrachloroethylene or

---

[1] Asbestos-Containing Materials Survey Report, ERM, May 2000.

[2] Phase III Remedial Investigation Work Plan, ERM, February 2002.

[3] Phase I Environmental Site Assessment and Limited Phase II Investigation, ERM, August 2001.

perchloroethylene (PCE), were present in the subsurface near the TCE Degreaser (AOC 3) and Hazardous Material Storage Area (AOC 2).

- Soil samples collected from the borings installed near these AOCs (AOCs 2 and 3) were reported to contain TCE and PCE at concentrations exceeding potentially applicable regulatory thresholds or levels of concern.
- The soil and ground water samples collected at the Former Hazardous Waste Storage Area/Light Gauge Paint Room (AOC 5) were reported to contain only trace concentrations of site-related chemical constituents.
- Elevated levels of ethylbenzene and total xylene were reported to be present in surficial soil samples collected along the exterior wall of the satellite hazardous waste accumulation area (AOC 12).
- Ground water flow in the shallow water-bearing zone in the vicinity of AOCs 2 and 3 is toward the west-southwest, in the direction of property owned and operated by the CSX railroad. Ground water samples collected from the shallow monitoring wells installed near AOCs 2 and 3 were reported to contain TCE, PCE and VC at concentrations several orders of magnitude above federal/state MCLs. The railroad property and the relatively undeveloped property immediately west of the railroad property appear to be or have been impacted by off-site migration of contaminants from the Site.
- Ground water flow in the bedrock aquifer is toward the east based on the water level measurements obtained from the four deep monitoring wells (DW1 through DW4). Low levels of total petroleum hydrocarbons-diesel range organics (TPH-DRO) were reported to be present in the ground water samples collected from the bedrock wells DW 2 and DW 3 installed along the west and south sides of the Site; respectively. However, chlorinated hydrocarbons (i.e., TCE) were not reported to be present in the ground water samples collected from the four bedrock wells installed in the underlying sandstone bedrock aquifer at locations along the north (DW1), west (DW2), south (DW3), and east (DW4) perimeter of the Site.

1.0 INTRODUCTION

This report presents the findings of the Phase III Remedial Investigation (RI) completed by Environmental Resources Management (ERM) at the Greif Bros. Corporation (Greif) property located at 409 Second Avenue, N.E. in Cullman, Alabama along with the Cullman Supply Company (CUSCO) also located at this address and owned by Greif Bros. (Figure 1). The work was completed in accordance with the Phase III Remedial Work Plan submitted to Scott Doran of the Vorys, Sater, Seymour, and Pease, LLP dated February 2002.

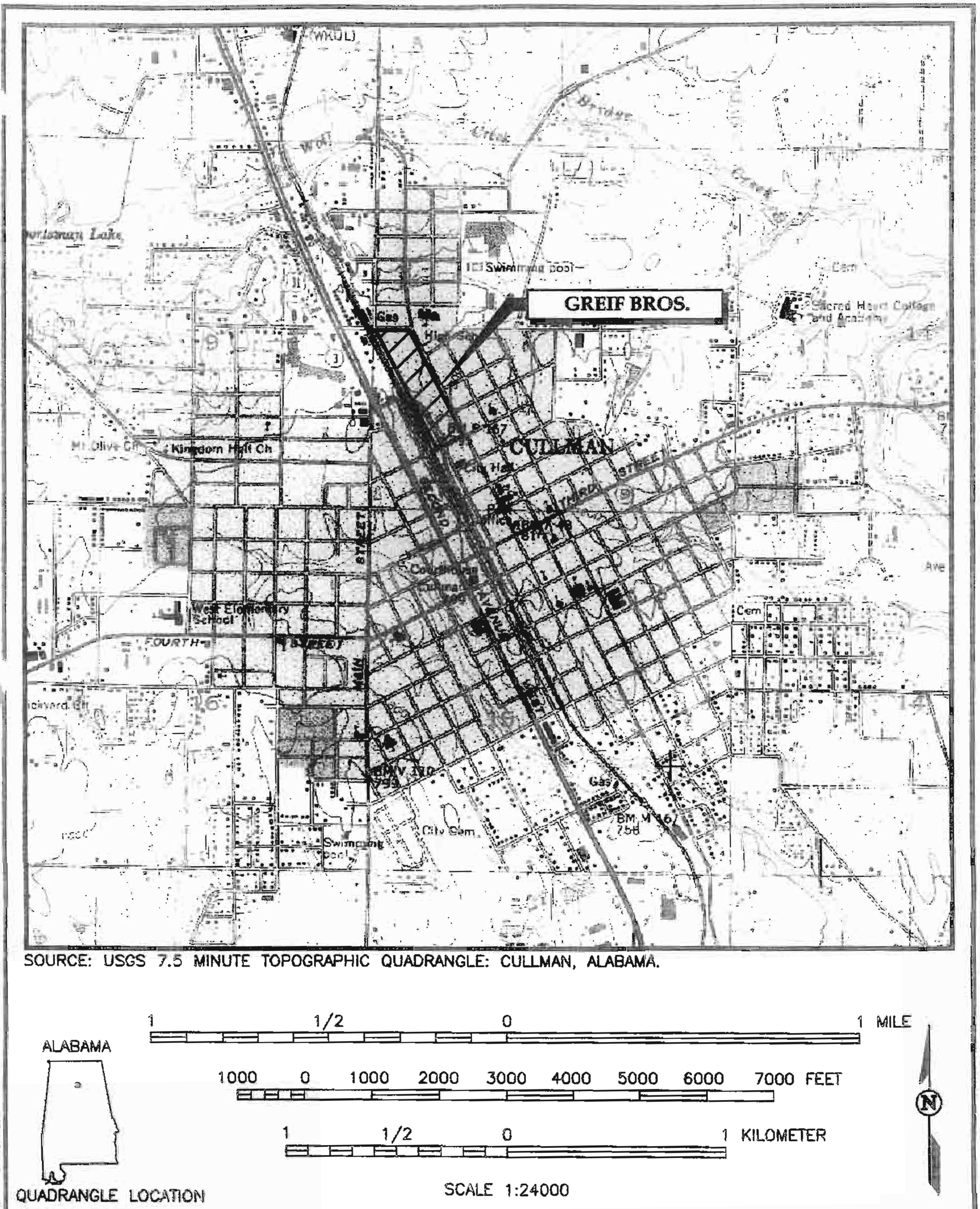
The Work Plan was developed in accordance with the *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, USEPA, 1988.

The primary objective of the RI was to confirm and/or further define the impacts at the Site from areas of concern (AOCs) that were initially identified in a Phase I Environmental Site Assessment (ESA) conducted by ERM on June 12 and June 14, 2001 and further evaluated in a Limited Phase II ESA conducted on July 18-20, 2001 (Reference: *Phase I Environmental Site Assessment and Limited Phase II Investigation*, ERM, August 2001). The data were also used to formulate an action plan for presenting the findings to the Alabama Department of Environmental Management (ADEM).

1.1 DOCUMENT ORGANIZATION

This RI Report is divided into the following sections:

- Section 1 Introduction- general site and project background and project objectives;
- Section 2 Previous Assessments;
- Section 3 RI Scope of Work;
- Section 4 Methods;
- Section 5 RI Results; and
- Section 6 References used in this document.



SOURCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE: CULLMAN, ALABAMA.

QUADRANGLE LOCATION

SCALE 1:24000

31854.1 GREIF 8-16-02 MLW

ERM Environmental Resources Management

SITE LOCATION
GREIF BROS.
409 2ND AVENUE N.E.
CULLMAN, ALABAMA

FIGURE
1

Included with this RI Report are the following appendices:

Appendix A	Limited Phase II Summary Analytical Tables
Appendix B	Beacon Environmental Soil Gas Survey Report
Appendix C	Soil Boring Logs
Appendix D	Monitoring Well Completion Diagrams
Appendix E	Laboratory Analytical Results-Soil
Appendix F	Laboratory Analytical Results-Water

1.2 *SITE LOCATION*

The Greif Bros. and CUSCO facilities are co-located at 409 Second Avenue, N.E. in Cullman, Alabama and are referred to as a single site ("Site") in the remainder of this document. The Site is located in the older section of Cullman. Properties adjacent to the Site are primarily industrial or commercial with a few residential properties located nearby. A general site topographic location map is included as Figure 1. A detailed site location map is included as Figure 2.

1.3 *PROJECT BACKGROUND*

Environmental Resources Management (ERM) conducted a Phase I Environmental Site Assessment (ESA) and Limited Phase II Investigation at the Greif Bros. Site in June and July 2001.

Based on the data obtained during a Phase I and limited Phase II ESA of the Site and presented in ERM's report entitled *Phase I Environmental Site Assessment and Limited Phase II Investigation* and dated August 2001, certain Areas of Concern were identified with reported concentrations of one or more constituents of concern in soil and/or ground water above applicable screening levels and/or regulatory standards.

Of the 11 Areas of Concern (AOC) where Phase II investigation activities (i.e., soil sampling and analysis) were performed, AOCs 1, 2, 3, 4, 5, and 11 had reported concentrations of one or more constituents above a federal and/or state established level of concern (e.g., maximum contaminant level). Most notably, aromatic and/or chlorinated solvents (i.e., TCE) were reported to be present in the soils and/or shallow ground water above their respective levels of concern in AOCs 2, 3, and 4; heavy metals (i.e., chromium) were reported to be present in the soils above their respective levels of concern in AOCs 1, 5, and 11; and total petroleum hydrocarbons were reported to be present in the shallow ground water above their respective levels of concern in AOC 5.

Of the above AOCs with identified impacts above federal and/or state established levels of concern, AOC 2 (Hazardous Material Storage Area) appeared to be of the most concern based on the preliminary data. The ground water sample (7918-018), collected from the shallow saturated zone, was reported by the laboratory to have concentrations of the TCE degradation constituents cis-1, 2-dicholoroethene, 1,2-dicholorethene, and vinyl chloride of 2,440 ug/l, 16.8 ug/l, and 2,980 ug/l, respectively, compared to the published levels of concern of 70 ug/l, 5 ug/l, and 2 ug/l, respectively. Toluene and benzene were reported to be present at 4,420 ug/l and 19.7 ug/l, respectively, compared to the levels of concern of 1,000 ug/l and 5 ug/l. TPH (gasoline range) and TPH (diesel range) were reported to be present at 50,000 ug/l and 27,200 ug/l; naphthalene was reported to be present at 1,110 ug/l compared to a level of concern of 20 ug/l.

In the ground water sample (7918-011) for AOC 3 (TCE Degreaser Area), TCE and its degradation constituents cis-1, 2-dicholoroethene and vinyl chloride were reported at 33.4 ug/l, 71.1 ug/l, and 16.1 ug/l, respectively, compared to the published levels of concern of 5 ug/l, 70 ug/l, and 2 ug/l, respectively. Lead and chromium (total) were also reported to be present at 1.05 mg/l and 0.60 mg/l, respectively, compared to levels of concern of 0.15 mg/l and 0.1 mg/l.

In the soil samples (7918-003 and/or 7918-004) for AOC 4 (Oil Stained Soil along the West Property Line), tetrachloroethene (PCE) and TCE were reported at 0.2774 mg/kg and 17.9 mg/kg, respectively, compared to the published level of concern for each of 0.06 mg/kg. Lead and chromium (total) were also reported to be present at 5,090 mg/kg and 997 mg/kg, respectively, compared to a level of concerns of 400 mg/kg and 38 mg/kg. In the ground water sample (7918-009) for AOC 5 (Hazardous Waste Storage Area/Light Gauge Paint Room), lead, cadmium, and chromium (total) were reported to be present at 181 mg/l, 0.07 mg/l, and 18.3 mg/l, respectively, compared to a level of concerns of 0.015 mg/l, 0.005 mg/l, and 0.1 mg/l. TPH (gasoline range) and TPH (diesel range) were reported to be present at 113 ug/l and 1,280 ug/l, respectively.

1.4 *SITE HISTORY*

The ownership and activities that have occurred on the Site is complex. Documentation was located that indicates that the Site was developed for industrial use at least as far back as 1917 (~85 years ago). Uses have included a wide range of industrial activities to include those by Bremen (or Dremen) Manufacturing Company, Standard Industrial Laundry, Porter Knitting Mills Company, Cullman Supply Company (since at least 1946), Acadia Planing, King Phorr Canning Company, Raible Division Sheet Metal and Stamping Company, and Greif Bros. Corporation (steel drum manufacturing).

1.5 *REMEDIAL INVESTIGATION (RI) OBJECTIVES*

The overall objective of the Phase III RI was to provide further delineation of the on-site lateral extent of the previously identified impacts at the Site. The specific objectives of the RI were as follows:

1. Determine whether the constituents of concern (COCs) are at levels that require remediation or, conversely, are at levels that will allow for the implementation of a natural attenuation strategy complemented by institutional controls, if necessary.
2. Determine whether COCs can be grouped or excluded to allow the use of limited remedial techniques (i.e., metals and VOCs may each require a distinct technology).
3. Determine whether the sandstone bedrock water-bearing zone underlying the Site was impacted.
4. Evaluate the probability of off-site contaminant migration.

2.0 PREVIOUS ASSESSMENT RESULTS

This section summarizes the physical site characteristics and previous investigation results.

2.1 SITE PHYSICAL CHARACTERISTICS

The following subsections describe the physical characteristics of the site, including topographic and surface features, geology, hydrogeology, hydrology, and land uses adjacent to the Site.

2.1.1 Topographic and Surface Features

The Site is situated in an area of low topographic relief that is at an average elevation of approximately 800 feet above mean sea level. The manufacturing complex is comprised of several single story metal buildings, a single story brick building that houses the sales department and a two story brick building that houses the research and development department. The initial building on the property was constructed at the turn of the 20th century. This structure, encompassing approximately 250,000 square feet under roof, occupies the southeast corner of the property. The property is bordered on the west by tracks owned by the Louisville and Nashville (L&N) railroad. The locations of these features are shown on Figure 2.

2.1.2 Regional and Site Geology

According to the Geologic Map of Alabama and e-mail correspondence with the Alabama Division of Geology, the Site is underlain by Pottsville Formation of Pennsylvanian age. This formation is comprised of light-gray thin- to thick-bedded quartzose sandstone and conglomerate containing interbedded dark-gray shale, siltstone, and thin coals.

2.1.3 Regional and Site Hydrogeology

The closest bodies of surface water are Sportsman Lake, located approximately 1 mile to the northwest, Wolf Creek located approximately one mile to the north, an unnamed stream located approximately two miles to the east and an unnamed stream located approximately two miles to the south.

One water well was identified in the database search conducted in the Phase I ESA as being within a 1-mile radius of the facility. The well is located approximately 0.5 mile south of the facility. Reportedly, ground water in the well was measured at 28.70 feet on 09-03-1929.

In the Phase II investigation, 3 of the 10 Geoprobe borings drilled at the Site encountered saturated conditions at the overburden/bedrock interface, which was encountered at depths that ranged from 5 to 10 feet below ground surface. No wells were drilled into the sandstone bedrock in the Phase II investigation.

2.1.4 *Adjacent Land Use*

In general, adjacent properties are industrial use. A few residential and commercial areas are in the vicinity of the Site. Adjoining properties are as follows:

North: 8th Street N.E. is located to the north. Residential housing is located across 8th Street N.E. An animal feed mill is located north of the Stamping Building at the southeast corner of the intersection of 8th Street N.E. and the L&N track.

South: Undeveloped property and a paved parking area owned by the City of Cullman.

East: 2nd Avenue North. A Texaco station, feed store and single-family housing are located across 2nd Avenue. There are four houses located east of the Greif Bros. facility and west of 2nd Avenue. Greif Bros. owns three of these and a private individual owns one.

West: Undeveloped property and tracks owned by L&N Railroad. The railroad property appears to have been impacted by petroleum hydrocarbons.

2.2 *PREVIOUS ASSESSMENTS*

A Phase I (ESA) was initially conducted by ERM on June 12 and June 14, 2001 at the Site. Eleven AOCs were identified in the Phase I. A limited Phase II investigation was conducted at the site on July 18-20, 2001 to address these 11 AOCs. Soil and ground water samples were collected from the site during the Phase II. The soil samples were collected using hand auger or direct push technology (DPT) sampling equipment (i.e. Geoprobe). Ground water samples were collected at select locations with the Geoprobe. This section presents the analytical results of the Phase II environmental investigation. The summary analytical tables for the samples collected in the Phase II are included for reference as Appendix A.

2.2.1 *Soil Investigations*

Ten soil borings were completed during the limited Phase II investigation performed at the site. One or more soil borings were installed at AOCs 1 to 3, and AOCs 5 to 11 and two surface soil samples were collected at AOC 4 (refer to Figure 3 for locations of sample points).

At least one soil sample from each DPT boring was selected for laboratory analysis of target parameters. The sample selected for analysis met one or more of the following criteria:

- displayed the most elevated PID readings;
- was stained with potential constituents of concern; or,
- was the deepest sample collected from the boring.

Soil samples collected from AOCs 1, 3-5, 8, and 11 were analyzed for TPH, TCL-SVOCs, PCBs, TCL-VOCs, and TAL metals. Soil samples collected from AOCs 2 and 10 were analyzed for TPH, TCL-SVOCs, PCBs, and TCL-VOCs. AOCs 6 and 7 were analyzed for TPH, TCL-SVOCs, and TCL-VOCs.

2.2.2 *Shallow Ground Water Monitoring*

A total of three shallow ground water samples and one surface water sample were collected during the previous Phase II investigation performed at the site. Ground water samples collected from AOCs # 3 and # 5 were analyzed for TPH, TCL-SVOCs, PCBs, TCL-VOCs, and TAL metals; AOCs # 2 and # 9 (the surface water sample) were analyzed for TPH, TCL-SVOCs, PCBs, and TCL-VOCs.

2.2.3 *Deep Ground Water Monitoring*

No deep ground water monitoring was performed as part of the Phase II investigation.

2.2.4 *Chemical Distribution*

The analytical results of the phase II soil and ground water sampling program are summarized in the sections that follow.

2.2.4.1 *Chemical Distribution in Soil*

The soil analytical results are presented in the following sections.

2.2.4.1.1 Scrap Metal and Equipment Storage Area (AOC # 1)

TPH (gasoline and diesel ranges), PCBs and VOCs were not detected at the reportable limits in the soil at this location.

The reported concentration of bis (2-ethylhexyl) phthalate (0.786 mg/kg) is below the applicable Preliminary Remediation Goal (PRG) of 176 mg/kg (reference Section 5.7 for a discussion of PRGs).

The TAL metal arsenic was detected in soil sample 7918-012 and a duplicate (7918-013) at concentrations of 15.5 mg/kg and 17.8 mg/kg, respectively, which both exceeded the ADEM RBSL of 11.1 mg/kg? The total chromium concentration (44.8 mg/kg) in sample 7918-012 exceeded the SSL of 38 mg/kg.

2.2.4.1.2 Hazardous Materials Storage Area (AOC 2)

TPH (diesel range) was detected at 492 mg/kg in sample 7918-016 (0-4'). TPH (gasoline range) was detected at 46.5 mg/kg and TPH (diesel range) was not detected above the reportable limit in soil sample 7918-017 (4-8'). TPH in the 0-4' interval exceeds the ADEM Corrective Action Limit.

None of the SVOCs detected in the soil samples collected from this area exceeded the regulatory screening levels.

In addition, the concentrations of the detected VOCs in soil sample 7918-016 (0-4') were below the applicable regulatory standards. In sample 7918-017 (4-8'), the concentration of cis-1, 2-dichloroethene (cis-1, 2-DCE), 4.762 mg/kg, exceeded the SSL of 0.355 mg/kg and the concentration of vinyl chloride (0.4524 mg/kg) exceeded the SSL of 0.01 mg/kg.

2.2.4.1.3 Trichloroethene (TCE) Degreaser Area (AOC # 3)

TPH (diesel range) was detected at a concentration of 26.0 mg/kg in sample 7918-010 collected from 4-8'. TPH (gasoline range) was not detected above the reportable limits.

The only detected SVOC in soil sample 7918-010 was less than the PRG of 176 mg/kg. In addition, none of the detected VOC concentrations, including TCE, exceeded the SSL levels and none of the detected TAL metals exceeded the applicable PRGs, SSLs, or RBSLs.

2.2.4.1.4 Oil Stained Soil along West Property Line, Adjacent to Railroad Tracks (AOC # 4)

TPH (diesel range) was detected at a concentration of 62 mg/kg in surface soil sample 7918-002, collected near the southwest corner of the Sheet Processing and Steel Storage Building.

Ethylbenzene, toluene and total xylenes were detected above the reportable limits in soil sample 7918-002. However, the reported concentrations were less than the applicable standards.

Regarding the surface soil sample 7918-003, collected on the west side of the Sheet Processing and Steel Storage Building, the concentration of 1,1,1-trichloroethane (1,1,1-TCA), 17.99 mg/kg, exceeded the SSL of 2 mg/kg; the concentration of PCE exceeded the SSL of 0.06 mg/kg; and the concentration of TCE (TCE), 17.99 mg/kg, exceeded the applicable SSL of 0.06 mg/kg.

The VOCs 1,1,1-TCA and TCE were detected above the reportable limits in duplicate soil sample 7918-004. The concentration of TCE (3.855 mg/kg) exceeded the applicable SSL of 0.06 mg/kg.

The TAL detected metals arsenic, total chromium and lead exceeded the applicable standards in sample 7918-002 collected near the southwest corner of the Sheet Processing and Steel Storage Building. Arsenic (69.3 mg/kg) exceeded the ADEM RBSL of 11.1 mg/kg; total chromium (997 mg/kg) exceeded the PRG of 38 mg/kg; and, lead (5,090 mg/kg) exceeded the ADEM RBSL of 400 mg/kg.

The concentration of arsenic (18.4 mg/kg) in sample 7918-003 and duplicate sample 7918-004 (18.4 mg/kg) collected on the west side of the building also exceeded the applicable ADEM RBSL of 11.1 mg/kg.

2.2.4.1.5 Hazardous Waste Storage Area/Light Gauge Paint Room (AOC 5)

TPH (diesel range) was detected at a concentration of 19.2 mg/kg in soil sample 7918-008 collected from 4-7.5'.

The detected SVOCs in soil sample 7918-008 were less than the applicable RBSL or PRG. Regarding TAL metals, arsenic (15.5 mg/kg) exceeded the ADEM RBSL of 11.1 mg/kg and total chromium (78.7 mg/kg) exceeded the PRG of 38.

2.2.4.1.6 Former Hazardous Waste Storage Shed (AOC 11)

The reported concentration of bis (2-ethylhexyl) phthalate, which was the only organic chemical detected in the soil sample from this location, was below the PRG of 176 mg/kg. Total chromium was the only detected TAL Metal that exceeded the applicable standard. The concentration of total chromium (73.2 mg/kg) exceeded the PRG of 38 mg/kg.

2.2.4.2 *Chemical Distribution in Ground Water*

The analytical results of ground water samples collected during previous investigations at the site are presented in Appendix A.

2.2.4.2.1 Chemical Distribution in Shallow Ground Water

Hazardous Materials Storage Area (AOC 2)

TPH (gasoline range) was detected at a concentration of 50,000 ug/l and TPH (diesel range) was detected at a concentration of 27,200 ug/l in a ground water sample collected above bedrock.

With respect to SVOCs, the concentration of isophorone (78.9 ug/l) exceeded the PRG for tap water ingestion of 70.77 ug/l and the concentration of naphthalene (1,100 ug/l) exceeded the ADEM RBSL of 20 ug/l for tap water ingestion.

With respect to VOCs in water sample 7918-018, the concentration of benzene (19.7 ug/l) exceeded the National Primary Drinking Water Standards (NPDWS) of 5 ug/l; the concentration of toluene (4,420 ug/l) exceeded the NPDWS of 1,000 ug/l; the concentration of 1,2-dichloroethane (1,2-DCA), 16.8 ug/l, exceeded the NPDWS of 5 ug/l; the concentration of 1,1-DCE (17.9 ug/l) exceeded the NPDWS of 7 ug/l; the concentration of cis-1, 2-DCE (2,440 ug/l) exceeded the NPDWS of 70 ug/l; and, the concentration of vinyl chloride (2,980 ug/l) exceeded the NPDWS of 2 ug/l.

Trichloroethene (TCE) Degreaser Area (AOC 3)

TPH (gasoline and diesel ranges), SVOCs and PCBs were not detected above the reportable limits in sample 7918-011 and 7918-011D.

Regarding VOCs in water sample 7918-011, the concentration of cis-1, 2-DCE (71.1 ug/l) exceeded the NPDWS of 70 ug/l; the concentration of TCE (33.4 ug/l) exceeded the NPDWS of 5 ug/l; and, the concentration of vinyl chloride (16.1 ug/l) exceeded the NPDWS of 2 ug/l. In the duplicate ground water sample (7981-011D), the concentration of TCE (27.4 ug/l) exceeded the NPDWS of 5 ug/l; and, the concentration of vinyl chloride (14.5 ug/l) exceeded the NPDWS of 2 ug/l.

With respect to TAL metals detected in sample 7918-011, antimony (0.09 mg/l) exceeded the PRG (tap water ingestion) of 0.006 mg/l; arsenic (0.06 mg/l) exceeded the NPDWS of 0.05 mg/l; chromium (0.69 mg/l) exceeded the NPDWS of 0.1 mg/l; iron (608.5 mg/l) exceeded the SDWS of 0.3 mg/l; lead (1.05 mg/l) exceeded the NPDWS of 0.015 mg/l; manganese (2.12 mg/l) exceeded the SDWS of 0.05 mg/l; and selenium (0.06 mg/l) exceeded the NPDWS of 0.05 mg/l.

In the duplicate ground water sample ((7918-011D), antimony (0.014 mg/l) exceeded the PRG (tap water ingestion) of 0.006 mg/l; chromium (0.18 mg/l) exceeded the NPDWS of 0.1 mg/l; iron (254.5 mg/l) exceeded the SDWS of 0.3 mg/l; lead (0.283 mg/l) exceeded the NPDWS of 0.015 mg/l; and, manganese (0.887 mg/l) exceeded the SDWS of 0.05 mg/l.

Hazardous Waste Storage Area/Light Gauge Paint Room (AOC 5)

TPH (gasoline range) was detected at a concentration of 113 ug/l and TPH (diesel range) was detected at a concentration of 1,280 ug/l in water sample 7918-009.

The concentrations of the TAL Metals aluminum, antimony, arsenic, barium, cadmium, total chromium, copper, iron, lead, manganese, selenium and zinc exceeded the applicable standards. Aluminum (432 mg/l) exceeded the SDWS of 0.2 mg/l; antimony (0.51 mg/l) exceeded the PRG for tap water ingestion of 0.006 mg/l; arsenic (0.13 mg/l) exceeded the NPDWS of 0.05 mg/l; barium (23.8 mg/l) exceeded the PRG for tap water ingestion of 2 mg/l; cadmium (0.07 mg/l) exceeded the PRG for tap water ingestion of 0.005 mg/l; total chromium (18.3 mg/l) exceeded the NPDWS of 0.1 mg/l; copper (1.46 mg/l) exceeded the SDWS of 1 mg/l; iron (993.2 mg/l) exceeded the SDWS of 0.3 mg/l; lead (181 mg/l) exceeded the NPDWS of 0.015 mg/l; manganese (9.21 mg/l) exceeded the SDWS of 0.05 mg/l; and zinc (79.7 mg/l) exceeded the PRG for tap water ingestion of 2 mg/kg.

3.0 *REMEDIAL INVESTIGATION (RI) SCOPE OF WORK*

The scope of work developed for the Phase III ESA focused primarily on further delineating the lateral extent of soil and shallow ground water contamination in the area of the Hazardous Material Storage Area (AOC2), the TCE degreaser (AOC3) and the Hazardous Waste/Paint Room Storage Area (AOC5). A soil gas survey followed by a soil boring and shallow ground water investigation was conducted in these areas in the RI.

In addition to these three areas of concern, soil gas samples were collected and a geoprobe boring was drilled near the exterior wall of a former hazardous waste satellite accumulation/paint room located in a building situated near the southeast corner of the property.

Four bedrock-monitoring wells were also installed at the north, east, south and west ends of the property to assess the water quality in the bedrock aquifer. The scope of work elements completed in the RI were as follows:

- Contracted with Beacon Environmental Services to conduct a soil gas survey using the EMFLUX™ system in the area of the TCE degreaser, the hazardous material storage building, the hazardous waste storage area/light gauge paint room, and the satellite hazardous waste accumulation area/paint room located near the southwest corner of the facility;
- Drilled eight geoprobe soil borings within areas where soil gas samples exhibited elevated concentrations of chlorinated and/or aromatic petroleum hydrocarbons;
- Collected continuous soil samples at 4-foot intervals in each of the eight Geoprobe borings until refusal;
- Selected one soil sample from each Geoprobe boring for submittal to Test America for analysis of TAL metals, chlorinated hydrocarbons, semi-volatile organic compounds, PCBs and total petroleum hydrocarbons;
- Installed three monitoring wells in three of the eight Geoprobe borings where saturated conditions were encountered;
- Installed three overburden monitoring wells at the Geoprobe locations (three) where saturated conditions were previously encountered in the Phase II investigation;

- Collected continuous split-spoon soil samples at 2-foot intervals until refusal on bedrock at each of the four bedrock monitoring well locations;
- Selected one soil sample from each bedrock well soil boring for submittal to Test America for analysis of TAL metals, chlorinated hydrocarbons, semi-volatile organic compounds, PCBs and total petroleum hydrocarbons;
- Installed permanent protective steel casings several feet into bedrock at each of the bedrock well locations;
- Drilled through the steel casings with an air rotary drill until saturated conditions were encountered and installed a monitoring well in the bedrock at three of the four locations (one of the wells was completed as an open-hole well);
- Developed both the overburden and bedrock monitoring wells;
- Collected ground water samples from the overburden and bedrock monitoring wells and contracted with Test America Laboratory to analyze the samples for TAL metals, chlorinated hydrocarbons, semi-volatile organic compounds, PCBs and total petroleum hydrocarbons;
- Contracted a licensed State of Alabama Surveyor (Conn Surveyors of Cullman) to establish north and east coordinates and elevations for the soils gas sample stations, geoprobe locations and top of casing elevations for the monitoring wells installed in the RI; and
- Reduced the data and interpreted the results.

4.0 FIELD INVESTIGATION AND SAMPLING PLAN

This section summarizes the field sampling and analytical methodologies implemented in the RI.

4.1 FIELD WORK PLANNING

The RI field activities were conducted in a specific order and coordinated to maximize the RI efficiency. The stages completed in the RI are presented in Section 4.1.1.

4.1.1 *Investigation Stages*

The RI was sequenced in the following four stages:

- Stage I - Passive Soil Gas Survey;
- Stage II - Installation of Deep (Bedrock) Monitoring Wells; and
- Stage III - Installation of Shallow Soil Borings and Monitoring Wells; and
- Stage IV - Monitoring Well Sampling and Analysis.

The data collected in Stage I was used to select the drilling targets for Stage III.

In the RI Work Plan it was initially planned to perform Stage II prior to Stage III. However, the Stage II work was performed prior to Stage III in order to adjust to the availability of drilling company equipment.

4.1.2 *Utility Clearance*

The proposed location of each soil gas survey sampling point was reviewed with a Greif representative to determine whether underground utilities were present. The same procedure was conducted prior to drilling each geoprobe and bedrock-monitoring well. Subsurface sampling and drilling locations were adjusted to account for underground utilities and/or structures.

4.1.3 *Sample Numbering System*

Each sample location was identified with prefixes that were representative of the sampling technique. The following prefixes were used:

- Soil gas sample point from specific area – "A, B or C-#"
- Soil boring- "SB-#"
- Overburden Monitoring well – "MW-#"
- Deep (bedrock) Monitoring well – "DW-#"

The numbering sequence for the RI borings began with SB-1. The borings drilled in the Phase II are designated with the suffix -1 (i.e. SB1-1).

Each soil sample collected from a given location is preceded by the internal project number (8185) followed by the sequence number (i.e. 001 for the first sample collected). A description of each sample and its location was recorded in a field logbook.

The numbering sequence for the overburden monitoring wells began with MW-1. The numbering sequence for the bedrock wells began with DW-1.

4.1.4 *Surveying*

All soil gas sampling locations, soil borings, geoprobe locations and monitoring wells installed in the RI were surveyed as were the soil sampling locations and geoprobe locations drilled in the Phase II. A licensed Alabama surveyor (Conn Surveyors of Cullman) surveyed each well casing elevation datum to the nearest 0.01 foot and the x and y coordinates to the nearest 0.1 foot. Ground surface elevations were surveyed to the nearest 0. 1-foot. All site surveying was from a local datum referenced to mean sea level.

4.2 *SOIL INVESTIGATION*

The RI source area investigation was completed through implementation of a shallow soil gas survey followed by a verification shallow soil boring sampling event.

4.2.1 *Shallow Soil Gas Survey*

A shallow soil gas survey was conducted as a screening tool to identify areas of elevated concentrations of VOC and to define the approximate limits of soil and ground water contamination within source areas.

4.2.1.1 *Sampling Methodology*

Approximately 100-EMFLUX® soil gas sampling stations were sited at predetermined locations near the area of the TCE degreaser, the hazardous material storage building, the hazardous waste storage area/light gauge paint room, and the paint room located near the southwest corner of the facility. Soil gas stations were located inside and outside of the buildings. The stations in these areas were spaced on approximate 25-foot centers.

At each station, a ¾ inch diameter hole was drilled to an approximate depth of four inches below grade using an electric drill. The EMFLUX® collector was typically installed in the top four inches of the hole and exposed to subsurface gas for a predetermined period of time. Following the exposure period, the collectors were retrieved and shipped to the laboratory for analysis. A complete description of the sampling procedures is included with the Sampling Report Prepared by Beacon Environmental, which is included as Appendix B.

4.2.1.2 *Sample Analyses*

Soil vapor samples were analyzed for VOCs by gas chromatograph/ mass spectrometer (GC/MS) methods. The concentration distribution of the target compounds (PCE, TCE, 1-1-1 TCA, cis-1, 2 DCE, trans 1-2 DCE, benzene, toluene, ethylbenzene, xylene, and vinyl chloride) was used to identify potential soil boring/monitoring well locations ("targets") to assess the horizontal extent of VOC contamination in the vadose zone. The VOC target compound list was consistent with USEPA Method 8260 for soil.

4.2.2 ***Installation of Shallow Soil Borings***

A test-boring program was conducted to collect soil samples using direct-push methods ("geoprobe") to test areas with elevated concentrations of VOCs. Continuous soil samples were collected using dual-tube, direct-push methods with polyvinyl chloride (PVC) liners to refusal

The field geologist logged all borings. Soils were classified in accordance with the Unified Soil Classification System (USCS). Field notes were prepared to document olfactory and/or visual evidence of soil and/or ground water impact (e.g., solvent-like odor, chemical staining). A PID was used to screen soil samples for potential volatile constituents. Soil samples were collected using sampling procedures consistent with SOP #2 of the RI Work Plan.

Soil samples were submitted to TestAmerica, Inc., an Alabama-certified laboratory, located in Nashville, Tennessee. Selected soil samples were analyzed for VOCs. All analyses were conducted according to the methods described in Section 4.5.

4.3 GROUND WATER INVESTIGATION

Ground water investigation activities were completed in the second part (Stages II and III) of this RI.

4.3.1 *Installation of Shallow Ground Water Monitoring Wells*

A 2-inch diameter well was installed in those geoprobe borings that encountered saturated conditions at the overburden/bedrock interface. Wells were installed in three of the eight Geoprobe borings.

A 2-inch monitoring well was also installed at the three locations where saturated conditions were encountered at the overburden/bedrock interface in the Phase II assessment. These wells were located in the hazardous material storage area, near the TCE degreaser area, and near the hazardous waste/light gauge paint room.

4.3.2 *Installation of Deep (Bedrock) Monitoring Wells*

Four 2-inch diameter monitoring wells were installed into the bedrock within the facility property boundary but outside the areas of known contamination to obtain subsurface lithological and hydrogeological data to characterize the bedrock, ground water chemistry, and ground water flow underlying the Site.

The deep monitoring wells were installed using an air rotary drilling rig. Soil samples of the overburden were collected continuously in 2-foot intervals with a split spoon sampler until refusal on bedrock.

The overburden and upper bedrock were then overdrilled and a 6-¾ inch diameter steel casing was emplaced approximately 5-feet into bedrock and grouted into the socket. After the grout cured for a minimum 24-hour period, the casing was entered with a 6-inch diameter rock bit and drilled through the bedrock until water was encountered.

4.3.2.1 *Well Development*

All new wells were developed prior to sampling to ensure high quality monitoring data. Wells were developed according to the procedures outlined in SOP #4 of the RI Work Plan. All well development information was recorded on appropriate well development forms.

4.3.2.2 *Water Level Measurements*

Ground water levels were measured in all new and existing monitoring wells before sampling according to the procedures outlined in SOP #5 of the RI Work Plan. Water level measurements were taken using an electronic water level meter and recorded to the nearest 0.01 foot. Ground water levels were recorded in a field notebook.

4.3.2.3 *Ground Water Sampling*

Following the installation of the six overburden and four bedrock monitoring wells (Stage II and III), each well was developed to remove suspended solids and permit formation water to enter the well screen. Each well was then sampled according to the following steps:

- Well caps were removed and the water level was allowed to equilibrate to atmospheric pressure;
- After the water level equilibrated, the static water level and total depth of the well were measured and recorded in the logbook;
- The overburden wells were bailed to dryness or until a minimum of three well volumes of water were purged from using a disposal bailer;
- The wells were sampled by lowering a disposable bailer into the wells; and
- The laboratory supplied 40-ml glass ample vials equipped with Teflon septum lids (VOC samples) were filled first followed by the other sample containers.

The soil and ground water samples were store in an ice-filled cooler for shipment to the laboratory for analysis.

The sample parameters specified for analysis included VOCs, SVOCs, gasoline and diesel range TPH, PCBs and for metals using EPA Methods 8260, 8270, 8015M/B, 6010, and 7470.

As a part of the QAPP, quality assurance samples included field duplicates, field blanks, rinse blanks and trip blanks.

4.4 *INVESTIGATION-DERIVED WASTE*

Wastes generated during the RI will be handled according to the type of waste generated. All soil, ground water, and decontamination water is temporarily stored on site.

4.4.1 *Soil*

Soil drill cuttings are stored in 55-gallon drums in a secured area of the site. The drums are labeled as to the sources (individual sample locations) of the soil in the drum. A composite sample of the soil was collected and analyzed for appropriate compounds.

4.4.2 *Wastewater*

Wastewater generated from drilling, sampling, or other activity (e.g., well development or purging) is temporarily stored on site in plastic water storage tanks and 55-gallon drums. A sample of the IDW water was collected and tested for appropriate compounds.

4.5 *ANALYTICAL METHODS*

Samples were analyzed for a variety of inorganic and organic compounds by the following analytical methods:

- TCL VOCs by USEPA Method 8260;
- TCL SVOCs by USEPA Method 8270;
- TPH (gasoline and diesel range) by USEPA Method 8015;
- PCBs by USEPA Method 8082.
- TAL Metals by USEPA SW-846, Method 6010/7470

4.6 *QUALITY ASSURANCE/QUALITY CONTROL*

The site-wide quality assurance/quality control (QA/QC) program developed for the RI is included as Appendix D of the RI Work Plan. Specific QA/QC requirements for the RI were consistent with the field and sampling QA/QC procedures presented in the following subsections.

4.6.1 *Field QA/QC Procedures*

Field QA/QC activities were summarized daily. Daily logs were prepared that noted the instruments used, a description of the work performed, health and safety monitoring conducted, problems encountered, deviations from the approved Work Plan, any events that may impact the quality of data collected, and a listing of original and QA/QC samples collected.

4.6.2 *Sampling QA/QC*

QA/QC samples were collected during all stages of sampling during the Phase III RI. QA/QC samples included duplicates, trip blanks, and sampling equipment rinsates. Collection procedures of QA/QC samples are presented in the individual SOPs included in the RI Work Plan. Laboratory QA/QC samples included laboratory control samples, method blanks, and matrix spike/matrix spike duplicate samples.

4.7 *HEALTH AND SAFETY MONITORING*

This discussion of Health and Safety (H&S) monitoring addresses scheduled field activities for the RI. All field work was conducted according to the *Health and Safety Plan* included as Appendix E of the RI Work Plan.

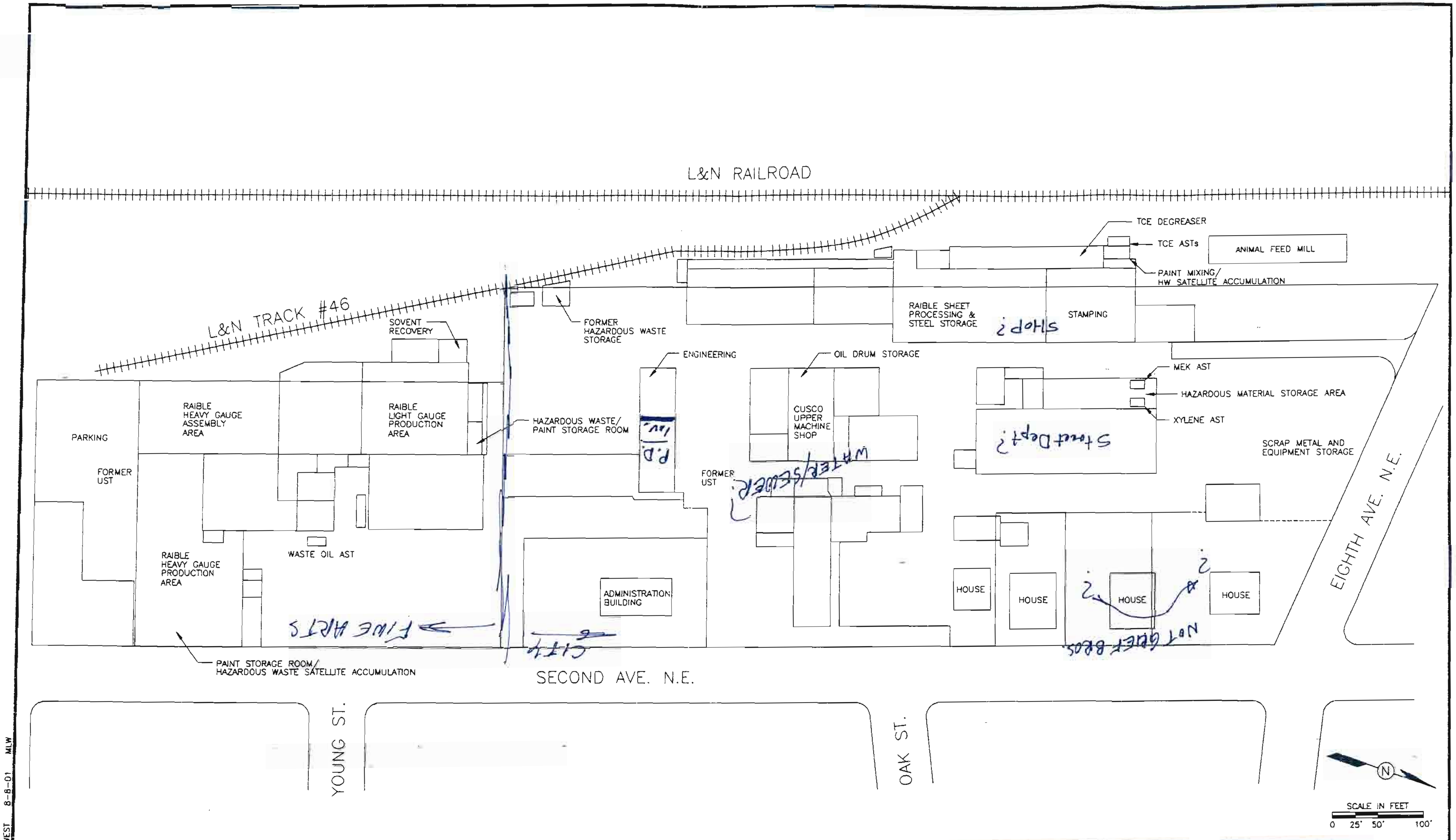
Field work was conducted at a level D protection level. No situations were encountered that required upgrading to a higher level of protection during implementation of the RI.

8185SITELOC GREIF 6-18-02 MLW

Environmental Resources Management
ERM

DETAILED SITE LOCATION
GREIF BROS.
CULLMAN, ALABAMA

FIGURE
2

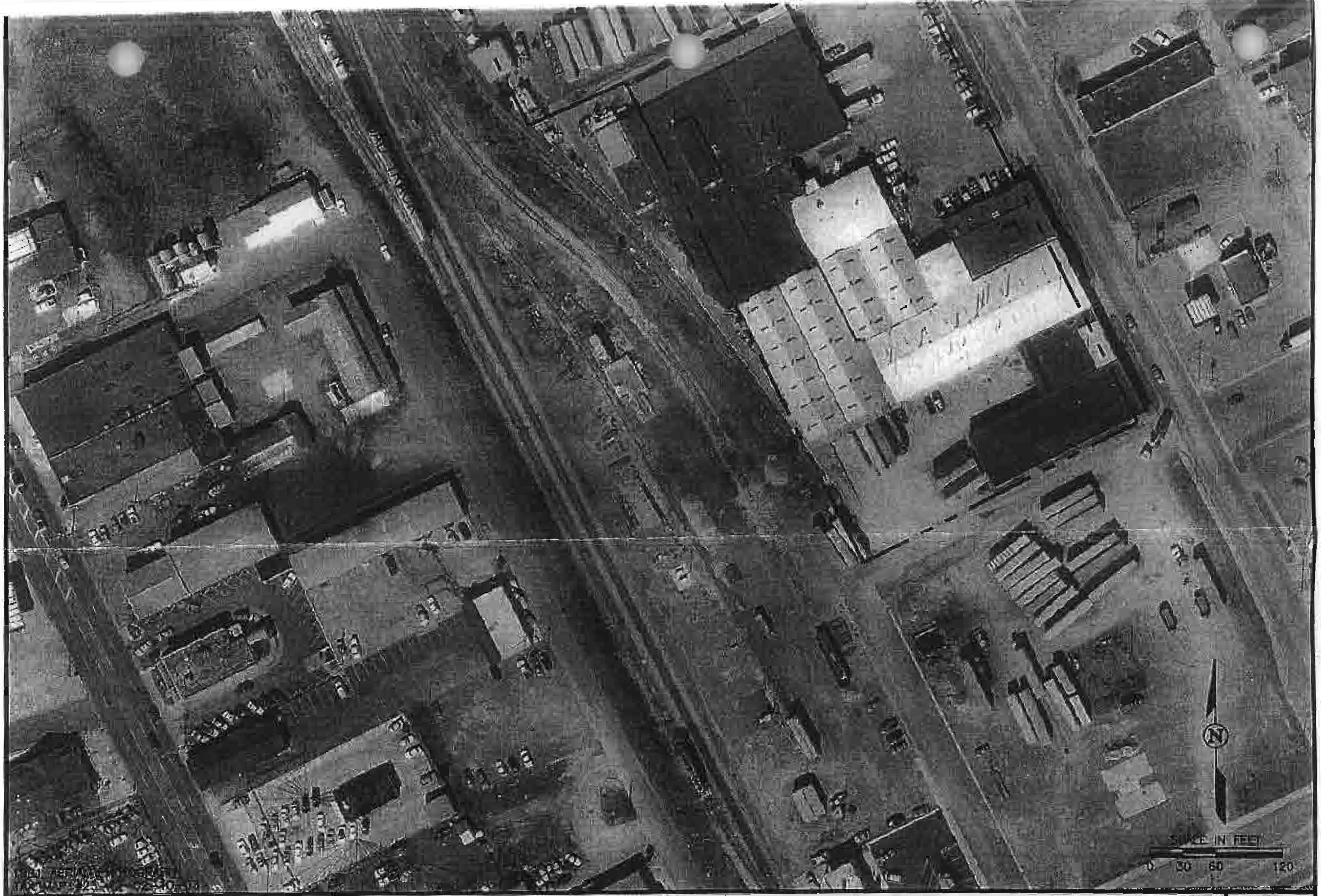


ERM Environmental Resources Management

FACILITY LAYOUT DIAGRAM
GREIF BROS.
409 2ND AVENUE N.E.
CULLMAN, ALABAMA

FIGURE
2-2

7918BPROP ERMWEST 8-8-01 MLW



Environmental
Resources
ERM Management

DETAILED SITE LOCATION

GREIF BROS.
CULLMAN, ALABAMA

FIGURE
2

8185LOC/ GREIF 6-14-02 MLW

Environmental Resources Management
ERM

SOIL BORING, MONITORING WELL, SURFACE SOIL, AND SUMP SAMPLE LOCATION MAP

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FIGURE
3

8185LO GREIF 6-14-02 MLW

Environmental Resources Management
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OVERBURDEN GROUNDWATER CONTOUR MAP
GREIF BROS.
CULLMAN, ALABAMA

FIGURE
4

8185DW GREI 6-14-02 MLW

Environmental Resources Management
ERM

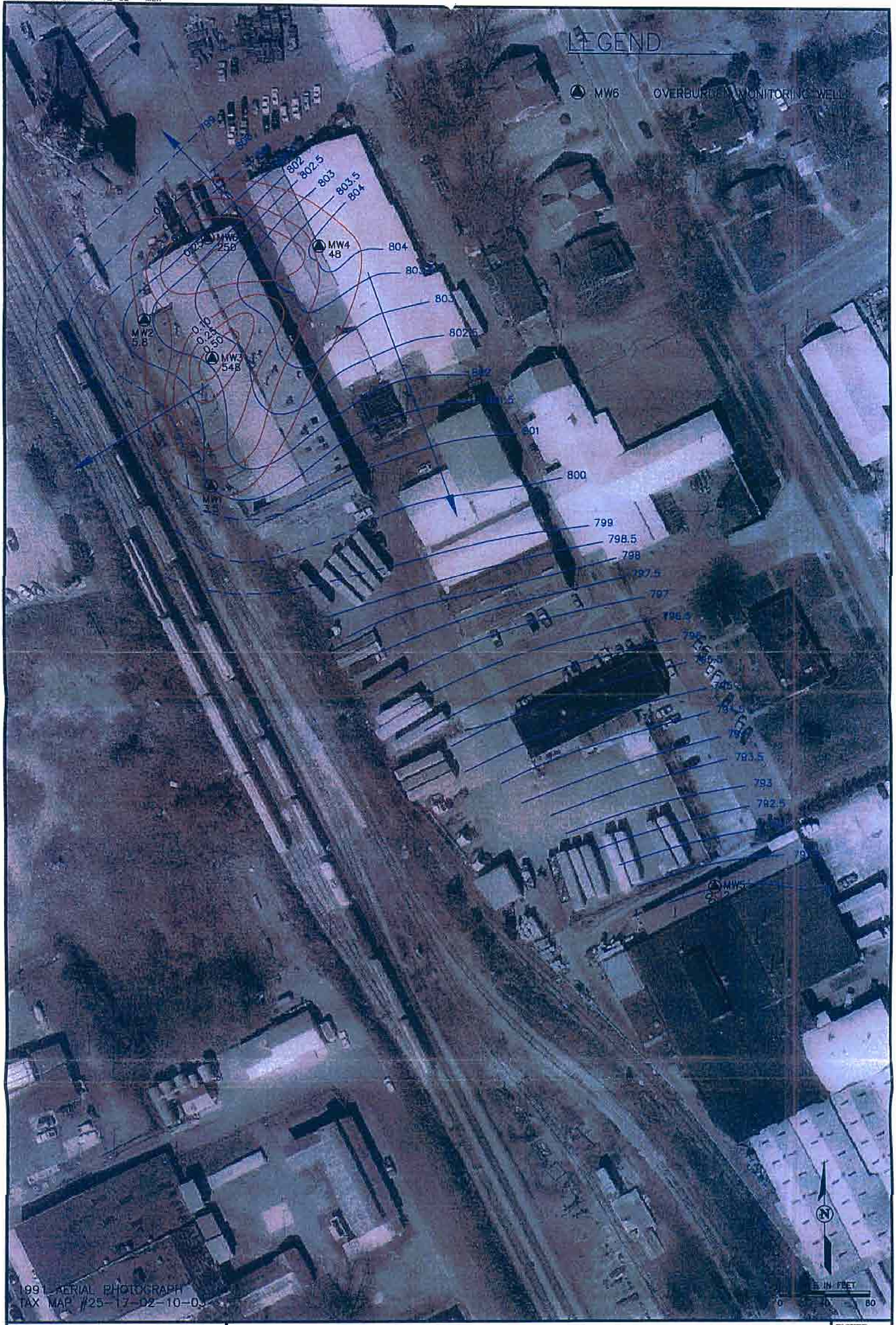
BEDROCK GROUNDWATER CONTOUR MAP
GREIF BROS.
CULLMAN, ALABAMA

FIGURE
5

8185TCE GREIF 6-12-02 MLW

Environmental Resources Management ERM	TRICHLOROETHYLENE PLUME IN SHALLOW GROUNDWATER GREIF BROS. 409 2ND AVENUE N.E. CULLMAN, ALABAMA	FIGURE 6

8185VC GREIF 8-12-02 MLW



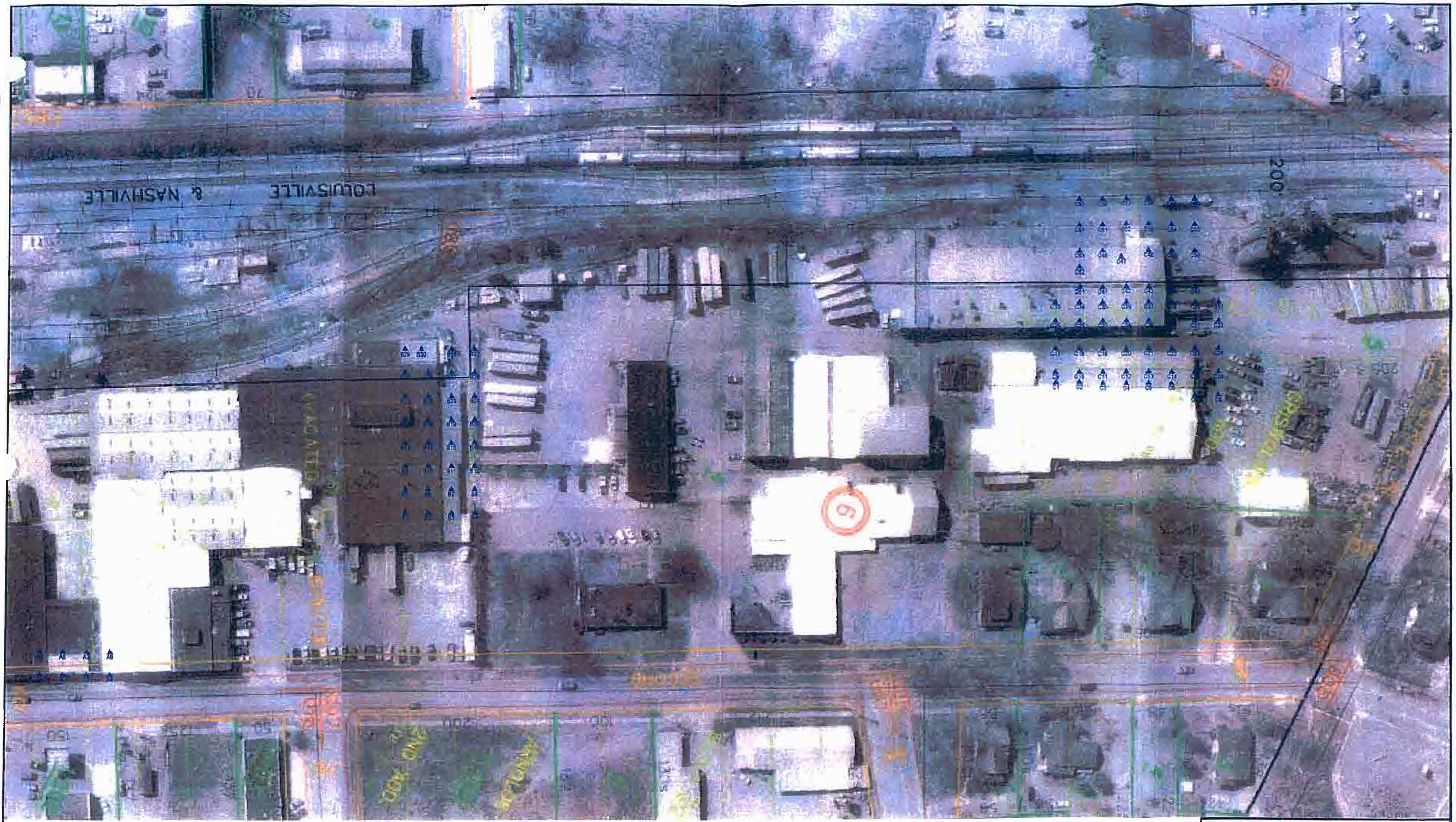
Environmental
Resources
ERM Management

VINYL CHLORIDE PLUME IN SHALLOW GROUNDWATER
GREIF BROS.
409 2ND AVENUE N.E.
CULLMAN, ALABAMA

FIGURE
7

8185CIS GREIF 6-12-02 MLW

Environmental Resources Management ERM	CIS-1,2 DICHLOROETHENE PLUME IN SHALLOW GROUNDWATER GREIF BROS. 409 2ND AVENUE N.E. CULLMAN, ALABAMA	FIGURE 9



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Scale in Feet
0 100 200

▲ EMFLUX SOIL-GAS SAMPLE LOCATION

Figure 1
EMFLUX Soil-Gas Locations

Greif Bros.
409 2nd Avenue N.E.
Cullman, Alabama

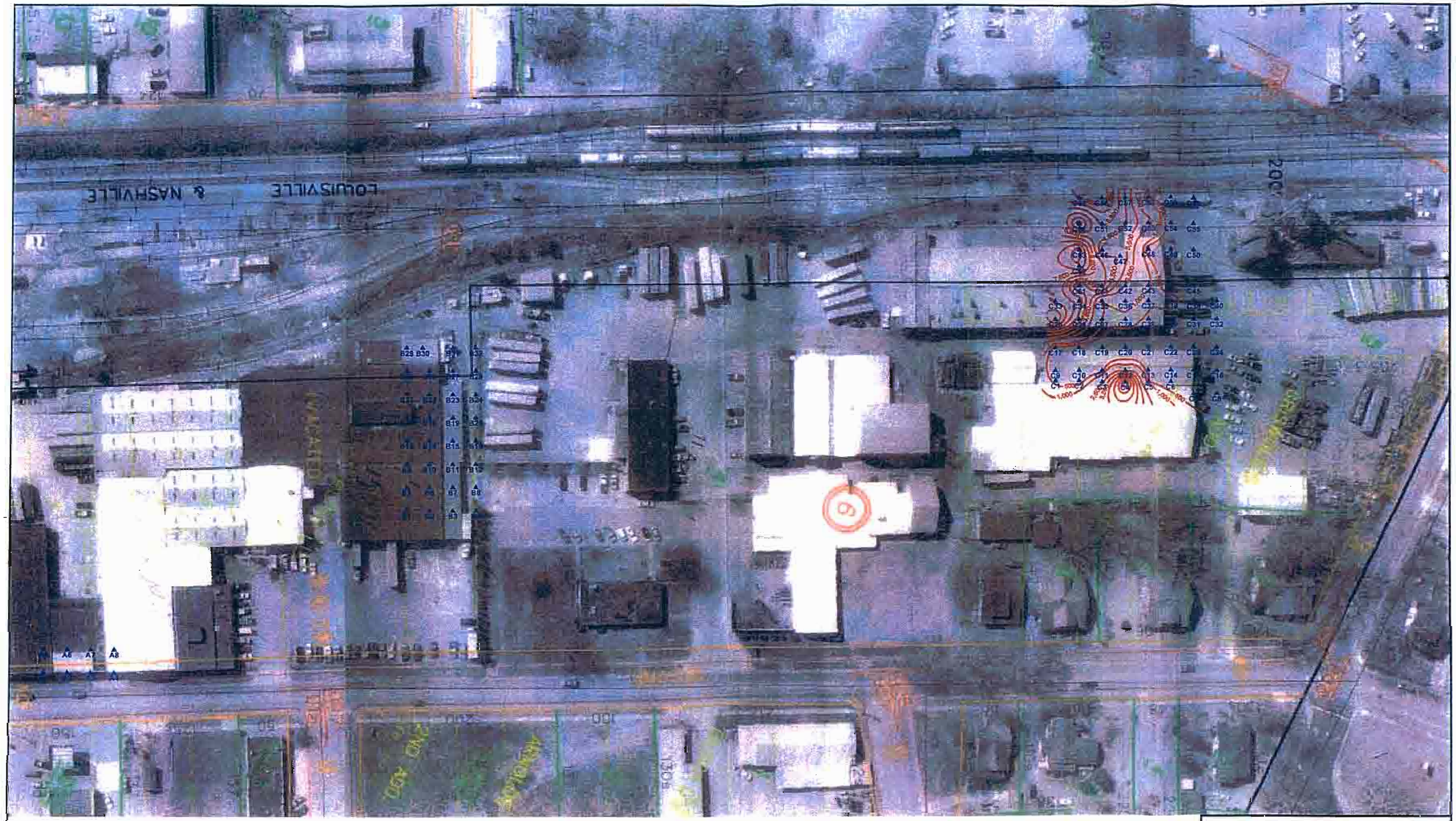

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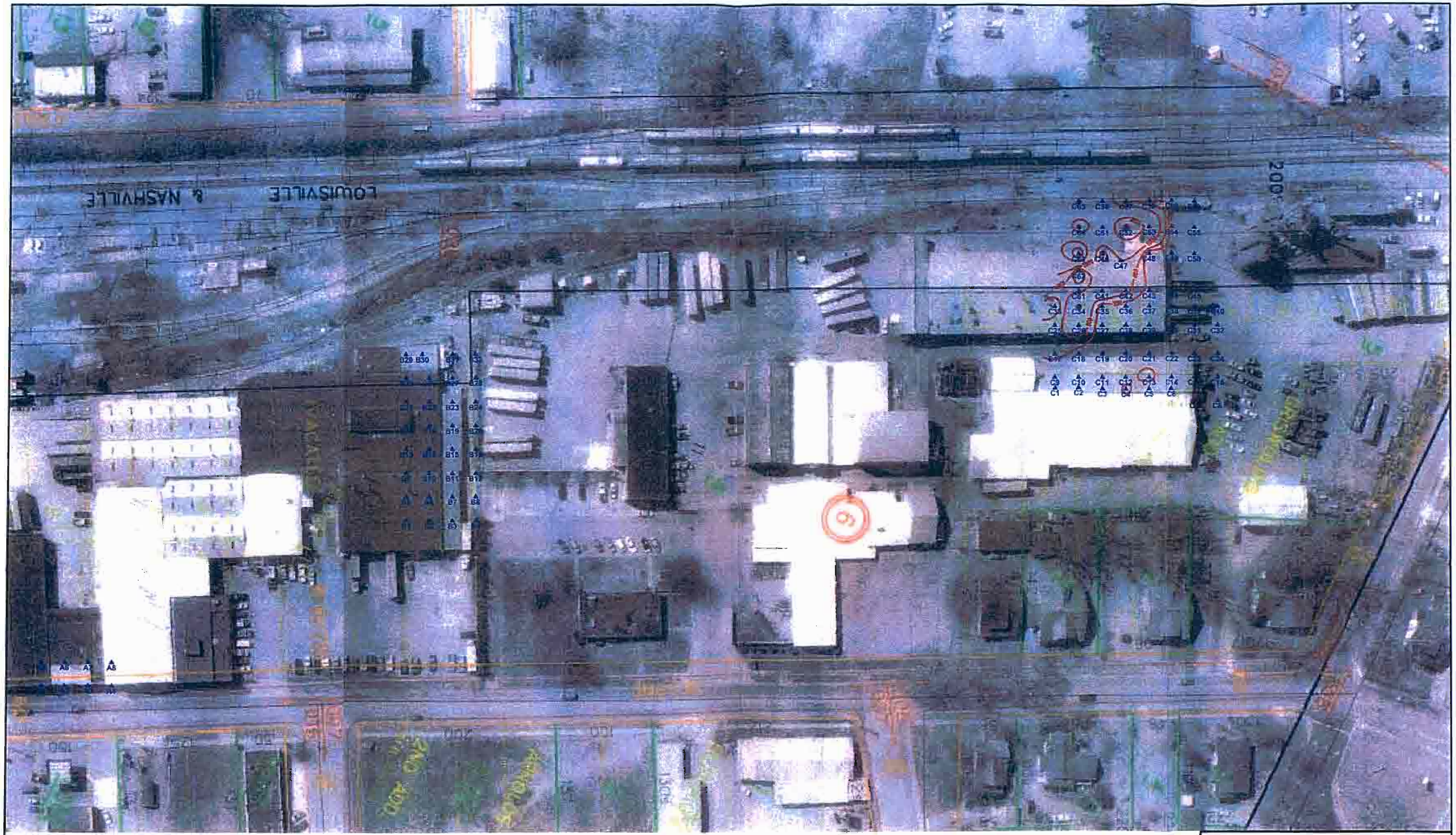
Figure 3
Trichloroethene

Greif Bros. Site
409 2nd Avenue NE
Cullman, Alabama



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Scale in Feet
0 100 200

1,1-Dichloroethane (nanograms)
▲ EMFLUX SOIL-GAS SAMPLE LOCATION

Figure 5
1,1-Dichloroethane

Greif Bros. Site
409 2nd Avenue NE
Cullman, Alabama

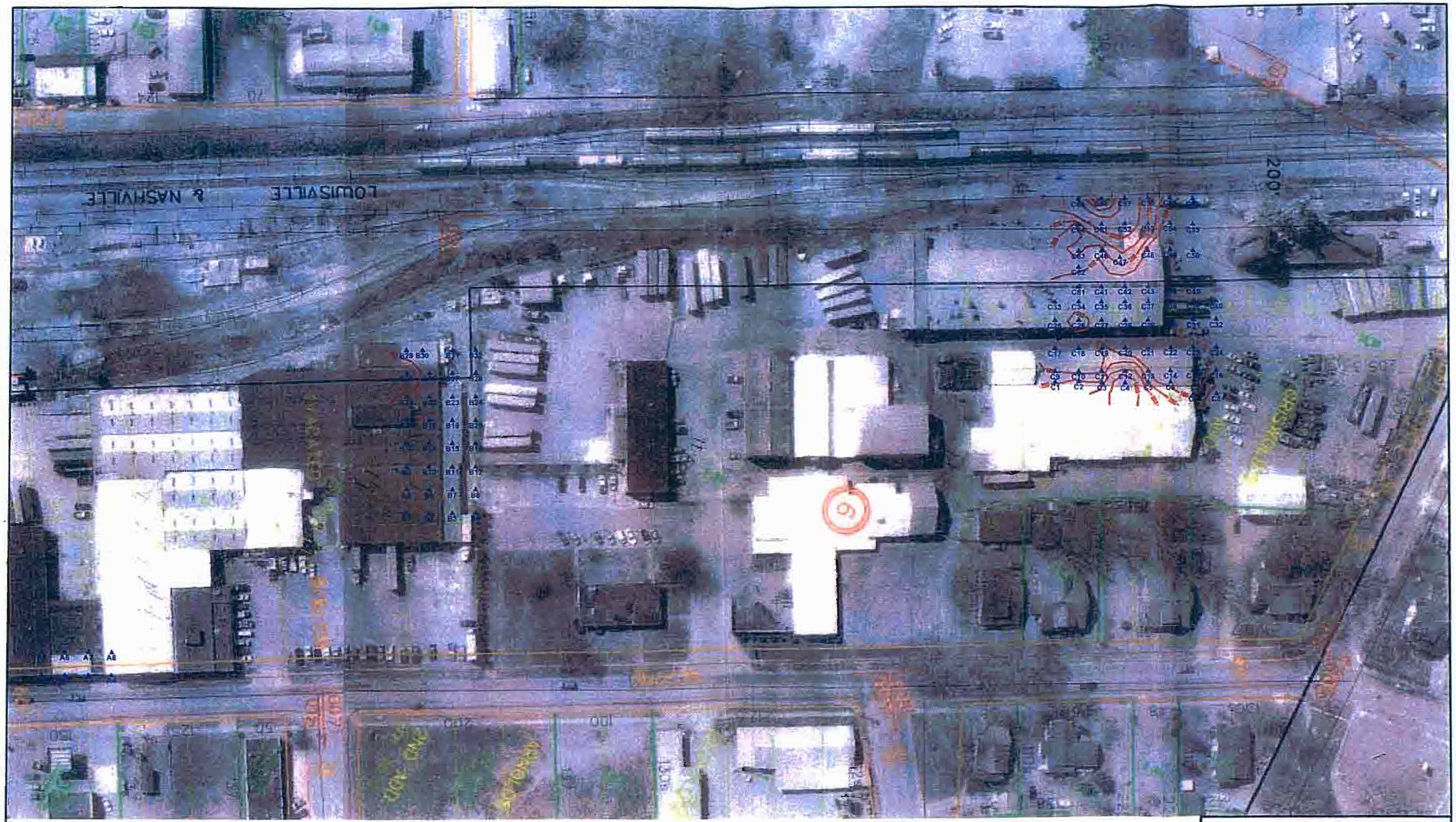

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Figure 6
Tetrachloroethene

Greif Bros. Site
409 2nd Avenue NE
Cullman, Alabama

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Beacon Project No. EM1386, March 2002

Figure 7
1,1,1-Trichloroethane

Greif Bros. Site
409 2nd Avenue NE
Cullman, Alabama

5.0 REMEDIAL INVESTIGATION (RI) RESULTS

ERM conducted a RI investigation in specific AOCs identified in the Phase II ESA to assess the surficial and subsurface impact to soils and shallow ground water that were impacted by historical releases of chemicals used by the site.

The principal AOCs that were the focus of the RI were the Hazardous Material Storage Area (AOC #2), the trichloroethylene (TCE) Degreaser Area (AOC #3) and the Hazardous Waste Storage Area/Light Gauge Paint Room (AOC #5). An additional area located along the southeast side of the property, near the exterior wall of a former satellite hazardous waste accumulation and paint storage room was also assessed in the RI. A sample of the surface water in the sump system that was present under the stamping presses in the Raible Building was also collected and analyzed. The bedrock wells are also discussed in this section.

The investigation was conducted in accordance with the RI Work Plan.

The locations of all soil borings and monitoring wells installed in the Phase II ESA and RI are shown in Figure 3. The locations of the surface soil and sump samples collected are also shown on Figure 3.

The overburden ground water contour map is presented as Figure 4 and the bedrock ground water contour map is presented as Figure 5.

The TCE concentration in overburden ground water contour map is presented as Figure 6; the vinyl chloride concentration contour map is presented as Figure 7; the PCE concentration contour map is presented as Figure 8; and, the cis 1,2 DCE concentration contour map is presented as Figure 9.

Soil Boring Logs are included as Appendix C. Monitoring well completion drawings are included as Appendix D. Laboratory Analytical Reports-Soil are included as Appendix E. Water Analytical Reports are included as Appendix F.

5.1 HAZARDOUS MATERIAL STORAGE AREA (AOC #2)

The former hazardous material storage area is located in the north portion of the property. The former storage area was comprised of a concrete slab that was formerly under roof. The roof and supporting structural elements were removed in 2002 and moved to another facility. The concrete slab remains. Two above ground storage tanks (ASTs), formerly used to store MEK and xylene, were formerly located near the center of the storage area. In addition, an AST or UST used to store either diesel or gasoline was reportedly located near the southeast corner of the storage area. This area was used for storage of 55-gallon drums that contain MEK, xylene and paint. Oily wastewater contained in 55-gallon drums was also stored in the area.

5.1.1 *Phase II Results Summary*

In the Phase II investigation, two soil samples collected from 0-4' and 4-8' and an in-situ ground water sample, were analyzed from DPT soil boring (SB-9-1) drilled near the middle of the concrete floor.

The soil samples and ground water sample were analyzed for the following analytical parameters:

- TPH (GC, USEPA Method 8015);
- TCL SVOCs (USEPA SW-846, Method, 8270);
- PCBs (USEPA SW846, Method 8270); and
- TCL VOCs (USEPA SW-846, Method 8260).

A summary of the Phase II sample results was presented in Section 2.2.4.1.2

5.1.2 *RI Results*

In the RI, monitoring well (MW4) was installed in the overburden at the location of soil gas sample station C4, which exhibited elevated concentrations of TCE and PCE during the soil gas survey. In addition, one DPT boring (SB-7) was drilled between the Raible Building and the cement slab floor of the former Hazardous Material Storage Area. The soil and ground water analytical results are summarized in the sections below.

5.1.2.1 *Soil Chemistry*

No soil samples were collected during the drilling of MW-4. This well was installed near the location of SB-9-1 drilled in the Phase II. Drill cuttings from MW-4 were analyzed for target parameters, since they exhibited strong solvent odors.

Soil sample (8185-008) collected from the 0-4′ interval in DPT boring SB-7 was analyzed for target parameters. The detected analytes are presented in Table 5-1 and discussed below.

5.1.2.1.1 TPH

TPH (gasoline range) was not detected above the reportable limit in soil sample 8185-008 collected from 0-4′. TPH (diesel range) was detected at a concentration of 20.6 mg/kg.

5.1.2.1.2 TCL SVOCs

In soil sample 8185-008 (0-4'), the SVOC naphthalene was detected at a concentration of 1.05 mg/kg. All other SVOC concentrations were below the reportable limits in the sample.

5.1.2.1.3 PCBs

PCBs were not detected at the reportable limits in sample 8185-008 (0-4').

5.1.2.1.4 TCL VOCs

The following VOCs were detected in sample 8185-008 collected from 0-4′ in SB-7: cis-1, 2-DCE at a concentration of 0.0371 mg/kg; ethylbenzene at a concentration of 0.362 mg/kg; 4-methyl-2-pentanone at a concentration of 0.0651 mg/kg; toluene at a concentration of 0.35 mg/kg; vinyl chloride at a concentration of 0.02 mg/kg; and total xylenes at a concentration of 1.26 mg/kg. All other VOCs were less than the reportable limits in the sample.

5.1.2.1.5 TAL Metals

The TAL metals detected above the reportable limits are: aluminum, arsenic, barium, calcium, chromium, cobalt, copper, iron, lead, manganese, nickel, potassium, sodium, vanadium and zinc. All other TAL metals were below the reportable limits.

5.1.2.2 *Ground Water Chemistry*

A ground water sample was collected from MW-4 and analyzed for target parameters. The detected analytes are presented in Table 5-2 and discussed below.

5.1.2.2.1 TPH

TPH (gasoline range) was detected at a concentration of 56,300 ug/l and TPH (diesel range) was detected at a concentration of 6,090 ug/l in the ground water sample

5.1.2.2.2 TCL SVOCs

The SVOC naphthalene was detected at a concentration of 456 ug/l; isopropyl benzene was detected at 110 ug/l; n-propyl benzene was detected at 232 ug/l; 1,2,4 trimethylbenzene was detected at 1,540 ug/l; and, 1,3,5 trimethylbenzene was detected at 536 ug/l. All other SVOCs concentrations were below the reportable limits in the water sample.

5.1.2.2.3 PCBs

PCBs were not-detected at the reportable limits.

5.1.2.2.4 TCL VOCs

The VOC ethylbenzene was detected at a concentration of 310 ug/l; total xylenes were detected at a concentration of 1,650 ug/l; 1,1-DCA was detected at 112 ug/l; cis-1, 2-DCE was detected at 15,800; PCE was detected at 98 ug/l; TCE was detected at 88,600 ug/l; 1,1,2 TCA was detected at 156 ug/l; and vinyl chloride was detected at 48 ug/l. All other VOCs were less than the reportable limits in the sample.

5.1.2.2.5 TAL Metals

The TAL Metals detected above the reportable limits were: barium, copper, manganese and zinc. The concentrations of all other TAL metals were less than the reportable limits.

5.2 *TRICHLOROETHYLENE (TCE) DEGREASER AREA (AOC #3)*

The TCE degreaser is located in the northwest corner of the Sheet Processing and Stamping Building within a concrete containment vault. Access to the lower section of the degreaser is through a subgrade entryway. While not currently in service, the degreaser was formerly used to clean machine parts. Two ASTs used to store TCE were formerly part of this system. The ASTs were located outside the building, along the exterior wall. Possible leaks and spills from the degreaser and tanks were considered as a potential source of subsurface contamination in this area.

5.2.1 *Phase II Results*

A DPT boring (SB-5) was drilled near the northwest corner of the Raible Sheet Processing and Stamping Building, adjacent to the exterior TCE ASTs and in close proximity to the TCE degreaser located inside the building, at the northwest corner. The DPT boring was advanced to refusal on sandstone bedrock at a depth of 9' below grade. Soil samples were collected in acetate sleeves from the 0-4' and 4-8' interval.

The soil sample collected from the 4-8' interval (7918-010) was selected for analytical testing. A sample of the formation water (7918-011) and a duplicate sample (7918-011D) were also collected in this boring. These water samples were collected with a 42", 0.75 ID polyethylene bailer through a 1-inch ID PVC screen and casing assembly inserted into the open DPT borehole. The soil samples and ground water sample were analyzed for the following analytical parameters:

- TPH (GC, USEPA Method 8015);
- TCL SVOCs (USEPA SW-846, Method, 8270);
- PCBs (USEPA SW846, Method 8270);
- TCL VOCs (USEPA SW-846, Method 8260); and
- TAL Metals (USEPA SW-846, Method 3050/6010B).

A summary of the Phase II sample results was presented in Section 2.2.4.1.3.

5.2.2 *RI Results-AOC #3*

The DPT borings and wells drilled to assess the extent of releases from the TCE degreaser area were as follows:

- DPT boring SB-9/MW-1, drilled on the southwest side of the Raible building;
- DPT boring SB-10/MW-6, drilled on the north side of the Raible building;
- DPT boring SB-11/MW-3; drilled inside the Raible building, near the center;
- MW-2 (Phase II boring SB-5-1, installed outside, near the TCE degreaser area;
- DPT boring SB-6, drilled near the south side of the Raible building; and,
- DPT boring SB-8, drilled on the west side of the Raible building.

5.2.2.1 *Soil Chemistry*

Monitoring well MW2 was installed at the location of SB-5-1, which was drilled in the Phase II. No additional soil samples were collected during the installation of MW2. The detected analytes are presented in Table 5-1 and discussed below.

5.2.2.1.1 TPH

TPH (gasoline range) was not detected at the reportable limits in soil sample 8185-0070 collected from 4-7′ in SB-6; in sample 8185-009 collected from 4-8′ in SB-8; in sample 8185-010 collected from 4-8′ in SB-9; in sample 8185-011 collected from 0-4.5′ in SB-10; and in sample 8185-012 collected from 0-4′ in SB-11. TPH (diesel range) was detected at a concentration of 134 mg/kg in sample 8185-007 and 93.6 mg/kg in sample 8185-009.

5.2.2.1.2 TCL SVOCs

All SVOCs were not detected at the reportable limits in samples 8185-0070 collected from 4-7′ in SB-6; in sample 8185-009 collected from 4-8′ in SB-8; in sample 8185-010 collected from 4-8′ in SB-9; in sample 8185-011 collected from 0-4.5′ in SB-10; and in sample 8185-012 collected from 0-4′ in SB-11.

5.2.2.1.3 PCBs

PCBs were not-detected at the reportable limits in samples 8185-0070 collected from 4-7′ in SB-6; in sample 8185-009 collected from 4-8′ in SB-8; in sample 8185-010 collected from 4-8′ in SB-9; in sample 8185-011 collected from 0-4.5′ in SB-10; and in sample 8185-012 collected from 0-4′ in SB-11.

5.2.2.1.4 TCL VOCs

VOCs were not detected above the reportable limits in sample 8185-007 collected from 4-7′ in SB-6.

The following VOCs were detected in sample 8185-009 collected from 4-8′ in SB-8: carbon disulfide at a concentration of 0.0029 mg/kg; chloroethane at a concentration of 0.142 mg/kg; 1,1-DCA at a concentration of 0.0253 mg/kg; cis-1, 2-DCE at a concentration of 2.28 mg/kg; ethylbenzene at a concentration of 0.0273 mg/kg; vinyl chloride at a concentration of 0.16 mg/kg; and total xylenes at a concentration of 0.0496 mg/kg. All other analyzed VOCs were below the reportable limits in the sample.

The following VOCs were detected in sample 8185-010 collected from 4-8′ in SB-9: cis-1, 2-DCE at a concentration of 0.194 mg/kg and TCE at a concentration of mg/kg. All other analyzed VOCs were below the reportable limits in the sample.

The following VOCs were detected in sample 8185-011 collected from 0-4.5′ in SB-10: cis-1, 2-DCE at a concentration of 0.194 mg/kg; TCE at a concentration of 0.0125 mg/kg; and vinyl chloride at a concentration of 0.01 mg/kg. All other analyzed VOCs were below the reportable limits in the sample.

The following VOCs were detected in sample 8185-012 collected from 0-4′ in SB-11: chloroethane at a concentration of 0.0074 mg/kg; 1,1-DCA at a concentration of 2.88 mg/kg; cis-1, 2-DCE at a concentration of 0.0323 mg/kg; TCE at a concentration of 0.0095 mg/kg; toluene at a concentration of 0.0123 mg/kg; and vinyl chloride at a concentration of 0.61 mg/kg. All other analyzed VOCs were below the reportable limits in the sample.

5.2.2.1.5 TAL Metals

The following TAL metals were detected above the reportable limits in sample 8185-007 collected from 4-7′ in SB-6: aluminum, arsenic, barium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, sodium and vanadium. Antimony, beryllium, cadmium, mercury, silver, thallium and zinc were below the reportable limits.

The following TAL metals were detected in sample 8185-009 collected from 4-8′ in SB-8: aluminum, arsenic, barium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, and vanadium. Antimony, beryllium, cadmium, mercury, selenium, silver, sodium, thallium and zinc were below the reportable limits.

The following TAL metals were detected in sample 8185-010 collected from 4-8′ in SB-9: aluminum, arsenic, barium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, sodium, vanadium and zinc. Antimony, beryllium, cadmium, mercury, silver and thallium were below the reportable limits.

The following TAL metals were detected in sample 8185-011 collected from 0-4.5′ in SB-10: aluminum, arsenic, barium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, vanadium and zinc. Antimony, beryllium, cadmium, mercury, selenium, silver, sodium and thallium were below the reportable limits.

The following TAL Metals were detected in sample 8185-012 collected from 0-4.′ in SB-11: aluminum, arsenic, barium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, vanadium and zinc. Antimony, beryllium, cadmium, mercury, selenium, silver, sodium and thallium were below the reportable limits.

5.2.2.2 *Ground Water Chemistry*

The detected analytes are presented in Table 5-2 and discussed below.

5.2.2.2.1 TPH

TPH (gasoline range) was detected in the sample collected from MW-1 at a concentration of 263 ug/l and in the sample collected from MW-3 at a concentration of 21,200 ug/l. TPH (gasoline range) was below the reportable limit in the samples collected from MW-2 and MW-6. TPH (diesel range) was detected at a concentration of 178 ppb in the sample collected from MW-3. TPH (diesel range) was below the reportable limit in the samples collected from MW-1, MW-2 and MW-6.

5.2.2.2.2 TCL SVOCs

TCL SVOCs were below the reportable limits in the samples analyzed from MW-1, MW-2, MW-3 and MW-4.

5.2.2.2.3 PCBs

PCBs were below the reportable limits in the samples analyzed from MW-1, MW-2, MW-3, and MW-4.

5.2.2.2.4 TCL VOCs

The following VOCs were detected in the sample collected from MW-1: 1,1 DCE at a concentration of 28.3 ug/l; cis 1,2 DCE at a concentration of 174 ug/l; trans 1,2 DCE at a concentration of 2.7 ug/l; TCE at a concentration of 341 ug/l; and, vinyl chloride at a concentration of 3.5 ug/l. The concentrations of all other TCL VOCs analyzed in the sample were below reportable limits.

The following VOCs were detected in the sample collected from MW-2: cis 1,2 DCE at a concentration of 31.2 ug/l; TCE at a concentration of 7.5 ug/l; vinyl chloride at a concentration of 5.8 ug/l; and, chloroethene at a concentration of 17.4 ug/l. The concentrations of the other TCL VOCs analyzed in the sample were below reportable limits.

The following VOCs were detected in the sample collected from MW-3: 1,1 DCA at a concentration of 6,340 ug/l; 1,1 DCE at a concentration of 8,920 ug/l; cis 1,2 DCE at a concentration of 12,200 ug/l; PCE at a concentration of 54 ug/l; TCE at a concentration of 21,600 ug/l; 1,1,1 TCA at a concentration of 524 ug/l; 1,1,2 TCA at a concentration of 44 ug/l; toluene at a concentration of 154; and, vinyl chloride at a concentration of 548 ug/l. The concentrations of all other TCL VOCs analyzed in the sample were below reportable limits.

The following VOCs were detected in the sample collected from MW-6: 1,1 DCA at a concentration of 15.8 ug/l; 1,1 DCE at a concentration of 8.5 ug/l; cis 1,2 DCE at a concentration of 1,660 ug/l; trans 1,2 DCE at a concentration of 6 ug/l; TCE at a concentration of 178 ug/l; 1,1,1 TCA at a concentration of 524 ug/l; and, vinyl chloride at a concentration of 250 ug/l. The concentrations of the other TCL VOCs analyzed in the sample were below reportable limits.

5.2.2.2.5 TAL Metals

The TAL metals detected above the reportable limits in the sample collected from MW-1 were as follows: aluminum, barium, manganese and zinc. Antimony, beryllium, cadmium, calcium, total chromium, cobalt, copper, iron, lead, magnesium, mercury, nickel, potassium, silver, selenium, sodium thallium and vanadium, and zinc were below the reportable limits.

The TAL metals detected above the reportable limits in the sample collected from MW-2 and MW-3 were as follows: aluminum, barium and manganese. Antimony, beryllium, cadmium, calcium, total chromium, cobalt, copper, iron, lead, magnesium, mercury, nickel, potassium, silver, selenium, sodium thallium and vanadium, and zinc were below the reportable limits.

The TAL metals detected above the reportable limits in the sample collected from MW-6 were as follows: aluminum, arsenic, barium, total chromium, magnesium, selenium, vanadium and zinc. Antimony, beryllium, cadmium, calcium, cobalt, copper, iron, lead, manganese, mercury, nickel, potassium, silver, sodium and thallium were below the reportable limits.

5.3 *HAZARDOUS WASTE STORAGE AREA/LIGHT GAUGE PAINT ROOM (AOC #5)*

Hazardous waste, paint, and solvents are stored in this room, located on east side of the Light Gauge Production Building. The cement floor was stained with different colors of paint indicating a history of releases in the area. Cracks in the floor were observed. The hazardous waste, paint, and solvents stored in this room are considered a potential source of subsurface contamination.

5.3.1 *Phase II Results*

A DPT boring (SB-4) was drilled outside the north side of the Light Gauge Production Building, near the exterior wall of the paint room. The DPT boring was advanced to refusal on sandstone bedrock at a depth of 7.5 feet below grade. Soil samples were collected in acetate sleeves from the 0-4' and the 4-7.5' interval.

The soil sample collected from the 4-7.5' interval (7918-008) was selected for analytical testing. A sample of the formation water (7918-009) was also collected in this boring. The water samples were collected with a 42", 0.75 ID polyethylene bailer through a 1-inch I.D PVC screen and casing assembly inserted through the drilling rods. The soil sample and ground water sample were analyzed for the following analytical parameters:

- TPH (GC, USEPA Method 8015)
- TCL SVOCs (USEPA SW-846, Method, 8270)
- PCBs (USEPA SW846, Method 8270)
- TCL VOCs (USEPA SW-846, Method 8260)
- TAL Metals (USEPA SW-846, Method 3050/6010B)

A summary of the results is presented in Section 2.2.4.1.5.

5.3.2 *RI Results*

The DPT borings and wells drilled to assess the extent of releases from the Hazardous Waste Storage/Paint Room Area were as follows:

- DPT boring SB-12 drilled to the southwest of the Hazardous Waste Storage/Paint Room inside the building; and,
- MW-5 (phase II boring SB-4-1, installed outside on the north side of the Hazardous Waste Storage/Paint Room.

5.3.2.1 *Soil Chemistry*

The soil sample collected from the 4-6′ interval (8185-013) was analyzed for the target parameters. The detected analytes are presented in Table 5-1 and discussed below.

5.3.2.1.1 TPH

TPH (gasoline range) and TPH (diesel range) were not detected at the reportable limits in soil sample 8185-013.

5.3.2.1.2 TCL SVOCs

TCL SVOCs were not detected at the reportable limits in soil sample 8185-013.

5.3.2.1.3 PCBs

PCBs were not detected at the reportable limits in sample 8185-013.

5.3.2.1.4 TCL VOCs

TCL VOCs were not detected at the reportable limits in soil sample 8185-013.

5.3.2.1.5 TAL Metals

The TAL metals detected above the reportable limits in sample 8185-013 were as follows: aluminum, arsenic, barium, calcium, total chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, sodium and vanadium. Antimony, beryllium, cadmium, mercury, selenium, silver, thallium and zinc were below the reportable limits.

5.3.2.2 *Ground Water*

A ground water was collected and analyzed from MW5, installed at the location of boring SB4-1 drilled in the Phase II. The detected analytes are presented in Table 5-2 and discussed below.

5.3.2.2.1 TPH

TPH (gasoline range) was non detect in the sample. TPH (diesel range) was detected at a concentration of 102 ug/l.

5.3.2.2.2 TCL SVOCs

TCL SVOCs were non detect at the reportable limits

5.3.2.2.3 PCBs

PCBs were non-detect at the reportable limits.

5.3.2.2.4 TCL VOCs

Vinyl chloride was detected at a concentration of 2.4 ug/l. All other TCL VOCs were non detect.

5.3.2.2.5 TAL Metals

The TAL metals detected above the reportable limits were as follows: aluminum, barium, total chromium, lead, manganese and zinc. Antimony, arsenic, beryllium, cadmium, calcium, cobalt, copper, iron, magnesium, mercury, nickel, potassium, selenium, silver, sodium, thallium and were below the reportable limits.

5.4 EXTERIOR AREA NEAR HAZARDOUS WASTE ACCUMULATION AREA

5.4.1 Phase II

No samples were collected from this area in the Phase II.

5.4.2 RI Results

The soil gas samples collected along the exterior wall showed that elevated levels of benzene, toluene, ethylbenzene, and xylenes (BTEX) were present in this area. DPT boring SB-5 was drilled near the exterior wall to further assess the extent of chemical releases in this area.

5.4.2.1 Soil Chemistry

The soil sample (8185-005) collected from the 0-4' interval was analyzed for the target parameters. The detected analytes are presented in Table 5-1 and discussed below.

5.4.2.1.1 TPH

TPH (gasoline range) was detected at a concentration level of 14.1 mg/kg. TPH (diesel range) was not detected at the reportable limits

5.4.2.1.2 TCL SVOCs

TCL SVOCs were not detected at the reportable limits.

5.4.2.1.3 PCBs

PCBs were not detected at the reportable limits.

5.4.2.1.4 TCL VOCs

Ethyl benzene was detected at a concentration of 0.0187 mg/kg and total xylenes were detected at a concentration of 0.446 mg/kg. All other TCL VOCs were not detected at the reportable limits.

5.4.2.1.5 TAL Metals

The TAL metals detected above the reportable limits were as follows: Aluminum, arsenic, barium, calcium, total chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, sodium, vanadium and zinc. Antimony, beryllium, cadmium, mercury, selenium, silver and thallium were below the reportable limits.

5.5 *SUMP SYSTEM IN RAIBLE BUILDING*

A water sample was collected of the surface water found in the sump system that was present under the stamping presses. The sample was analyzed for TPH and TCL VOCs.

5.5.1.1.1 TPH

TPH (gasoline range) was present at a concentration of 259 ug/l and TPH (diesel range) was present at a concentration of 3,890 ug/l.

5.5.1.1.2 TCL VOCs

The VOCs detected in the sample collected from the sump were as follows: 1,1 DCA at a concentration of 25.7 ug/l; cis 1,2 DCE at a concentration of 317 ug/l; trans 1,2 DCE at a concentration of 3.7 ug/l; TCE at a concentration of 185 ug/l; and, vinyl chloride at a concentration of 6.4 ug/l. The concentrations of all other TCL VOCs analyzed in the sample were below reportable limits.

5.6 *BEDROCK WELLS*

5.6.1 *Phase II*

No bedrock wells were installed in the Phase II.

5.6.2 *RI Results*

Four bedrock wells were installed along the perimeter of the property. DW-1 was installed near the north side of the property; DW-2 was installed along the west side; DW-3 was installed along the south side; and DW-4 was installed along the east side.

5.6.2.1 *Soil Chemistry*

Soil samples were collected at 2-foot intervals with a split spoon sampler from the surface to the top of bedrock at locations DW-1, DW-2 and DW-4. Insufficient soil cover was present at location DW-3 to enable collection of soil samples. The soil samples were analyzed for the target parameters to provide a baseline of the soil chemistry in the vicinity of each bedrock well. The detected analytes are presented in Table 5-1 and discussed below.

5.6.2.1.1 TPH

TPH (gasoline range) and TPH (diesel range) were not detected at the reportable limits.

5.6.2.1.2 TCL SVOCs

TCL SVOCs were not detected at the reportable limits.

5.6.2.1.3 PCBs

PCBs were not detected at the reportable limits.

5.6.2.1.4 TCL VOCs

TCL VOCs were not detected at the reportable limits. All other TCL VOCs were not detected at the reportable limits.

5.6.2.1.5 TAL Metals

The TAL metals detected above the reportable limits in sample 8185-001 collected from 6.5-8.5′ at DW-1 were as follows: aluminum, arsenic, barium, cadmium, calcium, total chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, sodium, vanadium and zinc. Antimony, beryllium, mercury, selenium, silver and thallium were below the reportable limits.

The TAL metals detected above the reportable limits in sample 8185-003 collected from 3-5' at DW-3 were as follows: aluminum, arsenic, barium, calcium, total chromium, cobalt, iron, lead, magnesium, manganese, nickel, potassium, sodium, vanadium and zinc. Antimony, beryllium, cadmium, copper, mercury, selenium, silver and thallium were below the reportable limits.

The TAL metals detected above the reportable limits in sample 8185-004 collected from 6-7' at DW-4 were as follows: aluminum, arsenic, barium, cadmium, calcium, total chromium, cobalt, iron, lead, magnesium, manganese, nickel, potassium, sodium, vanadium and zinc. Antimony, beryllium, copper, mercury, selenium, silver and thallium were below the reportable limits.

5.6.2.2 *Ground Water Chemistry*

Ground water samples were collected from DW-1, DW-2, DW-3 and DW-4 and analyzed for the target parameters. The detected analytes are presented in Table 5-2 and discussed below.

5.6.2.2.1 TPH

TPH (gasoline range) was non detect in the samples collected from DW-1, DW-2, DW-3, and DW-4. TPH (diesel range) was detected 129 ug/l in the sample collected from DW-2 and at 234 ug/l in the sample collected from DW-3. TPH (diesel range) were not detected at the reportable limits in the samples from DW-1 and DW-4

5.6.2.2.2 TCL SVOCs

TCL SVOCs were not detected at the reportable limits.

5.6.2.2.3 PCBs

PCBs were not detected at the reportable limits.

5.6.2.2.4 TCL VOCs

TCL VOCs were not detected at the reportable limits

5.6.2.2.5 TAL Metals

The TAL metals detected above the reportable limits in the sample collected from DW-1 were as follows: aluminum, barium and manganese. Antimony, beryllium, cadmium, calcium, total chromium, cobalt, copper, iron, lead, magnesium, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium and zinc were below the reportable limits.

The TAL metals detected above the reportable limits in the sample collected from DW-2 were as follows: aluminum, barium and manganese. Antimony, beryllium, cadmium, calcium, total chromium, cobalt, copper, iron, lead, magnesium, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium and zinc were below the reportable limits.

The TAL metals detected above the reportable limits in the sample collected from DW-3 were as follows: aluminum, arsenic, barium, total chromium, lead, nickel and zinc. Antimony, beryllium, cadmium, calcium, cobalt, copper, iron, magnesium, mercury, potassium, selenium, silver, sodium, thallium and vanadium were below the reportable limits.

The TAL metals detected above the reportable limits in the sample collected from DW-4 were as follows: aluminum, arsenic, barium, manganese and nickel. Antimony, beryllium, cadmium, calcium, total chromium, cobalt, copper, iron, lead, magnesium, mercury, potassium, selenium, silver, sodium, thallium and vanadium were below the reportable limits.

5.7 *DISCUSSION OF RI RESULTS*

The soil, ground water and surface water data generated in the RI investigation were compared to published USEPA and ADEM maximum contaminant levels (MCLs) or to published screening levels, if MCLs were not available. The data were compared in order to make a preliminary determination as to whether surface and subsurface media were potentially impacted by chemical releases. The specific standards of comparison used in the evaluation are as follows:

- Alabama Department of Environmental Management (ADEM) Risk Base Screening Levels (RBSLs) for surficial soils and ingested tap water. RBSLs for subsurface soils are not provided by ADEM. However, if the ADEM RBSL value was more conservative than the USEPA PRG (see below) then the ADEM RBSL value was used as the standard of comparison;
- USEPA Soil Screening Levels (SSL) with a Dilution Attenuation Factor of 20 (DAF20) for soils. The SSL value assumes that there is a potential for a chemical to be leached out of the soil and migrate to underlying ground water. The DAF20 value assumes that the initial concentration of a chemical in the soil will be attenuated by a factor of 20 before it reaches ground water;

- USEPA Region IX Preliminary Remediation Goals (PRGs) for soils in an industrial setting. These values are developed to assure that no significant impact to ground water results from a chemical leached out of the soil;
- National Primary Drinking Water Standards (NPDWS) for ground water and surface water, and;
- Secondary Drinking Water Standards (SDWS) for ground water and surface water.
- ADEM utilizes a corrective action limit of 100 mg/kg for soils impacted by Total Petroleum Hydrocarbons. ADEM utilizes PAH concentrations to determine impact to ground water.

5.7.1 *Site Geology*

The overburden is comprised of silty clay derived from the residual weathering of sandstone interbedded with shale. The residual overburden varies from 1 to 10 feet in thickness across the Site.

5.7.2 *Site Hydrogeology*

Ground water in the overburden, when present, is found in the residual material near the overburden/bedrock contact. The direction of ground water flow in the overburden is to the southeast across the Site.

Ground water levels in the sandstone bedrock range from 14 to 45 below grade. The ground water is present in the fractured sandstone. The direction of ground water flow is to the east.

5.7.3 *Hazardous Material Storage Area (AOC #2)*

The soil and overburden ground water underneath the concrete slab that was the floor of the hazardous material storage area (AOC #2) have been impacted by chemical constituents. The soil gas survey results indicate that volatile organic hydrocarbons are present underneath the slab and extend some distance away from the area covered by the slab.

5.7.3.1 *Soil Chemistry*

DPT boring SB-7 was drilled southwest of the southwest corner of the slab. The soil sample (8185-004) collected from 0-4′ was analyzed for the target parameters.

Vinyl chloride was detected at a concentration of 0.02 mg/kg, which exceeded the SSL of 0.01 mg/kg.

The drill cuttings from MW4 were also analyzed for the target parameters. The concentration of cis-1, 2-DCE (1.77 mg/kg) exceeded the SSL of 0.4 mg/kg and the concentration of TCE (9.35 mg/kg) exceeded the SSL of 0.06 mg/kg.

5.7.3.2 *Ground Water*

A ground water sample was collected from overburden well MW-4 and analyzed for the target parameters. The concentration of 1,1 DCE (112 ug/l) exceeded the NPDWS of 7 ug/l. The concentration of cis 1,2 DCE (19,500 ug/l) exceeded the NPDWS of 70 ug/l. The concentration of PCE (98 ug/l) exceeded the NPDWS of 5 ug/l. The concentration of TCE (88,600 ug/l) exceeded the NPDWS of 5 ug/l. The concentration of vinyl chloride (48 ug/l) exceeded the NPDWS of 2 ug/l.

The concentration of aluminum (1,580 ug/l) exceeded the SDWS of 200 ug/l. The concentration of iron (7,690 ug/l) exceeded the SDWS of 300 ug/l. The concentration of manganese (122 ug/l) exceeded the SDWS of 50 ug/l.

The concentrations of all other COCs were below applicable NPDWS, SDWS and ADEM RBSLs.

5.7.4 *Trichloroethylene (TCE) Degreaser Area (AOC #3)*

The soil gas survey results and the data obtained in the follow-up soil boring and monitoring well installation program confirm that soil and overburden ground water underneath the concrete floor of the Raible Building (north end) and the exterior areas adjacent to the location of the former TCE degreaser (northwest corner-interior of Raible Building have been impacted by chemical constituents.

5.7.4.1 *Soil Chemistry*

Soil samples were collected and analyzed from DPT borings SB-6, SB-9, SB-10 and SB-11, which were drilled over locations that exhibited elevated levels of VOCs in the soil gas samples.

The concentration of TPH-diesel range (134 mg/kg) in sample 8185-007 collected from 4-7′ in SB-6 exceeded the ADEM screening level of 100 mg/kg.

The concentration of arsenic in sample 8185-007 (31 mg/kg) exceeded the ADEM RBSL for surficial soils of 11 mg/kg. The concentration of chromium (40 mg/kg) exceeded the PRG of 38 mg/kg.

The concentration of arsenic in sample 8185-010 (16 mg/kg) collected from 4-8' in DPT boring SB-9 exceeded the ADEM RBSL for surficial soil of 11 mg/kg.

The concentration of arsenic in sample 8185-011 (16 mg/kg) collected from 0-4.5' in DPT boring SB-10 exceeded the ADEM RBSL for surficial soil of 11 mg/kg.

The concentration of vinyl chloride in sample 8185-012 (61 mg/kg) collected from 0-4' in DPT boring SB-11 exceeded the SSL of 0.1 mg/kg.

The concentrations of all other COCs were below applicable PRGs, SSLs and ADEM RBSLs.

5.7.4.2 *Ground Water*

Monitoring wells MW-1, MW-2, MW-3 and MW-6 were installed to monitor ground water in the overburden within AOC #3.

5.7.4.2.1 <u>MW1</u>

TPH (gasoline range) was present at a concentration of 263 ug/l.

The concentration of 1,1 DCE (28.3 ug/l) exceeded the NPDWS of 7 ug/l. The concentration of cis 1,2 DCE (174 ug/l) exceeded the NPDWS of 70 ug/l. The concentration of TCE (341 ug/l) exceeded the NPDWS of 5 ug/l. The concentration of vinyl chloride (3.5 ug/l) exceeded the NPDWS of 2 ug/l.

The concentration of aluminum (376 ug/l) exceeded the SDWS of 200 ug/l. The concentration of iron (8,650 ug/l) exceeded the SDWS of 300 ug/l. And the concentration of manganese (579 ug/l) exceeded the SDWS of 50 ug/l.

The concentrations of all other COCs were below applicable PRGs, SSLs and ADEM RBSLs.

5.7.4.2.2 <u>MW-2</u>

The concentration of cis 1,2 DCE (31.2 ug/l) exceeded the NPDWS of 70 ug/l. The concentration of TCE (7.5 ug/l) exceeded the NPDWS of 5 ug/l. The concentration of vinyl chloride (5.8 ug/l) exceeded the NPDWS of 2 ug/l.

The concentration of aluminum (1,210 ug/l) exceeded the SDWS of 200 ug/l. The concentration of iron (9,780 ug/l) exceeded the secondary SDWS of 300 ug/l and the concentration of manganese (384 ug/l) exceeded the secondary SDWS of 50 ug/l.

The concentrations of all other COCs were below applicable NPDWS, SDWS and ADEM RBSLs.

5.7.4.2.3 MW-3

TPH (gasoline range) was present at a concentration of 21,200 ug/l. and TPH (diesel range) was present at a concentration of 178 ug/l.

The concentration of 1,1 DCE (8,920 ug/l) exceeded the NPDWS of 7 ug/l. The concentration of cis 1,2 DCE (12,200 ug/l) exceeded the NPDWS of 70 ug/l. The concentration of PCE (52 ug/l) exceeded the NPDWS of 5 ug/l. The concentration of TCE (21,600 ug/l) exceeded the NPDWS of 5 ug/l. The concentration of 1,1,1 TCA (524 ug/l) exceeded the NPDWS of 200 ug/l. The concentration of vinyl chloride (548 ug/l) exceeded the NPDWS of 2 ug/l.

The concentration of iron (13,000 ug/l) exceeded the SDWS of 300 ug/l and the concentration of manganese (434 ug/l) exceeded the SDWS of 50 ug/l.

The concentrations of all other COCs were below applicable NPDWS, SDWS and ADEM RBSLs.

5.7.4.2.4 MW-6

The concentration of 1,1 DCE (8.5 ug/l) exceeded the NPDWS of 7 ug/l. The concentration of cis 1,2 DCE (1,660 ug/l) exceeded the NPDWS of 70ug/l. The concentration of TCE (178 ug/l) exceeded the NPDWS of 5 ug/l. The concentration of vinyl chloride (250 ug/l) exceeded the NPDWS of 2 ug/l.

The concentration of aluminum (4,050 ug/l) exceeded the SDWS of 200 ug/l and the concentration of iron (1,610 ug/l) exceeded the secondary SDWS of 300 ug/l.

The concentrations of all other COCs were below applicable NPDWS, SDWS and ADEM RBSLs.

5.7.5 *Hazardous Waste Storage Area/Light Gauge Paint Room (AOC #5)*

The soil gas survey results were used to locate boring SB-12, which was drilled inside the light gauge drum manufacturing area. The boring was located southwest of the hazardous waste storage/paint room located in the same building.

Monitoring well MW-5 was installed at the location of SB-4-1 drilled in the Phase II outside the building, to the north of the hazardous waste storage/paint room.

5.7.5.1 *Soil Chemistry*

Sample 8185-013 collected from 4-6' in DPT boring SB-12 was analyzed for target parameters.

The concentrations of all COCs were below applicable PRGs, SSLs and ADEM RBSLs.

5.7.5.2 *Ground Water Chemistry*

TPH (diesel range) was present at a concentration of 102 ug/l.

The concentration of vinyl chloride (2.4 ug/l) exceeded the NPDWS of 2 ug/l.

The concentration of lead (23 ug/l) exceeded the NPDWS of 15 ug/l.

The concentration of aluminum (390 ug/l) exceeded the SDWS of 200 ug/l. The concentration of iron (27,000 ug/l) exceeded the SDWS of 300 ug/l. The concentration of manganese (812 ug/l) exceeded the SDWS of 50 ug/l.

The concentrations of all other COCs were below applicable NPDWS, SDWS and ADEM RBSLs.

5.7.6 *Exterior Area Outside of Satellite Hazardous Waste Accumulation Area*

The soil gas survey indicated that there were elevated levels of BTEX in the subsurface in this area. DPT boring SB-11 was drilled in this area to confirm the soil gas survey results.

5.7.6.1 *Soil Chemistry*

The soil sample (8185-005) and a duplicate (8185-006) collected from 0-4′ were analyzed for target parameters.

The concentration of ethylbenzene (162 mg/kg) in sample 8185-006 exceeded the SSL of 13 mg/kg. The concentration of total xylenes (1,340 mg/kg) in sample 8185-006 exceeded the SSL of 210 mg/kg.

The concentrations of all other COCs were below applicable PRGs, SSLs and ADEM RBSLs.

5.7.7 *Sump System inside Raible Building*

A sample of the surface water present in the sump was collected for analysis of TPH and VOCs.

5.7.7.1 *Surface Water Chemistry*

TPH (gasoline range) was present at a concentration of 259 ug/l. TPH (diesel range) was present at a concentration of 3,980 ug/l.

The concentration of cis 1,2 DCE (317 ug/l) exceeded the NPDWS of 70 ug/l. The concentration of TCE (185 ug/l) exceeded the NPDWS of 5 ug/l. The concentration of vinyl chloride (6.4 ug/l) exceeded the NPDWS of 2 ug/l.

The concentrations of all other COCs were below applicable NPDWS, SDWS and ADEM RBSLs.

5.7.8 *Bedrock Wells*

Four bedrock wells were installed around the perimeter of the property. DW-1 was installed at the north end; DW-21 was installed on the west side; DW-3 was installed at the south end; and, DW-4 was installed on the east side.

5.7.8.1 *Soil Chemistry*

Split spoon soil samples were collected at 2-foot intervals from the surface to refusal at each well location. The split spoon sampler was attached to the drill rod and pushed through the overburden. A sample was not collected from DW-3 because of poor recovery in the sampler.

One soil sample from DW-1, DW-2 and DW-4 was analyzed for the target parameters

5.7.8.1.1 DW-1

The sample collected from the 6.5 to 8.5′ interval was analyzed for the target parameters.

Arsenic at a concentration of 12 mg/kg exceeded the ADEM RBSL of 11 mg/kg.

The concentrations of all other COCs did not exceed applicable PRGs, SSLs and ADEM RBSLs.

5.7.8.1.2 DW-2

The sample collected from the 3 to 5′ interval was analyzed for the target parameters.

The concentrations of all COCs did not exceed applicable PRGs, SSLs and ADEM RBSLs.

5.7.8.1.3 DW-4

The sample collected from the 6 to 7′ interval was analyzed for the target parameters.

The concentrations of all COCs did not exceed applicable PRGs, SSLs and ADEM RBSLs.

5.7.8.2 *Ground Water Chemistry*

Ground water samples were collected from DW-1, DW-2 and DW-4 and analyzed for the target parameters.

5.7.8.2.1 DW-1

The concentration of aluminum (201 ug/l) exceeded the SDWS of 200 ug/l; the concentration of iron (1,610 ug/l) exceeded the secondary SDWS of 300 ug/l; and, the concentration of manganese (363 ug/l) exceeded the SDWS of 50 ug/l.

The concentrations of all other COCs did not exceed applicable NPDWS, SDWS and ADEM RBSLs.

5.7.8.2.2 DW-2

TPH (diesel range organics) was detected at a concentration of 129 ug/l.

The concentration of aluminum (540 ug/l) exceeded the SDWS of 200 ug/l; the concentration of iron (11,500 ug/l) exceeded the secondary SDWS of 300 ug/l; and, the concentration of manganese (377 ug/l) exceeded the SDWS of 50 ug/l.

The concentrations of all COCs did not exceed applicable NPDWS, SDWS and ADEM RBSLs.

5.7.8.2.3 DW-4

TPH (diesel range organics) was detected at a concentration of 234 ug/l.

The concentration of aluminum (562 ug/l) exceeded the SDWS of 200 ug/l; the concentration of iron (1,270 ug/l) exceeded the SDWS of 300 ug/l; and, the concentration of manganese (ug/l) exceeded the SDWS of 50 ug/l.

The concentrations of all COCs did not exceed applicable NPDWS, SDWS and ADEM RBSLs.

6.0 CONCLUSIONS

As requested by Mr. Scott Doran of the Vorys, Sater, Seymour, and Pease, LLP Law Firm, Environmental Resources Management (ERM) conducted a Phase III Remedial Investigation (RI) at the Greif Bros. Corporation facility located at 409 Second Avenue, N.E. in Cullman, Alabama and the Cullman Supply Company, also located at this address and owned by Greif Bros. Corporation (the "Site"). The RI was conducted in accordance with the scope and protocols defined in the RI Work Plan[4] prepared by ERM.

The principal objective of the RI was to confirm and, if present, further define the extent of the impacts of chemical constituents to soil and ground water in three of the eleven Areas of Concern (AOC) that were identified and investigated as part of prior site assessment[5] activities. The three AOCs that were the focus of the RI were the:

- Hazardous Material Storage Area (AOC #2);
- TCE Degreaser Area (AOC #3), both of which are located on the northern portion of the Site; and
- Hazardous Waste Storage Area/Light Gauge Paint Room (AOC #5), which is located in the central portion of the Site.

An additional potential AOC (not previously identified) located along the southeast side of the property, near the exterior wall of a former satellite hazardous waste accumulation and paint storage room, was also assessed in the RI.

The significant findings of the RI are as follows:

- The soil overburden beneath the Site is characterized as low permeability clay, while the underlying bedrock is a sandstone formation that exhibits a range of permeabilities, controlled by the presence and interconnection of fracture zones.
- The soil gas survey results indicated that significant concentrations of TCE and other chlorinated solvents, such as PCE, were present in the subsurface in the areas of the TCE degreaser (AOC #3) and hazardous material storage area (AOC #2).

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[4] Phase III Remedial Investigation Work Plan, ERM, February 2002.

[5] Phase I Environmental Site Assessment and Limited Phase II Investigation, ERM, August, 2001.

- The soil sample analyzed from the boring installed along the exterior wall of the satellite hazardous waste accumulation area exhibited elevated levels of ethylbenzene and total xylene that potentially exceed applicable regulatory thresholds.
- Soil samples collected from the borings installed near AOCs #2 and #3 were reported to contain vinyl chloride and cis 1,2 DCE concentrations that potentially exceed applicable regulatory thresholds.
- Ground water flow in the overburden water-bearing zone in the vicinity of AOCs #2 and #3 is toward the west-southwest, in the direction of property owned and operated by the CSX railroad.
- Ground water flow in the bedrock aquifer is toward the east based on the water level measurements obtained from the four deep monitoring wells (DW-1 through DW-4).
- The soils and ground water within the adjacent to the former Hazardous Waste Storage Area/Light Gauge Paint Room (AOC #5) do not appear to be significantly impacted by chemical constituents as only trace concentration of site-related chemical constituents were reported to be present in this area.
- Ground water samples collected from the shallow monitoring wells installed near AOCs #2 and #3 were reported to contain TCE, PCE, and vinyl chloride (VC) at concentrations several orders of magnitude above federal maximum contaminant levels (MCLs).
- Ground water does not appear to have been impacted by chlorinated hydrocarbons in the four bedrock wells installed in the underlying sandstone bedrock aquifer at locations along the north (DW-1), west (DW-2), south (DW-3), and east (DW-4) perimeter of the Site.
- Low levels of total petroleum hydrocarbons-diesel range organics were reported to be present in the ground water samples collected from the bedrock wells DW-2 and DW-3 installed along the west and south sides of the Site, respectively.
- Ground water chemistry is undefined in the area upgradient of the most upgradient well on the site, MW-4, which was installed along the eastern edge of the cement slab at AOC#3.
- The railroad property and the relatively undeveloped property immediately west of the railroad property appear to be impacted by off-site migration of contaminated ground water from the Site.

7.0 REFERENCES

ERM, August 2001, Phase I Environmental Site Assessment and Limited Phase II Investigation.

USEPA, October 1988, Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA.

Appendix A
Detailed Phase II Analytical Summary Tables

Table 6-1 Detected Compounds - Scrap Metal and Equipment Storage Area
Greif Bros. Corporation, Cullman, Alabama

Boring Number		SB-6	SB-6
Sample ID		7918-012	7918-013
Sample Matrix		Soil	Soil
Sample Interval (feet)		4-8	4-8
Sample Date		7/20/2001	7/20/2001
Regulatory Standards	**PRGs [1]/RBSLs [4]**		
TAL Metals	**mg/kg**	**mg/kg**	**mg/kg**
Aluminum [1]	100,000	30,700	26,700
Antimony [1(A)]	5	<11.5	<11.8
Arsenic [4]	11.1	**15.5**	**17.8**
Barium [1(A)]	1,600	66.2	55.6
Beryllium [1(A)]	63	<1.15	<1.18
Cadmium [1(A)]	8	<1.15	<1.18
Calcium	N	94.8	433
Chromium(total) [1]	38	**44.8**	**32.9**
Cobalt [1]	100,000	1.85	2.13
Copper [1]	75,908	<1.15	<1.18
Iron [1]	100,000	76,000	41,800
Lead [4]	400	12.2	8.05
Magnesium	N	837	755
Manganese [1]	32,250	9	8.28
Mercury [1]	613	<0.115	<0.118
Nickel [1(A)]	130	9	8.28
Potassium	N	2,570	1,730
Selenium [1(A)]	5	3.92	1.89
Silver [1(A)]	34	<1.15	<1.18
Sodium	N	466	286
Thallium [1]	135	<1.15	<1.18
Vanadium [1(A)]	6,000	<67.8	56.3
Zinc [1(A)]	120,000	18.2	27.9

[1] USEPA Region IX Industrial Soil Preliminary Remediation Goals for year 2000.

[1(A)] Soil Screening Level with DAF of 20.

[1(A)W] PRG for tapwater ingestion

[2] National Primary Drinking Water Standards

[3] Secondary Drinking Water Standards

[4] ADEM Risk Based Screening Levels (levels are for surficial soils only)

[5] ADEM Risk Based Screening Levels (tapwater ingestion)

N= No standard

Table 6-2 Detected Compounds - Hazardous Material Storage Area
Greif Bros. Corporation, Cullman, Alabama

Boring Number		SB-9	SB-9		SB-9
Sample ID		7918-016	7918-017		7918-018
Sample Matrix		Soil	Soil		Ground Water
Sample Interval (feet)		0-4'	4-8'		8-9
Sample Date		7/20/2001	7/20/2001		7/20/2001
Regulatory Standards	PRGs [1]/RBSLs [4]			MCL [2,3,5]	
TPH (8015B)	mg/kg	mg/kg	mg/kg	ug/l	ug/l
TPH (gasoline range)	100	222	46.5	N	50,000
TPH (diesel range)	100	492	<11.9	N	27,200
SVOCs (8270C)	mg/kg	mg/kg	mg/kg	ug/l	ug/l
Isophorone [1(A), 1(A)W]	0.5	<0.384	<0.393	70.77	**78.9**
2-Methylnaphthalene	N	0.499	<0.393	N	38.9
2-Methylphenol [1(A)]	15	0.384	<0.393	1,825	<10
Naphthalene [1(A), 5]	84	3.69	<0.393	20	**1,110**
Bis(2-ethylhexyl)phthalate [1, 1(A)W]	176	4.99	1.65	4.8	<10
VOCs (8260B)	mg/kg	mg/kg	mg/kg	ug/l	ug/l
Acetone [1(A)]	16	0.252	<0.0531	608	71.8
Benzene [1(A), 2]	0.03	0.0071	<0.0021	5	**19.7**
2-Butanone	N	0.0994	<0.0531	N	<50
Carbon Disulfide [1(A), 1(A)W]	32	0.0028	<0.0021	1,043	<2
1,1-Dichloroethane [1(A), 1(A)W]	23	<0.002	<0.0021	811	<2
1,2-Dichloroethane [1(A),2]	0.02	<0.002	<0.0021	5	**16.8**
1,1-Dichloroethene [1(A),2]	0.06	<0.002	<0.0021	7	**17.9**
cis-1,2-dichloroethene [1(A),2]	0.4	0.355	**4.762**	70	**2,440**
trans-1,2-dichloroethene [1(A), 2]	0.7	0.0084	0.0263	100	69.9
Ethylbenzene [1(A),2,5]	13	0.7093	0.026	700	480
4-Methyl-2-Pentanone	N	0.7201	<0.0106	N	1,670
Toluene [1(A), 2]	12	3.256	<0.0021	1,000	**4,420**
Vinyl Chloride [1(A), 2]	0.01	<0.1163	**0.4524**	2	**2,980**
Xylenes (total) [1(A), 2, 5]	210	6.59	0.1507	10,000	3,590

[1] USEPA Region IX Industrial Soil Preliminary Remediation Goals for year 2000.

[1(A)] Soil Screening Level with DAF of 20.

[1(A)W] PRG for tapwater ingestion

[2] National Primary Drinking Water Standards

[3] Secondary Drinking Water Standards

[4] ADEM Risk Based Screening Levels (levels are for surficial soils only)

[5] ADEM Risk Based Screening Levels (tapwater ingestion)

N= No standard

Table 6-3 Detected Compounds - TCE Degreaser Area
Greif Bros. Corporation, Cullman, Alabama

Boring Number		SB-5		SB-5	SB-5
Sample ID		7918-010		7918-011	7918-011D
Sample Matrix		Soil		Ground Water	Ground Water
Sample Interval (feet)		4-8		8-9	8-9
Sample Date		7/20/2001		7/20/2001	7/20/2001
Regulatory Standards	**PRGs [1]/RBSLs [4]**		**MCL [2,3,5]**		
TAL Metals	**mg/kg**	**mg/kg**	**mg/l**	**mg/l**	**mg/l**
Aluminum [1]	100,000	13,900	0.05 to 0.2	439	133
Antimony [1(A)]	5	<11.6	0.006	**0.09**	**0.014**
Arsenic [4]	11.1	6.5	0.05	**0.06**	0.033
Barium [1(A)]	1,600	51.5	2	3.18	1.06
Beryllium [1(A)]	63	<1.16	N	<0.04	0.006
Cadmium [1(A)]	8	<1.16	0.005	<0.01	<0.01
Calcium	N	13,300	N	716.4	348.8
Chromium(total) [1]	38	16.5	0.1	**0.69**	**0.18**
Cobalt [1]	100,000	1.39	N	<0.2	<0.02
Copper [1]	75,908	<1.16	1	0.11	<0.01
Iron [1]	100,000	19,600	0.3	**608.5**	**254.5**
Lead [4]	400	8.36	0.015	**1.05**	**0.283**
Magnesium	N	1140	N	61.2	35.25
Manganese [1]	32,250	26.2	0.05	**2.12**	**0.887**
Mercury [1]	613	<0.116	4	0.00156	0.00104
Nickel [1(A)]	130	6.27	N	0.23	0.052
Potassium	N	1,490	N	37.9	29.5
Selenium [1(A)]	5	<1.16	0.05	**0.06**	0.02
Silver [1(A)]	34	<1.16	0.1	<0.05	<0.005
Sodium	N	490	N	11.2	17.92
Thallium [1]	135	<1.16	0.002	<0.002	<0.002
Vanadium [1(A)]	6,000	22.7	N	0.93	0.293
Zinc [1(A)]	120,000	28.8	5	2	0.268
TPH (8015B)	**mg/kg**	**mg/kg**	**ug/l**	**ug/l**	**ug/l**
TPH (gasoline range)	100	<5.81	N	<100	<100
TPH (diesel range)	100	26	N	<111	<114
SVOCs (8270C)	**mg/kg**	**mg/kg**	**ug/l**	**ug/l**	**ug/l**
Bis(2-ethylhexyl)phthalate [1]	176	4.84	N	<11.1	<11.1

Table 6-3 Detected Compounds - TCE Degreaser Area
Greif Bros. Corporation, Cullman, Alabama

Boring Number		SB-5		SB-5	SB-5
Sample ID		7918-010		7918-011	7918-011D
Sample Matrix		Soil		Ground Water	Ground Water
Sample Interval (feet)		4-8		8-9	8-9
Sample Date		7/20/2001		7/20/2001	7/20/2001
Regulatory Standards	**PRGs [1]/RBSLs [4]**		MCL [2,3,5]		
VOCs (8260B)	**mg/kg**	**mg/kg**	**ug/l**	**ug/l**	**ug/l**
Chloroethane [1, 1(A)W]	6.5	0.0027	4.63	53.9	54.2
1,1-Dichloroethane [1(A), 1(A)W]	23	0.0085	811	21.2	19.3
1,1-Dichloroethene [1(A),2]	0.06	<0.0019	7	<2	2.0
cis-1,2-dichloroethene [1(A),2]	0.4	0.0283	70	**71.1**	65.1
1,1,1-Trichloroethane [1(A), 2]	2	<0.0019	200	2.5	2.5
Trichloroethene [1(A), 2]	0.06	0.0376	5	**33.4**	**27.4**
Vinyl Chloride [1(A),2]	0.01	0.0071	2	**16.1**	**14.5**

[1] USEPA Region IX Industrial Soil Preliminary Remediation Goals for year 2000.

[1(A)] Soil Screening Level with DAF of 20.

[1(A)W] PRG for tapwater ingestion

[2] National Primary Drinking Water Standards

[3] Secondary Drinking Water Standards

[4] ADEM Risk Based Screening Levels (levels are for surficial soils only)

[5] ADEM Risk Based Screening Levels (tapwater ingestion)

N= No standard

Table 6-4 Detected Compounds - West Property Line Area
Greif Bros. Corporation, Cullman, Alabama

Boring Number		SSR-1	SSR-2	SSR-2
Sample ID		7918-002	7918-003	7918-004
Sample Matrix		Soil	Soil	Soil
Sample Interval (feet)		0-1	0-1	0-1
Sample Date		7/18/2001	7/18/2001	7/18/2001
Regulatory Standards	PRGs [1]/RBSLs [4]			
TAL Metals	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum [1]	100,000	10,700	15,000	14,700
Antimony [1(A)]	5	**212**	<11.7	<11.8
Arsenic [4]	11.1	**69.3**	**28.5**	**18.4**
Barium [1(A)]	1,600	417	52.3	52.8
Beryllium [1(A)]	63	<1.15	<1.17	<1.18
Cadmium [1(A)]	8	<1.15	<1.17	<1.18
Calcium	N	8,470	4,210	5,220
Chromium(total) [1]	38	**997**	18	17.2
Cobalt [1]	100,000	5.99	2.57	2.36
Copper [1]	75,908	82.7	8.88	7.54
Iron [1]	100,000	35,700	10,800	9,600
Lead [4]	400	**5,090**	17.1	15.8
Magnesium	N	1,080	2,080	2,180
Manganese [1]	32,250	334	47.7	42.7
Mercury [1]	613	0.261	<0.123	<0.116
Nickel [1(A)]	130	26.5	8.88	6.37
Potassium	N	1,790	984	1,030
Selenium [1(A)]	5	2.99	<1.17	<1.18
Silver [1(A)]	34	<1.15	<1.17	<1.18
Sodium	N	178	255	288
Thallium [1]	135	<1.15	<1.17	<1.18
Vanadium [1(A)]	6,000	30.4	26.9	26.2
Zinc [1(A)]	120,000	357	41.8	37
TPH (8015B)	mg/kg	mg/kg	mg/kg	mg/kg
TPH (gasoline range)	100	<5.88	<6.10	<6.02
TPH (diesel range)	100	62	<12.3	<12.1

Table 6-4 Detected Compounds - West Property Line Area
Greif Bros. Corporation, Cullman, Alabama

Boring Number		SSR-1	SSR-2	SSR-2
Sample ID		7918-002	7918-003	7918-004
Sample Matrix		Soil	Soil	Soil
Sample Interval (feet)		0-1	0-1	0-1
Sample Date		7/18/2001	7/18/2001	7/18/2001
Regulatory Standards	**PRGs [1]/RBSLs [4]**			
VOCs (8260B)	mg/kg	mg/kg	mg/kg	mg/kg
1,1,1-Trichloroethane [1(A)]	2	<0.1176	**17.99**	0.1446
Ethylbenzene [4]	1,970	0.4118	<0.122	<0.1205
Tetrachloroethene [1(A)]	0.06	<0.1176	**0.2744**	<0.1205
Toluene [4]	767	9.0590	0.1585	<0.1205
Trichloroethene [1(A)]	0.06	<0.1176	**17.99**	**3.855**
Xylenes [4] (total)	493	3.488	<0.122	<0.1205

[1] USEPA Region IX Industrial Soil Preliminary Remediation Goals for year 2000.

[1(A)] Soil Screening Level with DAF of 20.

[1(A)W] PRG for tapwater ingestion

[2] National Primary Drinking Water Standards

[3] Secondary Drinking Water Standards

[4] ADEM Risk Based Screening Levels (levels are for surficial soils only)

[5] ADEM Risk Based Screening Levels (tapwater ingestion)

N= No standard

Table 6-5 Detected Compounds - Light Gauge Paint Storage Room
Greif Bros. Corporation, Cullman, Alabama

Boring Number		SB-4		SB-4
Sample ID		7918-008		7918-009
Sample Matrix		Soil		Ground Water
Sample Interval (feet)		4-7.5		7.5
Sample Date		7/19/2001		7/19/2001
Regulatory Standards	**PRGs [1]/RBSLs [4]**		**MCL [2,3,5]**	
TAL Metals	**mg/kg**	**mg/kg**	**mg/l**	**mg/l**
Aluminum [1]	100,000	19,100	0.05 to 0.2	**432**
Antimony [1(A)]	5	<13	0.006	**0.51**
Arsenic [4]	11.1	**15.5**	0.05	**0.13**
Barium [1(A)]	1,600	106	2	**23.8**
Beryllium [1(A)]	63	<1.3	N	<0.04
Cadmium [1(A)]	8	<1.3	0.005	**0.07**
Calcium	N	1700	N	817.1
Chromium(total) [1]	38	**78.7**	0.1	**18.3**
Cobalt [1]	100,000	2.07	N	0.38
Copper [1]	75,908	,1.3	1	**1.46**
Iron [1]	100,000	42,800	0.3	**993.2**
Lead [4]	400	225	0.015	**181**
Magnesium	N	697	N	71.8
Manganese [1]	32,250	45.6	0.05	**9.21**
Mercury [1]	613	<0.127	4	0.00406
Nickel [1(A)]	130	6.48	N	0.51
Potassium	N	2,020	N	58.3
Selenium [1(A)]	5	1.81	0.05	**0.07**
Silver [1(A)]	34	<1.3	0.1	<0.05
Sodium	N	593	N	592.7
Thallium [1]	135	<1.3	0.002	<0.002
Vanadium [1(A)]	6,000	26.9	N	0.83
Zinc [1(A)]	120,000	214	2	**79.7**
TPH (8015B)	**mg/kg**	**mg/kg**	**ug/l**	**ug/l**
TPH (gasoline range)	100	<6.58	N	113
TPH (diesel range)	100	19.2	N	1,280
SVOCs (8270C)	**mg/kg**	**mg/kg**	**ug/l**	**ug/l**
Fluoranthene [4,5]	101	0.521	0.206	<68400
Bis(2-ethylhexyl)phthalate [1, 1(A)W]	180	1.53	4.8	<68400

[1] USEPA Region IX Industrial Soil Preliminary Remediation Goals for year 2000.

[1(A)] Soil Screening Level with DAF of 20.

[1(A)W] PRG for tapwater ingestion

[2] National Primary Drinking Water Standards

[3] Secondary Drinking Water Standards

[4] ADEM Risk Based Screening Levels (levels are for surficial soils only)

[5] ADEM Risk Based Screening Levels (tapwater ingestion)

N= No standard

Table 6-6 Detected Compounds - Dry Well and Solvent Recovery Room Area
Greif Bros. Corporation, Cullman, Alabama

Boring Number		SB-2
Sample ID		7918-006
Sample Matrix		Soil
Sample Interval (feet)		0-5.5
Sample Date		7/19/2001
Regulatory Standards	PRGs [1]/RBSLs [4]	
TAL Metals	mg/kg	mg/kg
Aluminum [1]	100,000	19,900
Antimony [1(A)]	5	<11.4
Arsenic [4]	11.1	5.49
Barium [1(A)]	1,600	41.9
Beryllium [1(A)]	63	<1.14
Cadmium [1(A)]	8	<1.14
Calcium	N	950
Chromium(total) [1]	38	21.7
Cobalt [1]	100,000	2.29
Copper [1]	75,908	<1.14
Iron [1]	100,000	15,000
Lead [4]	400	5.49
Magnesium	N	975
Manganese [1]	32,250	29.3
Mercury [1]	613	<0.118
Nickel [1(A)]	130	7.33
Potassium	N	1,780
Selenium [1(A)]	5	<1.14
Silver [1(A)]	34	<1.14
Sodium	N	266
Thallium [1]	135	<1.14
Vanadium [1(A)]	6,000	36.4
Zinc [1(A)]	120,000	28.6
SVOCs (8270C)	**mg/kg**	**mg/kg**
Bis(2-ethylhexyl)phthalate	180	1.69

[1] USEPA Region IX Industrial Soil Preliminary Remediation Goals for year 2000.

[1(A)] Soil Screening Level with DAF of 20.

[1(A)W] PRG for tapwater ingestion

[2] National Primary Drinking Water Standards

[3] Secondary Drinking Water Standards

[4] ADEM Risk Based Screening Levels (levels are for surficial soils only)

[5] ADEM Risk Based Screening Levels (tapwater ingestion)

N= No standard

Table 6-7 Detected Compounds - Former Hazardous Waste Storage Shed
Greif Bros. Corporation, Cullman, Alabama

Boring Number		SB-3
Sample ID		7918-007
Sample Matrix		Soil
Sample Interval (feet)		1-5
Sample Date		7/19/2001
Regulatory Standards	**PRGs [1]/RBSLs [4]**	
TAL Metals	**mg/kg**	**mg/kg**
Aluminum [1]	100,000	19,900
Antimony [1(A)]	5	<11.6
Arsenic [4]	11.1	7.41
Barium [1(A)]	1,600	33.6
Beryllium [1(A)]	63	1.16
Cadmium [1(A)]	8	1.16
Calcium	N	1,500
Chromium(total) [1]	38	73.2
Cobalt [1]	100,000	2.08
Copper [1]	75,908	<1.16
Iron [1]	100,000	20,000
Lead [4]	400	5.56
Magnesium	N	804
Manganese [1]	32,250	31
Mercury [1]	613	<0.118
Nickel [1(A)]	130	8.57
Potassium	N	875
Selenium [1(A)]	5	<1.16
Silver [1(A)]	34	<1.16
Sodium	N	354
Thallium [1]	135	<1.16
Vanadium [1(A)]	6,000	41.2
Zinc [1(A)]	120,000	36.8
SVOCs (8270C)	**mg/kg**	**mg/kg**
Bis(2-ethylhexyl)phthalate [1]	180	1.1

[1] USEPA Region IX Industrial Soil Preliminary Remediation Goals for year 2000.

[1(A)] Soil Screening Level with DAF of 20.

[1(A)W] PRG for tapwater ingestion

[2] National Primary Drinking Water Standards

[3] Secondary Drinking Water Standards

[4] ADEM Risk Based Screening Levels (levels are for surficial soils only)

[5] ADEM Risk Based Screening Levels (tapwater ingestion)

N= No standard

Appendix B
Beacon Environmental Report

BEACON Report No. EM1386

EMFLUX® Passive Soil-Gas Survey

GREIF BROS. SITE
409 AND 601 2nd AVENUE NE
CULLMAN, AL

Prepared for

ERM—Southeast, Inc.
7106 Crossroads Blvd
Suite 228
Brentwood, TN 37027

by

Beacon Environmental Services, Inc.
19 Newport Drive
Suite 102
Forest Hill, MD 21050

March 8, 2002

Applying Results from Soil-Gas Surveys

The utility of soil-gas surveys is directly proportional to their accuracy in reflecting and representing changes in the subsurface concentrations of source compounds. Passive soil-gas survey results are the mass collected from the vapor-phase emanating from the source. The vapor-phase is merely a fractional trace of the source, so, as a matter of convenience, the units used in reporting detection values from EMFLUX® surveys are smaller than those employed for source-compound concentrations.

The critical fact is that, whatever the relative concentrations of source and associated soil gas, best results are realized when the ratio of soil-gas measurements to actual subsurface concentrations remains as close to constant as the real world permits. It is the reliability and consistency of this ratio, not the particular units of mass (*e.g.*, nanograms) that determine usefulness. Thus, BEACON emphasizes the necessity of conducting — at minimum — follow-on intrusive sampling at one or two points which show relatively high EMFLUX® values to obtain corresponding concentrations of soil and ground-water contaminants. These correspondent values furnish the basis for approximating the required ratio. Once that ratio is established, it can be used in conjunction with EMFLUX® measurements (regardless of the units adopted) to estimate subsurface contaminant concentrations across the survey field. It is important to keep in mind, however, that specific conditions at individual sample points, including soil porosity and permeability, depth to contamination, and perched ground water, can have significant impact on soil-gas measurements at those locations.

When EMFLUX® Surveys are handled in this way, the data provide information that can yield substantial savings in drilling costs and in time. They furnish, among other things, a checklist of compounds expected at each survey location and help to determine how and where drilling budgets can most effectively be spent.

EMFLUX® Survey Number: EM1386

Greif Bros. Site
409 and 601 2nd Avenue NE
Cullman, AL

This EMFLUX® Soil-Gas Survey Report has been prepared for ERM—Southeast, Inc. (ERM) by Beacon Environmental Services, Inc. (BEACON) in accordance with the terms of the Subcontract Agreement dated February 5, 2002. BEACON's principal technical contact at ERM for this project has been Mr. Ed Ossi.

1. Objectives

Soil-gas samples were collected to determine the presence, identity, and relative strength of targeted contaminants in soil and/or ground water at the Greif Bros. site. Survey results will be used to determine the distribution of contaminants and to guide further site investigation.

2. Target Compounds

In this survey, 91 samples were analyzed for the 21 compounds on the EMFLUX® EPA Method 8021 Target Compound List (TCL) and 22 samples were analyzed for the 31 compounds on the EMFLUX® EPA Method 8260 TCL. The compound lists, provided in **Attachments 1 and 2**, respectively, also supply the resulting laboratory data in nanograms (ng) of specific compounds per cartridge. **Tables 1 and 2** provide the data for only those compounds detected at one or more locations.

3. Survey Description

Analysis by EPA Method 8021

• No. of Field Sample Points:	85
• No. of Duplicate Samples:	3
• No. of Trip Blanks:	3
• Total No. of EMFLUX® Samples:	91

Analysis by EPA Method 8260

• No. of Field Sample Points:	20
• No. of Duplicate Samples:	1
• No. of Trip Blanks:	1
• Total No. of EMFLUX® Samples:	22

- Field sample locations for the three areas surveyed are shown on **Figure 1**.

4. Field Work

BEACON field personnel conducted a 105-point EMFLUX® Soil-Gas Survey. Collectors were deployed on February 6 and 7, 2002, and retrieved on February 14 and 15, 2002, in accordance with the EMFLUX® Timing Model. **Attachment 3** describes the field procedures used. Individual deployment and retrieval times will be found in the Field Deployment Report (**Attachment 4**).

5. BEACON Analysis and Reporting Dates

- BEACON's laboratory received 39 sample cartridges for analysis on February 15, 2002, and 52 sample cartridges for analysis on February 18, 2002.
- BEACON's laboratory analyzed the samples for the specified compounds, using thermal desorption and a capillary-column gas chromatograph (GC) with a photoionization detector (PID) in series with a dry electrolytic conductivity detector (DELCD) in accordance with EPA Method 8021 (**Attachment 5**).
- Analysis was completed on February 21, 2002. Following a laboratory review, results were provided to ERM on February 22, 2002.

Maryland Spectral Services, Inc. (MSS) Analysis and Reporting Dates

- MSS received 22 sample cartridges for analysis on February 15, 2002.
- EMFLUX® sample cartridges were thermally desorbed, then analyzed using gas chromatography/mass spectrometry (GC/MS) equipment, in accordance with EPA Method 8260 (Modified), as described in **Attachment 6**. MSS analyzed each cartridge for the targeted compounds listed in **Attachment 2**.
- MSS completed the analysis on February 18, 2002. Following a laboratory review, results were provided to ERM on February 22, 2002.

6. Report Notes and Quality Assurance/Quality Control Factors

- **Attachment 1** and **Table 1** provide the results for those samples analyzed by EPA Method 8021, and **Attachment 2** and **Table 2** provide the results for samples analyzed by EPA Method 8260. The survey results are in nanograms per cartridge by sample-point number and compound name. The quantitation levels represent values above which quantitative laboratory results can be achieved within specified limits of precision and with a high degree of confidence. The quantitation level for each compound, therefore, provides a reliable basis for comparing the relative strength of any detection of that compound.

- **Data Compatibility**. It is important to note that when sample locations are covered with or near the edge of an artificial surface (*e.g.*, asphalt or concrete), sample measurements are often distorted (increased) significantly. Such distortion can be attributed to the fact that gas rising from sources beneath impermeable caps tends to reach equilibrium underneath the cap. Thus, a reading taken below or near an impermeable surface is much higher than it would be in the absence of such a cap.

- The **Chain-of-Custody** form, which was shipped with the samples for this survey, is supplied as **Attachment** 7.

- **BEACON laboratory QA/QC procedures** consist of control blanks and verifications, as well as system calibration, as specified for EPA Method 8021. Laboratory personnel conducted internal control blanks and internal control verification analyses daily to ensure that the system was contaminant free and properly calibrated. The system was calibrated using external-standard procedures to at least three different concentrations for each compound targeted. A laboratory control sample (LCS) and LCS blank were performed daily.

- **MSS laboratory QA/QC procedures** included standards, surrogates, and blanks appropriate to EPA Method 8260 (Modified). MSS performed analyses under the laboratory's own Quality Assurance Plan.

- **QA/QC Contaminant Corrections.** Following EPA guidelines, EMFLUX® laboratory data is not corrected for method blank or trip blank sample contamination values; any contamination detected on QA/QC samples is reported in **Attachments 1 and 2**.

- **Laboratory method blanks** are run each day with project samples to identify contamination present in the laboratory. If contamination is detected on a method blank, measurements of identical compounds on samples analyzed the same day are considered to be suspect and are flagged in the laboratory report. The laboratory method blanks analyzed in connection with the present samples revealed no contamination.

- The **trip blank** is an EMFLUX® cartridge prepared, transported, and analyzed with other samples but intentionally not exposed. The analysis of the trip blanks (labeled TRIP-1, TRIP-2, TRIP-3, and TRIP-4 in **Attachments 1 and 2**) recorded none of the targeted compounds, indicating that the survey site itself is the source of detected contamination.

- **Duplicates.** EMFLUX® sample collectors are prepared with two cartridges for subsequent duplicate or confirmatory sample analysis. Duplicate analysis was performed for samples A8, B15, B25, and C64, designated A8-D, B25-D, B15-D, and C64-D in the data tables. Because of finite differences between the cartridges, and the random nature data tables. Because of finite differences between the cartridges, and the random nature of diffusive particle movement, comparisons between duplicates and primary samples should be made on a qualitative basis, as quantitative results may be subject to random distortions. In general, a duplicate correspondence should be defined as a difference of 50% or less between contaminant data for base and duplicate samples. Also, for the purpose of calculating correspondences, all non-detections should be assigned, as a baseline value, the quantitation level for the specific contaminant. Based on these assumptions, a 98% correlation was found between the duplicate samples and their base samples.

- **Survey findings** are relative exclusively to this project and should not routinely be compared with results of other EMFLUX® Surveys. *To establish a relationship between reported soil-gas measurements and actual subsurface contaminant concentrations, which will indicate those detections representing significant subsurface contamination, BEACON recommends the guidelines on the inside front cover of this report.*

- At the request of ERM, the following compound distribution maps have been provided:

  Figure 2 — cis-1,2-Dichloroethene
  Figure 3 — Trichloroethene
  Figure 4 — Total BTEX

- The following **Attachments** are included:

-1-	BEACON Laboratory Report
-2-	MSS Laboratory Report
-3-	EMFLUX® Field Procedures
-4-	Field Deployment Report
-5-	BEACON Laboratory Procedures
-6-	MSS Laboratory Procedures
-7-	Chain-of-Custody Form

Table 1

EMFLUX Passive Soil-Gas Survey
Greif Bros. Site
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	A1	A2	A3	A4	A5	A6	A7	A8	A8-D
COMPOUNDS									
Methylene Chloride	U	U	U	U	U	U	U	180	120
1,1,1-Trichloroethane	55	U	U	U	U	U	U	U	U
Tetrachloroethene	U	U	U	U	U	64	38	37	30
Benzene	U	U	U	U	U	U	U	U	U
Toluene	76	U	U	U	52	U	U	54	27
Ethylbenzene	290	U	U	29	300	38	39	290	210
Xylenes (total)	850	97	120	130	940	160	140	960	840
Total BTEX	1,216	97	120	159	1,292	198	179	1,304	1,077

Reported Quantitation Level = 25 nanograms

U = Below Reported Quantitation Level

Table 1
(continued)
EMFLUX Passive Soil-Gas Survey
Greif Bros. Site
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	B1	B5	B9	B13	B17	B21	B25	B25-D	B28
COMPOUNDS									
Trichloroethene	U	U	U	U	31	U	U	U	U
Tetrachloroethene	U	U	U	110	42	59	270	200	U
Benzene	U	U	U	U	U	U	U	U	U
Toluene	U	U	35	U	50	64	29	35	100
Ethylbenzene	U	44	32	35	75	150	360	100	99
Xylenes (total)	110	120	83	110	250	480	390	310	230
Total BTEX	110	164	150	145	375	694	779	445	429

SAMPLE NO.	B29	B30	B31	B32
COMPOUNDS				
Trichloroethene	U	U	U	U
Tetrachloroethene	U	U	U	U
Benzene	U	U	U	U
Toluene	47	95	56	U
Ethylbenzene	130	80	29	U
Xylenes (total)	530	210	120	U
Total BTEX	707	385	205	U

Reported Quantitation Level = 25 nanograms
U = Below Reported Quantitation Level

Table 1
(continued)
EMFLUX Passive Soil-Gas Survey
Greif Bros. Site
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	C1	C2	C3	C4	C5	C6	C7	C8	C9
COMPOUNDS									
1,1-Dichloroethene	U	U	U	26	U	U	U	U	U
Methylene Chloride	U	U	U	360	U	U	U	U	U
trans-1,2-Dichloroethen	U	U	U	U	U	U	U	U	U
1,1-Dichloroethane	U	U	U	310	U	U	280	U	U
cis-1,2-Dichloroethene	200	U	U	8,700	220	U	190	100	U
Chloroform	U	U	U	U	U	U	U	U	U
1,1,1-Trichloroethane	U	U	2,200	1,700	U	48	U	U	U
Carbon Tetrachloride	U	U	U	U	U	U	U	U	U
1,2-Dichloroethane	U	U	U	U	U	U	U	U	U
Trichloroethene	370	170	2,200	8,600	570	52	100	86	110
Tetrachloroethene	250	320	91	2,000	160	45	44	370	56
Chlorobenzene	U	U	U	U	U	U	U	U	U
Ethylene Dibromide	U	U	750	U	U	U	U	U	U
Bromoform	U	U	U	U	U	U	U	U	U
MTBE	U	U	U	U	U	U	U	U	U
Benzene	U	U	U	U	42	33	27	U	56
Toluene	96	29	U	62	76	67	39	61	U
Ethylbenzene	76	220	U	130	110	120	130	110	410
Xylenes (total)	300	1,400	560	530	290	390	540	420	660
Total BTEX	472	1,649	560	722	518	610	736	591	1,126

Reported Quantitation Level = 25 nanograms
U = Below Reported Quantitation Level

Table 1
(continued)
EMFLUX Passive Soil-Gas Survey
Greif Bros. Site
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	C10	C11	C12	C13	C14	C15	C16	C17	C18
COMPOUNDS									
1,1-Dichloroethene	U	U	52	U	U	U	U	U	U
Methylene Chloride	U	U	U	U	U	U	U	U	U
trans-1,2-Dichloroethen	U	34	950	76	U	U	U	U	82
1,1-Dichloroethane	U	U	150	400	60	U	U	340	150
cis-1,2-Dichloroethene	1,100	3,200	4,900	3,000	190	U	U	180	760
Chloroform	U	U	U	U	U	U	U	U	U
1,1,1-Trichloroethane	U	U	U	U	U	U	U	U	U
Carbon Tetrachloride	U	U	U	U	U	U	U	37	U
1,2-Dichloroethane	U	U	U	U	U	U	U	U	U
Trichloroethene	72	200	1,700	170	37	U	U	U	U
Tetrachloroethene	U	71	490	86	U	U	83	58	U
Chlorobenzene	U	U	U	U	U	U	U	U	U
Ethylene Dibromide	U	U	U	U	U	U	U	U	U
Bromoform	U	U	U	55	U	U	U	U	U
MTBE	U	U	96	U	U	U	U	U	U
Benzene	400	U	150	U	U	U	U	U	51
Toluene	69	220	52	U	140	38	72	79	79
Ethylbenzene	630	110	U	U	U	U	140	180	280
Xylenes (total)	750	990	830	640	1,400	170	420	690	360
Total BTEX	1,849	1,320	1,032	640	1,540	208	632	949	770

Reported Quantitation Level = 25 nanograms
U = Below Reported Quantitation Level

Table 1
(continued)
EMFLUX Passive Soil-Gas Survey
Greif Bros. Site
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	C19	C20	C21	C22	C23	C24	C25	C26	C27
COMPOUNDS									
1,1-Dichloroethene	U	U	U	U	U	U	U	61	U
Methylene Chloride	U	U	U	U	U	U	U	U	U
trans-1,2-Dichloroethen	170	U	U	U	U	U	30	U	U
1,1-Dichloroethane	U	57	U	U	U	U	380	820	37
cis-1,2-Dichloroethene	8,100	1,200	470	280	140	U	7,100	3,200	140
Chloroform	U	U	U	U	U	U	U	U	U
1,1,1-Trichloroethane	U	U	U	U	U	U	2,600	2,700	400
Carbon Tetrachloride	U	U	U	U	U	U	U	U	U
1,2-Dichloroethane	U	U	U	U	U	U	170	51	U
Trichloroethene	63	U	U	U	U	U	9,700	5,000	970
Tetrachloroethene	150	U	U	U	U	U	U	200	U
Chlorobenzene	U	U	U	66	U	U	U	U	U
Ethylene Dibromide	U	U	U	U	U	U	U	U	U
Bromoform	U	U	U	U	U	U	U	U	U
MTBE	U	U	U	U	U	U	U	U	U
Benzene	U	120	U	U	44	51	U	82	U
Toluene	200	170	110	74	73	27	31	33	30
Ethylbenzene	490	210	600	450	380	79	42	U	26
Xylenes (total)	1,600	540	1,300	1,100	700	180	93	230	100
Total BTEX	2,290	1,040	2,010	1,624	1,197	337	166	345	156

Reported Quantitation Level = 25 nanograms
U = Below Reported Quantitation Level

Table 1
(continued)
EMFLUX Passive Soil-Gas Survey
Greif Bros. Site
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	C28	C29	C30	C31	C32	C33	C34	C35	C36
COMPOUNDS									
1,1-Dichloroethene	U	U	U	U	U	100	51	U	U
Methylene Chloride	U	U	U	U	U	U	U	U	U
trans-1,2-Dichloroethen	U	U	U	U	U	U	U	U	U
1,1-Dichloroethane	U	120	U	U	U	U	1,100	87	120
cis-1,2-Dichloroethene	91	190	1,200	U	U	6,300	4,100	1,300	870
Chloroform	U	U	U	U	U	U	U	U	U
1,1,1-Trichloroethane	490	U	U	U	U	1,200	1,800	100	U
Carbon Tetrachloride	U	U	U	U	U	U	U	U	U
1,2-Dichloroethane	U	U	U	U	U	U	U	U	U
Trichloroethene	980	400	73	U	U	7,200	6,300	940	1,400
Tetrachloroethene	27	U	U	U	26	37	27	U	U
Chlorobenzene	U	U	U	U	U	U	U	U	U
Ethylene Dibromide	U	U	U	U	U	U	U	U	U
Bromoform	U	U	U	U	U	U	U	U	U
MTBE	U	U	U	U	U	U	U	U	U
Benzene	U	U	46	U	28	U	U	U	U
Toluene	37	U	73	58	55	31	U	U	U
Ethylbenzene	54	U	50	28	130	64	U	42	34
Xylenes (total)	40	85	170	400	450	170	61	150	110
Total BTEX	131	85	339	486	663	265	61	192	144

Reported Quantitation Level = 25 nanograms
U = Below Reported Quantitation Level

Table 1
(continued)
EMFLUX Passive Soil-Gas Survey
Greif Bros. Site
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	C37	C38	C39	C40	C41	C42	C43	C44	C45
COMPOUNDS									
1,1-Dichloroethene	U	41	U	U	74	U	U	U	U
Methylene Chloride	U	U	U	U	U	U	U	U	U
trans-1,2-Dichloroethen	U	U	U	U	U	U	U	U	U
1,1-Dichloroethane	U	150	U	U	1,000	620	210	U	U
cis-1,2-Dichloroethene	210	6,800	370	U	6,400	2,500	1.500	U	U
Chloroform	U	U	U	U	U	U	U	U	U
1,1,1-Trichloroethane	U	U	U	U	260	28	U	U	U
Carbon Tetrachloride	U	U	U	U	U	U	140	U	U
1,2-Dichloroethane	U	U	U	U	36	U	U	U	U
Trichloroethene	580	890	52	U	6,100	2,400	1,200	27	U
Tetrachloroethene	U	U	U	U	31	U	U	U	U
Chlorobenzene	U	U	U	U	U	U	U	U	U
Ethylene Dibromide	U	U	U	U	U	U	U	U	U
Bromoform	U	U	U	U	U	U	U	U	U
MTBE	U	U	U	U	U	U	U	U	U
Benzene	U	U	U	U	U	U	U	53	60
Toluene	U	49	63	38	U	80	53	110	130
Ethylbenzene	U	62	100	42	U	140	140	U	180
Xylenes (total)	U	220	350	100	34	430	U	470	600
Total BTEX	U	331	513	180	34	650	193	633	970

Reported Quantitation Level = 25 nanograms
U = Below Reported Quantitation Level

Table 1
(continued)
EMFLUX Passive Soil-Gas Survey
Greif Bros. Site
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	C46	C47	C48	C49	C50	C51	C52	C53	C54
COMPOUNDS									
1,1-Dichloroethene	U	U	U	U	U	69	390	33	U
Methylene Chloride	U	U	U	U	U	U	U	U	U
trans-1,2-Dichloroethen	U	U	U	U	U	68	U	U	U
1,1-Dichloroethane	220	1,000	U	85	U	1,400	3,900	2,400	U
cis-1,2-Dichloroethene	53	210	U	190	U	620	480	160	U
Chloroform	U	U	U	U	U	U	U	U	U
1,1,1-Trichloroethane	610	2,800	41	U	U	4,000	5,000	3,800	U
Carbon Tetrachloride	U	U	U	U	U	U	U	U	U
1,2-Dichloroethane	U	U	U	U	U	U	U	U	U
Trichloroethene	3,700	4,500	100	25	U	5,700	4,600	3,100	65
Tetrachloroethene	75	440	U	U	U	1,300	1,900	470	U
Chlorobenzene	U	U	U	U	U	47	U	U	U
Ethylene Dibromide	U	U	U	U	U	U	U	U	U
Bromoform	U	U	U	U	U	U	U	U	U
MTBE	U	U	U	U	U	U	U	U	U
Benzene	52	U	U	U	U	43	84	U	U
Toluene	41	50	110	54	U	340	U	49	26
Ethylbenzene	170	49	500	200	310	470	55	82	84
Xylenes (total)	520	290	1,100	840	970	980	230	190	260
Total BTEX	783	389	1,710	1,094	1,280	1,833	369	321	370

Reported Quantitation Level = 25 nanograms
U = Below Reported Quantitation Level

Table 1
(continued)
EMFLUX Passive Soil-Gas Survey
Greif Bros. Site
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	C55	C56	C57	C58	C59	C60	C61	C62	C63
COMPOUNDS									
1,1-Dichloroethene	U	1,000	330	48	44	U	40	U	29
Methylene Chloride	U	U	U	U	U	U	U	U	U
trans-1.2-Dichloroethen	U	U	U	U	U	U	U	U	140
1,1-Dichloroethane	U	1,400	260	97	220	70	420	U	4,500
cis-1,2-Dichloroethene	U	38	U	U	U	U	3,600	6,900	2,100
Chloroform	U	U	U	U	U	U	U	U	U
1,1,1-Trichloroethane	U	9,800	8,500	4,500	4,600	900	110	7,600	780
Carbon Tetrachloride	U	U	U	U	U	U	U	U	U
1,2-Dichloroethane	U	1,800	310	U	U	U	U	2,800	U
Trichloroethene	U	8,600	4,400	390	160	27	3,300	9,400	10,000
Tetrachloroethene	U	6,200	1,900	520	150	33	U	150	390
Chlorobenzene	U	U	U	U	U	U	U	U	U
Ethylene Dibromide	U	U	U	U	U	U	U	U	U
Bromoform	U	U	U	U	U	U	U	U	U
MTBE	U	U	U	U	U	U	U	U	U
Benzene	U	57	U	U	U	U	U	U	U
Toluene	U	U	U	U	U	U	36	U	U
Ethylbenzene	69	25	U	U	U	U	45	45	U
Xylenes (total)	300	U	65	86	U	U	120	200	51
Total BTEX	369	82	65	86	U	U	201	245	51

Reported Quantitation Level = 25 nanograms

U = Below Reported Quantitation Level

Table 1
(continued)
EMFLUX Passive Soil-Gas Survey
Greif Bros. Site
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	C64	C64-D	C65
COMPOUNDS			
1,1-Dichloroethene	U	U	260
Methylene Chloride	U	U	U
trans-1,2-Dichloroethen	U	U	U
1,1-Dichloroethane	320	230	2,700
cis-1,2-Dichloroethene	630	480	860
Chloroform	U	U	U
1,1,1-Trichloroethane	140	160	7,100
Carbon Tetrachloride	U	U	U
1,2-Dichloroethane	U	U	370
Trichloroethene	1,900	990	7,600
Tetrachloroethene	82	98	2,300
Chlorobenzene	U	U	U
Ethylene Dibromide	U	U	U
Bromoform	U	U	U
MTBE	U	U	U
Benzene	U	U	U
Toluene	380	360	U
Ethylbenzene	390	400	300
Xylenes (total)	900	910	440
Total BTEX	1,670	1,670	740

Reported Quantitation Level = 25 nanograms
U = Below Reported Quantitation Level

Table 2

EMFLUX Passive Soil-Gas Survey
Greif Bros. Site
Cullman, AL
Analytical Method: EPA Method 8260
Results in Nanograms (ng)

SAMPLE NO.	B2	B3	B4	B6	B7	B8	B10	B11	B12
COMPOUNDS									
2-Butanone	U	U	155	89	U	U	92	185	U
Chlorobenzene	U	U	U	U	U	U	U	48	U
Chloromethane	82	68	158	64	205	70	147	148	354
Tetrachloroethene	U	U	U	U	U	U	U	U	30
Benzene	U	U	117	26	34	U	30	28	490
Toluene	U	U	204	72	25	U	U	49	945
Ethylbenzene	U	31	59	156	47	U	32	U	316
Xylenes (total)	27	118	168	740	223	U	177	112	640
Total BTEX	27	149	548	994	329	U	239	189	2,391

SAMPLE NO.	B14	B15	B15-D	B16	B18	B19	B20	B22	B23
COMPOUNDS									
2-Butanone	143	18,200	31,800	U	64	2,820	154	U	82
Chlorobenzene	U	U	U	U	U	U	U	U	U
Chloromethane	U	76	201	113	147	227	215	U	60
Tetrachloroethene	U	U	U	26	38	U	U	U	U
Benzene	U	U	29	54	35	89	57	U	38
Toluene	U	55	85	62	85	160	107	33	95
Ethylbenzene	U	1,460	1,500	U	249	233	38	131	169
Xylenes (total)	U	4,860	4,860	36	1,010	975	81	750	715
Total BTEX	U	6,375	6,474	152	1,379	1,457	283	914	1,017

Reported Quantitation Level = 25 nanograms
Reported Quantitation Level = 50 nanograms for 2-Butanone and Chloromethane
U = Below Reported Quantitation Level

Table 2
(continued)
EMFLUX Passive Soil-Gas Survey
Greif Bros. Site
Cullman, AL
Analytical Method: EPA Method 8260
Results in Nanograms (ng)

SAMPLE NO.	B24	B26	B27
COMPOUNDS			
2-Butanone	U	U	U
Chlorobenzene	U	U	U
Chloromethane	258	U	79
Tetrachloroethene	U	40	U
Benzene	153	U	33
Toluene	377	U	52
Ethylbenzene	229	34	U
Xylenes (total)	605	231	37
Total BTEX	1,364	265	122

Reported Quantitation Level = 25 nanograms
Reported Quantitation Level = 50 nanograms for 2-Butanone and Chloromethane
U = Below Reported Quantitation Level

Attachment 1

BEACON Laboratory Report

EPA Method 8021

Attachment 1

Greif Bros. Site
409 and 601 2nd Avenue NE
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	A1	A2	A3	A4	A5	A6	A7	A8
COMPOUNDS								
1,1-Dichloroethene	U	U	U	U	U	U	U	U
Methylene Chloride	U	U	U	U	U	U	U	180
trans-1,2-Dichloroethene	U	U	U	U	U	U	U	U
1,1-Dichloroethane	U	U	U	U	U	U	U	U
cis-1,2-Dichloroethene	U	U	U	U	U	U	U	U
Chloroform	U	U	U	U	U	U	U	U
1,1,1-Trichloroethane	55	U	U	U	U	U	U	U
Carbon Tetrachloride	U	U	U	U	U	U	U	U
1,2-Dichloroethane	U	U	U	U	U	U	U	U
Trichloroethene	U	U	U	U	U	U	U	U
1,1,2-Trichloroethane	U	U	U	U	U	U	U	U
Tetrachloroethene	U	U	U	U	U	64	38	37
Chlorobenzene	U	U	U	U	U	U	U	U
Ethylene Dibromide	U	U	U	U	U	U	U	U
Bromoform	U	U	U	U	U	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U	U	U	U	U	U
MTBE	U	U	U	U	U	U	U	U
Benzene	U	U	U	U	U	U	U	U
Toluene	76	U	U	U	52	U	U	54
Ethylbenzene	290	U	U	29	300	38	39	290
Xylenes (total)	850	97	120	130	940	160	140	960
Total BTEX	1,216	97	120	159	1,292	198	179	1,304

Reported Quantitation Level = 25 nanograms

U = Below Reported Quantitation Level

Attachment 1
(continued)
Greif Bros. Site
409 and 601 2nd Avenue NE
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	A8-D	B1	B5	B9	B13	B17	B21	B25
COMPOUNDS								
1,1-Dichloroethene	U	U	U	U	U	U	U	U
Methylene Chloride	120	U	U	U	U	U	U	U
trans-1,2-Dichloroethene	U	U	U	U	U	U	U	U
1,1-Dichloroethane	U	U	U	U	U	U	U	U
cis-1,2-Dichloroethene	U	U	U	U	U	U	U	U
Chloroform	U	U	U	U	U	U	U	U
1,1,1-Trichloroethane	U	U	U	U	U	U	U	U
Carbon Tetrachloride	U	U	U	U	U	U	U	U
1,2-Dichloroethane	U	U	U	U	U	U	U	U
Trichloroethene	U	U	U	U	U	31	U	U
1,1,2-Trichloroethane	U	U	U	U	U	U	U	U
Tetrachloroethene	30	U	U	U	110	42	59	270
Chlorobenzene	U	U	U	U	U	U	U	U
Ethylene Dibromide	U	U	U	U	U	U	U	U
Bromoform	U	U	U	U	U	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U	U	U	U	U	U
MTBE	U	U	U	U	U	U	U	U
Benzene	U	U	U	U	U	U	U	U
Toluene	27	U	U	35	U	50	64	29
Ethylbenzene	210	U	44	32	35	75	150	360
Xylenes (total)	840	110	120	83	110	250	480	390
Total BTEX	1,077	110	164	150	145	375	694	779

Reported Quantitation Level = 25 nanograms
U = Below Reported Quantitation Level

Attachment 1
(continued)
Greif Bros. Site
409 and 601 2nd Avenue NE
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	B25-D	B28	B29	B30	B31	B32	C1	C2
COMPOUNDS								
1,1-Dichloroethene	U	U	U	U	U	U	U	U
Methylene Chloride	U	U	U	U	U	U	U	U
trans-1,2-Dichloroethene	U	U	U	U	U	U	U	U
1,1-Dichloroethane	U	U	U	U	U	U	U	U
cis-1,2-Dichloroethene	U	U	U	U	U	U	200	U
Chloroform	U	U	U	U	U	U	U	U
1,1,1-Trichloroethane	U	U	U	U	U	U	U	U
Carbon Tetrachloride	U	U	U	U	U	U	U	U
1,2-Dichloroethane	U	U	U	U	U	U	U	U
Trichloroethene	U	U	U	U	U	U	370	170
1,1,2-Trichloroethane	U	U	U	U	U	U	U	U
Tetrachloroethene	200	U	U	U	U	U	250	320
Chlorobenzene	U	U	U	U	U	U	U	U
Ethylene Dibromide	U	U	U	U	U	U	U	U
Bromoform	U	U	U	U	U	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U	U	U	U	U	U
MTBE	U	U	U	U	U	U	U	U
Benzene	U	U	U	U	U	U	U	U
Toluene	35	100	47	95	56	U	96	29
Ethylbenzene	100	99	130	80	29	U	76	220
Xylenes (total)	310	230	530	210	120	U	300	1,400
Total BTEX	445	429	707	385	205	U	472	1,649

Reported Quantitation Level = 25 nanograms
U = Below Reported Quantitation Level

Attachment 1
(continued)
Greif Bros. Site
409 and 601 2nd Avenue NE
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	C3	C4	C5	C6	C7	C8	C9	C10
COMPOUNDS								
1,1-Dichloroethene	U	26	U	U	U	U	U	U
Methylene Chloride	U	360	U	U	U	U	U	U
trans-1,2-Dichloroethene	U	U	U	U	U	U	U	U
1,1-Dichloroethane	U	310	U	U	280	U	U	U
cis-1,2-Dichloroethene	U	8,700	220	U	190	100	U	1,100
Chloroform	U	U	U	U	U	U	U	U
1,1,1-Trichloroethane	2,200	1,700	U	48	U	U	U	U
Carbon Tetrachloride	U	U	U	U	U	U	U	U
1,2-Dichloroethane	U	U	U	U	U	U	U	U
Trichloroethene	2,200	8,600	570	52	100	86	110	72
1,1,2-Trichloroethane	U	U	U	U	U	U	U	U
Tetrachloroethene	91	2,000	160	45	44	370	56	U
Chlorobenzene	U	U	U	U	U	U	U	U
Ethylene Dibromide	750	U	U	U	U	U	U	U
Bromoform	U	U	U	U	U	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U	U	U	U	U	U
MTBE	U	U	U	U	U	U	U	U
Benzene	U	U	42	33	27	U	56	400
Toluene	U	62	76	67	39	61	U	69
Ethylbenzene	U	130	110	120	130	110	410	630
Xylenes (total)	560	530	290	390	540	420	660	750
Total BTEX	560	722	518	610	736	591	1,126	1,849

Reported Quantitation Level = 25 nanograms
U = Below Reported Quantitation Level

Attachment 1
(continued)
Greif Bros. Site
409 and 601 2nd Avenue NE
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	C11	C12	C13	C14	C15	C16	C17	C18
COMPOUNDS								
1,1-Dichloroethene	U	52	U	U	U	U	U	U
Methylene Chloride	U	U	U	U	U	U	U	U
trans-1,2-Dichloroethene	34	950	76	U	U	U	U	82
1,1-Dichloroethane	U	150	400	60	U	U	340	150
cis-1,2-Dichloroethene	3,200	4,900	3,000	190	U	U	180	760
Chloroform	U	U	U	U	U	U	U	U
1,1,1-Trichloroethane	U	U	U	U	U	U	U	U
Carbon Tetrachloride	U	U	U	U	U	U	37	U
1,2-Dichloroethane	U	U	U	U	U	U	U	U
Trichloroethene	200	1,700	170	37	U	U	U	U
1,1,2-Trichloroethane	U	U	U	U	U	U	U	U
Tetrachloroethene	71	490	86	U	U	83	58	U
Chlorobenzene	U	U	U	U	U	U	U	U
Ethylene Dibromide	U	U	U	U	U	U	U	U
Bromoform	U	U	55	U	U	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U	U	U	U	U	U
MTBE	U	96	U	U	U	U	U	U
Benzene	U	150	U	U	U	U	U	51
Toluene	220	52	U	140	38	72	79	79
Ethylbenzene	110	U	U	U	U	140	180	280
Xylenes (total)	990	830	640	1,400	170	420	690	360
Total BTEX	1,320	1,032	640	1,540	208	632	949	770

Reported Quantitation Level = 25 nanograms
U = Below Reported Quantitation Level

Attachment 1
(continued)
Greif Bros. Site
409 and 601 2nd Avenue NE
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	C19	C20	C21	C22	C23	C24	C25	C26
COMPOUNDS								
1,1-Dichloroethene	U	U	U	U	U	U	U	61
Methylene Chloride	U	U	U	U	U	U	U	U
trans-1,2-Dichloroethene	170	U	U	U	U	U	30	U
1,1-Dichloroethane	U	57	U	U	U	U	380	820
cis-1,2-Dichloroethene	8,100	1,200	470	280	140	U	7,100	3,200
Chloroform	U	U	U	U	U	U	U	U
1,1,1-Trichloroethane	U	U	U	U	U	U	2,600	2,700
Carbon Tetrachloride	U	U	U	U	U	U	U	U
1,2-Dichloroethane	U	U	U	U	U	U	170	51
Trichloroethene	63	U	U	U	U	U	9,700	5,000
1,1,2-Trichloroethane	U	U	U	U	U	U	U	U
Tetrachloroethene	150	U	U	U	U	U	U	200
Chlorobenzene	U	U	U	66	U	U	U	U
Ethylene Dibromide	U	U	U	U	U	U	U	U
Bromoform	U	U	U	U	U	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U	U	U	U	U	U
MTBE	U	U	U	U	U	U	U	U
Benzene	U	120	U	U	44	51	U	82
Toluene	200	170	110	74	73	27	31	33
Ethylbenzene	490	210	600	450	380	79	42	U
Xylenes (total)	1,600	540	1,300	1,100	700	180	93	230
Total BTEX	2,290	1,040	2,010	1,624	1,197	337	166	345

Reported Quantitation Level = 25 nanograms
U = Below Reported Quantitation Level

Attachment 1
(continued)
Greif Bros. Site
409 and 601 2nd Avenue NE
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	C27	C28	C29	C30	C31	C32	C33	C34
COMPOUNDS								
1,1-Dichloroethene	U	U	U	U	U	U	100	51
Methylene Chloride	U	U	U	U	U	U	U	U
trans-1,2-Dichloroethene	U	U	U	U	U	U	U	U
1,1-Dichloroethane	37	U	120	U	U	U	U	1,100
cis-1,2-Dichloroethene	140	91	190	1,200	U	U	6,300	4,100
Chloroform	U	U	U	U	U	U	U	U
1,1,1-Trichloroethane	400	490	U	U	U	U	1,200	1,800
Carbon Tetrachloride	U	U	U	U	U	U	U	U
1,2-Dichloroethane	U	U	U	U	U	U	U	U
Trichloroethene	970	980	400	73	U	U	7,200	6,300
1,1,2-Trichloroethane	U	U	U	U	U	U	U	U
Tetrachloroethene	U	27	U	U	U	26	37	27
Chlorobenzene	U	U	U	U	U	U	U	U
Ethylene Dibromide	U	U	U	U	U	U	U	U
Bromoform	U	U	U	U	U	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U	U	U	U	U	U
MTBE	U	U	U	U	U	U	U	U
Benzene	U	U	U	46	U	28	U	U
Toluene	30	37	U	73	58	55	31	U
Ethylbenzene	26	54	U	50	28	130	64	U
Xylenes (total)	100	40	85	170	400	450	170	61
Total BTEX	156	131	85	339	486	663	265	61

Reported Quantitation Level = 25 nanograms
U = Below Reported Quantitation Level

Attachment 1
(continued)
Greif Bros. Site
409 and 601 2nd Avenue NE
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	C35	C36	C37	C38	C39	C40	C41	C42
COMPOUNDS								
1,1-Dichloroethene	U	U	U	41	U	U	74	U
Methylene Chloride	U	U	U	U	U	U	U	U
trans-1,2-Dichloroethene	U	U	U	U	U	U	U	U
1,1-Dichloroethane	87	120	U	150	U	U	1,000	620
cis-1,2-Dichloroethene	1,300	870	210	6,800	370	U	6,400	2,500
Chloroform	U	U	U	U	U	U	U	U
1,1,1-Trichloroethane	100	U	U	U	U	U	260	28
Carbon Tetrachloride	U	U	U	U	U	U	U	U
1,2-Dichloroethane	U	U	U	U	U	U	36	U
Trichloroethene	940	1,400	580	890	52	U	6,100	2,400
1,1,2-Trichloroethane	U	U	U	U	U	U	U	U
Tetrachloroethene	U	U	U	U	U	U	31	U
Chlorobenzene	U	U	U	U	U	U	U	U
Ethylene Dibromide	U	U	U	U	U	U	U	U
Bromoform	U	U	U	U	U	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U	U	U	U	U	U
MTBE	U	U	U	U	U	U	U	U
Benzene	U	U	U	U	U	U	U	U
Toluene	U	U	U	49	63	38	U	80
Ethylbenzene	42	34	U	62	100	42	U	140
Xylenes (total)	150	110	U	220	350	100	34	430
Total BTEX	192	144	U	331	513	180	34	650

Reported Quantitation Level = 25 nanograms
U = Below Reported Quantitation Level

Attachment 1
(continued)
Greif Bros. Site
409 and 601 2nd Avenue NE
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	C43	C44	C45	C46	C47	C48	C49	C50
COMPOUNDS								
1,1-Dichloroethene	U	U	U	U	U	U	U	U
Methylene Chloride	U	U	U	U	U	U	U	U
trans-1,2-Dichloroethene	U	U	U	U	U	U	U	U
1,1-Dichloroethane	210	U	U	220	1,000	U	85	U
cis-1,2-Dichloroethene	1,500	U	U	53	210	U	190	U
Chloroform	U	U	U	U	U	U	U	U
1,1,1-Trichloroethane	U	U	U	610	2,800	41	U	U
Carbon Tetrachloride	140	U	U	U	U	U	U	U
1,2-Dichloroethane	U	U	U	U	U	U	U	U
Trichloroethene	1,200	27	U	3,700	4,500	100	25	U
1,1,2-Trichloroethane	U	U	U	U	U	U	U	U
Tetrachloroethene	U	U	U	75	440	U	U	U
Chlorobenzene	U	U	U	U	U	U	U	U
Ethylene Dibromide	U	U	U	U	U	U	U	U
Bromoform	U	U	U	U	U	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U	U	U	U	U	U
MTBE	U	U	U	U	U	U	U	U
Benzene	U	53	60	52	U	U	U	U
Toluene	53	110	130	41	50	110	54	U
Ethylbenzene	140	U	180	170	49	500	200	310
Xylenes (total)	U	470	600	520	290	1,100	840	970
Total BTEX	193	633	970	783	389	1,710	1,094	1,280

Reported Quantitation Level = 25 nanograms
U = Below Reported Quantitation Level

Table 5-1 Summary of Soil Analyses
Greif Bros. Corporation, Cullman, Alabama

Boring Number		SB-DW1	Rinse Blank	SB-DW2	SB-DW4	SB-5	SB-5 (d)	SB-6	SB-7	SB-8	SB-9	SB-10	SB-11	SB-12	MW-4 cuttings
Sample ID		8185-001	8185-002	8185-003	8185-004	8185-005	8185-006	8185-007	8185-008	8185-009	8185-010	8185-011	8185-012	8185-013	8185-014
Sample Matrix		Soil	Water	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Sample Interval (feet)		6.5-8.5'	NA	3-5'	6-7'	0-4'	0-4'	4-7'	0-4'	4-8'	4-8'	0-4.5'	0-4'	4-6'	9-10'
Sample Date		04/02/02	04/02/02	04/02/02	04/03/02	04/08/02	04/08/02	04/08/02	04/08/02	04/08/02	04/08/02	04/08/02	04/08/02	04/08/02	04/09/02
Regulatory "Standards"	PRGs ^{1}/ RBSLs ^{4}														
TPH (8015B)	mg/kg														
TPH (gasoline range)	100	–	–	–	–	14.1	9.51	–	–	–	–	–	–	–	35.6
TPH (diesel range)	100	–	–	–	–	–	–	134	20.6	93.6	–	–	–	–	29.4
SVOCs (8270C)	mg/kg														
2-Methylnaphthalene	N	–	–	–	–	–	–	–	–	–	–	–	–	–	0.924
Naphthalene $^{1(A),5}$	84	–	–	–	–	–	–	–	1.05	–	–	–	–	–	2.81
VOCs (8260B)	mg/kg														
Acetone $^{1(A)}$	16	–	–	–	–	–	–	–	0.085	–	–	–	–	–	–
Benzene $^{1(A),2}$	0.03	–	–	–	–	–	–	–	0.0028	–	–	–	–	–	–
2-Butanone	N	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Carbon Disulfide $^{1(A), 1(A)W}$	32	–	–	–	–	–	–	–	–	0.0029	–	–	–	–	–
Chloroethane $^{1, 1(A)W}$	6.5	–	–	–	–	–	–	–	–	0.142	–	–	0.0074	–	–
1,1-Dichloroethane $^{1(A), 1(A)W}$	23	–	–	–	–	–	–	–	–	0.0253	0.0057	–	2.88	–	–
1,2-Dichloroethane $^{1(A),2}$	0.02	–	–	–	–	–	–	–	–			–	–	–	–
1,1-Dichloroethene $^{1(A),2}$	0.06	–	–	–	–	–	–	–	–	0.0099	0.0034	–	–	–	0.0037
cis-1,2-dichloroethene $^{1(A),2}$	0.4	–	–	–	–	–	–	–	0.0371	2.28	0.0362	0.194	0.0323	–	1.77
trans-1,2-dichloroethene $^{1(A),2}$	0.7	–	–	–	–	–	–	–	–	–	–	–	0.0082	–	–
1,1,1-Trichloroethane $^{1(A),2}$	2	–	–	–	–	–	–	–	–	–	–	–	–	–	0.0075
Trichloroethene $^{1(A),2}$	0.06	–	–	–	–	–	–	–	–	–	0.0588	0.0125	0.0095	–	9.35
Tetrachloroethene $^{1(A)}$	0.06	–	–	–	–			–	–	–	–	–	–	–	0.0059
Ethylbenzene $^{1(A),2,5}$	13	–	–	–	–	0.0187	162	–	0.362	0.0273	–	–	–	–	0.108
4-Methyl-2-Pentanone	N	–	–	–	–	–	–	–	0.0651	–	–	–	–	–	
Toluene $^{1(A),2}$	12	–	–	–	–	–	–	–	0.35	–	–	–	0.0123	–	0.0061
Vinyl Chloride $^{1(A),2}$	0.01	–	–	–	–	–	–	–	0.02	0.16	–	0.01	0.61	–	0.0084
Xylenes (total) $^{1(A),2,5}$	210	–	–	–	–	0.446	1340	–	1.26	0.0496	–			–	7.64
Methylene Chloride		–	123	–	–	–		–	–	–	–	–	–	–	–

Table 5-1 Summary of Soil Analyses
Greif Bros. Corporation, Cullman, Alabama

Boring Number			SB-DW1	Rinse Blank	SB-DW2	SB-DW4	SB-5	SB-5 (d)	SB-6	SB-7	SB-8	SB-9	SB-10	SB-11	SB-12	MW-4 cuttings
Sample ID			8185-001	8185-002	8185-003	8185-004	8185-005	8185-006	8185-007	8185-008	8185-009	8185-010	8185-011	8185-012	8185-013	8185-014
Sample Matrix			Soil	Water	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Sample Interval (feet)			6.5-8.5'	NA	3-5'	6-7'	0-4'	0-4'	4-7'	0-4'	4-8'	4-8'	0-4.5'	0-4'	4-6'	9-10'
Sample Date			04/02/02	04/02/02	04/02/02	04/03/02	04/08/02	04/08/02	04/08/02	04/08/02	04/08/02	04/08/02	04/08/02	04/08/02	04/08/02	04/09/02
TAL Metals	mg/kg															
Aluminum [1]		100,000	16,800	–	9,540	18,300	12,900	14,500	14,000	17,800	12,600	17,400	9,970	22,300	16,500	21,800
Antimony [1(A)]		5	–	–	--	–	–	–	–	–	–	–	–	–	--	–
Arsenic [4]		11	12	–	2	9	2	0	31	6	8	16	16	7	3	8
Barium [1(A)]		1,600	48	--	21	40	52	35	31	50	37	412	208	36	55	56
Beryllium [1(A)]		63		–	–	–	–	–	–	--	–	–	–	–	–	–
Cadmium [1(A)]		8	2	–	–	3	–	–	–	–	–	–	–	–	–	–
Calcium	N		41	–	118	655	1,330	886	119	445	947	312	796	2,450	3,260	1,230
Chromium(total) [1]		38	27	--	9	26	14	16	40	20	21	32	17	34	18	28
Cobalt [1]		100,000	2	–	2	3	2	2	1	3	2	3	3	2	2	3
Copper [1]		75,908	4	--	–	–	3	3	2	8	3	6	12	16	3	1,190
Iron [1]		100,000	19,000	269	8,250	33,300	9,090	10,700	39,300	15,500	17,800	43,600	37,100	30,200	12,100	26,100
Lead [4]		400	12	–	4	9	8	6	8	12	8	19	23	17	5.5	94
Magnesium	N		719	--	359	563	642	570	455	798	533	483	380	464	850	947
Manganese [1]		32,250	8	–	15	24	38	99	15	44	18	64	109	29	101	31
Mercury [1]		613	–	--	–	–	–	–	–	–	–	–	--	–	–	--
Nickel [1(A)]		130	7	--	2	9	5	5	2	6	2	18	13	5	4	9
Potassium	N		3,420	–	329	674	427	642	493	899	515	2,030	1,160	598	1,050	1,640
Selenium [1(A)]		5	–	–	--	--	–	–	2	–	–	2	–	–	–	--
Silver [1(A)]		34	–	--	–	--	–	–	--	–	–	–	–	–	–	–
Sodium	N		194	--	180	271	196		17	28	–	20	–	–	17	471
Thallium [1]		135		–	–	–	–	–	--	–	–	–	–	–	--	--
Vanadium [1(A)]		6,000	25	-	21	39	24	29	82	36	37	52	32	55	30	43
Zinc [1(A)]		120,000	12	–	10	17	14	–	--	40	–	21	27	17	–	77

Table 5-1 Summary of Soil Analyses
Greif Bros. Corporation, Cullman, Alabama

Attorney-Client Priveledged

Boring Number		SB-DW1	Rinse Blank	SB-DW2	SB-DW4	SB-5	SB-5 (d)	SB-6	SB-7	SB-8	SB-9	SB-10	SB-11	SB-12	MW-4 cuttings
Sample ID		8185-001	8185-002	8185-003	8185-004	8185-005	8185-006	8185-007	8185-008	8185-009	8185-010	8185-011	8185-012	8185-013	8185-014
Sample Matrix		Soil	Water	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Sample Interval (feet)		6.5-8.5'	NA	3-5'	6-7'	0-4'	0-4'	4-7'	0-4'	4-8'	4-8'	0-4.5'	0-4'	4-6'	9-10'
Sample Date		04/02/02	04/02/02	04/02/02	04/03/02	04/08/02	04/08/02	04/08/02	04/08/02	04/08/02	04/08/02	04/08/02	04/08/02	04/08/02	04/09/02
PCB's	mg/kg														
Aroclor 1016		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1221		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1232		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1242		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1248		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1254		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1260		--	--	--	--	--	--	--	--	--	--	--	--	--	--

[1] USEPA Region IX Industrial Soil Preliminary Remediation Goals for year 2000.

[1(A)] Soil Screening Level with DAF of 20.

[1(A)W] PRG for tapwater ingestion

[2] National Primary Drinking Water Standards

[3] Secondary Drinking Water Standards

[4] ADEM Risk Based Screening Levels (levels are for surficial soils only)

[5] ADEM Risk Based Screening Levels (tapwater ingestion)

N= No standard

Table 5-2 Summary of Water Analyses
Greif Bros. Corporation, Cullman, Alabama

Attorney-Client Priveledged

Well Number		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	DW-1	DW-2	DW-3	DW-4	Sump
Sample ID		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	DW-1	DW-2	DW-3	DW-4	PIT-1
Water Bearing Zone		Overburden	Overburden	Overburden	Overburden	Overburden	Overburden	Bedrock	Bedrock	Bedrock	Bedrock	Surface
Screened Interval (feet)		2.75 - 7.75	3.30 - 8.30	1.35 - 6.35	5.71 - 10.71	3.30 - 8.30	2.05 - 4.05	27.2 - 37.2	47.47 - 62.47	27.78 - 37.78	open	
Total Depth		7.75	8.3	6-Jan	10.7	8.3	4.05	37.2	62.47	37.78	70.98	
Top of Casing Elevation MSL)		803.38	803.98	804.11	806.65	794.83	801.97	810.96	804.44	795.74	796.84	
Sample Date		05/02/02	05/02/02	05/02/02	05/02/02	05/02/02	05/08/02	05/03/02	05/03/02	05/03/02	05/03/02	05/03/02
Regulatory "Standards"												
TPH (8015B)	ug/l											
TPH (gasoline range)	N	263	--	21,200	56,300	14	10	--	--	--	--	259
TPH (diesel range)	N	--	--	178	6,090	102	--	--	129	234	--	3,890
SVOCs (8270C)-Detects Only	ug/l											
Naphthalene [4]	20				456							
VOCs (8260B)-Detects Only	ug/l											
1,1,1-Trichloroethane [2]	200	--	--	524	--	--	--	--	--	--	--	--
,1,2-Trichloroethane [2]	5	--	--	44	156	--	--	--	--	--	--	--
,1-Dichloroethane [1(A)W]	811	--	--	6,340	--	--	15.8	--	--	--	--	25.7
,1-Dichloroethene [2]	7	28.3	--	8,920	112	--	8.5	--	--	--	--	--
,2,4 trimethylbenzene [1(A)W]	12.33	--	--	--	1,510	--	--	--	--	--	--	--
,3,5 trimethylbenzene [1(A)W]	12.33	--	--	--	536	--	--	--	--	--	--	--
Benzene [2]	5	--	--	--	--	--	--	--	--	--	--	--
Chloroethane [1(A)W]	4.63	--	17.4	--	--	--	--	--	--	--	--	--
cis-1,2-dichloroethene [2]	70	174	31.2	12,200	15,800	--	1,660	--	--	--	--	317
Ethylbenzene [2,5]	700	--	--	--	310	--	--	--	--	--	--	--
Isopropylbenzene [1(A)W]	658.20	--	--	--	110	--	--	--	--	--	--	--
Naphthalene [4]	20				360							
n-propylbenzene [1(A)W]	60.83	--	--	--	232	--	--	--	--	--	--	--
Tetrachloroethene 2	5	--		52	98	--	--	--	--	--	--	--
Toluene [2]	1,000	--	--	154	--	--	--	--	--	--	--	--
trans-1,2-dichloroethene [2]	100	2.7	--	--	--	--	6	--	--	--	--	3.7
Trichloroethene [2]	5	341	7.5	21,600	88,600	--	178	--	--	--	--	185
Vinyl Chloride [2]	2	3.5	5.8	548	48	2.4	250	--	--	--	--	6.4
Xylenes (total) [5]	10,000	--	--	--	1,650	--	--	--	--	--	--	--

Table 5-2 Summary of Water Analyses
Greif Bros. Corporation, Cullman, Alabama

Attorney-Client Priveledged

Well Number		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	DW-1	DW-2	DW-3	DW-4	Sump
Sample ID		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	DW-1	DW-2	DW-3	DW-4	PIT-1
Water Bearing Zone		Overburden	Overburden	Overburden	Overburden	Overburden	Overburden	Bedrock	Bedrock	Bedrock	Bedrock	Surface
Screened Interval (feet)		2.75 - 7.75	3.30 - 8.30	1.35 - 6.35	5.71 - 10.71	3.30 - 8.30	2.05 - 4.05	27.2 - 37.2	47.47 - 62.47	27.78 - 37.78	open	
Total Depth		7.75	8.3	6-Jan	10.7	8.3	4.05	37.2	62.47	37.78	70.98	
Top of Casing Elevation MSL)		803.38	803.98	804.11	806.65	794.83	801.97	810.96	804.44	795.74	796.84	
Sample Date		05/02/02	05/02/02	05/02/02	05/02/02	05/02/02	05/08/02	05/03/02	05/03/02	05/03/02	05/03/02	05/03/02
TAL Metals (all)	ug/l											
Aluminum[3]	200	376	1,210	167	1,580	390	4,050	201	540	7,840	562	--
Antimony[2]	6	--	--	--	--	--	--	--	--	--	--	--
Arsenic[4]	50	--	--	--	--	--	8	--	--	7	43	--
Barium[2]	2,000	51	99	67	87	162	19	60	64	81	267	--
Beryllium[2]	4	--	--	--	--	--	--	--	--	--	--	--
Cadmium[2]	5	--	--	--	--	--	--	--	--	--	--	--
Calcium	N	--	--	--	--	--	--	--	--	--	--	--
Chromium(total)[2]	100	--	--	--	--	7	7	--	--	20	--	--
Cobalt[1(A)W]	2,190	--	--	--	--	--	--	--	--	--	--	--
Copper[2]	1,300	--	--	--	12	--	--	--	--	--	--	--
Iron[3]	300	8,650	9,780	1,300	7,690	27,000	1,610	10,400	11,500	25,300	1,270	--
Lead[4] (action level)	15	--	--	--	--	23	--	--	--	9	--	--
Magnesium	N	--	--	--	--	--	16	--	--	--	--	--
Manganese[3]	50	579	384	434	122	812	--	363	377	--	191	--
Mercury[2]	2	--	--	--	--	--	--	--	--	--	--	--
Nickel[1(A)W]	N	--	--	--	--	--	--	--	--	25	16	--
Potassium	N	5,840	18,100	6,830	3,380	14,600	8,630	--	1,110	3,600	9,630	--
Selenium[2]	50	--	--	--	--	--	14	--	--	--	--	--
Silver[3]	100	--	--	--	--	--	--	--	--	--	--	--
Sodium	N	4,870	7,850	14,400	15,500	49,500	24,700	7,980	8,040	23,600	13,900	--
Thallium[2]	2	--	--	--	--	--	--	--	--	--	--	--
Vanadium	N	--	--	--	--	--	26	--	--	--	--	--
Zinc[3]	5,000	26	--	--	35	86	34	--	--	67	--	--

Table 5-2 Summary of Water Analyses
Greif Bros. Corporation, Cullman, Alabama

Well Number		**MW-1**	**MW-2**	MW-3	**MW-4**	MW-5	**MW-6**	DW-1	DW-2	DW-3	DW-4	Sump
Sample ID		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	DW-1	DW-2	DW-3	DW-4	PIT-1
Water Bearing Zone		Overburden	Overburden	Overburden	Overburden	Overburden	Overburden	Bedrock	Bedrock	Bedrock	Bedrock	Surface
Screened Interval (feet)		2.75 - 7.75	3.30 - 8.30	1.35 - 6.35	5.71 - 10.71	3.30 - 8.30	2.05 - 4.05	27.2 - 37.2	47.47 - 62.47	27.78 - 37.78	open	
Total Depth		7.75	8.3	6-Jan	10.7	8.3	4.05	37.2	62.47	37.78	70.98	
Top of Casing Elevation MSL)		803.38	803.98	804.11	806.65	794.83	801.97	810.96	804.44	795.74	796.84	
Sample Date		05/02/02	05/02/02	05/02/02	05/02/02	05/02/02	05/08/02	05/03/02	05/03/02	05/03/02	05/03/02	05/03/02
PCB's	ug/l											
Aroclor 1016 [2]	0.5	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1221 [2]	0.5	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1232 [2]	0.5	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1242 [2]	0.5	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1248 [2]	0.5	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1254 [2]	0.5	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1260 [2]	0.5	--	—	--	--	--	--	--	--	--	--	--

[1(A)W] PRG for tapwater ingestion

[2] National Primary Drinking Water Standards

[3] Secondary Drinking Water Standards

[4] ADEM Risk Based Screening Levels (tapwater ingestion)

N= No standard

----- Not Detected

Attachment 1
(continued)
Greif Bros. Site
409 and 601 2nd Avenue NE
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	C51	C52	C53	C54	C55	C56	C57	C58
COMPOUNDS								
1,1-Dichloroethene	69	390	33	U	U	1,000	330	48
Methylene Chloride	U	U	U	U	U	U	U	U
trans-1,2-Dichloroethene	68	U	U	U	U	U	U	U
1,1-Dichloroethane	1,400	3,900	2,400	U	U	1,400	260	97
cis-1,2-Dichloroethene	620	480	160	U	U	38	U	U
Chloroform	U	U	U	U	U	U	U	U
1,1,1-Trichloroethane	4,000	5,000	3,800	U	U	9,800	8,500	4,500
Carbon Tetrachloride	U	U	U	U	U	U	U	U
1,2-Dichloroethane	U	U	U	U	U	1,800	310	U
Trichloroethene	5,700	4,600	3,100	65	U	8,600	4,400	390
1,1,2-Trichloroethane	U	U	U	U	U	U	U	U
Tetrachloroethene	1,300	1,900	470	U	U	6,200	1,900	520
Chlorobenzene	47	U	U	U	U	U	U	U
Ethylene Dibromide	U	U	U	U	U	U	U	U
Bromoform	U	U	U	U	U	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U	U	U	U	U	U
MTBE	U	U	U	U	U	U	U	U
Benzene	43	84	U	U	U	57	U	U
Toluene	340	U	49	26	U	U	U	U
Ethylbenzene	470	55	82	84	69	25	U	U
Xylenes (total)	980	230	190	260	300	U	65	86
Total BTEX	1,833	369	321	370	369	82	65	86

Reported Quantitation Level = 25 nanograms
U = Below Reported Quantitation Level

Attachment 1

(continued)
Greif Bros. Site
409 and 601 2nd Avenue NE
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	C59	C60	C61	C62	C63	C64	C64-D	C65
COMPOUNDS								
1,1-Dichloroethene	44	U	40	U	29	U	U	260
Methylene Chloride	U	U	U	U	U	U	U	U
trans-1,2-Dichloroethene	U	U	U	U	140	U	U	U
1,1-Dichloroethane	220	70	420	U	4,500	320	230	2,700
cis-1,2-Dichloroethene	U	U	3,600	6,900	2,100	630	480	860
Chloroform	U	U	U	U	U	U	U	U
1,1,1-Trichloroethane	4,600	900	110	7,600	780	140	160	7,100
Carbon Tetrachloride	U	U	U	U	U	U	U	U
1,2-Dichloroethane	U	U	U	2,800	U	U	U	370
Trichloroethene	160	27	3,300	9,400	10,000	1,900	990	7,600
1,1,2-Trichloroethane	U	U	U	U	U	U	U	U
Tetrachloroethene	150	33	U	150	390	82	98	2,300
Chlorobenzene	U	U	U	U	U	U	U	U
Ethylene Dibromide	U	U	U	U	U	U	U	U
Bromoform	U	U	U	U	U	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U	U	U	U	U	U
MTBE	U	U	U	U	U	U	U	U
Benzene	U	U	U	U	U	U	U	U
Toluene	U	U	36	U	U	380	360	U
Ethylbenzene	U	U	45	45	U	390	400	300
Xylenes (total)	U	U	120	200	51	900	910	440
Total BTEX	U	U	201	245	51	1,670	1,670	740

Reported Quantitation Level = 25 nanograms
U = Below Reported Quantitation Level

Attachment 1
(continued)
Greif Bros. Site
409 and 601 2nd Avenue NE
Cullman, AL
Analytical Method: EPA Method 8021
Results in Nanograms (ng)

SAMPLE NO.	TRIP-1	TRIP-2	TRIP-3
COMPOUNDS			
1,1-Dichloroethene	U	U	U
Methylene Chloride	U	U	U
trans-1,2-Dichloroethene	U	U	U
1,1-Dichloroethane	U	U	U
cis-1,2-Dichloroethene	U	U	U
Chloroform	U	U	U
1,1,1-Trichloroethane	U	U	U
Carbon Tetrachloride	U	U	U
1,2-Dichloroethane	U	U	U
Trichloroethene	U	U	U
1,1,2-Trichloroethane	U	U	U
Tetrachloroethene	U	U	U
Chlorobenzene	U	U	U
Ethylene Dibromide	U	U	U
Bromoform	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U
MTBE	U	U	U
Benzene	U	U	U
Toluene	U	U	U
Ethylbenzene	U	U	U
Xylenes (total)	U	U	U
Total BTEX	U	U	U

Reported Quantitation Level = 25 nanograms
U = Below Reported Quantitation Level

Attachment 2

MSS Laboratory Report

MARYLAND SPECTRAL SERVICES, INC.

1500 Caton Center Drive Baltimore, MD 21227

VOLATILE ORGANICS BY EPA GC/MS METHOD MODIFIED 8260

CLIENT SAMPLE ID:	B2	B3	B4	B6	B7	B8
	EM1386	EM1386	EM1386	EM1386	EM1386	EM1386
LAB SAMPLE ID	02021516	02021517	02021518	02021519	02021520	02021521
RECEIVED DATE	02/15/02	02/15/02	02/15/02	02/15/02	02/15/02	02/15/02
ANALYSIS DATE	02/15/02	02/15/02	02/15/02	02/18/02	02/18/02	02/18/02
FILE NAME:	021516	021517	021518	021519	021520	021521
INSTRUMENT ID:	MSD	MSD	MSD	MSD	MSD	MSD
UNITS:	NG/TRAP	NG/TRAP	NG/TRAP	NG/TRAP	NG/TRAP	NG/TRAP
VOLATILE COMPOUNDS						
Benzene	25 U	25 U	117	26	34	25 U
Bromodichloromethane	25 U	25 U	25 U	25 U	25 U	25 U
Bromoform	25 U	25 U	25 U	25 U	25 U	25 U
Bromomethane	50 U	50 U	50 U	50 U	50 U	50 U
2-Butanone	50 U	50 U	155	89	50 U	50 U
Carbon Tetrachloride	25 U	25 U	25 U	25 U	25 U	25 U
Chlorobenzene	25 U	25 U	25 U	25 U	25 U	25 U
Chloroethane	50 U	50 U	50 U	50 U	50 U	50 U
Chloroform	25 U	25 U	25 U	25 U	25 U	25 U
Chloromethane	82	68	158	64	205	70
Dibromochloromethane	25 U	25 U	25 U	25 U	25 U	25 U
1,1-Dichloroethane	25 U	25 U	25 U	25 U	25 U	25 U
1,2-Dichloroethane	25 U	25 U	25 U	25 U	25 U	25 U
1,1-Dichloroethene	25 U	25 U	25 U	25 U	25 U	25 U
1,2-Dichloroethene (cis)	25 U	25 U	25 U	25 U	25 U	25 U
1,2-Dichloroethene (trans)	25 U	25 U	25 U	25 U	25 U	25 U
1,2-Dichloropropane	25 U	25 U	25 U	25 U	25 U	25 U
cis-1,3-Dichloropropene	25 U	25 U	25 U	25 U	25 U	25 U
trans-1,3-Dichloropropene	25 U	25 U	25 U	25 U	25 U	25 U
Ethylbenzene	25 U	31	59	156	47	25 U
2-Hexanone	50 U	50 U	50 U	50 U	50 U	50 U
4-Methyl-2-Pentanone	50 U	50 U	50 U	50 U	50 U	50 U
Styrene	25 U	25 U	25 U	25 U	25 U	25 U
1,1,2,2-Tetrachloroethane	25 U	25 U	25 U	25 U	25 U	25 U
Tetrachloroethene	25 U	25 U	25 U	25 U	25 U	25 U
Toluene	25 U	25 U	204	72	25	25 U
1,1,1-Trichloroethane	25 U	25 U	25 U	25 U	25 U	25 U
1,1,2-Trichloroethane	25 U	25 U	25 U	25 U	25 U	25 U
Trichloroethene	25 U	25 U	25 U	25 U	25 U	25 U
Trichlorofluoromethane	27	25 U	25 U	25 U	25 U	25 U
112-Trichlorotrifluoroethane	25 U	25 U	25 U	25 U	25 U	25 U
1,2,4-Trimethylbenzene	25 U	25 U	25 U	25 U	25 U	25 U
1,3,5-Trimethylbenzene	25 U	25 U	25	25 U	25 U	25 U
Vinyl Chloride	50 U	50 U	50 U	50 U	50 U	50 U
Xylenes (Total)	27	118	168	740	223	25 U

B - Detected in lab blank. U - Below reported quantitation level. J - Estimated value.

MARYLAND SPECTRAL SERVICES, INC.
1500 Caton Center Drive Baltimore, MD 21227

VOLATILE ORGANICS BY EPA GC/MS METHOD MODIFIED 8260

CLIENT SAMPLE ID:	B10	B11	B12	B14	B15	B16
	EM1386	EM1386	EM1386	EM1386	EM1386	EM1386
LAB SAMPLE ID.	02021522	02021523	02021524	02021525	02021526	02021527
RECEIVED DATE:	02/15/02	02/15/02	02/15/02	02/15/02	02/15/02	02/15/02
ANALYSIS DATE:	02/18/02	02/18/02	02/18/02	02/18/02	02/18/02	02/18/02
FILE NAME:	021522	021523	021524	021525	021526	021527
INSTRUMENT ID:	MSD	MSD	MSD	MSD	MSD	MSD
UNITS:	NG/TRAP	NG/TRAP	NG/TRAP	NG/TRAP	NG/TRAP	NG/TRAP
VOLATILE COMPOUNDS						
Benzene	30	28	490	25 U	25 U	54
Bromodichloromethane	25 U	25 U	25 U	25 U	25 U	25 U
Bromoform	25 U	25 U	25 U	25 U	25 U	25 U
Bromomethane	50 U	50 U	50 U	50 U	50 U	50 U
2-Butanone	92	185	50 U	143	18200	50 U
Carbon Tetrachloride	25 U	25 U	25 U	25 U	25 U	25 U
Chlorobenzene	25 U	48	25 U	25 U	25 U	25 U
Chloroethane	50 U	50 U	50 U	50 U	50 U	50 U
Chloroform	25 U	25 U	25 U	25 U	25 U	25 U
Chloromethane	147	148	354	50 U	76	113
Dibromochloromethane	25 U	25 U	25 U	25 U	25 U	25 U
1,1-Dichloroethane	25 U	25 U	25 U	25 U	25 U	25 U
1,2-Dichloroethane	25 U	25 U	25 U	25 U	25 U	25 U
1,1-Dichloroethene	25 U	25 U	25 U	25 U	25 U	25 U
1,2-Dichloroethene (cis)	25 U	25 U	25 U	25 U	25 U	25 U
1,2-Dichloroethene (trans)	25 U	25 U	25 U	25 U	25 U	25 U
1,2-Dichloropropane	25 U	25 U	25 U	25 U	25 U	25 U
cis-1,3-Dichloropropene	25 U	25 U	25 U	25 U	25 U	25 U
trans-1,3-Dichloropropene	25 U	25 U	25 U	25 U	25 U	25 U
Ethylbenzene	32	25 U	316	25 U	1460	25 U
2-Hexanone	50 U	50 U	50 U	50 U	50 U	50 U
4-Methyl-2-Pentanone	50 U	50 U	50 U	50 U	50 U	50 U
Styrene	25 U	25 U	25 U	25 U	25 U	25 U
1,1,2,2-Tetrachloroethane	25 U	25 U	25 U	25 U	25 U	25 U
Tetrachloroethene	25 U	25 U	30	25 U	25 U	26
Toluene	25 U	49	945	25 U	55	62
1,1,1-Trichloroethane	25 U	25 U	25 U	25 U	25 U	25 U
1,1,2-Trichloroethane	25 U	25 U	25 U	25 U	25 U	25 U
Trichloroethene	25 U	25 U	25 U	25 U	25 U	25 U
Trichlorofluoromethane	25 U	25 U	25 U	25 U	25 U	25 U
112-Trichlorotrifluoroethane	25 U	25 U	25 U	25 U	25 U	25 U
1,2,4-Trimethylbenzene	25 U	25 U	99	25 U	40	25 U
1,3,5-Trimethylbenzene	25 U	25 U	161	25 U	38	25 U
Vinyl Chloride	50 U	50 U	50 U	50 U	50 U	50 U
Xylenes (Total)	177	112	640	25 U	4860	36

B - Detected in lab blank. U - Below reported quantitation level. J - Estimated value.

MARYLAND SPECTRAL SERVICES, INC.

1500 Caton Center Drive Baltimore, MD 21227

VOLATILE ORGANICS BY EPA GC/MS METHOD MODIFIED 8260

CLIENT SAMPLE ID:	B18 EM1386	B19 EM1386	B20 EM1386	B22 EM1386	B23 EM1386	B24 EM1386
LAB SAMPLE ID:	02021528	02021529	02021530	02021531	02021532	02021533
RECEIVED DATE:	02/15/02	02/15/02	02/15/02	02/15/02	02/15/02	02/15/02
ANALYSIS DATE:	02/18/02	02/18/02	02/18/02	02/18/02	02/18/02	02/18/02
FILE NAME:	021528	021529	021530	021531	021532	021533
INSTRUMENT ID:	MSD	MSD	MSD	MSD	MSD	MSD
UNITS:	NG/TRAP	NG/TRAP	NG/TRAP	NG/TRAP	NG/TRAP	NG/TRAP
VOLATILE COMPOUNDS						
Benzene	35	89	57	25 U	38	153
Bromodichloromethane	25 U	25 U	25 U	25 U	25 U	25 U
Bromoform	25 U	25 U	25 U	25 U	25 U	25 U
Bromomethane	50 U	50 U	50 U	50 U	50 U	50 U
2-Butanone	64	2820	154	50 U	82	50 U
Carbon Tetrachloride	25 U	25 U	25 U	25 U	25 U	25 U
Chlorobenzene	25 U	25 U	25 U	25 U	25 U	25 U
Chloroethane	50 U	50 U	50 U	50 U	50 U	50 U
Chloroform	25 U	25 U	25 U	25 U	25 U	25 U
Chloromethane	147	227	215	50 U	60	258
Dibromochloromethane	25 U	25 U	25 U	25 U	25 U	25 U
1,1-Dichloroethane	25 U	25 U	25 U	25 U	25 U	25 U
1,2-Dichloroethane	25 U	25 U	25 U	25 U	25 U	25 U
1,1-Dichloroethene	25 U	25 U	25 U	25 U	25 U	25 U
1,2-Dichloroethene (cis)	25 U	25 U	25 U	25 U	25 U	25 U
1,2-Dichloroethene (trans)	25 U	25 U	25 U	25 U	25 U	25 U
1,2-Dichloropropane	25 U	25 U	25 U	25 U	25 U	25 U
cis-1,3-Dichloropropene	25 U	25 U	25 U	25 U	25 U	25 U
trans-1,3-Dichloropropene	25 U	25 U	25 U	25 U	25 U	25 U
Ethylbenzene	249	233	38	131	169	229
2-Hexanone	50 U	50 U	50 U	50 U	50 U	50 U
4-Methyl-2-Pentanone	50 U	50 U	50 U	50 U	50 U	50 U
Styrene	25 U	25 U	25 U	25 U	25 U	25 U
1,1,2,2-Tetrachloroethane	25 U	25 U	25 U	25 U	25 U	25 U
Tetrachloroethene	38	25 U	25 U	25 U	25 U	25 U
Toluene	85	160	107	33	95	377
1,1,1-Trichloroethane	25 U	25 U	25 U	25 U	25 U	25 U
1,1,2-Trichloroethane	25 U	25 U	25 U	25 U	25 U	25 U
Trichloroethene	25 U	25 U	25 U	25 U	25 U	25 U
Trichlorofluoromethane	25 U	25 U	25 U	25 U	25 U	25 U
112-Trichlorotrifluoroethane	25 U	25 U	25 U	25 U	25 U	25 U
1,2,4-Trimethylbenzene	25 U	25 U	25 U	25 U	25 U	25 U
1,3,5-Trimethylbenzene	25 U	25 U	26	25 U	25 U	42
Vinyl Chloride	50 U	50 U	50 U	50 U	50 U	50 U
Xylenes (Total)	1010	975	81	750	715	605

B - Detected in lab blank. U - Below reported quantitation level. J - Estimated value.

MARYLAND SPECTRAL SERVICES, INC.

1500 Caton Center Drive Baltimore, MD 21227

VOLATILE ORGANICS BY EPA GC/MS METHOD MODIFIED 8260

CLIENT SAMPLE ID:	B26	B27	B15-D	TRIP-4	VBLK0215D1	VBLK0218D1
	EM1386	EM1386	QC Replicate	EM1386		
LAB SAMPLE ID:	02021534	02021535	02021526	02021536	METHOD_BL.	METHOD_BL.
RECEIVED DATE:	02/15/02	02/15/02	02/15/02	02/15/02		
ANALYSIS DATE:	02/19/02	02/19/02	02/19/02	02/15/02	02/15/02	02/18/02
FILE NAME:	021534	021535	021526R	021536	0215VBLKD1	0218VBLKD1
INSTRUMENT ID:	MSD	MSD	MSD	MSD	MSD	MSD
UNITS:	NG/TRAP	NG/TRAP	NG/TRAP	NG/TRAP	NG/TRAP	NG/TRAP
VOLATILE COMPOUNDS						
Benzene	25 U	33	29	25 U	25 U	25 U
Bromodichloromethane	25 U	25 U	25 U	25 U	25 U	25 U
Bromoform	25 U	25 U	25 U	25 U	25 U	25 U
Bromomethane	50 U	50 U	50 U	50 U	50 U	50 U
2-Butanone	50 U	50 U	31800	50 U	50 U	50 U
Carbon Tetrachloride	25 U	25 U	25 U	25 U	25 U	25 U
Chlorobenzene	25 U	25 U	25 U	25 U	25 U	25 U
Chloroethane	50 U	50 U	50 U	50 U	50 U	50 U
Chloroform	25 U	25 U	25 U	25 U	25 U	25 U
Chloromethane	50 U	79	201	50 U	50 U	50 U
Dibromochloromethane	25 U	25 U	25 U	25 U	25 U	25 U
1,1-Dichloroethane	25 U	25 U	25 U	25 U	25 U	25 U
1,2-Dichloroethane	25 U	25 U	25 U	25 U	25 U	25 U
1,1-Dichloroethene	25 U	25 U	25 U	25 U	25 U	25 U
1,2-Dichloroethene (cis)	25 U	25 U	25 U	25 U	25 U	25 U
1,2-Dichloroethene (trans)	25 U	25 U	25 U	25 U	25 U	25 U
1,2-Dichloropropane	25 U	25 U	25 U	25 U	25 U	25 U
cis-1,3-Dichloropropene	25 U	25 U	25 U	25 U	25 U	25 U
trans-1,3-Dichloropropene	25 U	25 U	25 U	25 U	25 U	25 U
Ethylbenzene	34	25 U	1500	25 U	25 U	25 U
2-Hexanone	50 U	50 U	50 U	50 U	50 U	50 U
4-Methyl-2-Pentanone	50 U	50 U	50 U	50 U	50 U	50 U
Styrene	25 U	25 U	25 U	25 U	25 U	25 U
1,1,2,2-Tetrachloroethane	25 U	25 U	25 U	25 U	25 U	25 U
Tetrachloroethene	40	25 U	36	25 U	25 U	25 U
Toluene	25 U	52	85	25 U	25 U	25 U
1,1,1-Trichloroethane	25 U	25 U	25 U	25 U	25 U	25 U
1,1,2-Trichloroethane	25 U	25 U	25 U	25 U	25 U	25 U
Trichloroethene	25 U	25 U	25 U	25 U	25 U	25 U
Trichlorofluoromethane	25 U	25 U	25 U	25 U	25 U	25 U
112-Trichlorotrifluoroethane	25 U	25 U	25 U	25 U	25 U	25 U
1,2,4-Trimethylbenzene	25 U	25 U	27	25 U	25 U	25 U
1,3,5-Trimethylbenzene	25 U	25 U	31	25 U	25 U	25 U
Vinyl Chloride	50 U	50 U	50 U	50 U	50 U	50 U
Xylenes (Total)	231	37	4860	25 U	25 U	25 U

B - Detected in lab blank. U - Below reported quantitation level. J - Estimated value.

Attachment 3

FIELD PROCEDURES FOR EMFLUX® SOIL-GAS SURVEYS

The following field procedures are routinely used during EMFLUX® Soil-Gas Surveys. Modifications can be and are incorporated from time to time in response to individual project requirements. In all instances, BEACON adheres to EPA-approved Quality Assurance and Quality Control practices.

A. Field personnel carry EMFLUX® system components and support equipment to the site and deploy the EMFLUX® Collectors in a prearranged survey pattern. An EMFLUX® Collector consists of a glass vial containing hydrophobic adsorbent cartridges with a length of wire attached to the vial for retrieval. Although EMFLUX® Collectors require only one person for emplacement and retrieval, the specific number of field personnel required depends upon the scope and schedule of the project. Each Collector emplacement generally takes less than two minutes.

B. At each survey point a field technician clears vegetation as needed and, using a slide hammer with a ½" diameter probe or a hammer drill with a ½" diameter bit, creates a hole three-feet deep. The technician then uses a hammer and a ¾" diameter pointed metal stake to widen the top four inches of the hole. [Note: For locations covered with asphalt, concrete, or gravel surfacing, the field technician first drills a 1"- to 1½"-diameter hole through the surfacing to the soils beneath. If necessary, the Collector can be sleeved with a ¾" i.d. metal sleeve.]

C. The technician then removes the solid plastic cap from an EMFLUX® Collector and replaces it with a Sampling Cap (a plastic cap with a hole covered by screen meshing). The technician inserts the Collector, with the Sampling Cap end facing down, into the hole (**see attached figure**). The Collector is then covered with either local soils for uncapped locations or, for capped locations, aluminum foil and a concrete patch. The Collector's location, time and date of emplacement, and other relevant information are recorded on the Field Deployment Form.

D. One or more trip blanks are included as part of the quality-control procedures.

E. Once all EMFLUX® Collectors have been deployed, field personnel schedule Collector recovery (typically 72 hours after emplacement) and depart, taking all no-longer-needed equipment and materials with them.

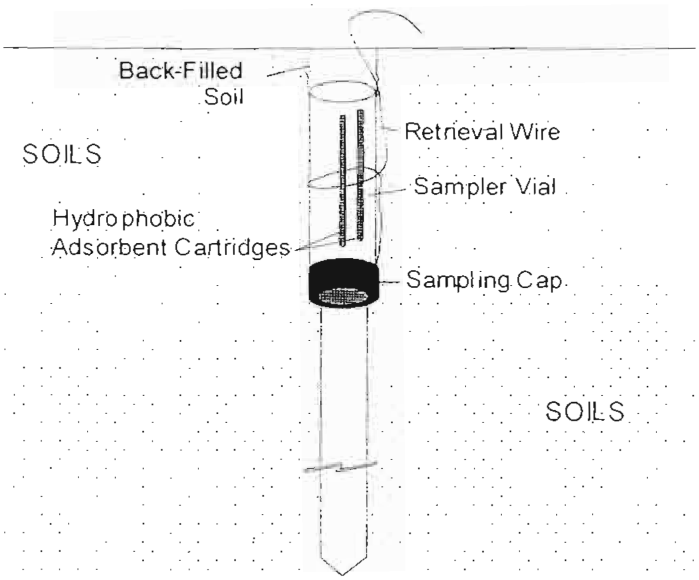
F. Field personnel retrieve the Collectors at the end of the exposure period. At each location, a field technician withdraws the Collector from its hole, removes the retrieval wire, and wipes the outside of the vial clean using gauze cloth; following removal of the Sampling Cap, the threads of the vial are also cleaned. A solid plastic cap is screwed onto the vial and the sample location number is written on the label. The technician then records sample-point location, date, time, etc. on the Field Deployment Form.

G. Sampling holes are refilled with soil, sand, or other suitable material. If Collectors have been installed through asphalt or concrete, the hole is filled to grade with a plug of cold patch or cement.

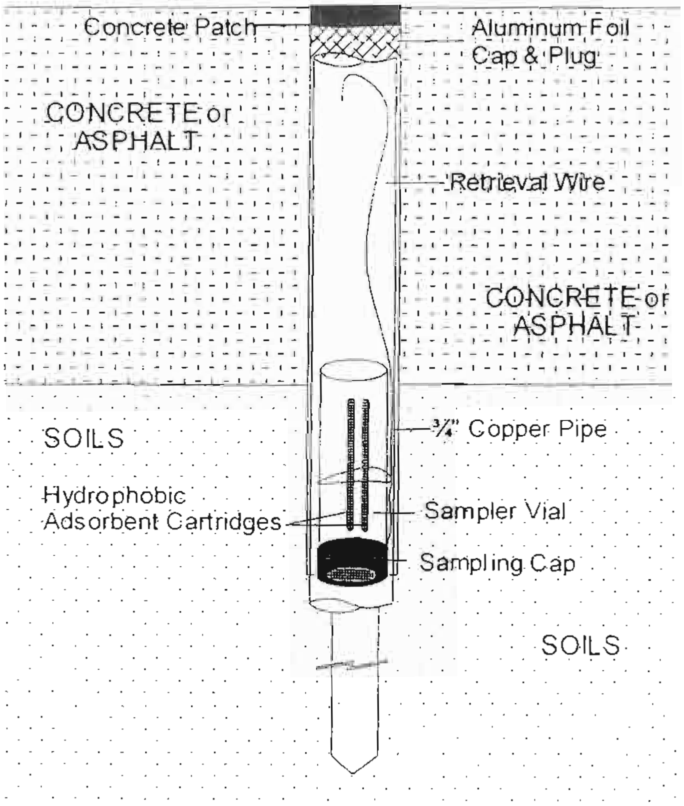
H. Following retrieval, field personnel ship or carry the EMFLUX® Collectors to the specified analytical laboratory.

EMFLUX® COLLECTOR

DEPLOYMENT IN SOILS



DEPLOYMENT THROUGH CONCRETE OR ASPHALT



Attachment 4

Field Deployment Report

BEACON ENVIRONMENTAL SERVICES, INC.
EMFLUX® SOIL-GAS SURVEY
FIELD DEPLOYMENT REPORT

PROJECT #: EM1386

CLIENT: Environmental Resources Management

SITE: Greif Bros. site, Cullman, AL

INDIVIDUAL SAMPLE INFORMATION

EMPLACEMENT DATE: Feb. 6, 2002

RETRIEVAL DATE: 2/14/02

SAMPLE NUMBER	TIME		FIELD NOTES (e.g., asphalt/concrete covering, description of sample location, cartridge/vial condition)
	Emplaced	Retrieved	
A1	1018	0738	Concrete outside building
A2	1016	0741	soils near sidewalk
A3	1015	0743	soils near sidewalk & loading dock
A4	1013	0745	soils near sidewalk
A5	1010	0749	in smaller building bathroom, concrete
A6	1008	0752	in smaller building, concrete
A7	1005	0756	in smaller building, concrete
A8	1002	0759	in large building, through concrete floor
B1	1058	0806	In building, through concrete floor
☆ B2	1114	0809	" " " " "
☆ B3	1116	0811	" " " " "
☆ B4	1249	0835	MOVED 4' onto Concrete Ramp (SE)
B5	1100	0815	IN BUILDING, through concrete floor
☆ B6	1114	0818	" " " " "

SAMPLE NUMBER	2/6/02 TIME	2/14/02	FIELD NOTES (e.g., asphalt/concrete covering, description of sample location, cartridge/vial condition)
	Emplaced	Retrieved	
☆ B7	1120	0822	IN BUILDING, THROUGH CONCRETE FLOOR
☆ B8	1245	0837	MOVED 2' ONTO CONCRETE ROAD (SE)
B9	1102	0826	IN BUILDING, THROUGH CONCRETE FLOOR
☆ B10	1124	0828	" " " " "
☆ B11	1126	0830	" " " " "
☆ B12	1240	0841	MOVED 4' ONTO CONCRETE ROAD (SE)
B13	1353	0908	IN BUILDING, THROUGH CONCRETE FLOOR
☆ B14	1355	0911	" " " " "
☆ B15	1445	0914	IN SOLVENT STORAGE ROOM
☆ B16	1235	0844	MOVED 3' ONTO CONCRETE ROAD (SE)
B17	1357	0923	IN BUILDING, THROUGH CONCRETE FLOOR
☆ B18	1359	0925	" " " " "
☆ B19	1441	0917	IN SOLVENT STORAGE ROOM
☆ B20	1228	0848	MOVED 8' ONTO CONCRETE ROAD (SE)
B21	1406	0934	IN BUILDING, THROUGH CONCRETE FLOOR
☆ B22	1417	0928	" " " " "
☆ B23	1419	0920	" " " " "
☆ B24	1212	0851	MOVED 3' ONTO CONCRETE ROAD (SE)

SAMPLE NUMBER	2/6/02 TIME 2/14/02		FIELD NOTES (e.g., asphalt/concrete covering, description of sample location, cartridge/vial condition)
	Emplaced	Retrieved	
B25	1411	0937	IN BUILDING THROUGH CONCRETE FLOOR
☆ B26	1422	0930	" " " " "
☆ B27	1159	0855	Through concrete outside
8021 → B28	1208	0859	MOVED 3' ONTO CONCRETE ROAD (SE)
B29	1432	0939	IN LOADING ROOM (GARAGE) Through CONCRETE
B30	1434	0942	MOVED 5-7' SE TO LOADING ROOM
B31	1202	0902	Through concrete outside
B32	1204	0905	MOVED 2' SOUTHEAST
C1	1626	1017	Through concrete in small building
C2	1628	1020	" " " " "
C3	1610	1028	Through concrete near building
C4	1608	1031	" " " "
C5	1557	1034	" " " "
C6	1554	1036	" " " "
C7	1551	1040	Through asphalt
C8	1633	1042	Through asphalt
C9	1630	1023	Through concrete in small building
C10	1631	1026	" " " " "

Page 1 of 7

SAMPLE NUMBER	TIME		FIELD NOTES (e.g., asphalt/concrete covering, description of sample location, cartridge/vial condition)
	Emplaced	Retrieved	
C11	1619	1045	2/6/02 Through concrete RETRIEVED 2/14/02
C12	1617	1048	2/6/02 " " Retrieved 2/14/02
C13	1604	1051	2/6/02 " " Retrieved 2/14/02
C14	1540	1054	2/6/02 " " Retrieved 2/14/02
C15	1610	1056	MOVED 4' SE, PIPE FULL OF WATER (2/6/02) RETRIEVED 2/14/02
C16	1543	1058	2/6/02 Through asphalt RETRIEVED 2/14/02
C17	0815	0714	2/7/02 IN ASPHALT Retrieved 2/15/02
C18	0817	0717	2/7/02 " " 2/15/02
C19	0821	0721	2/7/02 " " 2/15/02
C20	0831	0723	2/7/02 " " 2/15/02
C21	0834	0725	2/7/02 " " 2/15/02
C22	0836	0727	2/7/02 IN CONCRETE 2/15/02
C23	0839	0730	2/7/02 IN CONCRETE 2/15/02
C24	0842	0732	2/7/02 IN ASPHALT 2/15/02
C25	1137	0735	2/7/02 IN BUILDING 2/15/02
C26	0804	0739	2/7/02 IN BUILDING 2/15/02
C27	0802	0742	2/7/02 " " 2/15/02
C28	0748	0744	2/7/02 " " 2/15/02

2/6

2/7

SAMPLE NUMBER	2/7/02 TIME	2/15/02	FIELD NOTES (e.g., asphalt/concrete covering, description of sample location, cartridge/vial condition)
	Emplaced	Retrieved	
C29	0730	0746	IN BUILDING
C30	0900	0749	IN CONCRETE, LOADING RAMP ; STANDING WATER IN HOLE
C31	0902	0752	" " " "
C32	0904	0755	" " " "
C33	1134	0737	IN BUILDING
C34	0807	0811	IN BUILDING
C35	0809	0814	" "
C36	0750	0818	" "
C37	0736	0821	" "
C38	0910	0803	IN CONCRETE, LOADING RAMP
C39	0908	0801	" " " "
C40	0906	0759	" " " "
C41	0810	0825	IN BUILDING
C42	0752	0828	" "
C43	0754	0830	" "
C44	8945	0806	IN CONCRETE
C45	0947	0808	IN CONCRETE
C46	1114	0840	IN BUILDING

SAMPLE NUMBER	TIME 2/7/02 Emplaced	2/15/02 Retrieved	FIELD NOTES (e.g., asphalt/concrete covering, description of sample location, cartridge/vial condition)
C47	1128	0842	IN CONCRETE, (9' S & 5' E of original position)
C48	0955	0847	IN ASPHALT
C49	0957	0849	" "
C50	1000	0854	" "
C51	1101	0904	IN CONCRETE
C52	1059	0908	" "
C53	1056	0910	" "
C54	1027	0914	" "
C55	1020	0920	IN GRAVEL
C56	1043	0905	IN GRAVEL NEAR RR
C57	1040	0906	" " " "
C58	1037	0918	" " " "
C59	1029	0924	" " " "
C60	1032	0926	IN GRAVEL NEAR RR
C61	1122	0834	IN BUILDING
C62	1120	0836	IN BUILDING
C63	1116	0538	IN BUILDING
C64	1105	0858	IN CONCRETE WATER IN HOLE

SAMPLE NUMBER	TIME 2/7/02	2/15/02	FIELD NOTES (*e.g.*, asphalt/concrete covering, description of sample location, cartridge/vial condition)
	Emplaced	Retrieved	
C65	1045	0903	IN GRAVEL NEAR RR

Attachment 5

BEACON LABORATORY PROCEDURES FOR EMFLUX® ADSORBENT CARTRIDGES

Following are laboratory procedures used with the EMFLUX® Soil-Gas System, a screening technology for expedited site investigation. After exposure, EMFLUX® cartridges are analyzed using U.S. EPA Method 8021 as described in the Solid Waste Manual (SW-846) for screening purposes. This method, which is modified to accommodate thermal desorption screening of the adsorbent cartridges, uses a gas chromatograph equipped with a capillary column and a photo ionization detector (PID) in series with a dry electrolytic conductivity detector (DELCD). This procedure is summarized below:

A. EMFLUX® cartridges are placed in the thermal desorbtion chamber, where they are purged with carrier gas then desorbed into the capillary column. The capillary column separates the sample into single component analytes. Analytes in the carrier gas are detected with a PID then a DELCD.

B. The laboratory uses a 105-m, 0.53-mm-i.d., 3 μm-film-thickness MXT-624 capillary column for separation during analysis.

C. The PID and DELCD are set on high gain; ultra zero grade dry air is used in the DELCD.

D. Lab personnel conduct internal control blank and internal control verification analyses daily to ensure that the system is contaminant free and properly calibrated. The system is calibrated using the external standard calibration procedure to at least three different concentration levels for each compound targeted, with the lowest concentration level at or near the method detection limit. A laboratory control sample (LCS) and LCS blank are performed daily prior to field samples being analyzed.

E. The instrumentation used for these analyses is an SRI 8610 Gas Chromatograph, connected to a PID in series with a DELCD and equipped with a manually actuated thermal desorber.

Attachment 6

MSS LABORATORY PROCEDURES FOR EMFLUX® ADSORBENT CARTRIDGES

Following are laboratory procedures used with the EMFLUX® Soil-Gas System, a screening technology for expedited site investigation. After exposure, EMFLUX® cartridges are analyzed using U.S. EPA Method 8260 as described in the Solid Waste Manual (SW-846), a purge-and-trap capillary gas chromatographic/mass spectrometric method, modified to accommodate high-temperature thermal desorption of the adsorbent cartridges. This procedure is summarized as follows:

A. The adsorbent cartridges are thermally desorbed at 225°C for 11 minutes in a 40 mL/min helium flow, through 5 mL of reagent water spiked with 250 ng of internal standards and surrogates held in the sparging vessel. Any analytes in the helium stream are adsorbed onto a standard three-component trap (Tenax, silica gel, coconut charcoal).

B. Following cryofocusing, the three-component trap is thermally desorbed at 220°C onto a Supelco VOCOL 105 m, 0.5 mm ID, 3.00 micron filament thickness capillary column, per the U.S. EPA CLP Statement of Work (SOW) for the method.

C. Following the SOW, the GC/MS is scanned between 35 and 260 Atomic Mass Units (AMU) at one second per scan.

D. BFB tuning criteria and initial calibration are per the EPA CLP 2/88 guidelines, with an 18-hour tune window. A laboratory blank is analyzed after the daily standard to determine that the system is contaminant-free.

E. The instrumentation used for these analyses includes:

- Finnigan Model OWA 1050 Gas Chromatograph/Mass Spectrometer;
- Tekmar Model 6016 Aero Trap Autosampler;
- Tekmar Model LSC 2000 Liquid Sample Concentrator; and
- Tekmar Model ALS 2016 Autosampler.

Attachment 7

Chain-of-Custody Form

BEACON ENVIRONMENTAL SERVICES, INC.
CHAIN-OF-CUSTODY FORM

PROJECT NUMBER: **EM1386**
SITE: Greif Bros. site, Cullman, AL
CLIENT: Environmental Resources Management
TARGET COMPOUNDS: EMFLUX EPA Method 8021 TCL

Sample Number	Lab ID No. (for lab use only)	Remarks (only necessary if problem or discrepancy)			
		Condition of sample or vial	Date	Time	Init.
A-1					
A-2					
A-3					
A-4					
A-5					
A-6					
A-7					
A-8					
B-1					
B-5					
B-9					
B-13					
B-17					
B-21					
B-25					
B-28					
B-29					
B-30					
B-31					
B-32					
TRIP-3					
C-1					
C-2					
C-3					
C-4					
C-5					
C-6					
C-7					
C-8					
C-9					

Shipment of Field Kit to Site — Custody Seal #: **Intact? Y N**

Relinquished by:	Date/Time	Courier	Received by:	Date/Time

Shipment of Samples to Laboratory — Custody Seal #: 00029526 **Intact? [✓ Y] N**

Relinquished by:	Date/Time	Courier	Received by:	Date/Time
	2/14/02-1400	FedEx		2.15.02/14:21

BEACON ENVIRONMENTAL SERVICES, INC.
CHAIN-OF-CUSTODY FORM

PROJECT NUMBER: **EM1386**

SITE: Greif Bros. site, Cullman, AL

CLIENT: Environmental Resources Management

TARGET COMPOUNDS: EMFLUX EPA Method 8021 TCL

Sample Number	Lab ID No. (for lab use only)	Remarks (only necessary if problem or discrepancy)			
		Condition of sample or vial	Date	Time	Init.
C-10					
C-11					
C-12					
C-13					
C-14					
C-15					
C-16					

Shipment of Field Kit to Site — Custody Seal #: **Intact?** Y N

Relinquished by:	Date/Time	Courier	Received by:	Date/Time

Shipment of Samples to Laboratory — Custody Seal #: 00029526 **Intact?** [✓ Y] N

Relinquished by:	Date/Time	Courier	Received by:	Date/Time
	2/14/02 - 1400	FEDEX		2-15-02 / 14:21

BEACON ENVIRONMENTAL SERVICES, INC.
CHAIN-OF-CUSTODY FORM

PROJECT NUMBER: **EM1386**

SITE: Greif Bros. site, Cullman, AL

CLIENT: Environmental Resources Management

TARGET COMPOUNDS: EMFLUX EPA Method 8021 TCL

Sample Number	Lab ID No. (for lab use only)	Remarks (only necessary if problem or discrepancy)			
		Condition of sample or vial	Date	Time	Init.
Trip-2					
C-17					
C-18					
C-19					
C-20					
C-21					
C-22					
C-23					
C-24					
C-25					
C-26					
C-27					
C-28					
C-29					
C-30					
C-31					
C-32					
C-33					
C-34					
C-35					
C-36					
C-37					
C-38					
C-39					
C-40					
C-41					
C-42					
C-43					
C-44					
C-45					

Shipment of Field Kit to Site — Custody Seal #: **Intact?** Y N

Relinquished by:	Date/Time	Courier	Received by:	Date/Time

Shipment of Samples to Laboratory — Custody Seal #: 00029541 **Intact?** [✓ Y] N

Relinquished by:	Date/Time	Courier	Received by:	Date/Time
	2/15/02 - 1200	FedEx		2.18.02 - 1400

BEACON ENVIRONMENTAL SERVICES, INC.
CHAIN-OF-CUSTODY FORM

PROJECT NUMBER: EM1386

SITE: Greif Bros. site, Cullman, AL

CLIENT: Environmental Resources Management

TARGET COMPOUNDS: EMFLUX EPA Method 8021 TCL

Sample Number	Lab ID No. (for lab use only)	Remarks (only necessary if problem or discrepancy) Condition of sample or vial	Date	Time	Init.
C-46					
C-47					
C-48					
C-49					
C-50					
C-51					
C-52					
C-53					
C-54					
C-55					
C-56					
C-57					
C-58					
C-59					
C-60					
C-61					
C-62					
C-63					
C-64					
C-65					
TRIP-1					

Shipment of Field Kit to Site — Custody Seal #: **Intact?** Y N

Relinquished by:	Date/Time	Courier	Received by:	Date/Time

Shipment of Samples to Laboratory — Custody Seal #: 00029541 **Intact?** [✓ Y] N

Relinquished by:	Date/Time	Courier	Received by:	Date/Time
	2/15/02-1200	FedEx		2/18/02 1400

BEACON ENVIRONMENTAL SERVICES, INC.
CHAIN-OF-CUSTODY FORM

PROJECT NUMBER: **EM1386**

SITE: Greif Bros. site, Cullman, AL

CLIENT: Environmental Resources Management

TARGET COMPOUNDS: EMFLUX EPA Method 8260 TCL

Sample Number	Lab ID No. (for lab use only)	Remarks (only necessary if problem or discrepancy)			
		Condition of sample or vial	Date	Time	Init.
B-2	02021516				
B-3	17				
B-4	18				
B-6	19				
B-7	20				
B-8	21				
B-10	22				
B-11	23				
B-12	24				
B-14	25				
B-15	26				
B-16	27				
B-18	28				
B-19	29				
B-20	30				
B-22	31				
B-23	32				
B-24	33				
B-26	34				
B-27	35				
~~Trip 1~~ TRIP 4	36	VIAL SAYS "TRIP 4"			

Shipment of Field Kit to Site — Custody Seal #: **Intact? Y N**

Relinquished by:	Date/Time	Courier	Received by:	Date/Time

Shipment of Samples to Laboratory — Custody Seal #: 00204425 **Intact? Y N**

Relinquished by:	Date/Time	Courier	Received by:	Date/Time
	2/14/02 · 1400	FEDEX		
		Fed EX		2/15/02 11 AM

Appendix C
Soil Boring Logs

ERM-Southeast, Inc.	DRILLING LOG	Boring No. MW-1 Page 1 of 1

Date: 4/9/2002 Project No. 8185

Project: Greif Brothers

Owner:

Location: Cullman, Alabama

Drilling Company: Miller Drilling Company

Driller: Don Gerome

Logged By: Mike Johnson

Drilling Method: Auger

Surface Elevation: 803.38

Top of Casing Elevation: 803.18

Total Depth: 7.75' Diameter: 2"

Sampling Method:

Comments: Descriptions are made from cuttings.

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
0				4/09/2002 0-4.0': red brown silty clay
				4-5.0':wet brown clay, perch zone
				5-8.0': red brown silty sandy clay, moist. TD of casing 7.75'
10'				
20'				
30'				

ERM-Southeast, Inc.

DRILLING LOG

Boring No. MW-2
Page 1 of 1

Date: 4/9/2002
Project No. 8185
Project: Greif Brothers
Owner:
Location: Cullman, Alabama
Drilling Company: Miller Drilling Company
Driller: Don Gerome
Logged By: Mike Johnson
Drilling Method: Auger
Surface Elevation: 803.98
Top of Casing Elevation: 803.59
Total Depth: 8.3'
Diameter: 2"
Sampling Method:
Comments: Descriptions are made from cuttings.

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
				4/09/2002
0				0-2.0': backfill, gravel, yellow brown silty clay. 2.0-4.0': green/olive silty clay, soft, moist
				4-8.0':yellow brown silty clay, fine sand at 8.0' moist.
				8-9.0': yellow brown sandy silty clay, wet.
10'				TD of 2" casing 8.3'
20'				
30'				

ERM-Southeast, Inc.

DRILLING LOG

Boring No. MW-3
Page 1 of 1

Date: 4/9/2002 Project No. 8185
Owner:
Drilling Company: Miller Drilling Company
Logged By: Mike Johnson
Surface Elevation: 804.11
Total Depth: 6.35' Diameter: 2"
Comments: Descriptions are made from cuttings.

Project: Greif Brothers
Location: Cullman, Alabama
Driller: Don Gerome
Drilling Method: Auger
Top of Casing Elevation: 803.89
Sampling Method:

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
0				4/09/2002 0-6": Concrete 6"-4.0': orange/red clay, wet at 4.0' 4-6.5': red silty clay, wet. TD of 2" casing 6.35'
10'				
20'				
30'				

ERM-Southeast, Inc.	DRILLING LOG	Boring No. MW-4 Page 1 of 1

Date: 4/10/2002 Project No. 8185

Project: Greif Brothers

Owner:

Location: Cullman, Alabama

Drilling Company: Miller Drilling Company

Driller: Don Gerome

Logged By: Mike Johnson

Drilling Method: Auger

Surface Elevation: 806.65

Top of Casing Elevation: 806.54

Total Depth: 10.71 Diameter: 2"

Sampling Method:

Comments: Descriptions are made from cuttings.

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
				4/09/2002
0				0-4": Asphalt 4"-4.0': gray/dark grey clay
				4-8': red brown silty clay, very moist.
				8-10.71': grey to red silty clay, fine sand. TD of 2" casing
10'				
20'				
30'				

ERM-Southeast, Inc.

DRILLING LOG

Boring No. MW-5
Page 1 of 1

Date: 4/10/2002 Project No. 8185
Owner:
Drilling Company: Miller Drilling Company
Logged By: Mike Johnson
Surface Elevation:
Total Depth: 8.3' Diameter: 2"
Comments: Descriptions are made from cuttings.

Project: Greif Brothers
Location: Cullman, Alabama
Driller: Don Gerome
Drilling Method: Auger
Top of Casing Elevation:
Sampling Method:

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
				4/10/2002
0				0-4": Asphalt 4"-4.0': gray/olive green silty clay, dry
				4-8.5': grey to yellow brown silty clay, very moist. TD of 2" casing 8.3'
10'				
20'				
30'				

ERM-Southeast, Inc.

DRILLING LOG

Boring No. MW-6
Page 1 of 1

Date: 4/10/2002 Project No. 8185
Owner:
Drilling Company: Miller Drilling Company
Logged By: Mike Johnson
Surface Elevation: 801.97
Total Depth: 4.05' Diameter: 2"
Comments: Descriptions are made from cuttings.

Project: Greif Brothers
Location: Cullman, Alabama
Driller: Don Gerome
Drilling Method: Auger
Top of Casing Elevation: 801.77
Sampling Method:

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
				4/10/2002
0				0-6": Asphalt 6"-3.75': Red brown silty sandy clay
				3.75'-4.05': Sand. TD of 2" casing 4.05'
10'				
20'				
30'				

ERM-Southeast, Inc.	**DRILLING LOG**	**Boring No.** DW-1 **Page** 1 **of** 1

Date: 4/2/2002 Project No. 8185

Project: Greif Brothers

Owner:

Location: Cullman, Alabama

Drilling Company: Miller Drilling Company

Driller: Robert Gentry

Logged By: Mike Johnson

Drilling Method: Air Rotary

Surface Elevation: 808.08

Top of Casing Elevation: 810.96

Total Depth: 35.0' Diameter: 2"

Sampling Method:

Comments: Descriptions are made from cuttings.

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
				4/2/2002
0				0-6": Asphalt
				6"-8.5': Red brown silty sandy clay
				8.5'-17': Weathered sandstone
10'				
				17': Top of bedrock
20'				
				22': TD of 10" borehole (6 5/8" casing)
				4/3/2002
30'				
				34': TD of 2" casing
				35' TD of 6" borehole

ERM-Southeast, Inc.

DRILLING LOG

Boring No. DW-2
Page 1 of 2

Date: 4/2/2002 Project No. 8185
Owner:
Drilling Company: Miller Drilling Company
Logged By: Mike Johnson
Surface Elevation: 801.27
Total Depth: 59.3' Diameter: 2"
Comments: Descriptions are made from cuttings.

Project: Greif Brothers
Location: Cullman, Alabama
Driller: Robert Gentry
Drilling Method: Air Rotary
Top of Casing Elevation: 804.44
Sampling Method:

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
0				4/2/2002 0-1': Gravel 1-17': Red brown silty sandy clay
10'				
				17': Top of bedrock
20'				22': TD of 10" borehole (6 5/8" casing) 4/4/2002
30'				
				35' grey sandstone bedrock dry
40'				
				47-52': grey sandstone, water -bearing
50'				

ERM-Southeast, Inc.	DRILLING LOG	Boring No. DW-2 Page 2 of 2

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
60'				59.3': TD of 6" Boring, TD of 2" casing

ERM-Southeast, Inc.

DRILLING LOG

Boring No. DW-3
Page 1 **of** 1

Date: 4/2/2002 Project No. 8185
Project: Greif Brothers
Owner:
Location: Cullman, Alabama
Drilling Company: Miller Drilling Company
Driller: Robert Gentry
Logged By: Mike Johnson
Drilling Method: Air Rotary
Surface Elevation: 792.76
Top of Casing Elevation: 795.74
Total Depth: 35.0' Diameter: 2"
Sampling Method:
Comments: Descriptions are made from cuttings.

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
				4/3/2002
0				0-4': Gravel fill material
				4-6': Grey, silty clay. Wet.
				6-9': Weathered rock
				9': Top of competent sandstone bedrock
10'				
				14': TD of 10" borehole (6 5/8" casing)
				4/4/2002
20'				
30'				30-.31': Grey sandstone, waterbearing
				35': TD of 6" boring, TD of 2" casing
40'				
50'				

ERM-Southeast, Inc.

DRILLING LOG

Boring No. DW-4
Page 1 of 1

Date: 4/3/2002 Project No. 8185
Project: Greif Brothers
Owner:
Location: Cullman, Alabama
Drilling Company: Miller Drilling Company
Driller: Robert Gentry
Logged By: Mike Johnson
Drilling Method: Air Rotary
Surface Elevation: 795.59
Top of Casing Elevation: 796.84
Total Depth: 70.55 Diameter: 6"-open rock
Sampling Method:
Comments: Descriptions are made from cuttings.

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
				4/3/2002
0				0-2' Organic brown dry, silty clay increased with depth
				2-4' Brown silty clay 4-6': Red brown silty clay, some sand
				6-7': Red brown silty sandy clay, moist
10'				7-10': Weathered rock 11': Top of competent sandstone bedrock
				16': TD of 10" borehole (6 5/8" casing) 4/4/2002
20'				
30'				
				35': grey sandstone bedrock
				38': possible water bearing zone
40'				
50'				

ERM-Southeast, Inc.	**DRILLING LOG**	Boring No. DW-4 Page 2 of 2

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
60'				
70'				70.55': TD of 6" open rock well

ERM-Southeast, Inc.

DRILLING LOG

Boring No. SB-5
Page 1 **of** 1

Date: 4/8/2002 Project No. 8185
Project: Greif Brothers
Owner:
Location: Cullman, Alabama
Drilling Company: Miller Drilling Company
Driller: Don Gerome
Logged By: Mike Johnson
Drilling Method: Direct push
Surface Elevation: 792.58
Top of Casing Elevation:
Total Depth: 8.0' Diameter: 2" O.D.
Sampling Method: continuous
Comments: Descriptions are made from cuttings.

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
				4/08/2002
0				0-4': red brown silty clay
				4-8': brown to red clay, moist
10'				
20'				
30'				

ERM-Southeast, Inc.

DRILLING LOG

Boring No. SB-6
Page 1 of 1

Date: 4/8/2002 Project No. 8185
Owner:
Drilling Company: Miller Drilling Company
Logged By: Mike Johnson
Surface Elevation: 804.05
Total Depth: 7.0' Diameter: 2" O.D.
Comments: Descriptions are made from cuttings.

Project: Greif Brothers
Location: Cullman, Alabama
Driller: Don Gerome
Drilling Method: Direct push
Top of Casing Elevation:
Sampling Method: continuous

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
				4/08/2002
0				0-4': red brown silty clay, moist
				4-7': red brown silty sandy clay, moist to 5' then dry
10'				
20'				
30'				

ERM-Southeast, Inc.

DRILLING LOG

Boring No. SB-7
Page 1 **of** 1

Date: 4/8/2002 Project No. 8185
Project: Greif Brothers
Owner:
Location: Cullman, Alabama
Drilling Company: Miller Drilling Company
Driller: Don Gerome
Logged By: Mike Johnson
Drilling Method: Direct push
Surface Elevation: 806.56
Top of Casing Elevation:
Total Depth: 10.5' Diameter: 2" O.D.
Sampling Method: continuous
Comments: Descriptions are made from cuttings.

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
				4/08/2002
0				0-4': grey to dark grey clay, soft
				4-8': red brown silty clay
10'				8-10.5': grey to red silty clay, fine sand, moist
20'				
30'				

ERM-Southeast, Inc.

DRILLING LOG

Boring No. SB-8
Page 1 of 1

Date: 4/8/2002 Project No. 8185
Owner:
Drilling Company: Miller Drilling Company
Logged By: Mike Johnson
Surface Elevation: 803.4
Total Depth: 14.5' Diameter: 2" O.D.
Comments: Descriptions are made from cuttings.

Project: Greif Brothers
Location: Cullman, Alabama
Driller: Don Gerome
Drilling Method: Direct push
Top of Casing Elevation:
Sampling Method: continuous

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
				4/08/2002
0				0-1': asphalt
				1-4':grey brown silty clay, moist
				4-8': red brown silty clay
				8-12': red brown silty clay some sand at 10'
10'				
				12-14.5': red clay to fine sand
20'				
30'				

ERM-Southeast, Inc.	DRILLING LOG	Boring No. SB-9 Page 1 of 1

Date: 4/8/2002 Project No. 8185

Owner:

Drilling Company: Miller Drilling Company

Logged By: Mike Johnson

Surface Elevation: 803.38

Total Depth: 8.0' Diameter: 2" O.D.

Project: Greif Brothers

Location: Cullman, Alabama

Driller: Don Gerome

Drilling Method: Direct push

Top of Casing Elevation:

Sampling Method: continuous

Comments: Descriptions are made from cuttings.

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
				4/08/2002
0				0-4': red brown silty clay
				4-5': wet brown clay perch zone
				5-6': red brown silty clay, moist
				6-8': red brown sandy clay moist
10'				
20'				
30'				

ERM-Southeast, Inc.

DRILLING LOG

Boring No. SB-10
Page 1 of 1

Date: 4/8/2002 Project No. 8185
Owner:
Drilling Company: Miller Drilling Company
Logged By: Mike Johnson
Surface Elevation: 801.97
Total Depth: 4.5' Diameter: 2" O.D.
Comments: Descriptions are made from cuttings.

Project: Greif Brothers
Location: Cullman, Alabama
Driller: Don Gerome
Drilling Method: Direct push
Top of Casing Elevation:
Sampling Method: continuous

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
				4/08/2002
0				0-1': concrete, gravel
				1-4': red brown sand clay, moist
				4-4.5': sand
10'				
20'				
30'				

ERM-Southeast, Inc.

DRILLING LOG

Boring No. SB-11
Page 1 **of** 1

Date: 4/8/2002 Project No. 8185
Owner:
Drilling Company: Miller Drilling Company
Logged By: Mike Johnson
Surface Elevation: 804.11
Total Depth: 6.5' Diameter: 2" O.D.
Comments: Descriptions are made from cuttings.

Project: Greif Brothers
Location: Cullman, Alabama
Driller: Don Gerome
Drilling Method: Direct push
Top of Casing Elevation:
Sampling Method: continuous

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
				4/08/2002
0				0-0.5': concrete
				0.5-3': red clay, moist
				3-5': grey silty perch zone 5-6.5' red silty sandy clay
10'				
20'				
30'				

ERM-Southeast, Inc.	DRILLING LOG	Boring No. SB-12 Page 1 of 1

Date: 4/8/2002 Project No. 8185

Owner:

Drilling Company: Miller Drilling Company

Logged By: Mike Johnson

Surface Elevation: 796.22

Total Depth: 6.0' Diameter: 2" O.D.

Project: Greif Brothers

Location: Cullman, Alabama

Driller: Don Gerome

Drilling Method: Direct push

Top of Casing Elevation:

Sampling Method: continuous

Comments: Descriptions are made from cuttings.

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
0				4/08/2002 0-4': red brown silty clay, soft, moist
				4-6': red brown silty clay, fine sand
10'				
20'				
30'				

ERM-Southeast, Inc.

DRILLING LOG

Boring No. SB-DW1
Page 1 of 1

Date: 4/2/2002 Project No. 8185
Project: Greif Brothers
Owner:
Location: Cullman, Alabama
Drilling Company: Miller Drilling Company
Driller: Don Gerome
Logged By: Mike Johnson
Drilling Method: Direct push
Surface Elevation: 808.04
Top of Casing Elevation:
Total Depth: 8.5' Diameter: 2" O.D.
Sampling Method: continuous
Comments: Descriptions are made from cuttings.

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
				4/02/2002
0				0-6": Asphalt
				6"-2.5':red brown silty clay, slight plasticity
				2.5'-4.5': red brown silty clay, low moisture
				4.5'-6.5': red brown silty clay
				6.5'-8.5': red brown silty sandy clay.
10'				weathered sandstone refusal.
20'				
30'				

ERM-Southeast, Inc.

DRILLING LOG

Boring No. SB-DW2
Page 1 of 1

Date: 4/2/2002 Project No. 8185
Owner:
Drilling Company: Miller Drilling Company
Logged By: Mike Johnson
Surface Elevation: 801.27
Total Depth: 7.0' Diameter: 2" O.D.
Comments: Descriptions are made from cuttings.

Project: Greif Brothers
Location: Cullman, Alabama
Driller: Don Gerome
Drilling Method: Direct push
Top of Casing Elevation:
Sampling Method: continuous

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
				4/02/2002
0				0-1': gravel 1-3':red brown silty sandy clay, dry. 3-5': red brown silty caly, some sand, moist. 5-7': red brown silty sandy clay, wet.
10'				
20'				
30'				

ERM-Southeast, Inc.

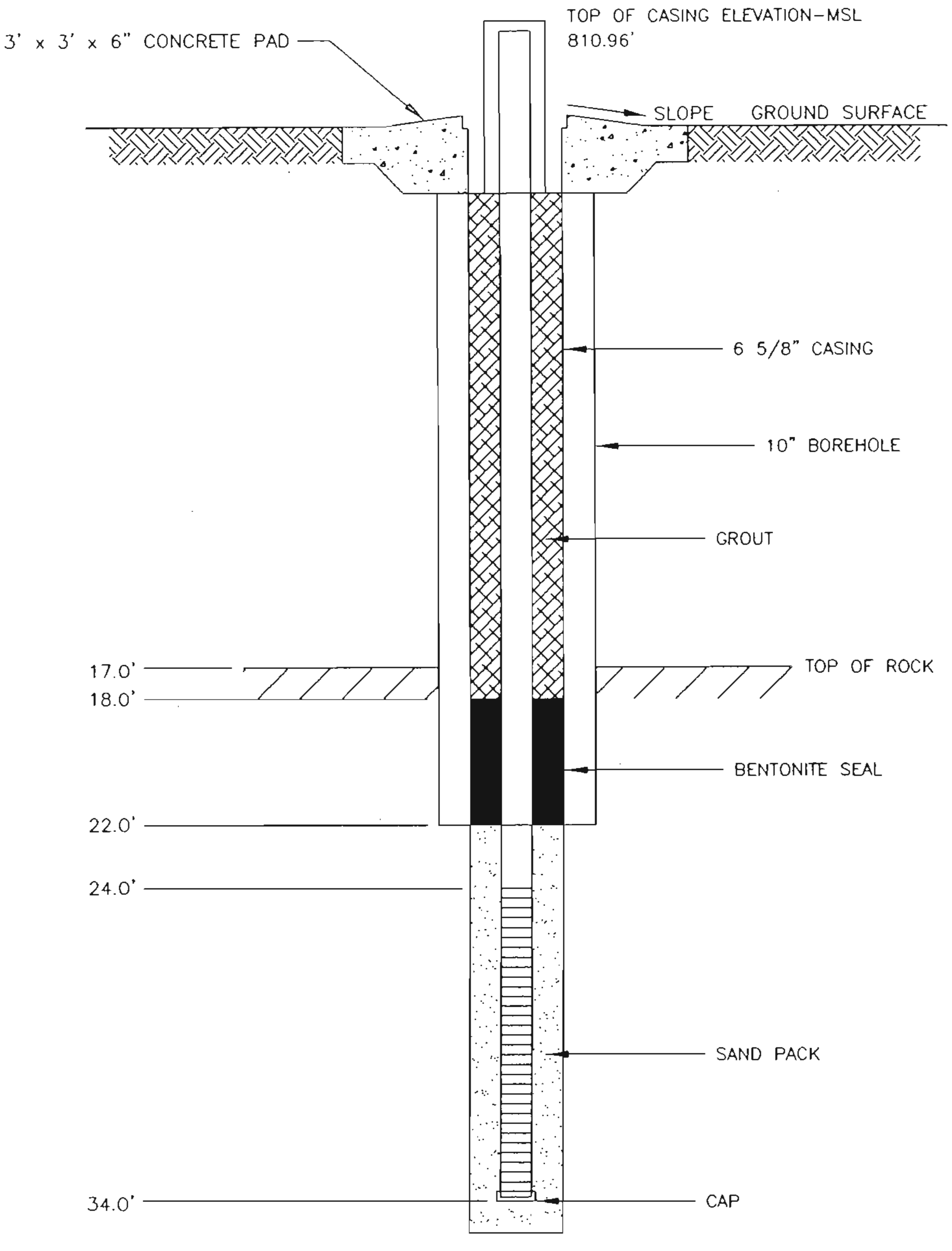
DRILLING LOG

Boring No. SB-DW4
Page 1 **of** 1

Date: 4/3/2002 **Project No.** 8185
Project: Greif Brothers
Owner:
Location: Cullman, Alabama
Drilling Company: Miller Drilling Company
Driller: Don Gerome
Logged By: Mike Johnson
Drilling Method: Direct push
Surface Elevation: 795.59
Top of Casing Elevation:
Total Depth: 7.0' **Diameter:** 2" O.D.
Sampling Method: continuous
Comments: Descriptions are made from cuttings.

Depth (ft.)	HNU Reading	Blow Count	Sample No. (Interval)	Description/Soil Classification (Color, Texture, Structures)
				4/03/2002
0				0-2' dark brown organic 2-4': brown silty clay
				4-6': red brown silty clay, some sand, moist
				6-7': red brown silty sandy clay, moist
10'				
20'				
30'				

Appendix D
Monitoring Well Completion Drawings



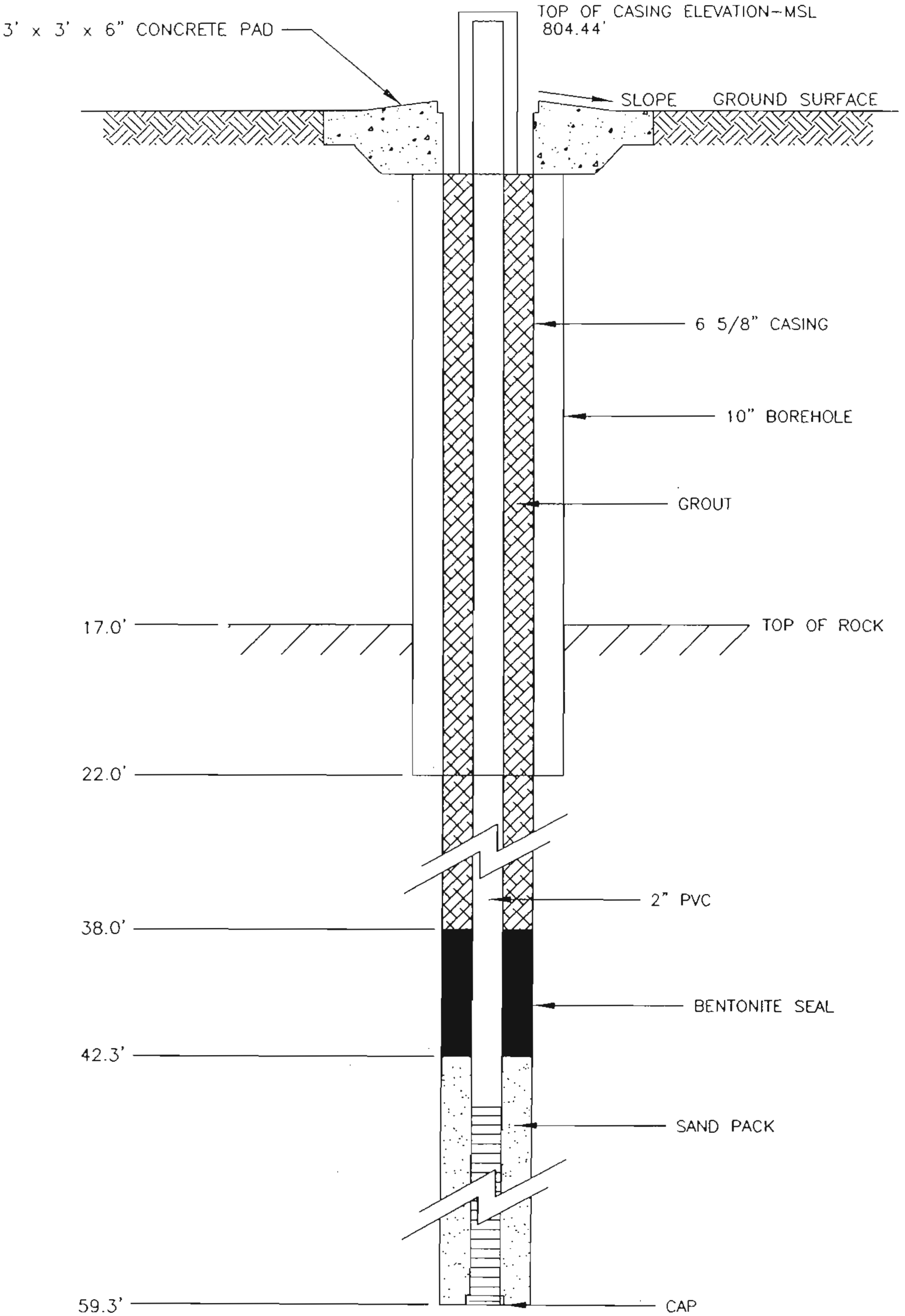
79180W-1 ST 5-20-02 MLW

Environmental
Resources
ERM Management

MONITORING WELL CONSTRUCTION DETAIL DW-1

GRIEF BROS.
CULLMAN, ALABAMA

FIGURE
—



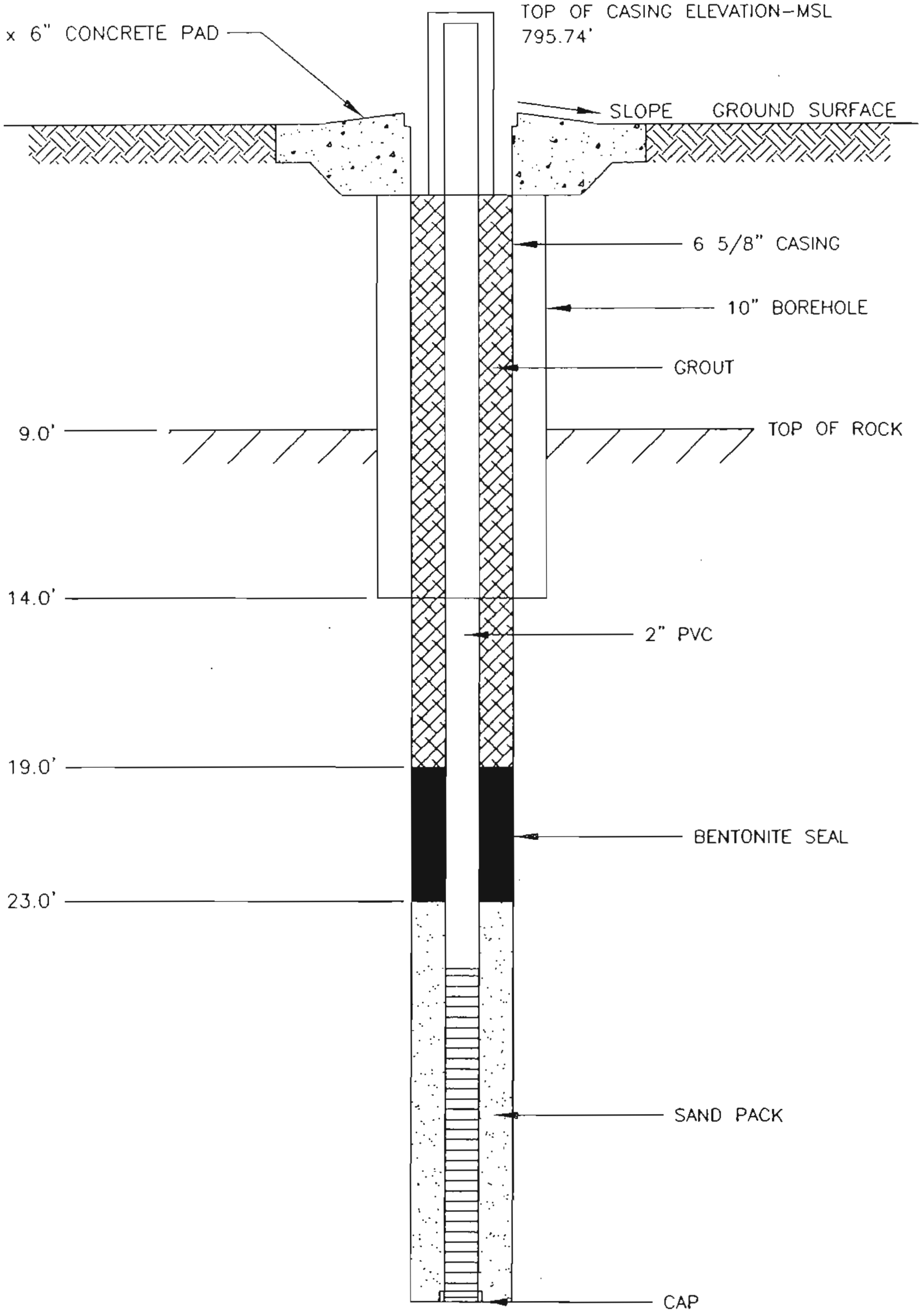
Environmental
Resources
ERM Management

MONITORING WELL CONSTRUCTION DETAIL DW-2

GRIEF BROS.
CULLMAN, ALABAMA

FIGURE
—

7918DW-2 .EST 5-20-02 MLW



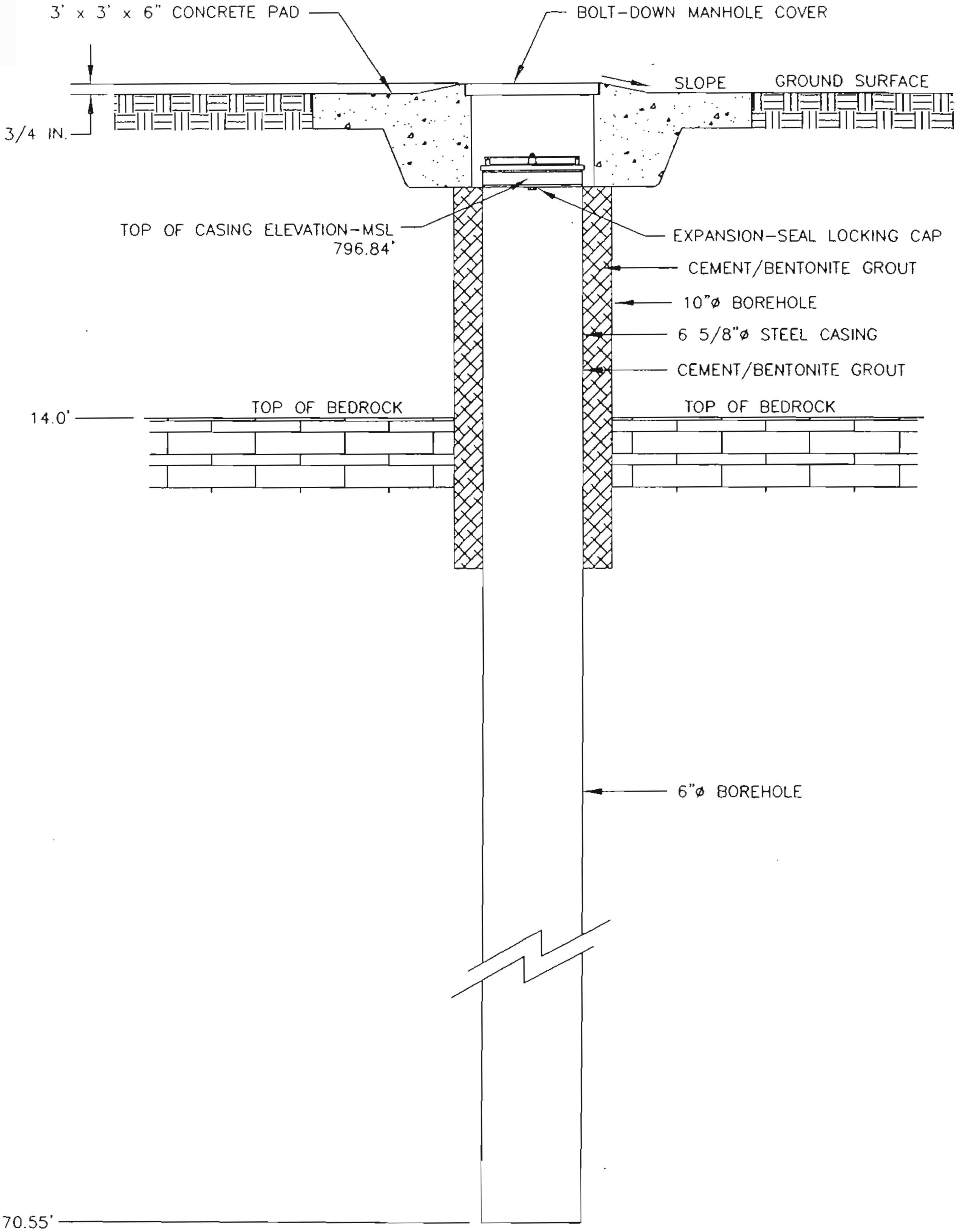
Environmental
Resources
ERM Management

MONITORING WELL CONSTRUCTION
DETAIL DW–3
GRIEF BROS.
CULLMAN, ALABAMA

FIGURE

—

7918DW–3 .EST 5–20–02 MLW



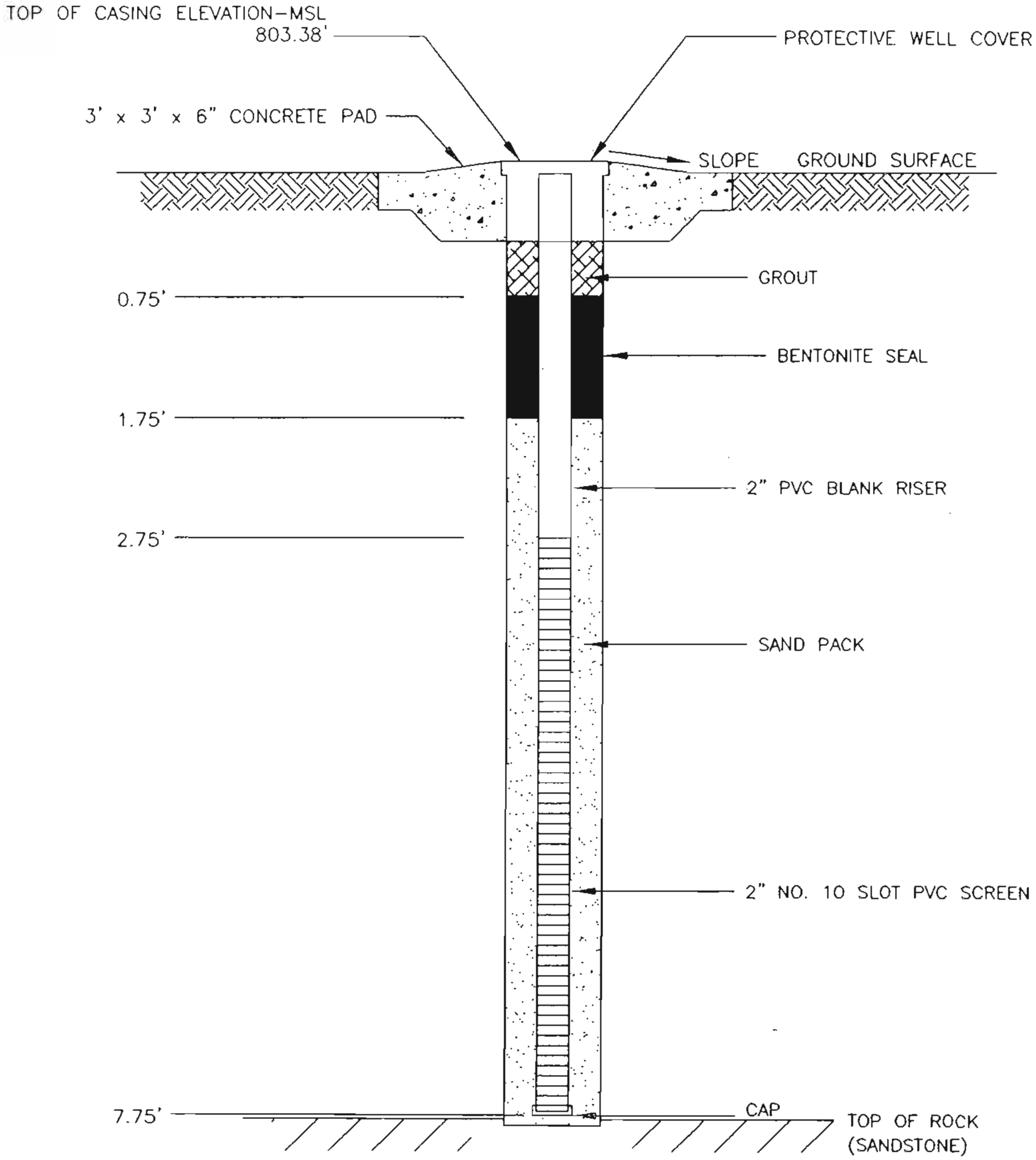
7918DW-4 .EST 5-20-02 MLW

ERM Environmental Resources Management

MONITORING WELL CONSTRUCTION DETAIL DW-4

GRIEF BROS.
CULLMAN, ALABAMA

FIGURE
—



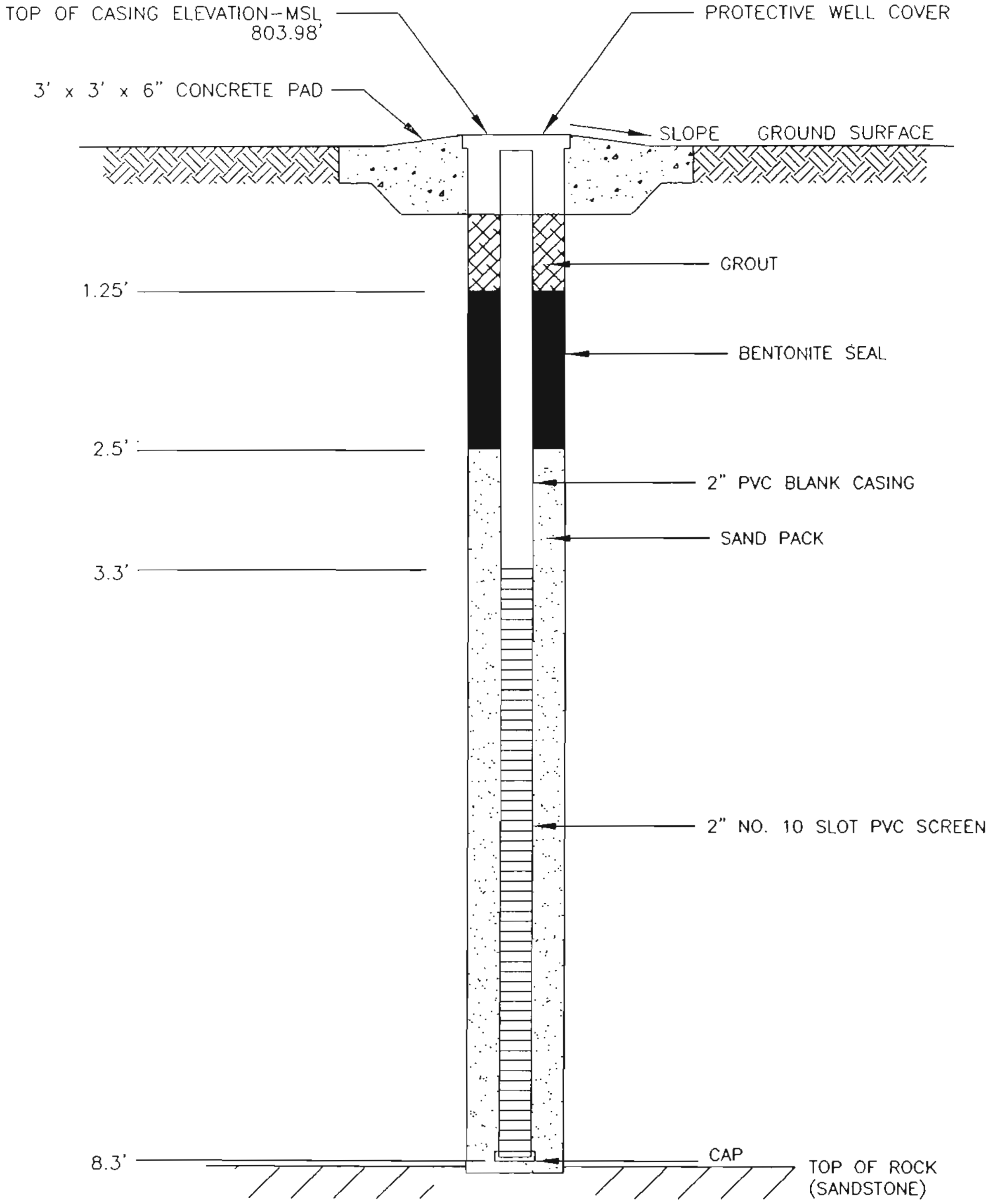
EST 5-20-02 MLW

7918MW-1

ERM Environmental Resources Management

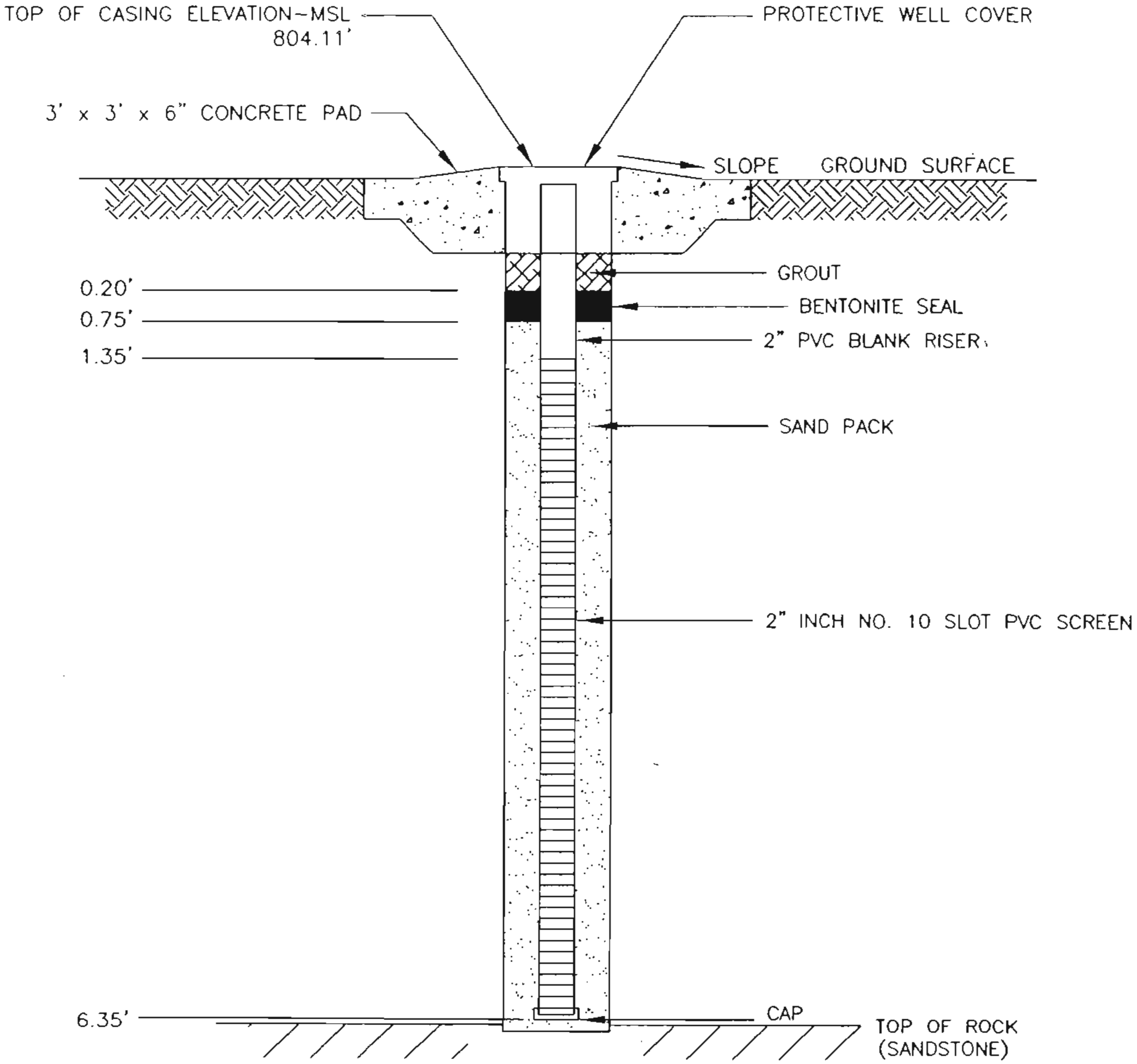
MONITORING WELL CONSTRUCTION DETAIL MW-1
GRIEF BROS.
CULLMAN, ALABAMA

FIGURE
—



7918MW-1 ST 5-20-02 MLW

Environmental Resources ERM Management	MONITORING WELL CONSTRUCTION DETAIL MW-2 GRIEF BROS. CULLMAN, ALABAMA	FIGURE —



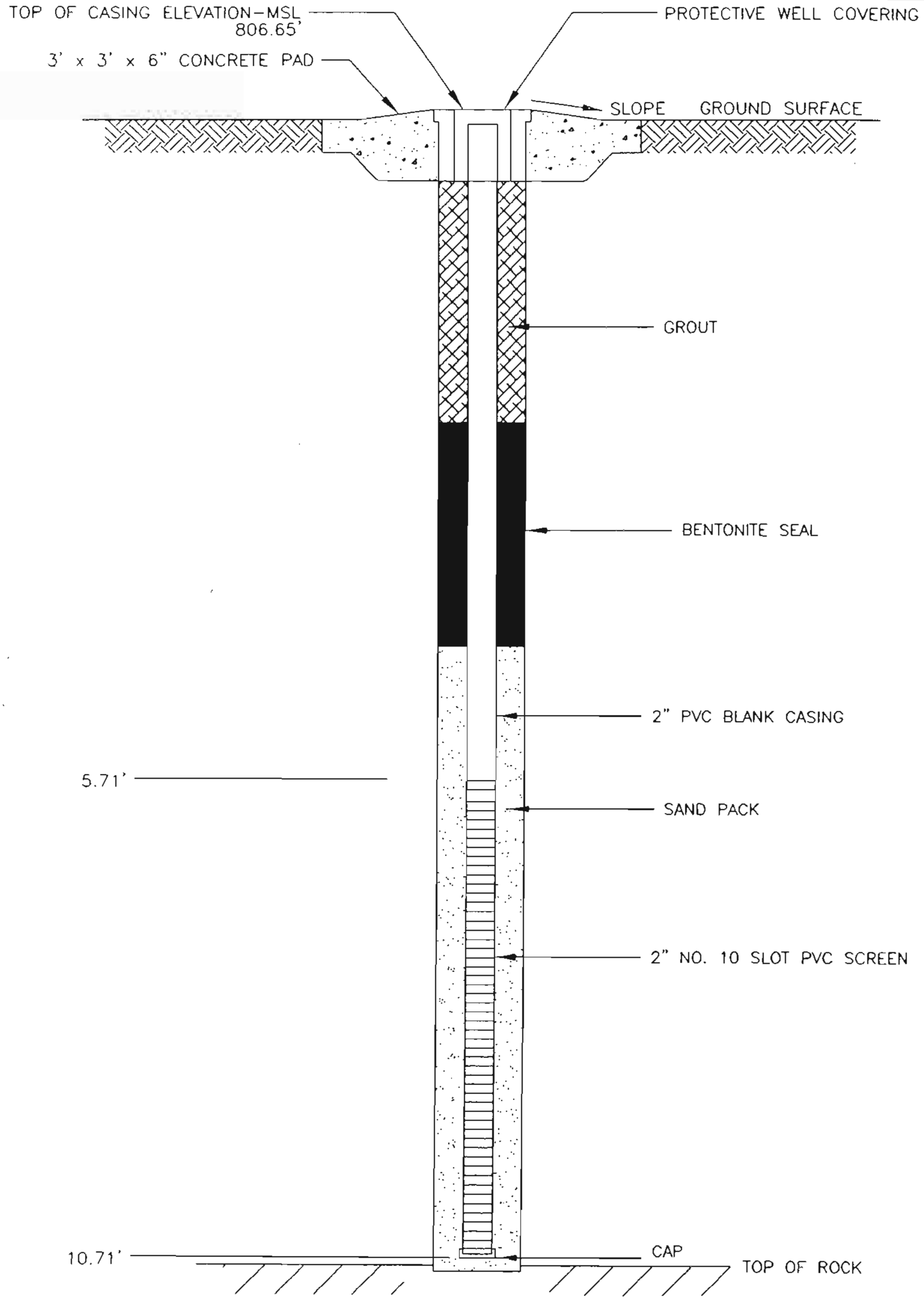
7918MW-1 .ST 5-20-02 MLW

Environmental
Resources
ERM Management

MONITORING WELL CONSTRUCTION DETAIL MW-3

GRIEF BROS.
CULLMAN, ALABAMA

FIGURE
—



Environmental
Resources
ERM Management

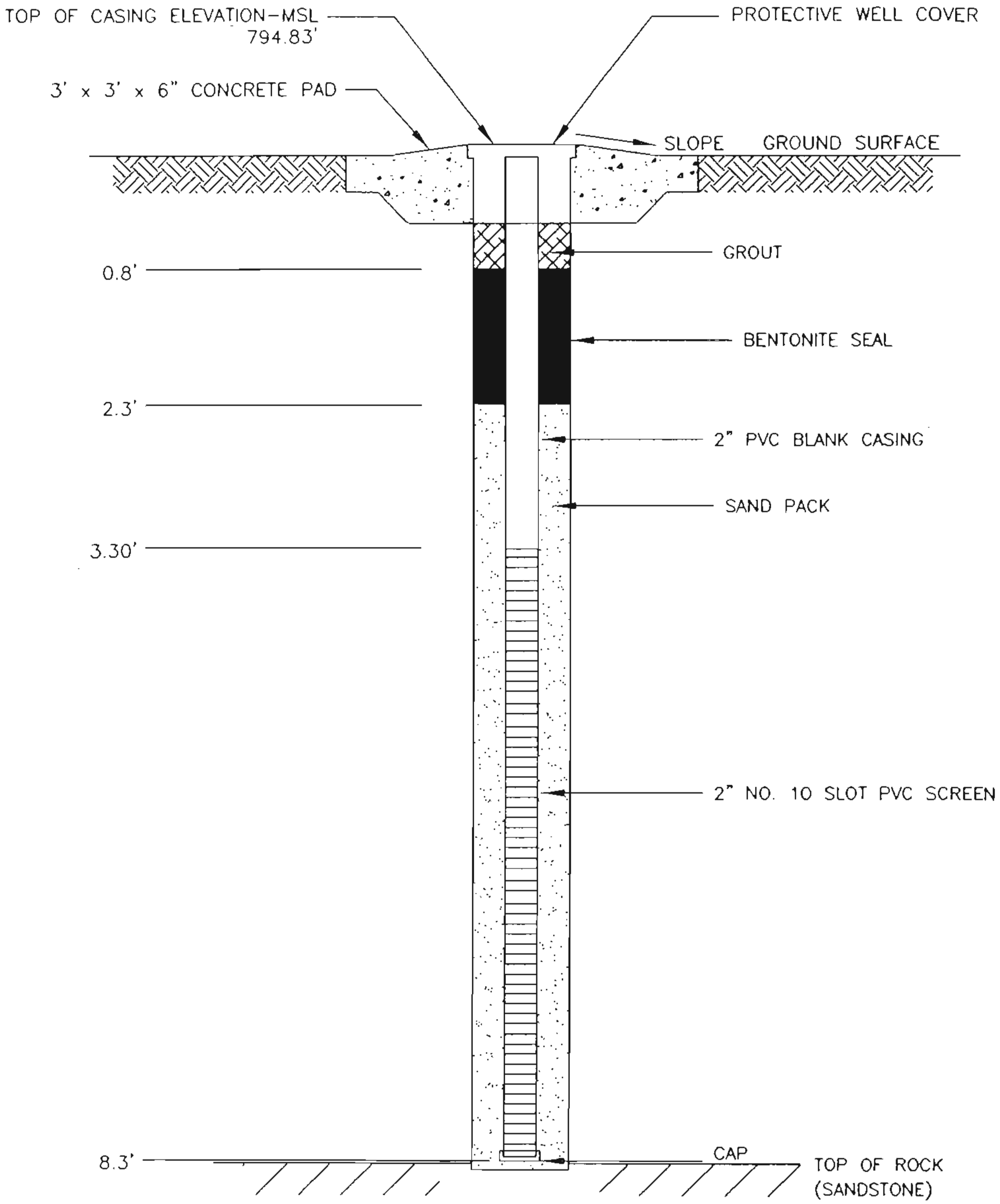
MONITORING WELL CONSTRUCTION DETAIL MW–4

GRIEF BROS.
CULLMAN, ALABAMA

FIGURE
—

ST 5–20–02 MLW

7918MW–1



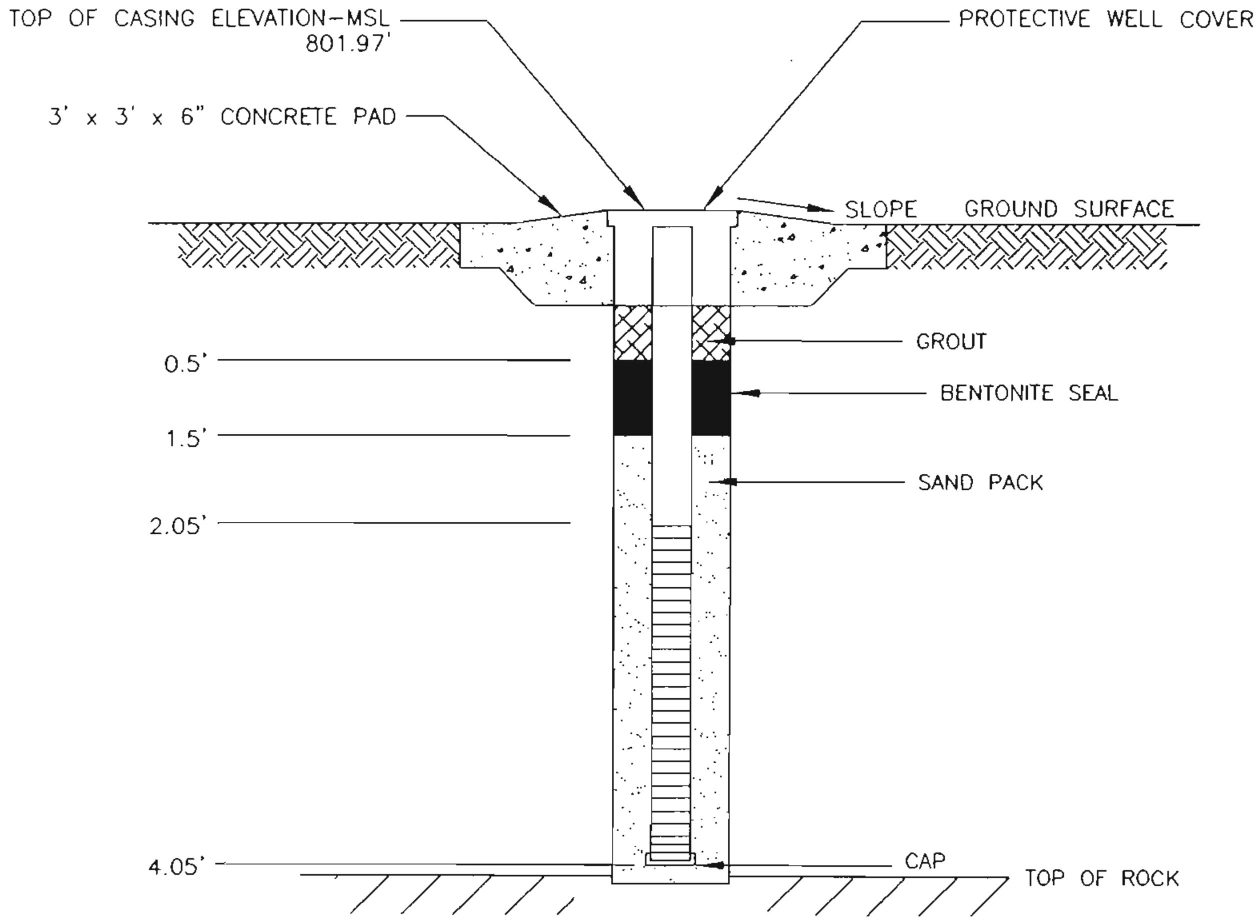
7918MW-1 .EST 5-20-02 MLW

Environmental Resources Management
ERM

MONITORING WELL CONSTRUCTION DETAIL MW-5

GRIEF BROS.
CULLMAN, ALABAMA

FIGURE
—



ERM Environmental Resources Management

MONITORING WELL CONSTRUCTION DETAIL MW-6

GRIEF BROS.
CULLMAN, ALABAMA

FIGURE
—

7918MW-1 ST 5-20-02 MLW

GOODWYN | MILLS | CAWOOD

RECEIVED
MAR 17 2010

March 15, 2010

Ms. Dixie Beatty
Alabama Department of Environmental Management
Land Division
1400 Coliseum Boulevard
Montgomery, Alabama 36110
Phone 334-271-7700

RE: **Goodwyn, Mills, & Cawood, Inc.**
City of Cullman/ Greif Brothers Brownfield Cleanup
PreRemedial Ground-Water Report

Dear Chairman,

Goodwyn, Mills, & Cawood, Inc. (**GMC**) is pleased to provide the pre-remedial ground-water report for the Greif Brothers project. This information supplements the data provided as Phase II reports that were provided earlier. This data was collected to define the ground-water conditions prior to the planned remedial activity.

If you have questions concerning this data, please do not hesitate to call me at 334-590-7010.

Sincerely,

Jymalyn E. Redmond.
Environmental Manager

GOODWYN, MILLS AND CAWOOD, INC.
2660 EastChase Lane, Suite 200
Montgomery, AL 36117
Tel 334.271.3200 **Fax** 334.272.1566
GMCNETWORK.COM

ARCHITECTURE ENGINEERING ENVIRONMENTAL GEOTECHNICAL INTERIOR DESIGN LANDSCAPE PLANNING SURVEYING TRANSPORTATION

Greif Brothers Phase II Report
Annual Sampling
2010

Introduction

Goodwyn, Mills and Cawood, Inc. (GMC) is assessing the nature and extent of chemical constituents of concern in the shallow ground water beneath the former Grief Brothers Facility in Cullman, Alabama (Figure 1). Releases of chemicals of concern occurred during the operational period of the facility. This report is provided as a supplement and update to previous investigations at the facility. Several site visits were completed during the past year and no additional spills were noted. Site use and conditions appear to be unchanged as reported in previous discussions. During the first quarter of 2010, ground-water samples were collected from eight shallow monitoring wells (Figure 2). The sampling was conducted by qualified staff in general accordance with ASTM Standards for Environmental Site Assessments. The assessment team consisted of James Robinson, geologist and Jymalyn Redmond, chemist.

The monitoring wells were purged and sampled over a two day period. Ground water samples were collected in appropriated sample containers, labeled, placed on ice, and transported to Sutherland Environmental Company in Birmingham, Alabama for analysis. Chain-of-custody documentation was maintained. The samples were analyzed for metals and volatile organic compounds. The results of analyses are attached along with a site map. The ground-water level in each well was measured, and a ground-water surface map was prepared (Figure 2). The wells were last sampled in 2009.

Initial investigations at the facility (ERM, 2002) indicated that metals and volatile organic compounds (VOC) were found to be present above regulatory levels in some of the shallow ground water wells. Since 2002, no exceedances of metal standards have been observed in ground water sampled from the site. The 2002 testing indicated arsenic and lead was present in ground water in monitoring well 5 in concentrations that exceeded the National Public Drinking Water Standards. Analyses of ground-water samples collected in 2007, 2009, and 2010 did not contain arsenic or lead above the method detection limit of .01 mg/l for arsenic and .0020 for lead. The cause of the decrease in concentration of metals is unknown, however; sometimes newly installed wells have suspended particles present in the water column that can be difficult to clear up during development. These suspended particles may influence results of analysis. Results of analyses of ground-water samples collected from monitoring wells 3, 4 and 6 indicated the presence of chlorinated solvents (i.e. trichloroethylene, TCE) at concentrations greater than their respective levels of concern. These wells are located near a former solvent management area. Samples from the wells contained the highest concentrations of chemicals of concern, and were of the most concern. In these wells, the analyses indicate that the TCE in the ground water is breaking down to its degradation constituents, dichloroethene and vinyl chloride. These constituents also were present in testing conducted in 2007 and 2009. A severe drought ended in 2009. The impact of the drought on the concentrations of chemicals of concern is unclear, but ground-water levels have not changed significantly when measured during the 2009 and 2010 sampling.

The 2009 and 2010 monitoring event included the sampling of two wells installed in 2008 (wells 7 and 8). The results of analyses of samples collected from these wells indicated no concentrations of chemicals of concern above the method detection limits. The results of analyses of ground-water samples from wells 7 and 8 indicate that the contaminant plume has not migrated to the south of the raible sheet processing and stamping building where these wells are located. The analytical results for samples collected in the first quarter of 2010 are included in the following tables.

Table of Field Parameters
Greif Monitoring Wells
2010

Well Number	pH	Specific Conductance (uS/cm)	Dissolved Oxygen (mg/L)	Temperature °C	Depth to water (feet below LSD)	Ground-water Surface elevation (ft above MSL)
1	6.40	261	6.4	9.0	1.90	801.48
2	6.28	337	6.2	9.9	1.17	802.81
3	7.37	317	8 ?	9.4	1.22	802.89
4	5.70	136	6.2	10.0	1.76	804.89
5	7.40	398	2.0	7.9	0.94	793.89
6	6.87	635	8.6	5.7	1.85	800.12
7	4.96	130	5	11.1	3.32	799.56
8	4.83	378	6.3	9.5	2.65	798.19

Table of Metal Analyses
Greif Monitoring Wells
2010

Result (mg/L)									
Metals	**MW-1**	**MW-2**	**MW-3**	**MW-4**	**MW-5**	**MW-6**	**MW-7**	**MW-8**	**Detection Limits (mg/l)**
Arsenic	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.01
Barium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.01
Selenium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.015
Mercury	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.0005
Cadmium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.01
Chromium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.01
Lead	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.002
Silver	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.01
Iron	**3.6**	**7.8**	**0.54**	**6.9**	**0.23**	**0.94**	**0.38**	**1.5**	0.01

Table of Volatile Organic Compounds Analyses
Greif Monitoring Wells
2010

Result (mg/L)									
Compound	**MW-1**	**MW-2**	**MW-3**	**MW-4**	**MW-5**	**MW-6**	**MW-7**	**MW-8**	**Detection Limits (mg/l)**
Benzene	BDL	BDL	BDL	BDL	BDL	**0.008**	BDL	BDL	0.005
Bromobenzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
Bromochloromethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
Bromodichloromethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
Bromoform	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
Bromomethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
n-Butylbenzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
sec-Butylbenzene	BDL	BDL	BDL	**0.012**	BDL	BDL	BDL	BDL	0.005
Tert-Butybenzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
Carbon Tetrachloride	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
Chlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
Chloroethane	BDL	**0.005**	BDL	BDL	BDL	BDL	BDL	BDL	0.005
Chloroform	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
2-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
4-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
Dibromochloromethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromo-3-Chloropropane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromoethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
Dibromomethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
1,3-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005

Table of Volatile Organic Compounds Analyses
Greif Monitoring Wells
2010

Result (mg/L)									
Compound	**MW-1**	**MW-2**	**MW-3**	**MW-4**	**MW-5**	**MW-6**	**MW-7**	**MW-8**	**Detection Limits (mg/l)**
1,4-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
Dichlorodifluoromethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
1,1 Dichloroethane	**0.016**	BDL	**0.099**	BDL	BDL	**0.020**	BDL	BDL	0.005
1,2-Dichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloroethene	**0.016**	BDL	**0.131**	**0.063**	BDL	**0.032**	BDL	BDL	0.005
Cis-1,2-Dichloroethene	**0.196**	**0.011**	**0.285**	**11.300**	BDL	**10.100**	BDL	BDL	0.005
Trans-1,2-Dichloroethene	BDL	BDL	BDL	**0.025**	BDL	**0.045**	BDL	BDL	0.005
1,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
1,3-Dichloropropane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
2,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloropropene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
Cic-1-3,Dichloropropene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
Trans-1,3-Dichloropropene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
Ethylbenzene	BDL	BDL	BDL	**0.310**	BDL	BDL	BDL	BDL	0.005
Hexachlorobutadiene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
Isopropylbenzene	BDL	BDL	BDL	**0.149**	BDL	BDL	BDL	BDL	0.005
4-Isopropyltoluene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
Methylene Chloride	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
Naphthalene	BDL	BDL	BDL	**0.455**	BDL	BDL	BDL	BDL	0.010
n-Propylbenzene	BDL	BDL	BDL	**0.380**	BDL	BDL	BDL	BDL	0.005
Styrene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005

Table of Volatile Organic Compounds Analyses
Greif Monitoring Wells
2010

Result (mg/L)									
Compound	**MW-1**	**MW-2**	**MW-3**	**MW-4**	**MW-5**	**MW-6**	**MW-7**	**MW-8**	**Detection Limits (mg/l)**
1,1,1,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
Tetrachloroethene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
Toluene	BDL	BDL	BDL	**0.050**	BDL	BDL	BDL	BDL	0.005
1,2,3-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1-Trichloroethane	BDL	BDL	**0.077**	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2-Trichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
Trichloroethylene	**0.197**	BDL	**0.323**	**30.400**	BDL	1.060	BDL	BDL	0.005
Trichlorofluoromethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
1,2,3-Trichloropropane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trimethylbenzene	BDL	BDL	BDL	**2.840**	BDL	BDL	BDL	BDL	0.005
1,3,5-Trimethylbenzene	BDL	BDL	BDL	**0.576**	BDL	BDL	BDL	BDL	0.005
Vinyl Chloride	**0.002**	**0.004**	**0.043**	**0.412**	BDL	**1.220**	BDL	BDL	0.002
Xylenes, o,m,p	BDL	BDL	BDL	**1.180**	BDL	BDL	BDL	BDL	0.005

GENERAL SITE CONDITIONS

Location

This site is a former industrial manufacturing facility located at 409 Second Ave, N.E., in Cullman County within the city limits of Cullman, Alabama, 35056, between Eighth Street and Elizabeth Street N.E. on the northern side of the CSX Railroad. The adjoining land use of the 11± acre site is mixed industrial, commercial and residential in nature. The site is located in Township 10 South, Range 3 West, Section 10 on the Cullman, Alabama 7.5 minute quadrangle map (Figure 1). The coordinates of the site are Latitude: 34° 10' 56" North, Longitude: 86° 50' 43" West (WGS84/NAD83).

History

The history of the site is complex having been industrial in use throughout the last eighty-eight years. Earliest dates suggest that the site was developed for industrial use as far back as 1917, since then the site has been home to several different industries. These industries include Bremen (or Dremen) Manufacturing Company, Standard Industrial Laundry, Porter Knitting Mills Company, Cullman Supply Company, Acadia Planning, King Pharr Canning Company, Raible Division Sheet Metal and Stamping Company and the latest being Greif Brothers Corporation (Greif). Greif used the site to manufacture steel drum containers ranging in size from 4.5 gallons to 85 gallons from around 1947 until September 30th, 2002. The raw materials used in the manufacturing process include steel coils, paints, inks and plastic liners. The Cullman Supply Company (CUSCO), also owned by Greif, was a machine shop and parts warehouse that shared the property. CUSCO operated several different processes including saw-blade manufacturing and repair, a welding shop, a machine shop, and a parts distribution center. The machine shop housed metal cutting, milling, and surface grinding equipment.

Review of regulatory agency records and files indicate that the site was listed as a large quantity hazardous waste generator (RCR-LQG) and on the list identifying current/past usage of underground storage tanks (AL-UST). The Site was not found on any of the federal or state lists of Superfund sites (NPL, CERCLIS, CERCLIS-NFAP), emergency response reports (ERNS), hazardous waste corrective action (CORRACTS), solid waste disposal (AL-HW/SWL) or leaking underground storage tanks (LUST).

This Site is now being considered a prime candidate for the Alabama Department of Environmental Management's (ADEM) Voluntary Cleanup Program.

Other Reports and Studies

In August of 2001 Environmental Resources Management (ERM) performed a Phase I Environmental Site Assessment and Limited Phase II Investigation on the Site. This report identified 11 Areas of Concern (AOC's) based on persons familiar with the Site and its history. Of these 11 AOC's, 6 of the areas were found to have one or more constituents above a federal and/or state listed maximum contaminant levels (MCL's). In July of 2002 a Phase III Remedial Investigation (RI) was performed on the site by ERM. The objective of the RI report was to confirm and/or further define the impacts at the Site that were identified in the Phase I ESA and limited Phase II performed by ERM in 2001. Soil and/or water samples were taken from the majority of the AOC's identified in the first report. An additional AOC (AOC #12) was found and sampled during this investigation as well. Additional testing of the site was conducted in August 2007. This testing was conducted to define conditions at shallow monitoring wells located near the areas of concern and provide a benchmark for comparison.

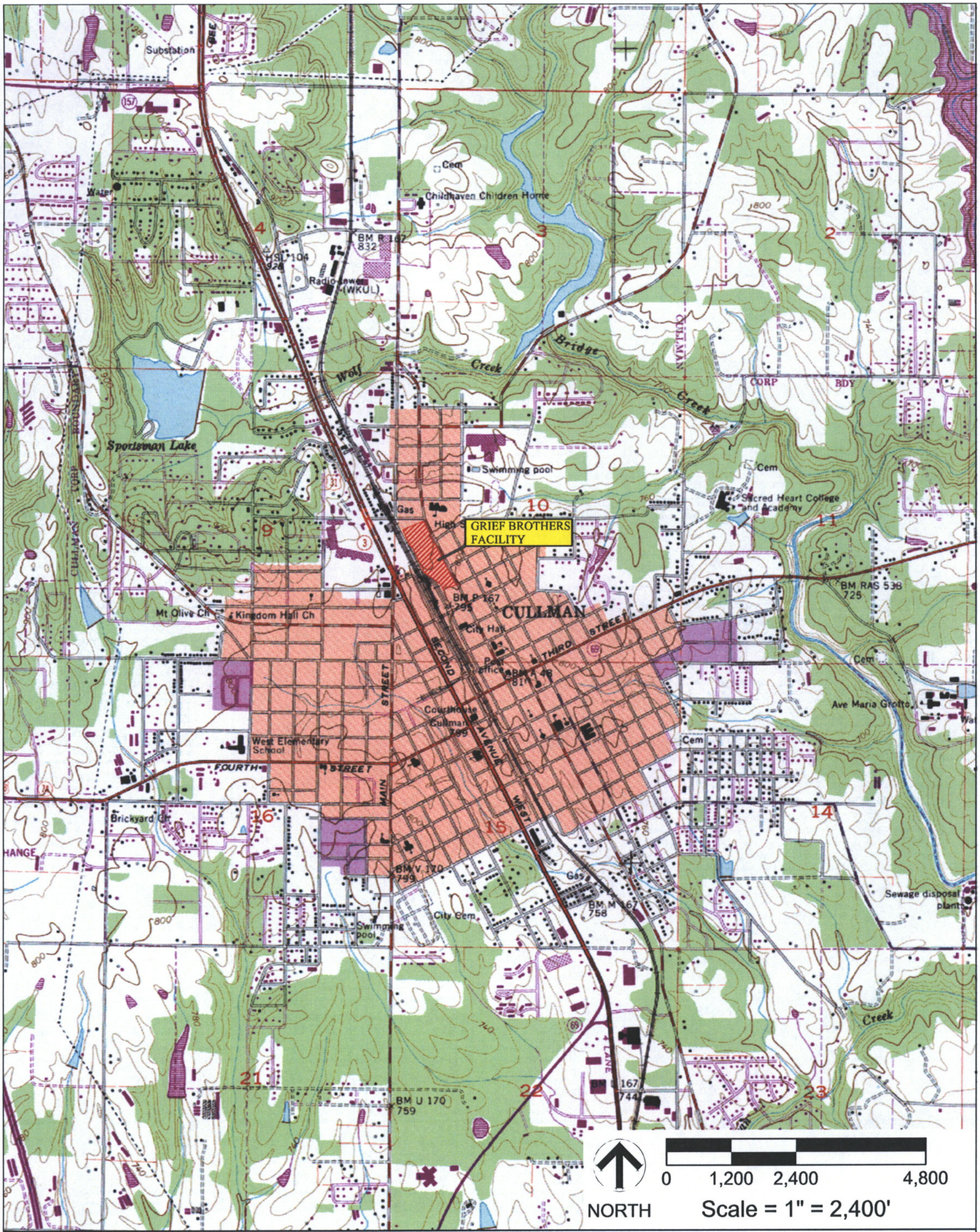
Additional updates to site conditions were made in 2009 in preparation for the purchase of the property. All appropriate inquiry was conducted. Testing for this Phase II was conducted in the first quarter of 2010. A comparison of target properties (Superfund and RCRIS) located near Greif did not identify additional sites of concern. Inquiry with ADEM did not identify outstanding orders or additional environmental issues other than those cited as areas of concern. The site is eligible to apply for EPA Brownfield grants.

CERTIFICATION

This environmental assessment was conducted in accordance with standard geologic and engineering practices consistent with similarly situated environmental professionals in this area. All ground water information collected was reviewed and the collecting of information was overseen by either a geologist, hydrogeologist or engineer experienced in subsurface investigation. The information submitted herein, to the best of my knowledge and belief is, true, accurate, and complete.

Jymalyn E. Redmond
Environmental Manager

James L. Robinson, PG



REF. SHEET: FIGURE 1

DESCRIPTION: PHASE II GROUND-WATER SAMPLING

LOCATION OF GRIEF BROTHERS CULLMAN, ALABAMA

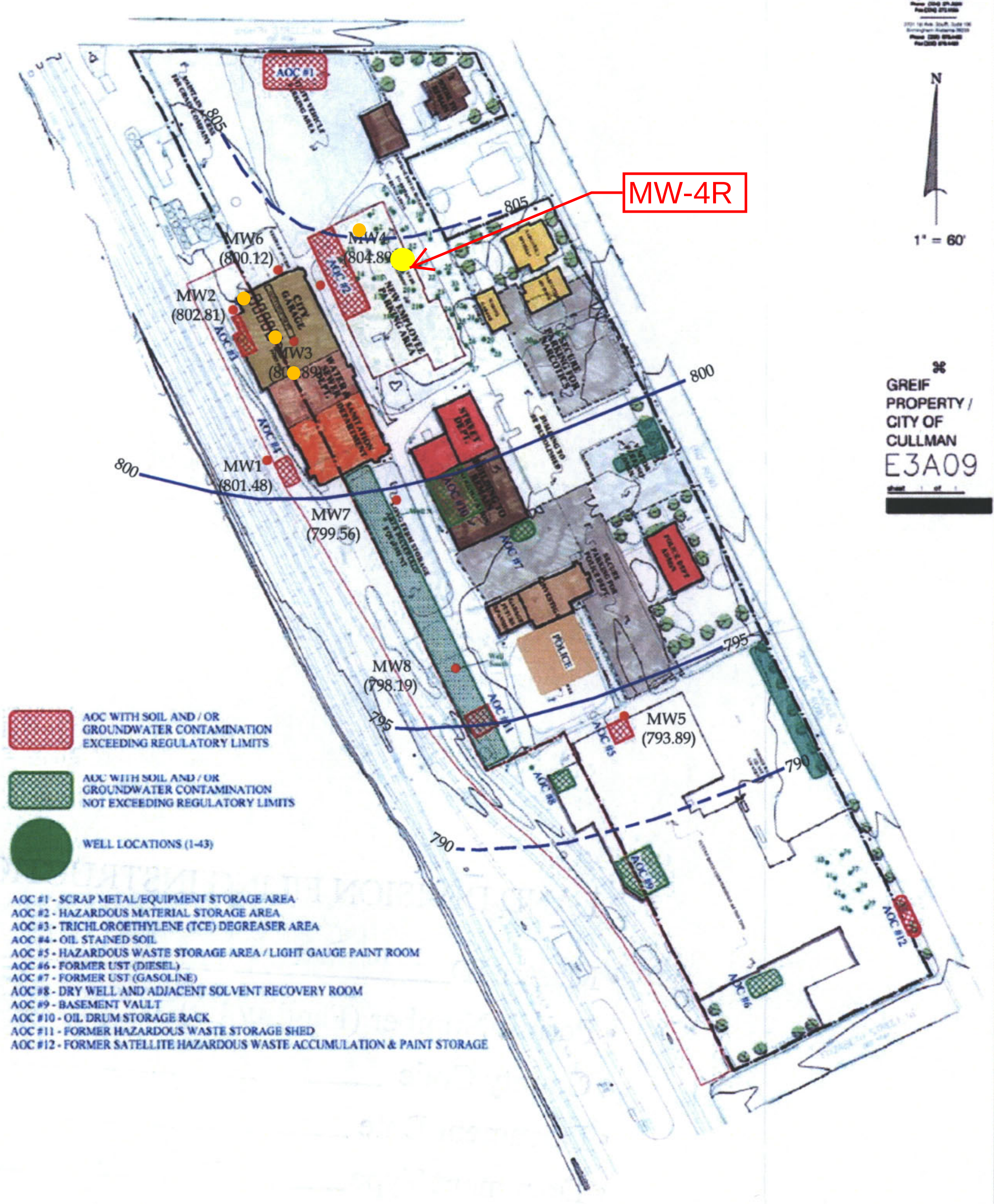
GMC # E10101
DATE: 03/01/2010
DRAWN BY: JLR

GOODWYN | MILLS | CAWOOD

2660 EASTCHASE LANE, SUITE 200 | MONTGOMERY, AL 36117
Tel 334.271.3200 | GMCNETWORK.COM

MASTERPLAN SITE STUDY

GREIF PROPERTY
CITY OF CULLMAN



🟥 AOC WITH SOIL AND / OR GROUNDWATER CONTAMINATION EXCEEDING REGULATORY LIMITS

🟩 AOC WITH SOIL AND / OR GROUNDWATER CONTAMINATION NOT EXCEEDING REGULATORY LIMITS

● WELL LOCATIONS (1-43)

AOC #1 - SCRAP METAL/EQUIPMENT STORAGE AREA
AOC #2 - HAZARDOUS MATERIAL STORAGE AREA
AOC #3 - TRICHLOROETHYLENE (TCE) DEGREASER AREA
AOC #4 - OIL STAINED SOIL
AOC #5 - HAZARDOUS WASTE STORAGE AREA / LIGHT GAUGE PAINT ROOM
AOC #6 - FORMER UST (DIESEL)
AOC #7 - FORMER UST (GASOLINE)
AOC #8 - DRY WELL AND ADJACENT SOLVENT RECOVERY ROOM
AOC #9 - BASEMENT VAULT
AOC #10 - OIL DRUM STORAGE RACK
AOC #11 - FORMER HAZARDOUS WASTE STORAGE SHED
AOC #12 - FORMER SATELLITE HAZARDOUS WASTE ACCUMULATION & PAINT STORAGE

Goodwyn, Mills & Cawood, Inc.
ENGINEERING
ARCHITECTURE
LANDSCAPE ARCHITECTURE
PLANNING

GREIF PROPERTY / CITY OF CULLMAN
E3A09

PREMEDIAL GROUND-WATER REPORT
GROUND-WATER SURFACE MAP
GRIEF BROTHERS FACILITY, CULLMAN, AL

GMC Project Number E10101

ISSUE	DATE
FINAL COPY	3/10
drawn by:	JLR
checked by:	JLR

GOODWYN | MILLS | CAWOOD
2660 EastChase Lane, Suite 200 | Montgomery, AL 36117
Tel 334.271.3200 | GMCNETWORK.COM

sheet 2 of 2

GOODWYN | MILLS | CAWOOD

TRANSPORTATION SURVEYING PLANNING LANDSCAPE INTERIOR DESIGN GEOTECHNICAL ENVIRONMENTAL ENGINEERING ARCHITECTURE

ADEM
RECEIVED
SEP 17 2012
GROUND WATER BRANCH

September 17, 2012

Ms. Ruth Maxey
Alabama Department of Environmental Management
1400 Coliseum Boulevard
Montgomery, Alabama 36110

RE: **City of Cullman**
Greif Brothers Brownfield Cleanup
UIC Progress Report August 2012
UIV permit #ALSI19922524

Dear Ms. Maxey,

Please find 2 copies of the UIC Progress Report for August 2012. Injections were completed for this site and monitoring wells have been replaced. This is the first quarterly report for this City of Cullman Grief Brothers project.

If you should need additional information, please contact me at my cell number 334-590-7010.

Sincerely,

Jymalyn E. Redmond.
Environmental Manager

Cc: Joe Kelly

GOODWYN, MILLS AND CAWOOD, INC.
2660 EastChase Lane, Suite 200
Montgomery, AL 36117
Tel 334.271.3200 Fax 334.272.1566
GMCNETWORK.COM

ADEM
RECEIVED
SEP 1 7 2012
GROUND WATER BRANCH

September 17, 2012

Mr. Joe Kelly
Alabama Department of Environmental Management
1400 Coliseum Boulevard
Montgomery, Alabama 36110

RE: City of Cullman Class V *UIC Injection Permit Report*
Permit # ALSI9922524

Dear Joe,

Please find attached a copy of the Class V UIC Injection Report for City of Cullman Greif Brothers Brownfield Cleanup (a Voluntary Cleanup Program Project). As indicated in our recent telephone conversation, we experienced some difficulty in replacing confirmatory wells in the treatment area due to soft soils where the rotary soil blending head incorporated chemical oxidants. Therefore, installation was delayed but we are providing this information at the earliest possible time.

We trust the attached information provides details to assist in your consideration of the current site conditions. We are pleased at the reduction in contaminant concentrations. If you should need additional information, please contact me at my cell number 334-590-7010.

Sincerely,

Jymalyn E. Redmond.
Environmental Manager

The Class V UIC Injection Permit # ALSI9922524 provided authorization to apply persulfate and lime as an in-situ treatment to reduce chlorinated compound concentrations at the Greif Brothers site. During January and February, 2012, a rotary soil blending head incorporated 37,000 pounds of sodium persulfate and 3,960 pounds of lime to a depth of approximately 12 feet (or to bed rock) via a continuous blending process. The attached photos provide visual images of this soil blending process. The location of the application is indicated on the attached map.

pH Concentrations – Table 1 Sampled August, 2012

Well Number	MW - 9	MW -4R	MW – 6	sump
pH	4.35	6.5	6.4	6.27

MW 9 and MW 4R are placed closest to required locations. Previously sampled wells were located within the treatment areas. MW – 6 and the sump location are up-gradient and are representative of conditions not effected by the chemical oxidation process. Data was collected by a registered professional geologist, James Robinson. Wells were purged as required by ADEM SOP and field parameters were stabilized.

Sulfate Concentrations -- Table 2 Sampled August 2012

Well Number	MW - 9	MW 4R	MW 6	sump
Sulfate mg/l	BDL <.1	3190	4.2	7.1

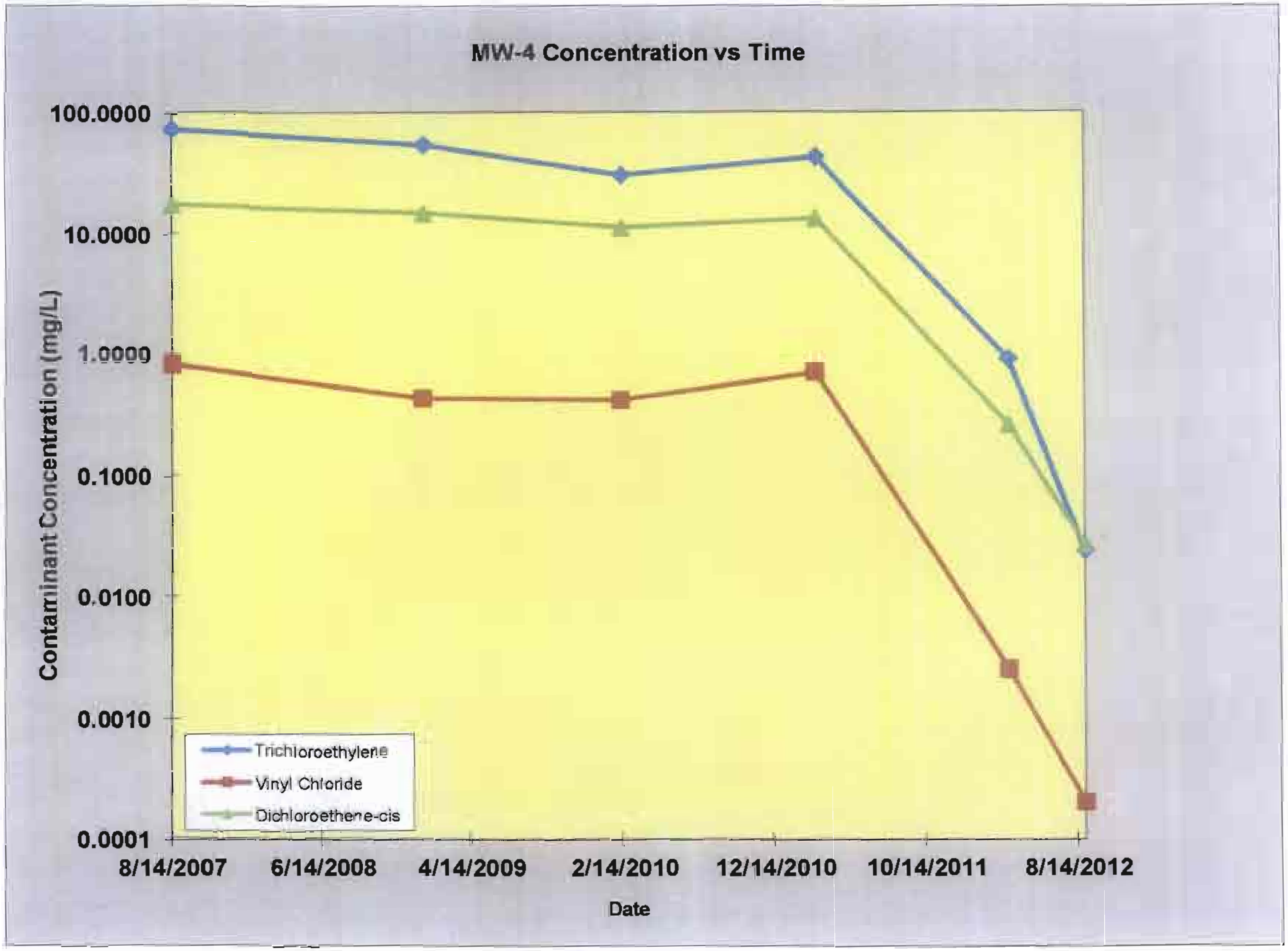
r

The persulfate anion is the most powerful oxidant of the peroxygen family of compounds and one of the strongest oxidants used in remediation. The basic oxidation reaction for sodium persulfate involves the release of sulfate radicals and is generally described as follows:

$$S_2O_8^{-2} + \textit{activator} \rightarrow SO_4^{\cdot-} + (SO_4^{\cdot-} \text{ or } SO_4^{-2})$$

Where $S_2O_8^{-2}$ is the persulfate ion, $SO_4^{\cdot}$ is the sulfate radical, and SO_4^{-2} is the sulfate anion. Activators in the equation include transition metal catalysts, pH adjusters, heat, etc. Oxidation reactions involving the sulfate radical result in by-products of carbon dioxide, water, and sulfate salts.

In comparison to other forms of remediation, the use of Sodium Persulfate has many benefits. The Sodium Persulfate should achieve lower levels at a faster rate than bioremedial or reductive chemical options, and when it is activated with lime the byproduct is gypsum which will assist in stabilizing the subsurface for future construction.


MW-4 Concentration vs Time
Contaminant Concentration (mg/L)
100.0000
10.0000
1.0000
0.1000
0.0100
0.0010
0.0001
8/14/2007
6/14/2008
4/14/2009
2/14/2010
12/14/2010
10/14/2011
8/14/2012
Date
Trichloroethylene
Vinyl Chloride
Dichloroethene-cis

Sutherland

Environmental Company, Inc.
2515 5th Avenue South
BIRMINGHAM, AL 35233
PHONE (205)581-9500 FAX (205)581-9504
E-Mail: suthlab@bellsouth.net

CHAIN OF CUSTODY ANALYSIS REQUEST

Client P.O. #

SEND REPORT TO:
Invoice # 27307
Name: Jymolyn Redmond
Company: Goodwyn, Mills & Cawood
Address: 2660 East Chase Ln Suite 200
Montgomery, AL 36117
Phone#:
Cell # 334 590 7010
E-mail: jymolyn.redmond@gmcnetwork.com
PDF Results: [✓ yes] no
Fax #:

CLIENT: Cullman
PROJECT: Cullman
SAMPLER(S): (print) James Robinson

DATE DELIVERED:

LAB ID	FIELD ID	DATE Collected	TIME Collected	SAMPLE DESCRIPTION (matrix)	ANALYSIS REQUESTED / METHOD								Number of sample containers
						VOC	SO4						
137211	mw 9	8/30/12	950	GW		✓	✓						4
137212	Sump	8/30/12	1015	water		✓	✓						4
137213	mw 4R	8/30/12	1045	GW		✓	✓						4
137214	mw 6	8/30/12	1115	GW		✓	✓						4
137215	Trip Blank					✓							1
Preservative: (a)HCL, (b)HNO$_3$, (c)H$_2$SO$_4$, (d)NaOH, (e)Zn Acetate				Preservative:		HCL	ice						Last revised
Container type: (a) Amber, (g) Glass, (p) Plastic, (v) VOC Vial, (air) air bag				Container:		G	P						5/29/12

Relinquished by Sampler: Signed:	Date	Time	Received by: Signed:	Date	Time
	8/30/12	1230			
Relinquished by: Signed:	Date	Time	Received by: Signed:	Date	Time
Relinquished by: Signed:	Date	Time	Received in Laboratory by: Signed: Tasha McNeely	Date	Time
				8/30/12	12:30

Turn Around Time (please note):
Standard ____ *RUSH, mark below ____
*3-Day *2-Day *Next Day *Same Day

Remarks:

Refrigerated upon receipt: [✓ yes] no

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	September 7, 2012
Attention:	Ms. Jymalyn Redmond	Reference #	27307
Address:	2660 East Chase Ln. Suite 200	P.O. #	verbal
	Montgomery, AL 36117	Project ID:	Cullman

Sample Matrix:	water	Analytical	
Date Received:	8/30/12	Analyst:	Hageman/Heard
Date Collected:	8/30/12	Date Analysis:	9/4-5/12
Sample Collector:	J. Robinson	Method:	***SW 846 Method 8260***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	
VOLATILE ORGANIC COMPOUNDS, PPM	**MW-9**	**Sump**	**MW-4R**	**MW-6**	**Trip Blank**	Detection Limit PPM
	LAB ID	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	
	137211	**137212**	**137213**	**137214**	**137215**	
Benzene	BDL	BDL	BDL	BDL	BDL	0.005
Bromobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Bromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromodichloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromoform	BDL	BDL	BDL	BDL	BDL	0.005
Bromomethane	BDL	BDL	**0.076**	BDL	BDL	0.005
n-Butylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
sec-Butylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
tert-Butybenzene	BDL	BDL	BDL	BDL	BDL	0.005
Carbon Tetrachloride	BDL	BDL	BDL	BDL	BDL	0.005
Chlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Chloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Chloroform	BDL	BDL	BDL	BDL	BDL	0.005
Chloromethane	BDL	BDL	**0.018**	BDL	BDL	0.005
2-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
4-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
Dibromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromo-3-Chloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromoethane	BDL	BDL	BDL	BDL	BDL	0.005
Dibromomethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,3-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,4-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Dichlorodifluoromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichloroethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

BDL = Below Detection Limit, Method
All results expressed as PPM (mg/L)

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	September 7, 2012
Attention:	Ms. Jymalyn Redmond	Reference #	27307
Address:	2660 East Chase Ln. Suite 200	P.O. #	verbal
	Montgomery, AL 36117	Project ID:	Cullman

Sample Matrix:	water	Analytical	
Date Received:	8/30/12	Analyst:	Hageman/Heard
Date Collected:	8/30/12	Date Analysis:	9/4-5/12
Sample Collector:	J. Robinson	Method:	***SW 846 Method 8260***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	
VOLATILE	**MW-9**	**Sump**	**MW-4R**	**MW-6**	**Trip Blank**	Detection
ORGANIC	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	Limit
COMPOUNDS, PPM	**137211**	**137212**	**137213**	**137214**	**137215**	PPM
1,1-Dichloroethene	BDL	BDL	BDL	**0.009**	BDL	0.005
cis-1,2-Dichloroethene	**0.300**	**0.302**	**0.026**	**6.610**	BDL	0.005
trans-1,2-Dichloroethene	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,3- Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
2,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
cis-1-3,Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
trans-1,3-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
Ethylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
Hexachlorobutadiene	BDL	BDL	BDL	BDL	BDL	0.005
Isopropylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
4-Isopropyltoluene	BDL	BDL	BDL	BDL	BDL	0.005
Methylene Chloride	BDL	BDL	BDL	BDL	BDL	0.005
Naphthalene	BDL	BDL	BDL	BDL	BDL	0.010
n-Propylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
Styrene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Tetrachloroethene	BDL	BDL	**0.016**	BDL	BDL	0.005
Toluene	BDL	BDL	BDL	BDL	BDL	0.005
1,2,3-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1-Trichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2-Trichloroethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

BDL = Below Detection Limit, Method
All results expressed as PPM (mg/L)

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	September 7, 2012
Attention:	Ms. Jymalyn Redmond	Reference #	27307
Address:	2660 East Chase Ln. Suite 200	P.O. #	verbal
	Montgomery, AL 36117	Project ID:	Cullman

Sample Matrix:	water	Analytical	
Date Received:	8/30/12	Analyst:	Hageman/Heard
Date Collected:	8/30/12	Date Analysis:	9/4-5/12
Sample Collector:	J. Robinson	Method:	***SW 846 Method 8260***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	FIELD ID	FIELD ID	FIELD ID	FIELD ID	
VOLATILE	**MW-9**	**Sump**	**MW-4R**	**MW-6**	**Trip Blank**	Detection
ORGANIC	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	Limit
COMPOUNDS, PPM	**137211**	**137212**	**137213**	**137214**	**137215**	PPM
Trichloroethylene	**0.225**	BDL	**0.023**	**0.435**	BDL	0.005
Trichlorofluoromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2,3-Trichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trimethylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,3,5-Trimethylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
Vinyl Chloride	**0.050**	**0.156**	BDL	**0.689**	BDL	0.002
Xylenes, o,m,p	BDL	BDL	BDL	BDL	BDL	0.005
MTBE	BDL	BDL	BDL	BDL	BDL	0.005

BDL = Below Detection Limit, Method
All results expressed as PPM (mg/L)

/QAQC

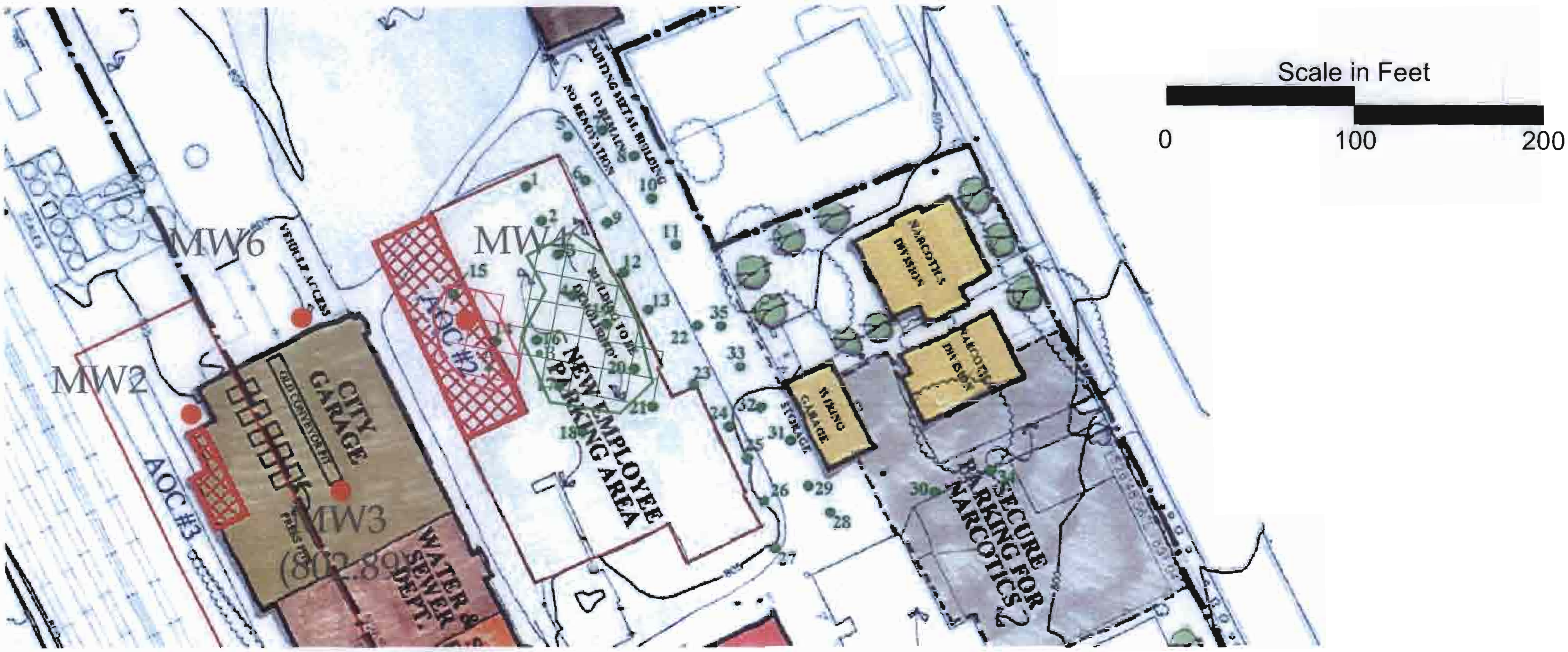
EPA Laboratory ID AL01084

Respectfully submitted,

Kevin Doriety

Kevin Doriety
Analytical Chemist

Quality Environmental Analytical Services


MW6
MW2
MW4
MW3
(802.89)
AOC #3
AOC #2
CITY GARAGE
OLD CONVEYOR PIT
PRESS PIT
VEHICLE ACCESS
WATER & SEWER DEPT.
NEW EMPLOYEE PARKING AREA
BUILDING TO BE DEMOLISHED
EXISTING METAL BUILDING TO REMAIN NO RENOVATION
NARCOTICS DIVISION
NARCOTICS DIVISION
WIRING GARAGE
STORAGE
SECURE PARKING FOR NARCOTICS
1
2
3
5
6
8
9
10
11
12
13
14
15
16
17
18
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
Scale in Feet
0
100
200

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	September 7, 2012
Attention:	Ms. Jymalyn Redmond	Reference #	27307
Address:	2660 East Chase Ln. Suite 200	P.O. #	verbal
	Montgomery, AL 36117	Project ID:	Cullman

Sample Matrix:	water	Sample Collector:	J. Robinson		
Date Received:	8/30/12	Method Reference:	Hach Methods		
Date /Time Collected:	8/30/12 @ 0950	Field ID:	**MW-9**	Lab ID:	137211

Parameter	Result	Units	Date / Time Assay		Analyst	Method	D.L.
Sulfate, Total	BDL	mg/L	8/30/12	1321	MSH	H TNT865	0.10

Sample Matrix:	water	Sample Collector:	J. Robinson		
Date Received:	8/30/12	Method Reference:	Hach Methods		
Date /Time Collected:	8/30/12 @ 1015	Field ID:	**Sump**	Lab ID:	137212

Parameter	Result	Units	Date / Time Assay		Analyst	Method	D.L.
Sulfate, Total	**7.1**	mg/L	8/30/12	1321	MSH	H TNT865	0.10

Sample Matrix:	water	Sample Collector:	J. Robinson		
Date Received:	8/30/12	Method Reference:	Hach Methods		
Date /Time Collected:	8/30/12 @ 1045	Field ID:	**MW-4R**	Lab ID:	137213

Parameter	Result	Units	Date / Time Assay		Analyst	Method	D.L.
Sulfate, Total	**3190**	mg/L	8/30/12	1321	MSH	H TNT865	0.10

Sample Matrix:	water	Sample Collector:	J. Robinson		
Date Received:	8/30/12	Method Reference:	Hach Methods		
Date /Time Collected:	8/30/12 @ 1115	Field ID:	**MW-6**	Lab ID:	137214

Parameter	Result	Units	Date / Time Assay		Analyst	Method	D.L.
Sulfate, Total	**4.2**	mg/L	8/30/12	1321	MSH	H TNT865	0.10

BDL = Below Detection Limit
DL · Detection Limit , Method
NA = Not Available

/ QAQC

EPA Laboratory ID AL01084

Respectfully submitted,

Kevin Doriety

Kevin Doriety
Analytical Chemist

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
BIRMINGHAM, AL 35233
PHONE (205)581-9500 FAX (205)581-9504
E-Mail: suthlab@bellsouth.net

CHAIN OF CUSTODY
ANALYSIS REQUEST

Client P.O. #

SEND REPORT TO:

Invoice # 27307

Name: Jymalyn Redmond
Company: Goodwyn, Mills + Cawood
Address: 2660 EastChase Ln Suite 200
Montgomery, Al 36117
Phone#:
Cell # 334 590 7010
E-mail: jymalyn.redmond@gmcnetwork.com
PDF Results: [✓ yes] no
Fax #:

CLIENT: Cullman

PROJECT: Cullman

SAMPLER(S): (print) James Robinson

DATE DELIVERED:

					ANALYSIS REQUESTED / METHOD								
LAB ID	FIELD ID	DATE Collected	TIME Collected	SAMPLE DESCRIPTION (matrix)		VOC	SO4						Number of sample containers
137211	mw 9	8/30/12	950	GW		✓	✓						4
137212	Sump	8/30/12	1015	water		✓	✓						4
137213	mw 4R	8/30/12	1045	GW		✓	✓						4
137214	mw 6	8/30/12	1115	GW		✓	✓						4
137215	Trip Blank					✓							1
Preservative: (a)HCL, (b)HNO$_3$, (c)H$_2$SO$_4$, (d)NaOH, (e)Zn Acetate				Preservative:		HCL	Ice						Last revised
Container type: (a) Amber, (g) Glass, (p) Plastic, (v) VOC Vial, (air) air bag				Container:		G	P						5/29/12

Relinquished by Sampler:	Date	Time	Received by:	Date	Time
Signed:	8/30/12	1230	Signed:		
Relinquished by:	Date	Time	Received by:	Date	Time
Signed:			Signed:		
Relinquished by:	Date	Time	Received in Laboratory by:	Date	Time
Signed:			Signed: Tasha McNeely	8/30/12	12:30

Turn Around Time (please note):

Standard ____ *RUSH, mark below ____

*3-Day *2-Day *Next Day *Same Day

Remarks:

Refrigerated upon receipt [✓ yes] no

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham. AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	September 7, 2012
Attention:	Ms. Jymalyn Redmond	Reference #	27307
Address:	2660 East Chase Ln. Suite 200	P.O. #	verbal
	Montgomery, AL 36117	Project ID:	Cullman

Sample Matrix:	water	Analytical	
Date Received:	8/30/12	Analyst:	Hageman/Heard
Date Collected:	8/30/12	Date Analysis:	9/4-5/12
Sample Collector:	J. Robinson	Method:	*SW 846 Method 8260*

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	
VOLATILE ORGANIC COMPOUNDS, PPM	**MW-9** **LAB ID** **137211**	**Sump** **LAB ID** **137212**	**MW-4R** **LAB ID** **137213**	**MW-6** **LAB ID** **137214**	**Trip Blank** **LAB ID** **137215**	Detection Limit PPM
Benzene	BDL	BDL	BDL	BDL	BDL	0.005
Bromobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Bromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromodichloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromoform	BDL	BDL	BDL	BDL	BDL	0.005
Bromomethane	BDL	BDL	**0.076**	BDL	BDL	0.005
n-Butylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
sec-Butylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
tert-Butybenzene	BDL	BDL	BDL	BDL	BDL	0.005
Carbon Tetrachloride	BDL	BDL	BDL	BDL	BDL	0.005
Chlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Chloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Chloroform	BDL	BDL	BDL	BDL	BDL	0.005
Chloromethane	BDL	BDL	**0.018**	BDL	BDL	0.005
2-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
4-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
Dibromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromo-3-Chloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromoethane	BDL	BDL	BDL	BDL	BDL	0.005
Dibromomethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,3-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,4-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Dichlorodifluoromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichloroethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

BDL = Below Detection Limit, Method
All results expressed as PPM (mg/L)

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	September 7, 2012
Attention:	Ms. Jymalyn Redmond	Reference #	27307
Address:	2660 East Chase Ln. Suite 200	P.O. #	verbal
	Montgomery, AL 36117	Project ID:	Cullman

Sample Matrix:	water	Analytical	
Date Received:	8/30/12	Analyst:	Hageman/Heard
Date Collected:	8/30/12	Date Analysis:	9/4-5/12
Sample Collector:	J. Robinson	Method:	*SW 846 Method 8260*

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	
VOLATILE ORGANIC COMPOUNDS, PPM	**MW-9**	**Sump**	**MW-4R**	**MW-6**	**Trip Blank**	Detection Limit PPM
	LAB ID	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	
	137211	**137212**	**137213**	**137214**	**137215**	
1,1-Dichloroethene	BDL	BDL	BDL	**0.009**	BDL	0.005
cis-1,2-Dichloroethene	**0.300**	**0.302**	**0.026**	**6.610**	BDL	0.005
trans-1,2-Dichloroethene	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,3- Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
2,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
cis-1-3,Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
trans-1,3-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
Ethylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
Hexachlorobutadiene	BDL	BDL	BDL	BDL	BDL	0.005
Isopropylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
4-Isopropyltoluene	BDL	BDL	BDL	BDL	BDL	0.005
Methylene Chloride	BDL	BDL	BDL	BDL	BDL	0.005
Naphthalene	BDL	BDL	BDL	BDL	BDL	0.010
n-Propylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
Styrene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Tetrachloroethene	BDL	BDL	**0.016**	BDL	BDL	0.005
Toluene	BDL	BDL	BDL	BDL	BDL	0.005
1,2,3-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1-Trichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2-Trichloroethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

BDL = Below Detection Limit, Method
All results expressed as PPM (mg/L)

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	September 7, 2012
Attention:	Ms. Jymalyn Redmond	Reference #	27307
Address:	2660 East Chase Ln. Suite 200	P.O. #	verbal
	Montgomery, AL 36117	Project ID:	Cullman

Sample Matrix:	water	Analytical	
Date Received:	8/30/12	Analyst:	Hageman/Heard
Date Collected:	8/30/12	Date Analysis:	9/4-5/12
Sample Collector:	J. Robinson	Method:	***SW 846 Method 8260***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	
VOLATILE	**MW-9**	**Sump**	**MW-4R**	**MW-6**	**Trip Blank**	Detection
ORGANIC	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	Limit
COMPOUNDS, PPM	**137211**	**137212**	**137213**	**137214**	**137215**	PPM
Trichloroethylene	**0.225**	BDL	**0.023**	**0.435**	BDL	0.005
Trichlorofluoromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2,3-Trichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trimethylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,3,5-Trimethylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
Vinyl Chloride	**0.050**	**0.156**	BDL	**0.689**	BDL	0.002
Xylenes, o,m,p	BDL	BDL	BDL	BDL	BDL	0.005
MTBE	BDL	BDL	BDL	BDL	BDL	0.005

BDL = Below Detection Limit, Method
All results expressed as PPM (mg/L)

/QAQC

EPA Laboratory ID AL01084

Respectfully submitted,

Kevin Doriety

Kevin Doriety
Analytical Chemist

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	September 7, 2012
Attention:	Ms. Jymalyn Redmond	Reference #	27307
Address:	2660 East Chase Ln. Suite 200 Montgomery, AL 36117	P.O. #	verbal
		Project ID:	Cullman

Sample Matrix:	water	Sample Collector:	J. Robinson		
Date Received:	8/30/12	Method Reference:	Hach Methods		
Date /Time Collected:	8/30/12 @ 0950	Field ID:	**MW-9**	Lab ID:	137211

Parameter	Result	Units	Date / Time Assay		Analyst	Method	D.L.
Sulfate, Total	BDL	mg/L	8/30/12	1321	MSH	H TNT865	0.10

Sample Matrix:	water	Sample Collector:	J. Robinson		
Date Received:	8/30/12	Method Reference:	Hach Methods		
Date /Time Collected:	8/30/12 @ 1015	Field ID:	**Sump**	Lab ID:	137212

Parameter	Result	Units	Date / Time Assay		Analyst	Method	D.L.
Sulfate, Total	**7.1**	mg/L	8/30/12	1321	MSH	H TNT865	0.10

Sample Matrix:	water	Sample Collector:	J. Robinson		
Date Received:	8/30/12	Method Reference:	Hach Methods		
Date /Time Collected:	8/30/12 @ 1045	Field ID:	**MW-4R**	Lab ID:	137213

Parameter	Result	Units	Date / Time Assay		Analyst	Method	D.L.
Sulfate, Total	**3190**	mg/L	8/30/12	1321	MSH	H TNT865	0.10

Sample Matrix:	water	Sample Collector:	J. Robinson		
Date Received:	8/30/12	Method Reference:	Hach Methods		
Date /Time Collected:	8/30/12 @ 1115	Field ID:	**MW-6**	Lab ID:	137214

Parameter	Result	Units	Date / Time Assay		Analyst	Method	D.L.
Sulfate, Total	**4.2**	mg/L	8/30/12	1321	MSH	H TNT865	0.10

BDL = Below Detection Limit
DL = Detection Limit , Metbod
NA = Not Available

/ QAQC

EPA Laboratory ID AL01084

Respectfully submitted,

Kevin Doriety

Kevin Doriety
Analytical Chemist

Sutherland

Environmental Company, Inc.
2515 5th Avenue South
BIRMINGHAM, AL 35233
PHONE (205)581-9500 FAX (205)581-9504
E-Mail: suthlab@bellsouth.net

CHAIN OF CUSTODY ANALYSIS REQUEST

Client P.O. #

SEND REPORT TO:

Invoice # 20305

Name: Jymalyn Redmond
Company: Goodwyn, Mills and Cawood
Address: 2660 East Chase Lane Suite 200
Montgomery, Al 36117
Phone#: 334-271-3200 Cell # 334-590-7010
E-mail: Jymalyn.Redmond@gmcnetwork.com
PDF Results: [✓ yes] no Fax #:

CLIENT:

PROJECT: X 10 101

SAMPLER(S): James Robinson
(print)

DATE DELIVERED:

ANALYSIS REQUESTED / METHOD

LAB ID	FIELD ID	DATE Collected	TIME Collected	SAMPLE DESCRIPTION (matrix)	VOC								Number of sample containers
133200	MW-4R	3/29/12	0800	Groundwater	✓								3
133201	MW-6	3/29/12	0810	Groundwater	✓								3
	Temp Blank												1
Preservative: (a)HCL, (b)HNO$_3$, (c)H$_2$SO$_4$, (d)NaOH, (e)Zn Acetate				Preservative:	HCL								Last revised
Container type: (a) Amber, (g) Glass, (p) Plastic, (v) VOC Vial, (t) Tedlar bag				Container:	V								3/2/12

Relinquished by Sampler:	Date	Time	Received by:	Date	Time
Signed: James Robinson	3/29/12	10:20	Signed:		
Relinquished by:	**Date**	**Time**	**Received by:**	**Date**	**Time**
Signed:			Signed:		
Relinquished by:	**Date**	**Time**	**Received in Laboratory by:**	**Date**	**Time**
Signed:			Signed: Tasha Porter	3/29/12	10:20

Turn Around Time (please note):
Standard X *RUSH, mark below
*3-Day *2-Day *Next Day *Same Day

Remarks:

Refrigerated upon receipt: [✓ yes] no

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	April 5, 2012
Attention:	Ms. Jymalyn Redmond	Reference #	26365
Address:	2660 Eastchase Ln, Ste. 200	P.O. #	verbal
	Montgomery, AL 36117	Project ID:	X10101

Sample Matrix:	water	Analytical	
Date Received:	3/29/12	Analyst:	Hageman/Heard
Date Collected:	3/29/12	Date Analysis:	4/2/12
Sample Collector:	J. Robinson	Method:	***SW 846 Method 8260***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**				
VOLATILE ORGANIC COMPOUNDS, PPM	**MW-4R**	**MW-6**				Detection Limit PPM
	LAB ID	**LAB ID**				
	133200	**133201**				
Benzene	BDL	BDL				0.005
Bromobenzene	BDL	BDL				0.005
Bromochloromethane	BDL	BDL				0.005
Bromodichloromethane	BDL	BDL				0.005
Bromoform	**0.012**	BDL				0.005
Bromomethane	BDL	BDL				0.005
n-Butylbenzene	BDL	BDL				0.005
sec-Butylbenzene	BDL	BDL				0.005
tert-Butybenzene	BDL	BDL				0.005
Carbon Tetrachloride	BDL	BDL				0.005
Chlorobenzene	BDL	BDL				0.005
Chloroethane	BDL	BDL				0.005
Chloroform	BDL	BDL				0.005
Chloromethane	**0.170**	BDL				0.005
2-Chlorotoluene	BDL	BDL				0.005
4-Chlorotoluene	BDL	BDL				0.005
Dibromochloromethane	BDL	BDL				0.005
1,2-Dibromo-3-Chloropropane	BDL	BDL				0.005
1,2-Dibromoethane	BDL	BDL				0.005
Dibromomethane	BDL	BDL				0.005
1,2-Dichlorobenzene	BDL	BDL				0.005
1,3-Dichlorobenzene	BDL	BDL				0.005
1,4-Dichlorobenzene	BDL	BDL				0.005
Dichlorodifluoromethane	BDL	BDL				0.005
1,1-Dichloroethane	BDL	BDL				0.005
1,2-Dichloroethane	BDL	BDL				0.005

Compound List Contiuued next page

BDL = Below Detection Limit, Method
All results expressed as PPM (mg/L)

Sutherland

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	Montgomery, AL 36117	Project ID:	X10101

Sample Matrix:	water	Analytical	
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Date Collected:	3/29/12	Date Analysis:	4/2/12
Sample Collector:	J. Robinson	Method:	***SW 846 Method 8260***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**				
VOLATILE ORGANIC COMPOUNDS, PPM	**MW-4R**	**MW-6**				Detection Limit PPM
	LAB ID	**LAB ID**				
	133200	**133201**				
1,1-Dichloroethene	BDL	**0.017**				0.005
cis-1,2-Dichloroethene	**0.257**	**8.000**				0.005
trans-1,2-Dichloroethene	**0.045**	**0.045**				0.005
1,2-Dichloropropane	BDL	BDL				0.005
1,3- Dichloropropane	BDL	BDL				0.005
2,2-Dichloropropane	BDL	BDL				0.005
1,1-Dichloropropene	BDL	BDL				0.005
cis-1-3,Dichloropropene	BDL	BDL				0.005
trans-1,3-Dichloropropene	BDL	BDL				0.005
Ethylbenzene	BDL	BDL				0.005
Hexachlorobutadiene	BDL	BDL				0.005
Isopropylbenzene	BDL	BDL				0.005
4-Isopropyltoluene	BDL	BDL				0.005
Methylene Chloride	BDL	BDL				0.005
Naphthalene	BDL	BDL				0.010
n-Propylbenzene	BDL	BDL				0.005
Styrene	BDL	BDL				0.005
1,1,1,2-Tetrachloroethane	BDL	BDL				0.005
1,1,2,2-Tetrachloroethane	BDL	BDL				0.005
Tetrachloroethene	**0.138**	BDL				0.005
Toluene	BDL	BDL				0.005
1,2,3-Trichlorobenzene	BDL	BDL				0.005
1,2,4-Trichlorobenzene	BDL	BDL				0.005
1,1,1-Trichloroethane	**0.036**	BDL				0.005
1,1,2-Trichloroethane	BDL	BDL				0.005

Compound List Continued next page

BDL = Below Detection Limit, Method
All results expressed as PPM (mg/L)

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Client:	Goodwyn, Mills & Cawood	Report Date:	April 5, 2012
Attention:	Ms. Jymalyn Redmond	Reference #	26365
Address:	2660 Eastchase Ln, Ste. 200 Montgomery, AL 36117	P.O. #	verbal
		Project ID:	X10101

Sample Matrix:	water	Analytical	
Date Received:	3/29/12	Analyst:	Hageman/Heard
Date Collected:	3/29/12	Date Analysis:	4/2/12
Sample Collector:	J. Robinson	Method:	***SW 846 Method 8260***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**				
VOLATILE	**MW-4R**	**MW-6**				Detection
ORGANIC	**LAB ID**	**LAB ID**				Limit
COMPOUNDS, PPM	**133200**	**133201**				PPM
Trichloroethylene	**0.899**	**0.833**				0.005
Trichlorofluoromethane	BDL	BDL				0.005
1,2,3-Trichloropropane	BDL	BDL				0.005
1,2,4-Trimethylbenzene	BDL	BDL				0.005
1,3,5-Trimethylbenzene	BDL	BDL				0.005
Vinyl Chloride	BDL	**1.050**				0.002
Xylenes, o,m,p	BDL	BDL				0.005
MTBE	BDL	BDL				0.005

BDL = Below Detection Limit, Method
All results expressed as PPM (mg/L)

/QAQC

EPA Laboratory ID AL01084

Respectfully submitted,

Kevin Doriety
Analytical Chemist

Lance R. LeFleur
Director

ADEM

Alabama Department of Environmental Management
adem.alabama.gov

1400 Coliseum Blvd. 36110-2400 ■ Post Office Box 301463
Montgomery, Alabama 36130-1463
(334) 271-7700 ■ FAX (334) 271-7950

Robert J. Bentley
Governor

April 21, 2015

Honorable Max Townson
Mayor, City of Cullman
Post Office Box 278
Cullman, Alabama 35056-0278

RE: Former Greif Brothers, Inc.
ALRERA Site #461-9496

Dear Mayor Townson:

The Alabama Department of Environmental Management has completed the review of the Brownfield Cleanup Report dated September 29, 2014 and received by our office on March 25, 2015 for the referenced site. Based on our review, the followings comments resulted from this review:

1. The final BaP TEQ that was used is not an acceptable cleanup number goal. It was a level established by USEPA for an ongoing investigation of a specific area of the City of Birmingham/Jefferson County.
2. Sampling rational for monitoring wells MW-1 and MW-2 should be clarified. No data was given for 2008, 2011, 2012 or 2013, therefore trends cannot be determined for these wells.
3. There is no discussion of monitoring wells MW-9 or MW-10, even through lab data indicates exceedances in both wells.
4. Risk-based screening levels may only be used when a risk assessment is completed.
5. Monitoring well MW-2 shows a historical increase in the contaminant levels, yet no explanation is given.
6. The following sentence from Page 12, Paragraph 3 should be clarified: "At the time of the development of the VCP Cleanup Plan, actual cleanup goals were not established for the individual constituents recognized as these frequently encountered contaminants".
7. Figure 6 appears to be omitted.
8. Several issues were noted in the presentation of the data in the tables:
    a) The numbering of the data presented in the tables is confusing;
    b) There are several tables that indicate both mg/Kg and mg/L;
    c) Some tables are not numbered.

Should you have questions or comments regarding this matter, please contact Ms. Dixie Beatty at (334) 271-7919 or by e-mail at dlb@adem.state.al.us.

Sincerely,

Lawrence A. Norris

Lawrence A. Norris, Chief
Redevelopment Section

LAN/db
Cc: Jymalyn Redmond
Wanda Jennings

Birmingham Branch
110 Vulcan Road
Birmingham, AL 35209-4702
(205) 942-6168
(205) 941-1603 (FAX)

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2715 Sandlin Road, S.W.
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GOODWYN | MILLS | CAWOOD

ARCHITECTURE ENGINEERING ENVIRONMENTAL GEOTECHNICAL INTERIOR DESIGN LANDSCAPE PLANNING SURVEYING TRANSPORTATION

May 8, 2015

Mr. Larry Norris
Alabama Department of Environmental Management
1400 Coliseum Boulevard
Montgomery, Alabama 36110

RECEIVED
MA
LAND DIVISION

RE: **Former Greif Brothers -**
Cullman, Cullman County, Alabama
ALRERA site # - 461-9496
Voluntary Cleanup Program

Dear Mr. Norris Larry

Please find attached the amended report that addresses comments made by the ADEM. Each item is addressed as follows:

1. Benzo(a) pyrene is compared to 2009 Region 9 Screening Levels for the purpose of comparison as advised by Ms. Beatty. See Table 8.
2. Monitoring wells #1 and 2 were not on property owned by the City of Cullman until 2014. For almost 20 years the City of Cullman has been involved in a process negotiating the purchase of the portion of the property adjacent to the railroad. The northwestern wall of the building as well as Monitoring Well #1 and 2 were both offsite and the railroad did not give permission for access to the wells for testing. The testing was conducted to provide information concerning conditions during September 2014 and was not intended to establish trends for these wells. Existing data for these two wells is provided in Table 3 and Table 4.
3. Discussions of monitoring well #9 and 10 are now included in the modified report on Page 12 and on Page 13 in Table 7.
4. Comparisons to cleanup goals approved in 2009 were not intended to replace a risk assessment but were intended to allow comparisons to cleanup goals established when the Voluntary Cleanup Plan was submitted to ADEM in 2009. These comparisons are intended to aid in determining the degree of success of remedial activities.

GOODWYN, MILLS AND CAWOOD, INC.

2660 EastChase Lane, Suite 200
Montgomery, AL 36117
Tel 334.271.3200 Fax 334.272.1566

GMCNETWORK.COM

May 8, 2015

Mr. Larry Norris
Alabama Department of Environmental Management
RE: **Former Greif Brothers –**
Cullman, Cullman County, Alabama
ALRERA site # - 461-9496
Voluntary Cleanup Program

5. Monitoring well #2 did exhibit an increase in concentrations, however data for this well is limited by the fact that the well was located on property that was not owned by the City until recently. A "sentry" phyto plot is planned for establishment along the northwest border of the property that should reduce contaminant concentrations in this area. Access issues delayed the planting of this plot. Discussion of this limited data is provided on page 9.
6. At the time the VCP was approved in 2009, cleanup goals for PAH's (goals are listed in Table 1) were not listed separately by constituent. TPH was utilized as a surrogate. As the project progressed into the EPA portion of the cleanup, the cleanup was able to address this area. The revised report now compares BaP and other PAH's to Region 9 Screening Values as suggested by Ms. Beatty. Region 9 Tables from 2009 are attached in Appendix B.
7. The Figures in the report have been renumbered and Figure 6 is included.
8. Tables in the report have been reorganized and renumbered to prevent confusion. Typographical errors in two tables have been corrected.

If you should need additional information or have questions, please contact me at , 334-590-7010.

Sincerely,

Jymalyn E. Redmond.
Environmental Manager

Brownfield Cleanup for EPA Region 4 Grant Activities

Cleanup Action Activities for Grief Facility, Cullman, Alabama

Final Report

Prepared for:

THE CITY OF CULLMAN

and

ENVIRONMENTAL PROTECTION AGENCY REGION 4
BROWNFIELDS PROGRAM
ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

Goodwyn, Mills, and Cawood
2660 East Chase Lane
Montgomery, Alabama 36117
Jymalyn Redmond, Project Manager

Abstract: This Final Report documents the results of cleanup activities at the Greif Brothers Facility in Cullman Alabama and includes the results of the final sampling and analysis methods to be used at the site in accordance with the approved QAPP. The sampling and analyses were performed to determine the results of remediation of chlorinated solvent contamination of soil and ground-water. The remediation activities consisted of in-situ blending of contaminated soil with sodium persulfate enhanced with lime activation, and the use of phyto-remediation in areas of moderate to low concentrations. A UIC permit for the in-situ treatment was obtained from the Alabama Department of Environmental Management, Polishing of the remaining contaminants is being accomplished with phyto-remediation and low-vacuum (micro-blower attached to well) removal of vapors in the vadose zone.

To allow access to the area needed for treatment, the structure housing the Sanitation/Street Department, AOC 2, was partially demolished and the slab was removed (by the City of Cullman under contract with Solid Rock Demolition). After the chemical oxidation treatment was completed, soil samples were collected at four locations. These samples were analyzed for VOC's and RCRA 8 metals. The analyses for VOC's indicates that the chlorinated contaminant concentrations meet the target cleanup goals for tetrachloroethylene, trichloroethylene, dichloroethylene, vinyl chloride, benzene and toluene for almost all parameters in the soil samples at all the depths sampled. The only constituent that failed to meet the target soil cleanup level was trichloroethene in sample PA2-S1B, at .082 ppm which is greater than the goal of .06 ppm. Continued reduction of the concentration of trichloroethene is anticipated to result from natural degradation processes. A vapor extraction system near the building will ensure any residual concentrations under the building slab will be reduced.

Significant reduction in soil concentrations in this area appear to indicate that the chemical oxidation treatment was very effective. During the soil treatment process, GMC environmental professionals oversaw the soil blending and addition of sodium persulfate into the zone of contamination by ExoTech, Inc. Photoionization detectors were used to identify soils with elevated VOC concentrations so that the appropriate treatment was targeted to the appropriate locations.

Sampling and analyses of monitoring wells in AOC 2 was conducted to determine the improvement in groundwater quality as a result of cleanup activities. The results of analyses of groundwater helped document the impact of continued natural degradation on contaminant concentrations at MW 4. The results of analyses are documented in Appendix A. All volatile organic compound concentrations are compared to remedial goals established by the Alabama Department of Environmental Management for cleanup of the Voluntary Cleanup Program project at Greif Brothers. These goals are listed in Table 1.

Remedial efforts at AOC 3 were enhanced by phyo-remediation plots and by the installation of a vapor extraction system. The vapor extraction system will remove VOC's in the form of vadose zone gases originating from underlying contaminants.

Soil sampling and analyses conducted in AOC3 near the phyto-remediation plot have documented reductions in VOC concentrations as a result of the remedial actions. The results of analyses of soil samples from AOC3 are included in Appendix A.

Table 2. Results of analyses of soil samples at Grief Facility, Cullman, Alabama

Constituent:	Soils ppm (mg/Kg)					
Date- 9/24/14	**CAL (mg/Kg)**	**PA2-S1A**	**PA2-S1B**	**PA2-S2A**	**PA2-S2B**	**PA2-S2D**
1,1-Dichloroethene	**0.06**	BDL	0.012	BDL	BDL	BDL
cis-1,2-Dichloroethene	**0.4**	0.065	0.260	0.125	0.009	.009
Trichloroethylene	**0.06**	0.022	**0.082**	0.057	BDL	BDL
Tetrachloethene	**0.06**	BDL	BDL<.005	0.016	0.011	BDL
Vinyl Chloride	**0.01**	BDL	0.006	BDL	BDL	BDL
Arsenic	**11.1**	7.2	2.0	6.3	BDL	2.8
Lead	**400**	12	14	14	**11**	9.9
NA	**Not analyzed for**					
CAL	*ADEM VCP Site Specific target Levels for Grief facility, Cullman, Alabama					

Table 2B. Results of analyses of soil samples at Grief Facility. Cullman, Alabama

Constituents:	Soils ppm (mg/Kg)					
Date- 9/24/14	**CAL (mg/Kg)**	**PA2-S3A**	**PA2-S4A**	**PA2-S4B**	**PA3-S1**	**PA3-S2**
1,1-Dichloroethene	**0.06**	BDL	BDL	BDL	BDL	BDL
cis-1,2-Dichloroethene	**0.4**	BDL	BDL	BDL	BDL	BDL
Trichloroethylene	**0.06**	BDL	BDL	BDL	BDL	BDL
Tetrachloethene	**0.06**	BDL	BDL<.005	BDL	BDL	BDL
Vinyl Chloride	**0.01**	BDL<0.005	BDL	BDL	BDL	BDL
Arsenic	**11.1**	7.2	2.0	6.3	NA	NA
Lead	**400**	12	14	14	**NA**	NA
NA	**Not analyzed for**					
CAL	*ADEM VCP Site Specific target Levels for Grief facility, Cullman, Alabama, 2009					

Enhanced natural degradation at the site over time should achieve the corrective action goal. The metals concentrations for arsenic and lead met the cleanup goals.

In Priority Area 3, no volatile organic compounds were detected at concentrations above the laboratory reporting limits. It is very difficult to capture VOC's in soil samples, however earlier samples had indicated low levels of VOC's in this area. It is expected that soil gas venting and natural attenuation will continue to lower VOC concentrations in this area.

C 1.2 Ground Water in AOC 2

Post treatment ground-water samples were collected and analyzed to determine the effectiveness of cleanup efforts and are compared to ADEM VCP cleanup levels established for the project in 2009. The results of VOC sampling and analysis for MW 1 and 2 are presented in the following tables.

Monitoring wells 1 and 2 were located on property previously owned by the railroad. The City of Cullman has been negotiating purchase of this property for almost 20 years. Permission to access these wells for sampling was not granted by the railroad during 2011 -2013. Purchase of the property was not accomplished until the 2014 sampling event. The limited data available is not adequate to determine trends for these two wells, but it does at least supply current information. These wells have been sampled on the dates indicated in Tables 3 and 4 as follows:

Table 3 Monitoring/Recovery Well Concentration Data (mg/l)

Well No:	MW-1							
Date	8/14/2007	2008	1/9/2009	2/11/2010	2011	2012	2013	9/25/2014
1,1Dichloroethane	NA	NS	0.01200	0.01600	NS	NS	NS	0.01100
1,1Dichloroethene	0.00700	NS	0.00800	0.01600	NS	NS	NS	0.00500
cis-1,2Dichloroethene	0.12100	NS	0.15100	0.19600	NS	NS	NS	0.078000
Trichloroethylene	0.10900	NS	0.15100	0.19700	NS	NS	NS	0.06700
Vinyl Chloride	0.00500	NS	0.00200	0.00200	NS	NS	NS	0.00200

NA: not analyzed; NS: not sampled

Table 4 Monitoring/Recovery Well Concentration Data (mg/l)

Well No:	MW-2							
Date	8/14/2007	2008	2009	2010	2011	2012	2013	2014
cis-1,2Dichloroethene	0.02400	NS	0.01200	0.01100	NS	NS	NS	0.025
Chloroethane	0.00500	NS	0.00600	0.00500	NS	NS	NS	0.005
Vinyl Chloride	0.00500	NS	0.00200	0.00400	NS	NS	NS	0.006

NS- not sampled

Monitoring wells # 1 and 2 are located in an area near the property line where contaminant levels have historically been significantly less than monitoring wells closer to the hot zones. In monitoring well #1, cis 1,2 dichloroethene concentrations decreased from a high of 0.151 ppm in 2009 to 0.078 ppm in September 2014. Trichloroethene concentrations fell from 0.151 in 2009 to .067 ppm . These low level concentrations could be effectively reduced through a hybrid poplar phyto plot that enhances the natural degradation process. Concentrations in monitoring well #2 are largely unchanged or slightly increased. Considerations of any trends at the well are limited by access problems and a lack of data for consideration. A "sentry" phyto plot is planned for establishment along the northwest border of the property that should reduce contaminant concentrations in this area. Access issues delayed the planting of this plot.

Lead concentrations in groundwater exceed the site goals with concentrations of 0.037 ppm and 0.043 ppm for monitoring wells #1 and #2 respectively. Recent evaluations have indicated that the source of this lead is probably associated with contaminants from deposits located along the railroad rather than from the Greif Brothers site. Creosote treated cross ties, slags, and other waste materials have been observed near the railway in an area that appears to have been a dumping area.

Monitoring well number 6 is a valuable indicator of groundwater quality in the area of the AOC 2 where soils were treated with sodium persulfate (Table 5). Concentrations of VOC contaminants in this area decreased by roughly an order of magnitude. Cis 1,2 dichloroethene concentrations decreased from 10.3 ppm to 1.29 ppm. This is a reduction of 87.5 %. Trichloroethylene concentrations decreased from a high of 1.06 in 2010 to 0.096 in September 2014. Most notably, vinyl chloride concentrations decreased from a high of 1.29 ppm in 2007 to .028 ppm. The degradation of tetrachloroethene and trichloroethene often stalls at vinyl chloride. It is anticipated that natural attenuation will continue to reduce the concentrations of all the VOC's. The vapor extraction system will also reduce VOC concentrations and ensure that off gassing of solvents into the adjacent building will not occur. There is little opportunity for any human exposure above the 2009 site specific cleanup goals in these areas as most soil concentrations have met their respective goals.

Table 5. Results of analyses of ground-water samples at Grief Facility, Cullman, Alabama

Well No:	MW-6							
Date	CAL (mg/L)	8/14/07	1/9/09	2/11/10	3/18/11	3/29/12	8/30/12	9/25/14
Benzene	**0.005**	0.005	0.006	**0.008**	NS	<0.005	<0.005	<0.005
1,1-Dichloroethene	**0.007**	**0.013**	**0.026**	**0.032**	NS	**0.017**	**0.009**	<0.005
1,1-Dichloroethane	**0.081***	NA	0.025	0.020	NS	<0.005	<0.005	<0.005
1,2-Dichloroethane	**0.005**	<0.005	0.007	<0.005	NS	<0.005	<0.005	**0.006**
cis-1,2-Dichloroethene	**0.070**	**10.300**	**7.150**	**10.100**	NS	**8.000**	**6.610**	**1.290**
trans-1,2-Dichloroethene	**0.100**	**0.018**	**0.028**	**0.045**	NS	**0.045**	**<0.005**	**0.156**
Trichloroethylene	**0.005**	**0.780**	**0.815**	**1.060**	NS	**0.833**	**0.435**	**0.096**
1,3,5-Trimethylbenzene	**0.0012***	**0.019**	<0.005	<0.005	NS	<0.005	<0.005	<0.005
Vinyl Chloride	**0.002**	**1.290**	**0.810**	**1.220**	NS	**1.050**	**0.689**	**0.028**
Chloromethane	**0.016***	**NA**	<0.005	**NA**	NS	<0.005	<0.005	**0.084**
Methylene Chloride	**0.005***	<0.005	<0.005	<0.005	NS	<0.005	<0.005	**0.020**
1,1,2-Trichloroethane	**0.005***	<0.005	<0.005	<0.005	NS	<0.005	<0.005	**0.013**
Arsenic	**0.01**	<0.01	<0.01	<0.01	NS	NA	NA	**<0.010**
Lead	**0.015**	<0.01	<0.002	<0.002	NS	NA	NA	**0.066**
NS	not sampled							
NA	not analyzed for							
CAL	Corrective action target concentration, 2009							
	*ADEM VCP Site Specific target Levels for Grief facility, Cullman, Alabama, 2009							

Monitoring well number 4 is a significant indicator of groundwater conditions in the northern portion of the Greif Brothers site (Table 6 and 6B). In 2007, contaminant concentrations of trichloroethene were at a historical high of 71.9 mg/l. This area was treated through in-situ chemical oxidation in 2011and 2012 and the nearby phyto-remediation plots are thought to have contributed to the continued enhanced natural degradation of contaminants in this location. After chemical treatment, a replacement well (MW 4R) was advanced in the same area and during this last testing, trichloroethene concentrations were reduced to less than the method detection limit. This is a 99.99 % reduction in concentration. No other volatile organic contaminants were detected in groundwater in the area.

Table 6. Results of analyses of ground-water samples at Grief Facility, Cullman, Alabama

Well No:	MW-4				
Date	CAL (mg/L)	8/14/07	1/9/09	2/11/10	3/18/11
n-Butylbenzene	**N**	0.116	0.135	<0.005	0.128
sec-Butylbenzene	**0.024***	0.010	0.015	0.012	0.013
1,1-Dichloroethene	**0.00700**	**0.087**	**0.119**	**0.063**	**0.099**
1,2-Dichloroethane	**0.00500**	NA	**0.014**	<0.005	<0.005
cis-1,2-Dichloroethene	**0.07000**	**17.400**	**15.000**	**11.300**	**13.400**
trans-1,2-Dichloroethene	**0.10000**	0.015	0.020	0.025	0.040
Ethylbenzene	**0.70000**	0.540	0.314	0.310	0.319
Isopropylbenzene	**0.66***	0.196	0.234	0.149	0.160
4-Isopropyltoluene	**N**	<0.005	0.020	<0.005	0.045
Naphthalene	**20.00000**	0.490	0.745	0.455	0.598
n-Propylbenzene	**N**	0.625	0.382	0.380	0.310
Tetrachlororthene	**0.00500**	**0.052**	**0.061**	**0.050**	**0.067**
Toluene	**1.00000**	0.008	<0.005	<0.005	<0.005
Trichloroethylene	**0.00500**	**71.900**	**54.300**	**30.400**	**42.700**
1,1,1-Trichloroethane	**0.20000**	<0.005	0.009	<0.005	0.006
1,2,4-Trimethylbenzene	0.0012*	**1.020**	**3.680**	**2.840**	**1.570**
1,3,5-Trimethylbenzene	0.0012*	**3.120**	**0.514**	**0.576**	**0.661**
Vinyl Chloride	0.002	**0.810**	**0.429**	**0.412**	**0.699**
Xylenes, Total	10	2.330	1.500	1.180	1.070
2-Methylnaphthalene	N	0.123	NA	NA	NA
2-Chlorotoluene	0.012*	<0.005	**0.190**	<0.005	<0.005
4-Chlorotoluene	N	<0.005	0.055	<0.005	<0.005
Oil and Grease	N	1.000	NA	NA	NA
Arsenic	0.01				NA
lead	0.015				NA

NA: not analyzed for

CAL: *ADEM VCP Site Specific target Levels for Grief facility, Cullman, Alabama, 2009

Table 6B. Results of analyses of ground-water samples at Grief Facility, Cullman, Alabama

Well No:	MW-4R			
	CAL (mg/L)	**3/29/12**	**8/30/12**	**9/25/14**
Bromoform	**0.08***	0.01200	<0.005	<0.005
Chloromethane	**0.0016***	**0.17000**	**0.01800**	<0.005
cis-1,2-Dichloroethene	**0.07000**	**0.25700**	0.02600	<0.005
trans-1,2-Dichloroethene	**0.10000**	0.04500	<0.005	<0.005
Tetrachloroethene	**0.00500**	**0.13800**	**0.01600**	<0.005
1,1,1-Trichloroethane	**0.20000**	0.03600	<0.005	<0.005
Trichloroethylene	**0.00500**	**0.89900**	**0.02300**	<0.005
Bromomethane	**0.00087***	<0.005	**0.07600**	<0.005
Arsenic	**0.01**	NA	NA	<0.01
Lead	**0.01500**	NA	NA	0.024
NA: not analyzed for				
CAL: *ADEM VCP Site Specific target Levels for Grief facility, Cullman, Alabama, 2009				

Monitoring wells 9 and 10 are downgradient of the main source, located in AOC 1, that was treated with insitu blending and phyto-remediation. That source was reduced by 99% based on the analyses of ground-water samples collected from monitoring wells 4 and 4R. Vinyl chloride concentrations in ground-water samples collected from monitoring wells 9 and 10 (Table 7) indicate that degradation of tetrachloroethene and dichloroethene is continuing slowly. In monitoring well 10 trichloroethene and dichloroethene concentrations are declining. The final degradation product, vinyl chloride, is not declining because it continues to be generated by degradation of tetrachloroethene and trichloroethene. We anticipate that concentrations of chemicals of concern in AOC 1 will decrease because the source has been eliminated. The effects of the phyto plot nearby will also aid in reducing contaminant concentrations.[

Table 7. Results of analyses of ground-water samples at Grief Facility, Cullman, Alabama					
Well No:	MW-9				
Date	**CAL (mg/L)**	**2011**	**2012**	**2013**	**2014**
1,1-Dichloroethene	**0.00700**	0.0140	0.0050	NS	0.0050
1,2-Dichloroethane	**0.00500**	0.1020	0.0050	NS	0.0050
Trichloroethylene	**0.00500**	0.0360	0.2250	NS	0.2290
Vinyl Chloride	**0.002**	0.0340	0.0500	NS	0.0330
	MW-10				
1,1-Dichloroethene	**0.00700**	0.0050	NS	0.0100	0.0070
1,2-Dichloroethane	**0.00500**	0.1200	NS	0.1130	0.0480
Tetrachlorothene	**0.0050**	0.0680	NS	0.0550	0.0390
Trichloroethylene	**0.00500**	2.3000	NS	1.8900	2.5100
Vinyl Chloride	**0.002**	0.0050	NS	0.0120	0.0060
NS: not sampled					
CAL: *ADEM VCP Site Specific target Levels for Grief facility, Cullman, Alabama, 2009					

C1.3 Soils in AOC 3

In AOC 3 near the phyto plots, polycyclic aromatic hydrocarbons were known to be present. Historically, large storage piles of creosote railroad ties were present on the railroad side of the property up-gradient of Greif Brothers. This property was owned by the railroad until recently and they still maintain a significant switching and maintenance area nearby. Storm water runoff frequently brought residues from these storage areas on to the area of the phyto plots. At the time of the development of the VCP Cleanup Plan in 2009, actual cleanup goals for polycyclic aromatic hydrocarbons were not established (see Table 1). TPH was used as a surrogate. One of the goals of the phyto plots was to lower concentrations of these materials and to provide breakdown of the low- level contaminants that were expected from the hazardous waste storage in the area. The individual constituent concentrations of these contaminants are provided in Appendix A. Concentrations for benzo(a) pyrene in soil samples (Figure 3) are provided in the Table 8 below:

Table 8. Results of soil sample analyses in AOC 3		
Sample Identification	2009 US EPA Region 9 Screening Level	Benzo a Pyrene
CUL-SBG-1	.21 ppm	<. 05
PA3-S-1	.21 ppm	<.05
PA3-S-2	.21 ppm	0.067
PA3-S-3	.21 ppm	**0.468**
PA3-S-4	.21 ppm	**1.17**
PA3-S-5	.21 ppm	**0.72**
PA3-S-5D	.21 ppm	**5.45**

The phyto plot in this area was established in 2012 and the hybrid poplars and cypress are well established. The plots are covered with 6 to 10 inches of mulch to promote growth and improve conditions for degradation. All samples were collected from beneath this layer. All the trees are achieving about 4 feet of growth per year. The hybrid poplars are currently about 12 feet tall. The Benzo (a) Pyrene concentration at PA3- S-5D (3 -4 feet below ground surface) is 8 times greater than the surface Benzo (a) Pyrene concentration at this location. Little root development would impact this depth during the first summer of growth. Of the seven samples collected, two locations have already achieved the 2009 US EPA Region 9 Screening Level (Appendix B) for Benzo(a) pyrene of .21ppm . As the trees mature and develop significant root mass at depth, the degradation of contaminants at depth should increase. This result suggests that the phyto plots are enhancing the degradation of these constituents. Phyto-remediation is a relatively time consuming approach that requires the development of extensive root systems into the soils and extended time frames for the slow breakdown of contaminants.

Seven other PAH constituents of concern were analyzed from the Greif sampling locations at the ground surface where direct contact exposure might occur. Most concentrations were less than the 2009 Region 9 Industrial Screening Level. No surface samples exceeded the benzo(a) anthracene screening level of 2.1 ppm. One surface sample (PA3-S-40 exceeded the benzo(b) fluoranthene screening level of 2.1 ppm. No surface samples exceeded the benzo(k) fluoranthene screening level of 21.0 ppm. No surface samples exceeded the chrysene screening level of 210 ppm. One surface samples (PA3-S-4 at .212 ppm) exceeded the dibenzo(ah) anthracene screening level of .21 ppm. No surface samples exceeded the indeno(1,2,3 cd) pyrene screening level of 2.1 ppm. No surface samples exceeded the naphthalene screening level of 18 ppm.

C1. Conclusions and Recommendations

Results from a final round of testing conducted in September 2014 indicated all of the cleanup goals for the soils in a major hot spot in AOC 2 had been met except one for trichloroethene, which was .02 parts per million above its goal. However, because of the sustainable nature of the remedial strategies implemented, the enhanced natural degradation of contaminants will continue, thus achieving the goal in the future. This indicates that the in-situ chemical oxidation remediation was successful in meeting the objective of the cleanup. Groundwater concentrations in this area, while decreasing, did not meet the goals for all wells. However, the natural degradation processes and enhanced reductions through phyto-remediation and soil vapor extraction will continue to reduce these contaminant levels.

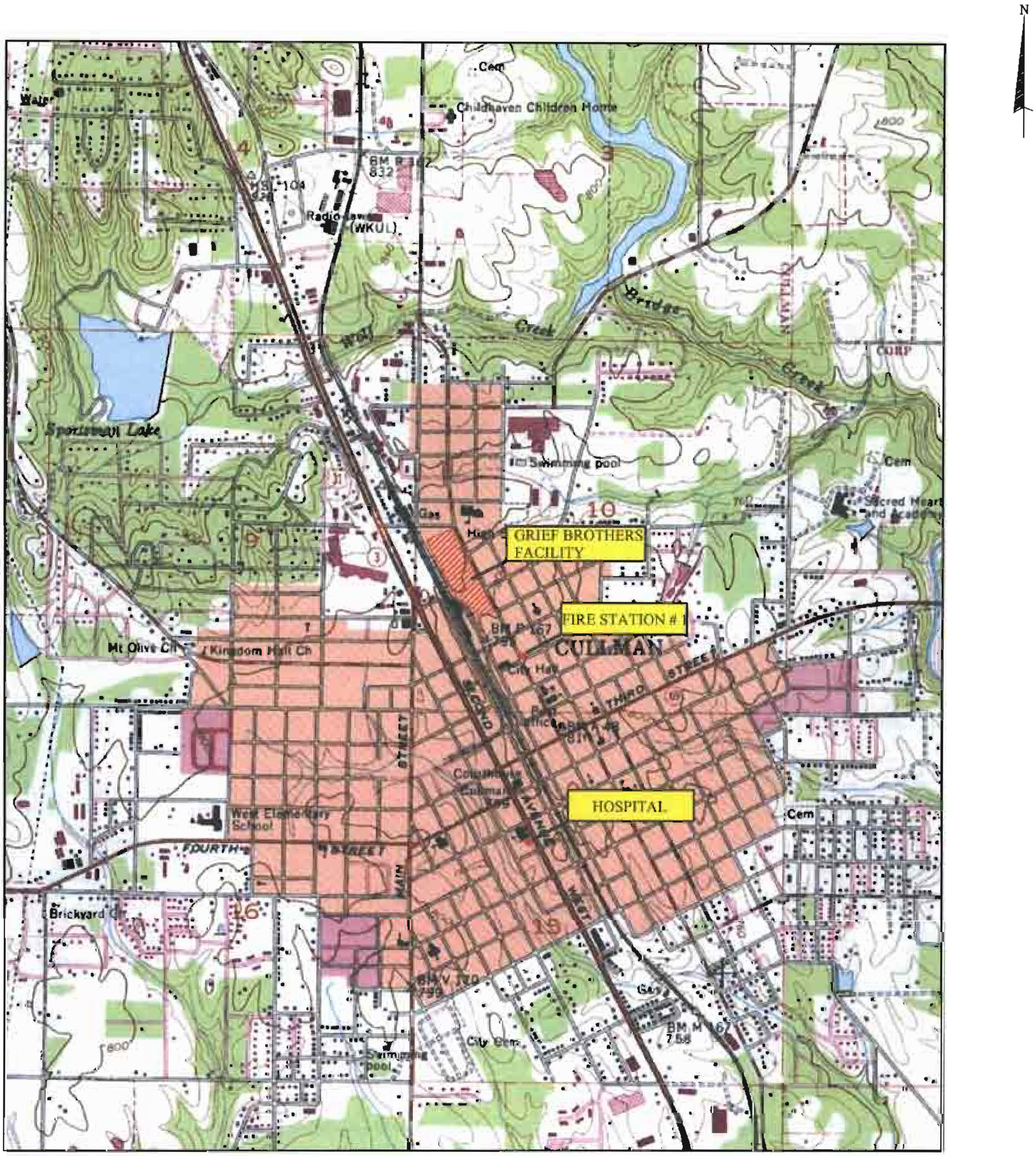
The enhanced natural attenuation was demonstrated at MW 4 and MW4R where concentrations continued to decrease. More than two years have passed since the initial chemical oxidation treatment was conducted in the area surrounding Monitoring Well 4 (MW 4), located near a phyto-remediation plot established to treat one of the major AOCs. Recent test results indicate the concentrations of contaminants have continued to steadily decrease and are below the detection limits of .005 parts per million in the groundwater for all the chlorinated solvents targeted. Groundwater levels fluctuated seasonally almost 6 feet in depth to the groundwater surface. This fluctuation is thought to be enhanced resulting from increased water uptake by the trees in the nearby phyto plot.

The potential for human exposure at the site through direct contact has been greatly reduced as concentrations in most soil samples were at or less than the 2009 site specific target levels. Surficial PAH concentrations in the southern phyto plot area (AOC 3) appear to be falling.

The goal of this project was to improve site conditions such that the Greif Brothers property could be cleaned up and readied for reuse. In our grant application, we set the goal of utilizing several processes that included green technologies to accomplish the cleanup of the site. Our goal was to achieve a successful cleanup that would allow 90% of the property to be ready for reuse. The cleanup has met this goal and the green technologies utilized will continue to improve site conditions in areas in need of additional reductions.

GMC recommends annual sampling of monitoring wells 1, 2, 4R, 6, 9, and 10 for analyses for volatile organic compounds.

Appendix A



FIGURE

1

Goodwyn, Mills & Cawood, Inc.

P. O. Box 242128
2660 East Chase Lane, Suite 200
Montgomery, Alabama 36124

TITLE: Location of Grief Brothers Facility, Cullman, AL

PROJECT: Grief Brothers Facility Brownsfield Remediation

DESIGNED:

DRAWN: JLR

SCALE: NTS

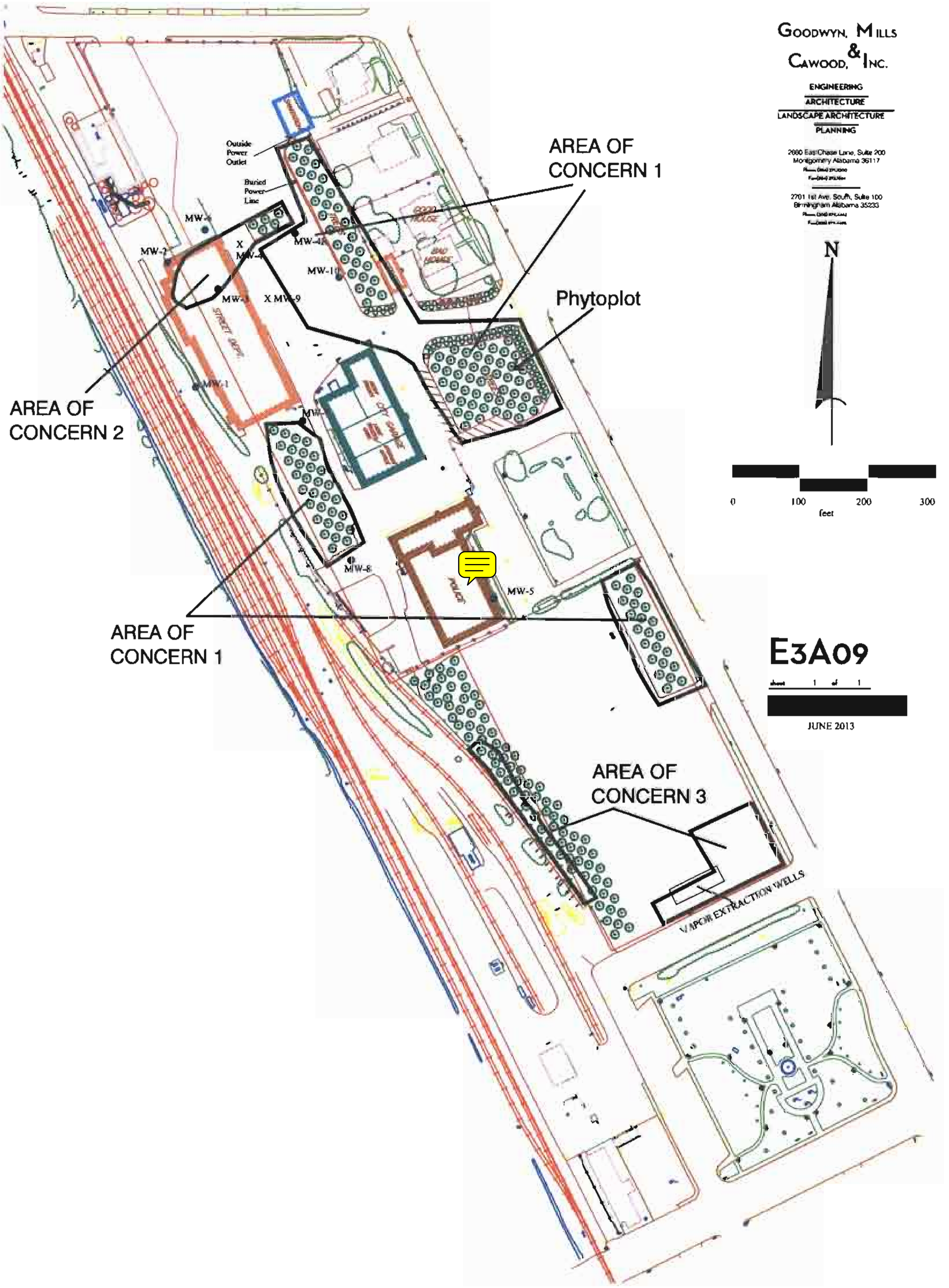
DATE: 12/09

MASTERPLAN SITE STUDY
GREIF PROPERTY
CITY OF CULLMAN

Figure 2. Location of AOCs

[redacted]

[redacted]



Goodwyn, Mills & Cawood, Inc.

ENGINEERING
ARCHITECTURE
LANDSCAPE ARCHITECTURE
PLANNING

2660 EastChase Lane, Suite 200
Montgomery Alabama 36117

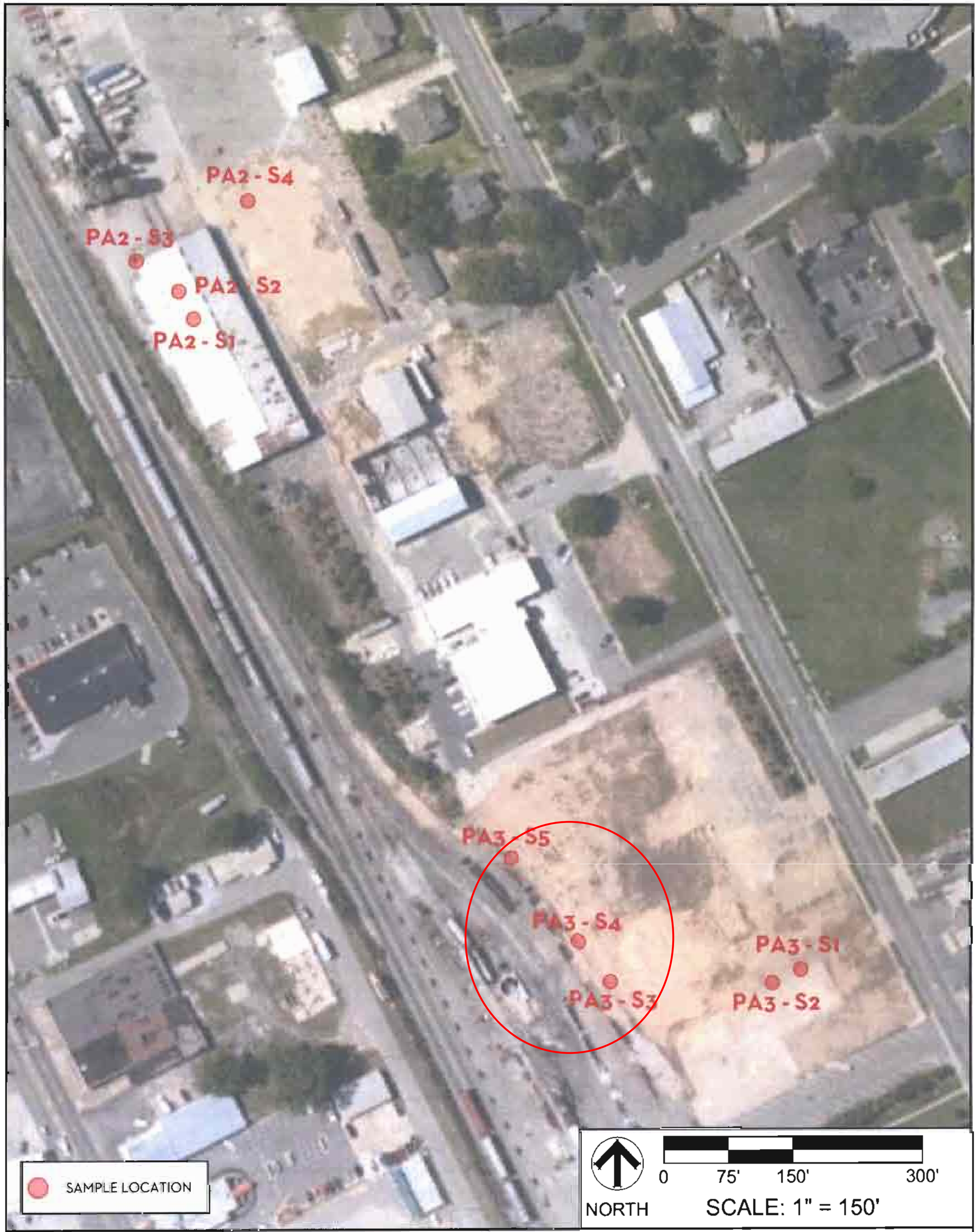
2701 1st Ave. South, Suite 100
Birmingham Alabama 35233

E3A09

sheet 1 of 1

[redacted]

JUNE 2013



REF. SHEET: ESRI WORLD IMAGERY
DESCRIPTION: SOIL SAMPLES

CULLMAN CLOSE OUT

CULLMAN, ALABAMA

FIGURE 3

AERIAL PHOTOGRAPH
GMC #
DATE: 10/30/2014
DRAWN BY: JDE

GOODWYN | MILLS | CAWOOD

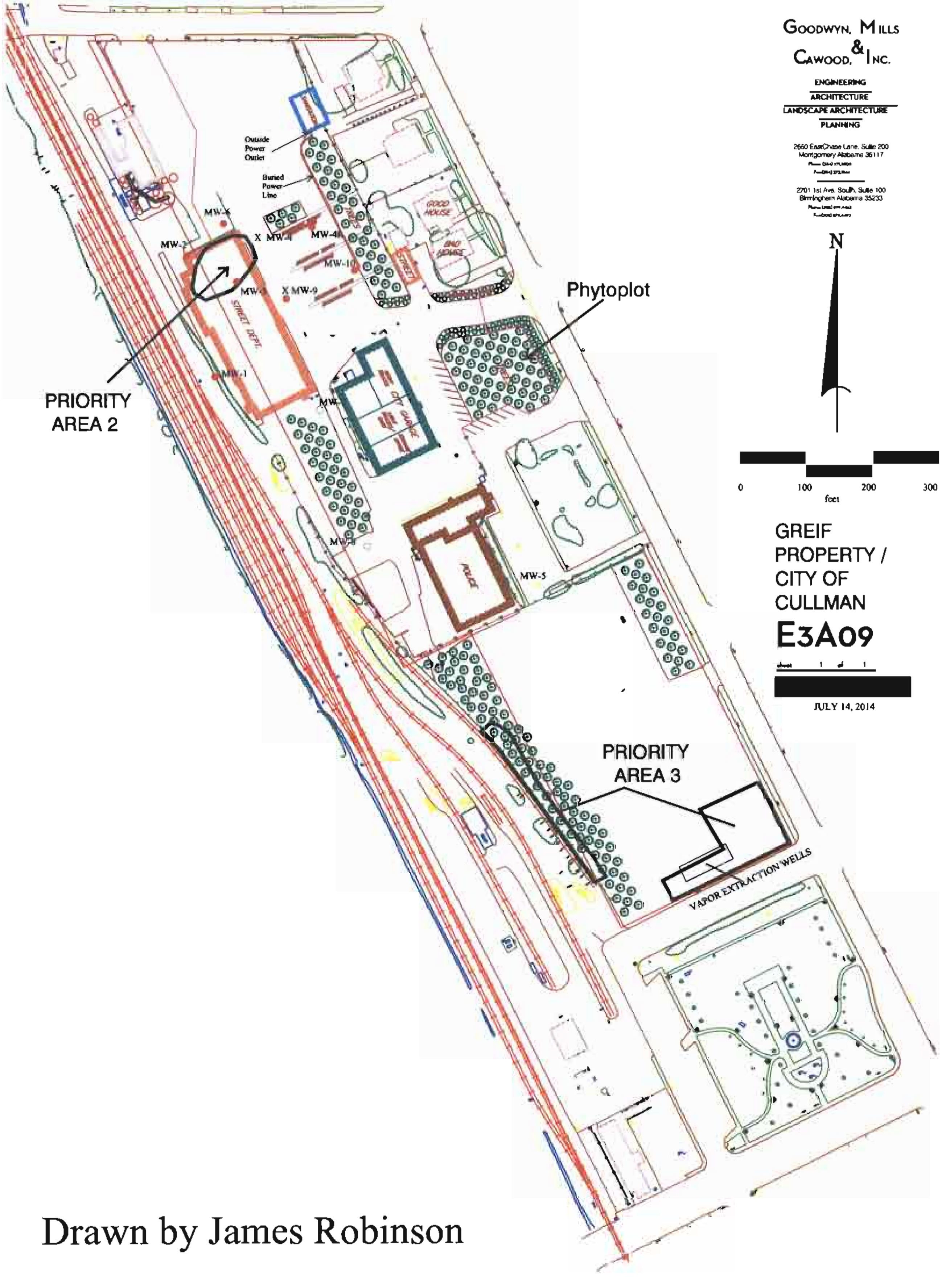
2660 EastChase Lane, Suite 200 | Montgomery, AL 36117
Tel 334.271.3200 | GMCNETWORK.COM

FIGURE 4

Summer 2014 ground-Water sampling points in red

GREIF PROPERTY

CITY OF CULLMAN



[redacted]

Drawn by James Robinson

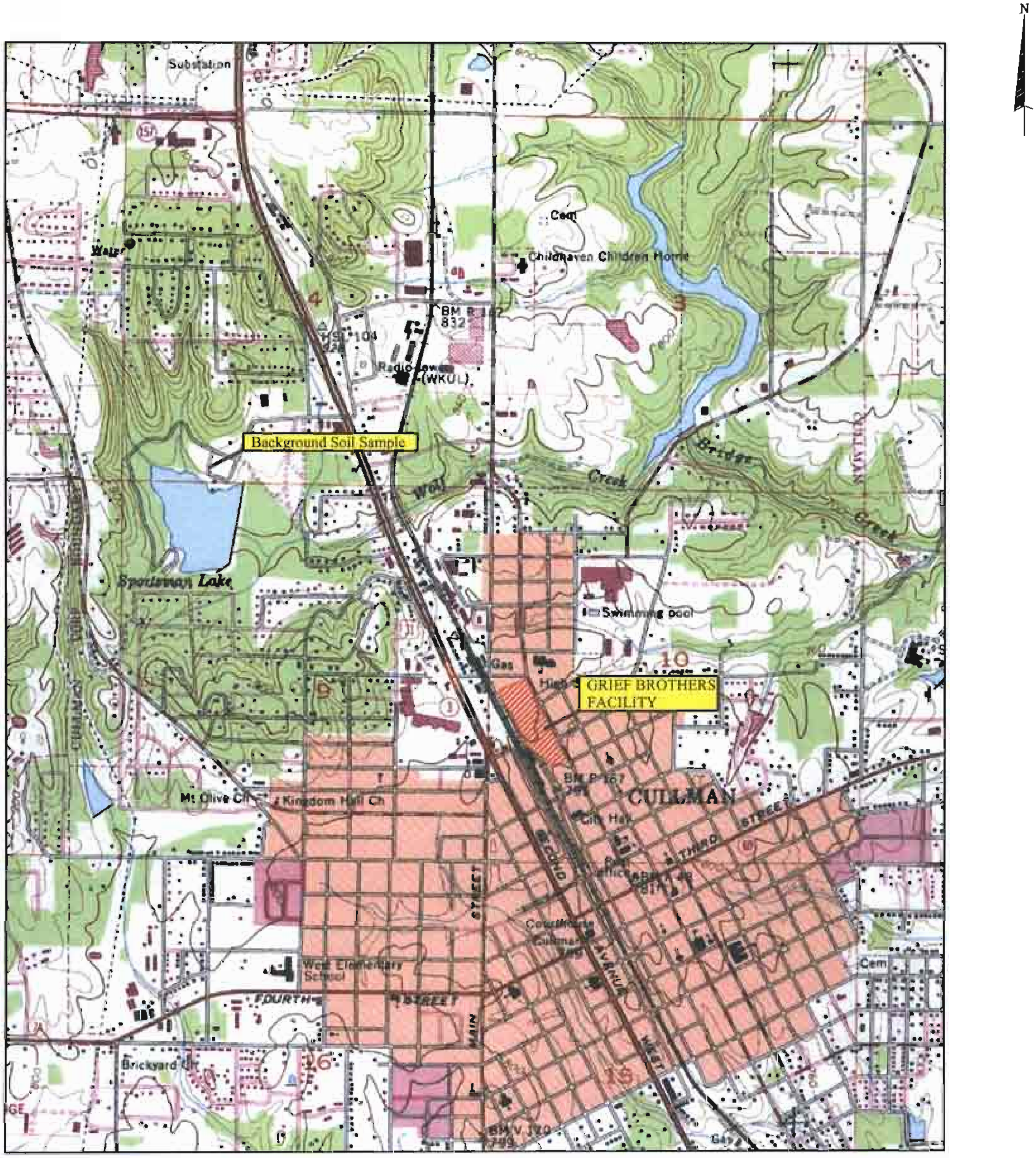


FIGURE
5

Goodwyn, Mills & Cawood, Inc.

P. O. Box 242128
2660 East Chase Lane, Suite 200
Montgomery, Alabama 36124

TITLE: Location of Grief Brothers Facility, Cullman, AL

PROJECT: Grief Brothers Facility Brownsfield Remediation

DESIGNED:

DRAWN: JLR

SCALE: NTS

DATE: 5/15

FIGURE 6

Monitoring Wells, ground-water surface, and direction of flow

[redacted]

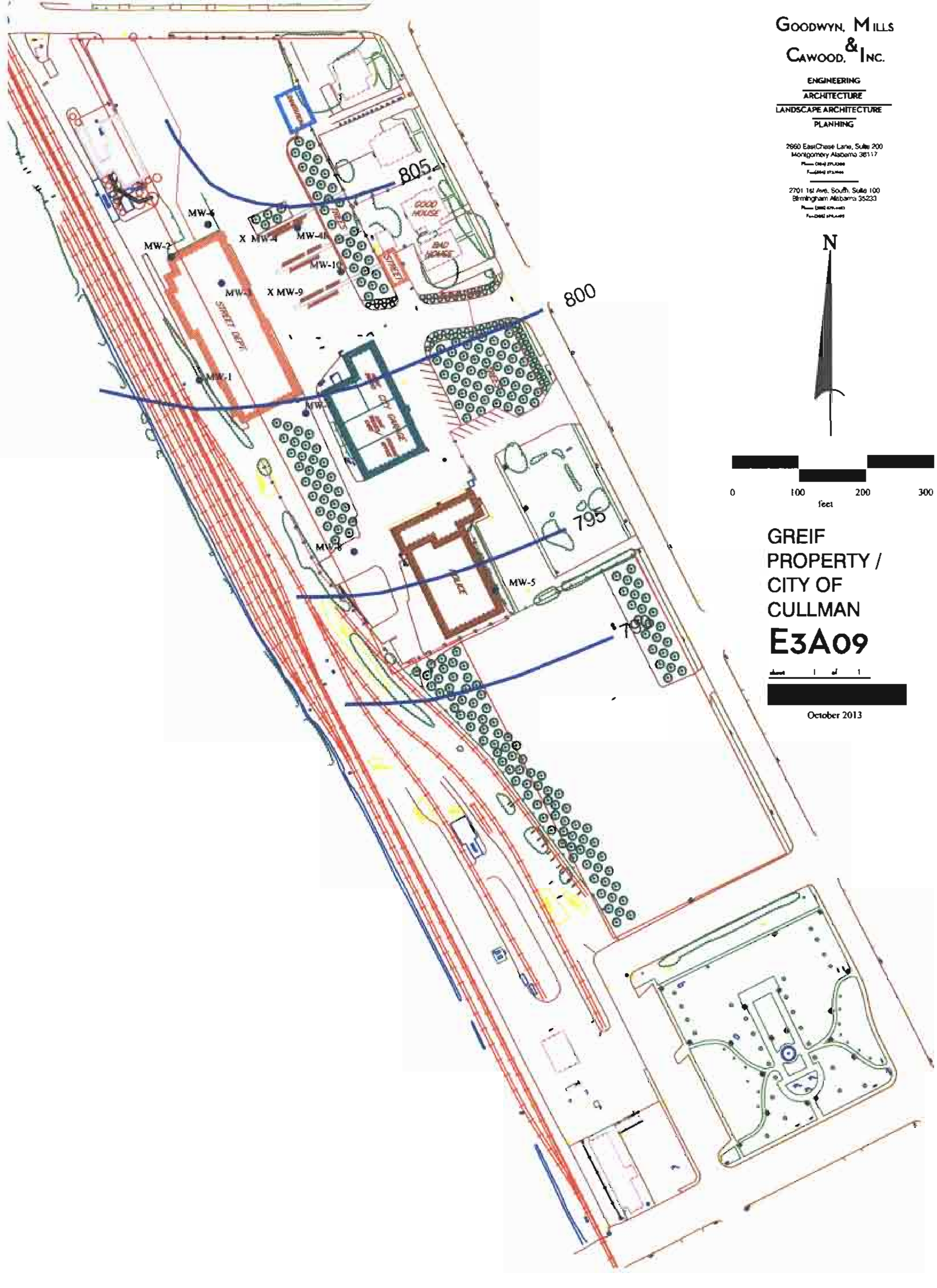
[redacted]

Goodwyn, Mills & Cawood, Inc.

ENGINEERING
ARCHITECTURE
LANDSCAPE ARCHITECTURE
PLANNING

2660 EastChase Lane, Suite 200
Montgomery Alabama 36117

2701 1st Ave. South, Suite 100
Birmingham Alabama 35233



GREIF
PROPERTY /
CITY OF
CULLMAN

E3A09

sheet 1 of 1

[redacted]

October 2013

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
B'HAM, AL 35233
PHONE (205)581-9500 FAX (205)581-9504
E-Mail: suthlab@bellsouth.net

CHAIN OF CUSTODY
ANALYSIS REQUEST

Client P.O. # EBHM131003

SEND REPORT TO: 31373

Name/Co.: Jymalyn Redmond
Address: 4659 Huffman Road Grady, AL 36036
Phone# / Cell#: 334-590-7010, 205-616-6116
E-mail: jymalyn.redmond@gmcnetwork.com, cory.troiano@gmcnetwork.com
PDF Results: yes no
Fax #:

CLIENT: City of Cullman
PROJECT: Cullman Closure
SAMPLER(S): (print) Redmond, Troiano, Edwards

DATE DELIVERED:

LAB ID	FIELD ID	DATE Collected	TIME Collected	SAMPLE DESCRIPTION (matrix)	ANALYSIS REQUESTED / METHOD **METALS RCRA 8**	**METALS AS, Pb**	**VOCs**	**PAH**					Number of sample containers
155846	MW 1	9/25/14	10:21	groundwater		X	X						4
155847	MW 2	9/25/14	10:41	groundwater		X	X						4
155848	MW 4R	9/25/14	11:01	groundwater		X	X						4
155849	MW 9	9/25/14	11:25	groundwater		X	X						4
155850	MW 10	9/25/14	11:35	groundwater		X	X						4
155851	Trip Blank	—	–				X						
Preservative: (a)HCL, (b)HNO_3, (c)H_2SO_4, (d)NaOH, (e)Zn Acetate				**Preservative:**	ICE								Last revised
Container type: (a) Amber, (g) Glass, (p) Plastic, (v) VOC Vial, (t) Tedlar bag				**Container:**	G								8/6/08

Relinquished by Sampler:	Date	Time	Received by:	Date	Time
Signed: Jymalyn Redmond	9/26	11:30	Signed:		
Relinquished by:	Date	Time	Received by:	Date	Time
Signed:			Signed:		
Relinquished by:	Date	Time	Received in Laboratory by:	Date	Time
Signed:			Signed: Tasha McNeely	9/26/14	1130

Turn Around Time (please note):
Standard ✓ *RUSH, mark below
*3-Day *2-Day *Next Day *Same Day

Refrigerated upon receipt: [✓ yes] no
Invoice # (LAB use only): 31373

313616

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
B'HAM, AL 35233
PHONE (205)581-9500 FAX (205)581-9504
E-Mail: suthlab@bellsouth.net

CHAIN OF CUSTODY
ANALYSIS REQUEST

Client P.O. # EBHM131003

SEND REPORT TO:
Name/Co.: Jymalyn Redmond
Address: 4659 Huffman Road Grady, AL 36036
Phone# / Cell#: 334-590-7010, 205-616-6116
E-mail: jymalyn.redmond@gmcnetwork.com, cory.troiano@gmcnetwork.com
PDF Results: yes no Fax #:

CLIENT: City of Cullman
PROJECT: Cullman Closure
SAMPLER(S): (print) Robinson, Redmond

DATE DELIVERED:

LAB ID	FIELD ID	DATE Collected	TIME Collected	SAMPLE DESCRIPTION (matrix)	METALS RCRA 8	METALS AS, Pb	VOCs	PAH					Number of sample containers
155801	PA2-S1A	9/24/14	13:15	SOIL	X		X						1
155802	PA2-S1B	9/24/14	13:20	SOIL	X		X						1
155803	PA2-S1D	9/24/14	13:15	SOIL	X								1
155804	PA2-S2A	9/24/14	13:30	SOIL	X		X						1
155805	PA2-S2B	9/24/14	13:35	SOIL	X		X						1
155806	PA2-S2D	9/24/14	13:20	SOIL			X						1
155807	PA2-S3A	9/24/14	13:40	SOIL	X		X						1
155808	PA2-S4A	9/24/14	13:50	SOIL	X		X						1
155809	PA2-S4B	9/24/14	13:55	SOIL	X		X						1
~~155810~~	~~PA3-S1~~	~~9/24/14~~	~~14:20~~	~~SOIL~~	X		X						1
~~155811~~	~~PA3-S2~~	~~9/24/14~~	~~14:27~~	~~SOIL~~	X		X		OMIT				1
~~155812~~	~~PA3-S3~~	~~9/24/14~~	~~14:45~~	~~SOIL~~	X		X						1
Preservative: (a)HCL, (b)HNO$_3$, (c)H$_2$SO$_4$, (d)NaOH, (e)Zn Acetate				**Preservative:**	ICE								Last revised
Container type: (a) Amber, (g) Glass, (p) Plastic, (v) VOC Vial, (t) Tedlar bag				**Container:**	G								8/6/08

Relinquished by Sampler:	Date	Time	Received by:	Date	Time
Signed:	9/25	2:20	Signed:		
Relinquished by: Signed:	Date	Time	Received by: Signed:	Date	Time
Relinquished by: Signed:	Date	Time	Received in Laboratory by: Signed: Sasha McNeely	Date 9/25/14	Time 800

Turn Around Time (please note):
Standard ______ *RUSH, mark below ______
*3-Day *2-Day *Next Day *Same Day

Remarks: 3 DAY RUSH ON PA2-S1A, PA2-S1B, PA2-S2A, PA2-S2B, MW-3, MW-6
25% mark-up
Page 1 of 2

Refrigerated upon receipt: [✓ yes] no
Invoice # (LAB use only): 313616

313666

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
B'HAM, AL 35233
PHONE (205)581-9500 FAX (205)581-9504
E-Mail: suthlab@bellsouth.net

CHAIN OF CUSTODY
ANALYSIS REQUEST

Client P.O. # EBHM131003

SEND REPORT TO:
Name/Co.: Jymalyn Redmond
Address: 4659 Huffman Road Grady, AL 36036
Phone# / Cell#: 334-590-7010, 205-616-6116
E-mail: jymalyn.redmond@gmcnetwork.com, cory.trojano@gmcnetwork.com
PDF Results: yes no Fax #:

CLIENT: City of Cullman
PROJECT: Cullman Closure
SAMPLER(S): (print) Robinson, Redmond

DATE DELIVERED:

					ANALYSIS REQUESTED / METHOD								
LAB ID	FIELD ID	DATE Collected	TIME Collected	SAMPLE DESCRIPTION (matrix)	METALS RCRA 8	METALS AS, Pb	VOCs	PAH					Number of sample containers
155813	CUL-SBG-1	9/24/14	11:00	SOIL	X		X	X					2
155814	PA3-S-1	9/24/14	14:20				X	X					1
155815	PA3-S-2	9/24/14	14:37				X	X					1
155816	PA3-S-3	9/24/14	14:45				X	X					1
155817	PA3-S-4	9/24/14	15:00				X	X					1
155818	PA3-S-5	9/24/14	15:06				X	X					1
155819	PA3-S-5D	9/24/14	15:10	↓				X					1
155820	MW-3	9/25/14	9:15/14	WATER		X	X						4
155821	MW-6	9/25/14	10/05/14	WATER		X	X						4
155822	Trip Blank	—	—	↓			X						
Preservative: (a)HCL, (b)HNO				**Preservative:**	B	ICE							Last revised
Container type: (a) Amber, (g) Glass, (p) Plastic, (v) VOC Vial, (t) Tedlar bag				**Container:**	G								8/6/08

Preservative: (a)HCL, (b)HNO_3, (c)H_2SO_4, (d)NaOH, (e)Zn Acetate

Relinquished by Sampler: Signed:	Date	Time	Received by: Signed:	Date	Time
	9/25	2:20			
Relinquished by: Signed:	Date	Time	Received by: Signed:	Date	Time
Relinquished by: Signed:	Date	Time	Received in Laboratory by: Signed: Tasha McNeely	Date	Time
				9/25/14	220

Turn Around Time (please note):
Standard ________ *RUSH, mark below ________
*3-Day *2-Day *Next Day *Same Day
3 Day Rush for MW-3, MW-6

25% mark-up

Page 2 of 2

Refrigerated upon receipt: [✓ yes] no
Invoice # (LAB use only): 313666

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	October 1, 2014
Attention:	Ms. Jymalyn Redmond	Reference #	31366
Address:	4659 Huffman Rd.	P.O. #	EBHM131003
	Grady, AL 36036	Project ID:	Cullman Closure

Sample Matrix:	soil	Analytical	
Date Received:	9/25/14	Analyst:	Hageman/Heard
Date Collected:	9/24/14	Date of Analysis:	9/27/14 - 10/1/14
Sample Collector:	Robinson/ Redmond	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

VOLATILE ORGANIC COMPOUNDS, PPM	**FIELD ID** **PA2-S1A** **LAB ID** **155801**	**FIELD ID** **PA2-S1B** **LAB ID** **155802**	**FIELD ID** **PA2-S2A** **LAB ID** **155804**	**FIELD ID** **PA2-S2B** **LAB ID** **155805**	**FIELD ID** **PA2-S2D** **LAB ID** **155806**	Practical Quantitation Limit PPM
Benzene	**0.007**	**0.006**	**0.008**	**0.005**	BDL	0.005
Bromobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Bromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromodichloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromoform	BDL	BDL	BDL	BDL	BDL	0.005
Bromomethane	BDL	BDL	BDL	BDL	BDL	0.005
n-Butylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
sec-Butylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
tert-Butybenzene	BDL	BDL	BDL	BDL	BDL	0.005
Carbon Tetrachloride	BDL	BDL	BDL	BDL	BDL	0.005
Chlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Chloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Chloroform	BDL	BDL	BDL	BDL	BDL	0.005
Chloromethane	BDL	BDL	BDL	BDL	BDL	0.005
2-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
4-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
Dibromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromo-3-Chloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromoethane	BDL	BDL	BDL	BDL	BDL	0.005
Dibromomethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,3-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,4-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Dichlorodifluoromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloroethane	BDL	**0.016**	BDL	BDL	BDL	0.005
1,2-Dichloroethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	October 1, 2014
Attention:	Ms. Jymalyn Redmond	Reference #	31366
Address:	4659 Huffman Rd.	P.O. #	EBHM131003
	Grady, AL 36036	Project ID:	Cullman Closure

Sample Matrix:	soil	Analytical	
Date Received:	9/25/14	Analyst:	Hageman/Heard
Date Collected:	9/24/14	Date of Analysis:	9/27/14 - 10/1/14
Sample Collector:	Robinson/ Redmond	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	Practical
VOLATILE	**PA2-S1A**	**PA2-S1B**	**PA2-S2A**	**PA2-S2B**	**PA2-S2D**	Quantitation
ORGANIC	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	Limit
COMPOUNDS, PPM	**155801**	**155802**	**155804**	**155805**	**155806**	PPM
1,1-Dichloroethene	BDL	**0.012**	BDL	BDL	BDL	0.005
cis-1,2-Dichloroethene	**0.065**	**0.260**	**0.125**	**0.020**	**0.009**	0.005
trans-1,2-Dichloroethene	BDL	**0.006**	BDL	BDL	BDL	0.005
1,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,3- Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
2,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
cis-1-3,Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
trans-1,3-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
Ethylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
Hexachlorobutadiene	BDL	BDL	BDL	BDL	BDL	0.005
Isopropylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
4-Isopropyltoluene	BDL	BDL	BDL	BDL	BDL	0.005
Methylene Chloride	**0.453**	**0.238**	**0.242**	**0.420**	BDL	0.100
Naphthalene	BDL	BDL	BDL	BDL	BDL	0.025
n-Propylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
Styrene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Tetrachloroethene	BDL	BDL	BDL	BDL	BDL	0.005
Toluene	BDL	**0.009**	**0.014**	BDL	**0.006**	0.005
1,2,3-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1-Trichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2-Trichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Trichloroethene	**0.022**	**0.082**	**0.057**	**0.009**	BDL	0.005
Trichlorofluoromethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	October 1, 2014
Attention:	Ms. Jymalyn Redmond	Reference #	31366
Address:	4659 Huffman Rd.	P.O. #	EBHM131003
	Grady, AL 36036	Project ID:	Cullman Closure

Sample Matrix:	soil	Analytical	
Date Received:	9/25/14	Analyst:	Hageman/Heard
Date Collected:	9/24/14	Date of Analysis:	9/27/14 - 10/1/14
Sample Collector:	Robinson/ Redmond	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	Practical
VOLATILE	**PA2-S1A**	**PA2-S1B**	**PA2-S2A**	**PA2-S2B**	**PA2-S2D**	Quantitation
ORGANIC	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	Limit
COMPOUNDS, PPM	**155801**	**155802**	**155804**	**155805**	**155806**	PPM
1,2,3-Trichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trimethylbenzene	BDL	BDL	**0.005**	BDL	BDL	0.005
1,3,5-Trimethylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
Vinyl Chloride	BDL	**0.006**	BDL	BDL	BDL	0.005
Xylenes, o,m,p	BDL	BDL	BDL	BDL	BDL	0.015
MTBE	BDL	BDL	BDL	BDL	BDL	0.005

Detection Limit is Practical Quantitation Limit
BDL = Below Detection Limit
All results expressed as PPM (mg/Kg)

ADEM # 41470
EPA Laboratory ID AL01084

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	October 1, 2014
Attention:	Ms. Jymalyn Redmond	Reference #	31366
Address:	4659 Huffman Rd. Grady, AL 36036	P.O. #	EBHM131003
		Project ID:	Cullman Closure

Sample Matrix:	soil	Analytical	
Date Received:	9/25/14	Analyst:	Hageman/Heard
Date Collected:	9/24/14	Date of Analysis:	10/1/14
Sample Collector:	Robinson/ Redmond	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	Practical Quantitation Limit PPM
VOLATILE ORGANIC COMPOUNDS, PPM	**PA2-S3A**	**PA2-S4A**	**PA2-S4B**	**CUL-SBG-1**	**PA3-S-1**	
	LAB ID	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	
	155807	**155808**	**155809**	**155813**	**155814**	
Benzene	BDL	BDL	BDL	BDL	**0.007**	0.005
Bromobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Bromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromodichloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromoform	BDL	BDL	BDL	BDL	BDL	0.005
Bromomethane	BDL	BDL	BDL	BDL	BDL	0.005
n-Butylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
sec-Butylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
tert-Butybenzene	BDL	BDL	BDL	BDL	BDL	0.005
Carbon Tetrachloride	BDL	BDL	BDL	BDL	BDL	0.005
Chlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Chloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Chloroform	BDL	BDL	BDL	BDL	BDL	0.005
Chloromethane	BDL	BDL	BDL	**0.007**	BDL	0.005
2-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
4-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
Dibromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromo-3-Chloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromoethane	BDL	BDL	BDL	BDL	BDL	0.005
Dibromomethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,3-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,4-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Dichlorodifluoromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichloroethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	October 1, 2014
Attention:	Ms. Jymalyn Redmond	Reference #	31366
Address:	4659 Huffman Rd.	P.O. #	EBHM131003
	Grady, AL 36036	Project ID:	Cullman Closure

Sample Matrix:	soil	Analytical	
Date Received:	9/25/14	Analyst:	Hageman/Heard
Date Collected:	9/24/14	Date of Analysis:	10/1/14
Sample Collector:	Robinson/ Redmond	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	Practical
VOLATILE	**PA2-S3A**	**PA2-S4A**	**PA2-S4B**	**CUL-SBG-1**	**PA3-S-1**	Quantitation
ORGANIC	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	Limit
COMPOUNDS, PPM	**155807**	**155808**	**155809**	**155813**	**155814**	PPM
1,1-Dichloroethene	BDL	BDL	BDL	BDL	BDL	0.005
cis-1,2-Dichloroethene	BDL	BDL	BDL	BDL	BDL	0.005
trans-1,2-Dichloroethene	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,3- Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
2,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
cis-1-3,Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
trans-1,3-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
Ethylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
Hexachlorobutadiene	BDL	BDL	BDL	BDL	BDL	0.005
Isopropylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
4-Isopropyltoluene	BDL	BDL	BDL	BDL	BDL	0.005
Methylene Chloride	BDL	BDL	**0.189**	**0.260**	**0.251**	0.100
Naphthalene	BDL	BDL	BDL	BDL	BDL	0.025
n-Propylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
Styrene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Tetrachloroethene	BDL	BDL	BDL	BDL	BDL	0.005
Toluene	BDL	BDL	**0.005**	BDL	BDL	0.005
1,2,3-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1-Trichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2-Trichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Trichloroethene	BDL	BDL	BDL	BDL	BDL	0.005
Trichlorofluoromethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

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Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	October 1, 2014
Attention:	Ms. Jymalyn Redmond	Reference #	31366
Address:	4659 Huffman Rd. Grady, AL 36036	P.O. #	EBHM131003
		Project ID:	Cullman Closure

Sample Matrix:	soil	Analytical	
Date Received:	9/25/14	Analyst:	Hageman/Heard
Date Collected:	9/24/14	Date of Analysis:	10/1/14
Sample Collector:	Robinson/ Redmond	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	Practical Quantitation Limit PPM
VOLATILE ORGANIC COMPOUNDS, PPM	**PA2-S3A**	**PA2-S4A**	**PA2-S4B**	**CUL-SBG-1**	**PA3-S-1**	
	LAB ID	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	
	155807	**155808**	**155809**	**155813**	**155814**	
1,2,3-Trichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trimethylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,3,5-Trimethylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
Vinyl Chloride	BDL	BDL	BDL	BDL	BDL	0.005
Xylenes, o,m,p	BDL	BDL	BDL	BDL	BDL	0.015
MTBE	BDL	BDL	BDL	BDL	BDL	0.005

Detection Limit is Practical Quantitation Limit
BDL = Below Detection Limit
All results expressed as PPM (mg/Kg)

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	October 1, 2014
Attention:	Ms. Jymalyn Redmond	Reference #	31366
Address:	4659 Huffman Rd.	P.O. #	EBHM131003
	Grady, AL 36036	Project ID:	Cullman Closure

Sample Matrix:	soil	Analytical	
Date Received:	9/25/14	Analyst:	Hageman/Heard
Date Collected:	9/24/14	Date of Analysis:	10/1/14
Sample Collector:	Robinson/ Redmond	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**		Practical Quantitation Limit PPM
VOLATILE	**PA3-S-2**	**PA3-S-3**	**PA3-S-4**	**PA3-S-5**		
ORGANIC	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**		
COMPOUNDS, PPM	**155815**	**155816**	**155817**	**155818**		
Benzene	**0.005**	**0.006**	BDL	**0.006**		0.005
Bromobenzene	BDL	BDL	BDL	BDL		0.005
Bromochloromethane	BDL	BDL	BDL	BDL		0.005
Bromodichloromethane	BDL	BDL	BDL	BDL		0.005
Bromoform	BDL	BDL	BDL	BDL		0.005
Bromomethane	BDL	BDL	BDL	BDL		0.005
n-Butylbenzene	BDL	BDL	BDL	BDL		0.005
sec-Butylbenzene	BDL	BDL	BDL	BDL		0.005
tert-Butybenzene	BDL	BDL	BDL	BDL		0.005
Carbon Tetrachloride	BDL	BDL	BDL	BDL		0.005
Chlorobenzene	BDL	BDL	BDL	BDL		0.005
Chloroethane	BDL	BDL	BDL	BDL		0.005
Chloroform	BDL	BDL	BDL	BDL		0.005
Chloromethane	BDL	BDL	BDL	BDL		0.005
2-Chlorotoluene	BDL	BDL	BDL	BDL		0.005
4-Chlorotoluene	BDL	BDL	BDL	BDL		0.005
Dibromochloromethane	BDL	BDL	BDL	BDL		0.005
1,2-Dibromo-3-Chloropropane	BDL	BDL	BDL	BDL		0.005
1,2-Dibromoethane	BDL	BDL	BDL	BDL		0.005
Dibromomethane	BDL	BDL	BDL	BDL		0.005
1,2-Dichlorobenzene	BDL	BDL	BDL	BDL		0.005
1,3-Dichlorobenzene	BDL	BDL	BDL	BDL		0.005
1,4-Dichlorobenzene	BDL	BDL	BDL	BDL		0.005
Dichlorodifluoromethane	BDL	BDL	BDL	BDL		0.005
1,1-Dichloroethane	BDL	BDL	BDL	BDL		0.005
1,2-Dichloroethane	BDL	BDL	BDL	BDL		0.005

Compound List Continued next page

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	October 1, 2014
Attention:	Ms. Jymalyn Redmond	Reference #	31366
Address:	4659 Huffman Rd.	P.O. #	EBHM131003
	Grady, AL 36036	Project ID:	Cullman Closure

Sample Matrix:	soil	Analytical	
Date Received:	9/25/14	Analyst:	Hageman/Heard
Date Collected:	9/24/14	Date of Analysis:	10/1/14
Sample Collector:	Robinson/ Redmond	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**		Practical Quantitation Limit PPM
VOLATILE	**PA3-S-2**	**PA3-S-3**	**PA3-S-4**	**PA3-S-5**		
ORGANIC	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**		
COMPOUNDS, PPM	**155815**	**155816**	**155817**	**155818**		
1,1-Dichloroethene	BDL	BDL	BDL	BDL		0.005
cis-1,2-Dichloroethene	BDL	BDL	BDL	BDL		0.005
trans-1,2-Dichloroethene	BDL	BDL	BDL	BDL		0.005
1,2-Dichloropropane	BDL	BDL	BDL	BDL		0.005
1,3- Dichloropropane	BDL	BDL	BDL	BDL		0.005
2,2-Dichloropropane	BDL	BDL	BDL	BDL		0.005
1,1-Dichloropropene	BDL	BDL	BDL	BDL		0.005
cis-1-3,Dichloropropene	BDL	BDL	BDL	BDL		0.005
trans-1,3-Dichloropropene	BDL	BDL	BDL	BDL		0.005
Ethylbenzene	BDL	BDL	BDL	BDL		0.005
Hexachlorobutadiene	BDL	BDL	BDL	BDL		0.005
Isopropylbenzene	BDL	BDL	BDL	BDL		0.005
4-Isopropyltoluene	BDL	BDL	BDL	BDL		0.005
Methylene Chloride	**0.284**	**0.243**	**0.139**	**0.209**		0.100
Naphthalene	BDL	BDL	BDL	BDL		0.025
n-Propylbenzene	BDL	BDL	BDL	BDL		0.005
Styrene	BDL	BDL	BDL	BDL		0.005
1,1,1,2-Tetrachloroethane	BDL	BDL	BDL	BDL		0.005
1,1,2,2-Tetrachloroethane	BDL	BDL	BDL	BDL		0.005
Tetrachloroethene	BDL	BDL	BDL	BDL		0.005
Toluene	BDL	BDL	BDL	BDL		0.005
1,2,3-Trichlorobenzene	BDL	BDL	BDL	BDL		0.005
1,2,4-Trichlorobenzene	BDL	BDL	BDL	BDL		0.005
1,1,1-Trichloroethane	BDL	BDL	BDL	BDL		0.005
1,1,2-Trichloroethane	BDL	BDL	BDL	BDL		0.005
Trichloroethene	BDL	BDL	BDL	BDL		0.005
Trichlorofluoromethane	BDL	BDL	BDL	BDL		0.005

Compound List Continued next page

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	October 1, 2014
Attention:	Ms. Jymalyn Redmond	Reference #	31366
Address:	4659 Huffman Rd.	P.O. #	EBHM131003
	Grady, AL 36036	Project ID:	Cullman Closure

Sample Matrix:	soil	Analytical	
Date Received:	9/25/14	Analyst:	Hageman/Heard
Date Collected:	9/24/14	Date of Analysis:	10/1/14
Sample Collector:	Robinson/ Redmond	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**		Practical Quantitation Limit PPM
VOLATILE	**PA3-S-2**	**PA3-S-3**	**PA3-S-4**	**PA3-S-5**		
ORGANIC	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**		
COMPOUNDS, PPM	**155815**	**155816**	**155817**	**155818**		
1,2,3-Trichloropropane	BDL	BDL	BDL	BDL		0.005
1,2,4-Trimethylbenzene	BDL	BDL	BDL	BDL		0.005
1,3,5-Trimethylbenzene	BDL	BDL	BDL	BDL		0.005
Vinyl Chloride	BDL	BDL	BDL	BDL		0.005
Xylenes, o,m,p	BDL	BDL	BDL	BDL		0.015
MTBE	BDL	BDL	BDL	BDL		0.005

Detection Limit is Practical Quantitation Limit
BDL = Below Detection Limit
All results expressed as PPM (mg/Kg)

MH / QAQC

ADEM # 41470
EPA Laboratory ID AL01084

Respectfully submitted,

Kevin Doriety

Kevin Doriety
Analytical Chemist

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	September 30, 2014
Attention:	Ms. Jymalyn Redmond	Reference #	31366
Address:	4659 Huffman Rd.	P.O. #	EBHM131003
	Grady, AL 36036	Project ID:	Cullman Closure

Sample Matrix:	water	Analytical	
Date Received:	9/25/14	Analyst:	Hageman/Heard
Date Collected:	9/25/14	Date Analysis:	9/27-29/14
Sample Collector:	Robinson/ Redmond	Method:	***EPA Method 8260***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**			
VOLATILE	**MW-3**	**MW-6**	**TripBlank**			Detection
ORGANIC	**LAB ID**	**LAB ID**	**LAB ID**			Limit
COMPOUNDS, PPM	**155820**	**155821**	**155822**			PPM
Benzene	BDL	BDL	BDL			0.005
Bromobenzene	BDL	BDL	BDL			0.005
Bromochloromethane	BDL	BDL	BDL			0.005
Bromodichloromethane	BDL	BDL	BDL			0.005
Bromoform	BDL	BDL	BDL			0.005
Bromomethane	BDL	BDL	BDL			0.005
n-Butylbenzene	BDL	BDL	BDL			0.005
sec-Butylbenzene	BDL	BDL	BDL			0.005
tert-Butybenzene	BDL	BDL	BDL			0.005
Carbon Tetrachloride	BDL	BDL	BDL			0.005
Chlorobenzene	BDL	BDL	BDL			0.005
Chloroethane	BDL	BDL	BDL			0.005
Chloroform	BDL	BDL	BDL			0.005
Chloromethane	BDL	**0.084**	BDL			0.005
2-Chlorotoluene	BDL	BDL	BDL			0.005
4-Chlorotoluene	BDL	BDL	BDL			0.005
Dibromochloromethane	BDL	BDL	BDL			0.005
1,2-Dibromo-3-Chloropropane	BDL	BDL	BDL			0.005
1,2-Dibromoethane	BDL	BDL	BDL			0.005
Dibromomethane	BDL	BDL	BDL			0.005
1,2-Dichlorobenzene	BDL	BDL	BDL			0.005
1,3-Dichlorobenzene	BDL	BDL	BDL			0.005
1,4-Dichlorobenzene	BDL	BDL	BDL			0.005
Dichlorodifluoromethane	BDL	BDL	BDL			0.005
1,1-Dichloroethane	**0.832**	BDL	BDL			0.005
1,2-Dichloroethane	BDL	**0.006**	BDL			0.005

Compound List Continued next page

BDL = Below Detection Limit, Method
All results expressed as PPM (mg/L)

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	September 30, 2014
Attention:	Ms. Jymalyn Redmond	Reference #	31366
Address:	4659 Huffman Rd.	P.O. #	EBHM131003
	Grady, AL 36036	Project ID:	Cullman Closure

Sample Matrix:	water	Analytical	
Date Received:	9/25/14	Analyst:	Hageman/Heard
Date Collected:	9/25/14	Date Analysis:	9/27-29/14
Sample Collector:	Robinson/ Redmond	Method:	***EPA Method 8260***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**			
VOLATILE ORGANIC COMPOUNDS, PPM	**MW-3**	**MW-6**	**TripBlank**			Detection Limit PPM
	LAB ID	**LAB ID**	**LAB ID**			
	155820	**155821**	**155822**			
1,1-Dichloroethene	**6.080**	BDL	BDL			0.005
cis-1,2-Dichloroethene	**1.840**	**1.290**	BDL			0.005
trans-1,2-Dichloroethene	**0.044**	**0.156**	BDL			0.005
1,2-Dichloropropane	BDL	BDL	BDL			0.005
1,3- Dichloropropane	BDL	BDL	BDL			0.005
2,2-Dichloropropane	BDL	BDL	BDL			0.005
1,1-Dichloropropene	BDL	BDL	BDL			0.005
cis-1-3,Dichloropropene	BDL	BDL	BDL			0.005
trans-1,3-Dichloropropene	BDL	BDL	BDL			0.005
Ethylbenzene	BDL	BDL	BDL			0.005
Hexachlorobutadiene	BDL	BDL	BDL			0.005
Isopropylbenzene	BDL	BDL	BDL			0.005
4-Isopropyltoluene	BDL	BDL	BDL			0.005
Methylene Chloride	**0.008**	**0.020**	BDL			0.005
Naphthalene	BDL	BDL	BDL			0.010
n-Propylbenzene	BDL	BDL	BDL			0.005
Styrene	BDL	BDL	BDL			0.005
1,1,1,2-Tetrachloroethane	BDL	BDL	BDL			0.005
1,1,2,2-Tetrachloroethane	**0.016**	BDL	BDL			0.005
Tetrachloroethene	**0.072**	BDL	BDL			0.005
Toluene	**0.033**	BDL	BDL			0.005
1,2,3-Trichlorobenzene	BDL	BDL	BDL			0.005
1,2,4-Trichlorobenzene	BDL	BDL	BDL			0.005
1,1,1-Trichloroethane	**0.722**	BDL	BDL			0.005
1,1,2-Trichloroethane	**0.024**	**0.013**	BDL			0.005

Compound List Continued next page

BDL = Below Detection Limit, Method
All results expressed as PPM (mg/L)

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	September 30, 2014
Attention:	Ms. Jymalyn Redmond	Reference #	31366
Address:	4659 Huffman Rd.	P.O. #	EBHM131003
	Grady, AL 36036	Project ID:	Cullman Closure

Sample Matrix:	water	Analytical	
Date Received:	9/25/14	Analyst:	Hageman/Heard
Date Collected:	9/25/14	Date Analysis:	9/27-29/14
Sample Collector:	Robinson/ Redmond	Method:	***EPA Method 8260***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**			
VOLATILE	**MW-3**	**MW-6**	**TripBlank**			Detection
ORGANIC	**LAB ID**	**LAB ID**	**LAB ID**			Limit
COMPOUNDS, PPM	**155820**	**155821**	**155822**			PPM
Trichloroethylene	**30.000**	**0.096**	BDL			0.005
Trichlorofluoromethane	BDL	BDL	BDL			0.005
1,2,3-Trichloropropane	BDL	BDL	BDL			0.005
1,2,4-Trimethylbenzene	BDL	BDL	BDL			0.005
1,3,5-Trimethylbenzene	BDL	BDL	BDL			0.005
Vinyl Chloride	**0.424**	**0.028**	BDL			0.002
Xylenes, o,m,p	BDL	BDL	BDL			0.005
MTBE	BDL	BDL	BDL			0.005

BDL = Below Detection Limit, Method
All results expressed as PPM (mg/L)

MH/QAQC

EPA Laboratory ID AL01084

Respectfully submitted,

Kevin Doriety

Kevin Doriety
Analytical Chemist

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	October 1, 2014
Attention:	Ms. Jymalyn Redmond	Reference #	31366
Address:	4659 Huffman Rd.	P.O. #	EBHM131003
	Grady, AL 36036	Project ID:	Cullman Closure

Sample Matrix:	soil	Extraction Date:	9/29/14
Date Received:	9/25/14	Analyst:	Hageman/Currence
Date Collected:	9/24/14	Date of Analysis:	9/30/14
Sample Collector:	Robinson/ Redmond	Method:	***EPA Method 8270C***

POLYNUCLEAR AROMATIC HYDROCARBONS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	
	CUL-SBG-1	**PA3-S-1**	**PA3-S-2**	**PA3-S-3**	**PA3-S-4**	**PA3-S-5**	
Polynuclear	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	Detection
Aromatics, ppm	**155813**	**155814**	**155815**	**155816**	**155817**	**155818**	Limit, ppm
Acenaphthene	BDL	BDL	BDL	BDL	BDL	**0.064**	0.050
Acenaphthylene	BDL	BDL	BDL	BDL	**0.238**	BDL	0.050
Anthracene	BDL	BDL	BDL	**0.067**	**0.469**	**0.182**	0.050
Benzo(a)anthracene	BDL	BDL	BDL	**0.263**	**0.835**	**0.485**	0.050
Benzo(b)fluoranthene	BDL	BDL	**0.053**	**0.496**	**2.840**	**0.775**	0.050
Benzo(k)fluoranthene	BDL	BDL	BDL	**0.335**	**1.840**	**0.550**	0.050
Benzo(ghi)perylene	BDL	BDL	BDL	**0.341**	**0.895**	**0.500**	0.050
Benzo(a)pyrene	BDL	BDL	**0.067**	**0.468**	**1.170**	**0.720**	0.050
Chrysene	BDL	BDL	**0.068**	**0.362**	**3.070**	**0.625**	0.050
Dibenzo(ah)anthracene	BDL	BDL	BDL	**0.116**	**0.212**	**0.108**	0.050
Fluoranthene	BDL	BDL	**0.059**	**0.443**	**3.170**	**0.965**	0.050
Fluorene	BDL	BDL	BDL	BDL	**0.085**	**0.060**	0.050
Indeno(1,2,3-cd)pyrene	BDL	BDL	BDL	**0.286**	**0.820**	**0.440**	0.050
Naphthalene	BDL	BDL	**0.113**	BDL	**0.076**	BDL	0.050
Phenanthrene	BDL	BDL	**0.163**	**0.200**	**0.830**	**0.575**	0.050
Pyrene	BDL	BDL	**0.053**	**0.352**	**2.590**	**0.740**	0.050

BDL = Below Detection Limit
Detection limit is Practical Quantitation Limit
All results expressed as PPM (mg/kg)

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	October 1, 2014
Attention:	Ms. Jymalyn Redmond	Reference #	31366
Address:	4659 Huffman Rd.	P.O. #	EBHM131003
	Grady, AL 36036	Project ID:	Cullman Closure

Sample Matrix:	soil	Extraction Date:	9/29/14
Date Received:	9/25/14	Analyst:	Hageman/Currence
Date Collected:	9/24/14	Date of Analysis:	9/30/14
Sample Collector:	Robinson/ Redmond	Method:	***EPA Method 8270C***

POLYNUCLEAR AROMATIC HYDROCARBONS

	FIELD ID						
	PA3-S-5D						
Polynuclear Aromatics, ppm	**LAB ID**						Detection Limit, ppm
	155819						
Acenaphthene	**0.057**						0.050
Acenaphthylene	BDL						0.050
Anthracene	**0.520**						0.050
Benzo(a)anthracene	**4.700**						0.050
Benzo(b)fluoranthene	**6.100**						0.050
Benzo(k)fluoranthene	**4.580**						0.050
Benzo(ghi)perylene	**3.180**						0.050
Benzo(a)pyrene	**5.450**						0.050
Chrysene	**5.100**						0.050
Dibenzo(ah)anthracene	**0.805**						0.050
Fluoranthene	**6.250**						0.050
Fluorene	**0.074**						0.050
Indeno(1,2,3-cd)pyrene	**2.860**						0.050
Naphthalene	BDL						0.050
Phenanthrene	**1.750**						0.050
Pyrene	**5.050**						0.050

BDL = Below Detection Limit
Detection limit is Practical Quantitation Limit
All results expressed as PPM (mg/kg)

MH / QAQC

EPA Laboratory ID AL01084

Respectfully submitted,

Kevin Doriety

Kevin Doriety
Analytical Chemist

Quality Environmental Analytical Services

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	September 30, 2014
Attention:	Ms. Jymalyn Redmond	Reference #	31366
Address:	4659 Huffman Rd. Grady, AL 36036	P.O. #	EBHM131003
		Project ID:	Cullman Closure

Sample Matrix:	soil	Analytical	
Date Received:	9/25/14	Analyst:	Kevin Doriety
Date Collected:	9/24/14	Date of Analysis:	9/30/14
Sample Collector:	Robinson/ Redmond	Method:	***EPA Method 6010B/ Hg: 7471A***

METALLIC ANALYTES

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**			
	PA2-S1A	**PA2-S1B**	**PA2-S2A**	**PA2-S2B**			
Analyte, mg/Kg	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**			Detection
as Total	**155801**	**155802**	**155804**	**155805**			Limit,mg/Kg
Arsenic	**7.2**	**2.0**	**6.3**	BDL			1.0
Barium	**16**	**15**	**16**	**18**			1.0
Cadmium	BDL	BDL	BDL	BDL			1.0
Chromium	**23**	**24**	**35**	**29**			1.0
Lead	**12**	**14**	**14**	**11**			1.0
Mercury	BDL	BDL	BDL	BDL			0.01
Selenium	BDL	BDL	BDL	BDL			1.0
Silver	BDL	BDL	BDL	BDL			1.0

BDL = Below Detection Limit
Detection Limit is Reporting Limit
All results expressed as PPM mg/Kg of total analyte

EPA Laboratory ID AL01084

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	September 30, 2014
Attention:	Ms. Jymalyn Redmond	Reference #	31366
Address:	4659 Huffman Rd. Grady, AL 36036	P.O. #	EBHM131003
		Project ID:	Cullman Closure

Sample Matrix:	soil	Analytical	
Date Received:	9/25/14	Analyst:	Kevin Doriety
Date Collected:	9/24/14	Date of Analysis:	9/30/14
Sample Collector:	Robinson/ Redmond	Method:	***EPA Method 6010B/ Hg: 7471A***

METALLIC ANALYTES

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**		
	PA2-S1D	**PA2-S3A**	**PA2-S4A**	**PA2-S4B**	**CUL-SBG-1**		
Analyte, mg/Kg as Total	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**		Detection Limit,mg/Kg
	155803	**155807**	**155808**	**155809**	**155813**		
Arsenic	**2.8**	**4.4**	**3.3**	**2.3**	**5.6**		1.0
Barium	**14**	**23**	**62**	**19**	**61**		1.0
Cadmium	BDL	BDL	BDL	BDL	BDL		1.0
Chromium	**21**	**17**	**15**	**20**	**36**		1.0
Lead	**9.9**	**46**	**83**	**11**	**66**		1.0
Mercury	BDL	BDL	BDL	BDL	BDL		0.01
Selenium	BDL	BDL	BDL	BDL	BDL		1.0
Silver	BDL	BDL	BDL	BDL	BDL		1.0

BDL = Below Detection Limit
Detection Limit is Reporting Limit
All results expressed as PPM mg/Kg of total analyte

MH / QAQC

EPA Laboratory ID AL01084

Respectfully submitted,

Kevin Doriety

Kevin Doriety
Analytical Chemist

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Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Goodwyn, Mills & Cawood	Report Date:	September 30, 2014
Attention:	Ms. Jymalyn Redmond	Reference #	31366
Address:	4659 Huffman Rd. Grady, AL 36036	P.O. #	EBHM131003
		Project ID:	Cullman Closure

Sample Matrix:	water	Analytical	
Date Received:	9/25/14	Analyst:	Kevin Doriety
Date Collected:	9/25/14	Date Analysis:	9/30/14
Sample Collector:	Robinson/ Redmond	Method:	***EPA Method 6010B***

METALLIC ANALYTES

	FIELD ID	**FIELD ID**					
	MW-3	**MW-6**					
Analyte, mg/L	**LAB ID**	**LAB ID**					Detection
as Total	**155820**	**155821**					Limit,mg/L
Arsenic	BDL	BDL					0.010
Lead	**0.12**	**0.066**					0.0020

BDL = Below Detection Limit
Detection Limit is Method Detection Limit
All results expressed as PPM mg/L of total analyte

MH / QAQC

EPA Laboratory ID AL01084

Respectfully submitted,

Kevin Doriety

Kevin Doriety
Analytical Chemist

Appendix B

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ #29; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User's Guide); s = Concentration may exceed Csat (See User's Guide); SSL values are based on DAF=1

Contaminant		Toxicity and Chemical-specific Information													Screening Levels											Protection of Groundwater Soil	
		SFO	key	IUR	key	RfDo	key	RfCi	key	voc	mutagen	GIABS	ABS	Csat	Residential Soil		Industrial Soil		Residential Air		Industrial Air		Tapwater		MCL	Risk-based SSL	MCL-based SSL
Analyte	CAS No.	(mg/kg-day)$^{-1}$		(ug/m^3)$^{-1}$		(mg/kg-day)		(mg/m^3)						mg/kg	mg/kg	key	mg/kg	key	ug/m^3	key	ug/m^3	key	ug/L	key	ug/L	mg/kg	mg/kg
ALAR	1596-84-5	1.8E-02	C	5.1E-06	C	1.5E-01	I					1	0.1		2.7E+01	c	9.6E+01	c	4.8E-01	c	2.4E+00	c	3.7E+00	c		8.2E-04	
Acephate	30560-19-1	8.7E-03	I			4.0E-03	I					1	0.1		5.6E+01	c**	2.0E+02	c*					7.7E+00	c*		1.7E-03	
Acetaldehyde	75-07-0			2.2E-06	I			9.0E-03	I	V		1		1.1E+05	1.0E+01	c**	5.2E+01	c**	1.1E+00	c**	5.6E+00	c**	2.2E+00	c**		4.5E-04	
Acetochlor	34256-82-1					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		5.8E-01	
Acetone	67-64-1					9.0E-01	I	3.1E+01	A	V		1		1.1E+05	6.1E+04	n	6.3E+05	nms	3.2E+04	n	1.4E+05	n	2.2E+04	n		4.5E+00	
Acetone Cyanohydrin	75-86-5					3.0E-03	P	6.0E-02	P	V		1		1.1E+05	2.0E+02	n	2.1E+03	n	6.3E+01	n	2.6E+02	n	5.8E+01	n		1.2E-02	
Acetonitrile	75-05-8							6.0E-02	I	V		1		1.3E+05	8.7E+02	n	3.7E+03	n	6.3E+01	n	2.6E+02	n	1.3E+02	n		2.6E-02	
Acetophenone	98-86-2					1.0E-01	I			V		1		2.5E+03	7.8E+03	ns	1.0E+05	nms					3.7E+03	n		1.1E+00	
Acetylaminofluorene, 2-	53-96-3	3.8E+00	C	1.3E-03	C							1	0.1		1.3E-01	c	4.5E-01	c	1.9E-03	c	9.4E-03	c	1.6E-02	c		8.2E-05	
Acrolein	107-02-8					5.0E-04	I	2.0E-05	I	V		1		2.3E+04	1.5E-01	n	6.5E-01	n	2.1E-02	n	8.8E-02	n	4.2E-02	n		8.4E-06	
Acrylamide	79-06-1	4.5E+00	I	1.3E-03	I	2.0E-04	I					1	0.1		1.1E-01	c	3.8E-01	c	1.9E-03	c	9.4E-03	c	1.5E-02	c		3.2E-06	
Acrylic Acid	79-10-7					5.0E-01	I	1.0E-03	I			1	0.1		3.0E+04	n	2.9E+05	nm	1.0E+00	n	4.4E+00	n	1.8E+04	n		3.7E+00	
Acrylonitrile	107-13-1	5.4E-01	I	6.8E-05	I	4.0E-02	A	2.0E-03	I	V		1		1.1E+04	2.4E-01	c*	1.2E+00	c*	3.6E-02	c*	1.8E-01	c*	4.5E-02	c*		9.9E-06	
Adiponitrile	111-69-3							6.0E-03	P			1	0.1		8.5E+06	nm	3.6E+07	nm	6.3E+00	n	2.6E+01	n					
Alachlor	15972-60-8	5.6E-02	C			1.0E-02	I					1	0.1		8.7E+00	c*	3.1E+01	c					1.2E+00	c	2.0E+00	9.9E-04	1.6E-03
Aldicarb	116-06-3					1.0E-03	I					1	0.1		6.1E+01	n	6.2E+02	n					3.7E+01	n		9.1E-03	
Aldicarb Sulfone	1646-88-4					1.0E-03	I					1	0.1		6.1E+01	n	6.2E+02	n					3.7E+01	n		8.0E-03	
Aldrin	309-00-2	1.7E+01	I	4.9E-03	I	3.0E-05	I					1	0.1		2.9E-02	c*	1.0E-01	c	5.0E-04	c	2.5E-03	c	4.0E-03	c		6.5E-04	
Ally	74223-64-6					2.5E-01	I					1	0.1		1.5E+04	n	1.5E+05	nm					9.1E+03	n		3.5E+00	
Allyl Alcohol	107-18-6					5.0E-03	I	1.0E-04	X			1	0.1		3.0E+02	n	3.1E+03	n	1.0E-01	n	4.4E-01	n	1.8E+02	n		3.7E-02	
Allyl Chloride	107-05-1	2.1E-02	C	6.0E-06	C			1.0E-03	I	V		1		1.4E+03	6.8E-01	c**	3.4E+00	c**	4.1E-01	c**	2.0E+00	c**	6.5E-01	c**		2.1E-04	
Aluminum	7429-90-5					1.0E+00	P	5.0E-03	P			1			7.7E+04	n	9.9E+05	nm	5.2E+00	n	2.2E+01	n	3.7E+04	n		5.5E+04	
Aluminum Phosphide	20859-73-8					4.0E-04	I					1			3.1E+01	n	4.1E+02	n					1.5E+01	n			
Amdro	67485-29-4					3.0E-04	I					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n		3.9E+03	
Ametryn	834-12-8					9.0E-03	I					1	0.1		5.5E+02	n	5.5E+03	n					3.3E+02	n		3.5E-01	
Aminobiphenyl, 4-	92-67-1	2.1E+01	C	6.0E-03	C							1	0.1		2.3E-02	c	8.2E-02	c	4.1E-04	c	2.0E-03	c	3.2E-03	c		1.6E-05	
Aminophenol, m-	591-27-5					8.0E-02	P					1	0.1		4.9E+03	n	4.9E+04	n					2.9E+03	n		1.1E+00	
Aminophenol, p-	123-30-8					2.0E-02	P					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		2.8E-01	
Amitraz	33089-61-1					2.5E-03	I					1	0.1		1.5E+02	n	1.5E+03	n					9.1E+01	n		4.7E+01	
Ammonia	7664-41-7							1.0E-01	I			1							1.0E+02	n	4.4E+02	n					
Ammonium Perchlorate	7790-98-9					7.0E-04	I					1			5.5E+01	n	7.2E+02	n					2.6E+01	n			
Ammonium Sulfamate	7773-06-0					2.0E-01	I					1			1.6E+04	n	2.0E+05	nm					7.3E+03	n			
Aniline	62-53-3	5.7E-03	I	1.6E-06	C	7.0E-03	P	1.0E-03	I			1	0.1		8.5E+01	c**	3.0E+02	c*	1.0E+00	n	4.4E+00	n	1.2E+01	c*		4.0E-03	
Antimony (metallic)	7440-36-0					4.0E-04	I					0.15			3.1E+01	n	4.1E+02	n					1.5E+01	n	6.0E+00	6.6E-01	2 7E-01
Antimony Pentoxide	1314-60-9					5.0E-04	H					0.15			3.9E+01	n	5.1E+02	n					1.8E+01	n			
Antimony Potassium Tartrate	11071-15-1					9.0E-04	H					0.15			7.0E+01	n	9.2E+02	n					3.3E+01	n			
Antimony Tetroxide	1332-81-6					4.0E-04	H					0.15			3.1E+01	n	4.1E+02	n					1.5E+01	n			
Antimony Trioxide	1309-64-4							2.0E-04	I			0.15			2.8E+05	nm	1.2E+06	nm	2.1E-01	n	8.8E-01	n					
Apollo	74115-24-5					1.3E-02	I					1	0.1		7.9E+02	n	8.0E+03	n					4.7E+02	n		2.9E+01	
Aramite	140-57-8	2.5E-02	I	7.1E-06	I	5.0E-02	H					1	0.1		1.9E+01	c	6.9E+01	c	3.4E-01	c	1.7E+00	c	2.7E+00	c		3.0E-02	
Arsenic, Inorganic	7440-38-2	1.5E+00	I	4.3E-03	I	3.0E-04	I	1.5E-05	C			1	0.03		3.9E-01	c*	1.6E+00	c	5.7E-04	c*	2.9E-03	c*	4.5E-02	c	1.0E+01	1.3E-03	2.9E-01
Arsine	7784-42-1					3.5E-06	C	5.0E-05	I			1			2.7E-01	n	3.6E+00	n	5.2E-02	n	2.2E-01	n	1.3E-01	n			
Assure	76578-14-8					9.0E-03	I					1	0.1		5.5E+02	n	5.5E+03	n					3.3E+02	n		5.1E+00	
Asulam	3337-71-1					5.0E-02	I					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		4.7E-01	
Atrazine	1912-24-9	2.3E-01	C			3.5E-02	I					1	0.1		2.1E+00	c	7.5E+00	c					2.9E-01	c	3.0E+00	1.9E-04	1.9E-03
Auramine	492-80-8	8.8E-01	C	2.5E-04	C										7.3E-01	c	3.3E+00	c	9.7E-03	c	4.9E-02	c	7.6E-02	c		7.0E-04	
Avermectin B1	65195-55-3					4.0E-04	I					1	0.1		2.4E+01	n	2.5E+02	n					1.5E+01	n		2.8E+01	
Azobenzene	103-33-3	1.1E-01	I	3.1E-05	I					V		1			5.1E+00	c	2.3E+01	c	7.8E-02	c	4.0E-01	c	1.2E-01	c		9.6E-04	
Barium	7440-39-3					2.0E-01	I	5.0E-04	H			0.07			1.5E+04	n	1.9E+05	nm	5.2E-01	n	2.2E+00	n	7.3E+03	n	2.0E+03	3.0E+02	8.2E+01
Baygon	114-26-1					4.0E-03	I					1	0.1		2.4E+02	n	2.5E+03	n					1.5E+02	n		4.7E-02	
Bayleton	43121-43-3					3.0E-02	I					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n		8.7E-01	
Baythroid	68359-37-5					2.5E-02	I					1	0.1		1.5E+03	n	1.5E+04	n					9.1E+02	n		2.4E+02	
Benefin	1861-40-1					3.0E-01	I					1	0.1		1.8E+04	n	1.8E+05	nm					1.1E+04	n		3.6E+02	
Benomyl	17804-35-2					5.0E-02	I					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		1.6E+00	
Bentazon	25057-89-0					3.0E-02	I					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n		2.4E-01	
Benzaldehyde	100-52-7					1.0E-01	I			V		1		1.2E+03	7.8E+03	ns	1.0E+05	nms					3.7E+03	n		8.1E-01	
Benzene	71-43-2	5.5E-02	I	7.8E-06	I	4.0E-03	I	3.0E-02	I	V		1		1.8E+03	1.1E+00	c*	5.4E+00	c*	3.1E-01	c	1.6E+00	c*	4.1E-01	c	5.0E+00	2.1E-04	2.6E-03
Benzenethiol	108-98-5					1.0E-05	H			V		1		1.3E+03	7.8E-01	n	1.0E+01	n					3.7E-01	n		2.4E-04	
Benzidine	92-87-5	2.3E+02	I	6.7E-02	I	3.0E-03	I				M	1	0.1		5.0E-04	c	7.5E-03	c	1.4E-05	c	1.8E-04	c	9.4E-05	c		2.4E-07	
Benzoic Acid	65-85-0					4.0E+00	I					1	0.1		2.4E+05	nm	2.5E+06	nm					1.5E+05	n		3.4E+01	
Benzotrichloride	98-07-7	1.3E+01	I							V		1		3.2E+02	4.9E-02	c	2.2E-01	c					5.2E-03	c		1.1E-05	
Benzyl Alcohol	100-51-6					1.0E-01	P					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n		6.9E-01	
Benzyl Chloride	100-44-7	1.7E-01	I	4.9E-05	C	2.0E-03	P	1.0E-03	P	V		1		1.5E+03	1.0E+00	c*	4.9E+00	c*	5.0E-02	c*	2.5E-01	c*	7.9E-02	c*		8.7E-05	
Beryllium and compounds	7440-41-7			2.4E-03	I	2.0E-03	I	2.0E-05	I			0.007			1.6E+02	n	2.0E+03	n	1.0E-03	c*	5.1E-03	c*	7.3E+01	n	4.0E+00	5.8E+01	3.2E+00
Bidrin	141-66-2					1.0E-04	I					1	0.1		6.1E+00	n	6.2E+01	n					3.7E+00	n		8.5E-04	
Bifenox	42576-02-3					9.0E-03	P					1	0.1		5.5E+02	n	5.5E+03	n					3.3E+02	n		2.5E+00	
Biphenthrin	82657-04-3					1.5E-02	I					1	0.1		9.2E+02	n	9.2E+03	n					5.5E+02	n		2.5E+03	
Biphenyl, 1,1'-	92-52-4					5.0E-02	I			V		1		2.1E+02	3.9E+03	ns	5.1E+04	ns					1.8E+03	n		1.9E+01	
Bis(2-chloro-1-methylethyl) ether	108-60-1	7.0E-02	H	1.0E-05	H	4.0E-02	I			V		1		1.0E+03	4.6E+00	c	2.2E+01	c	2.4E-01	c	1.2E+00	c	3.2E-01	c		1.2E-04	
Bis(2-chloroethoxy)methane	111-91-1					3.0E-03	P					1	0.1		1.8E+02	n	1.8E+03	n					1.1E+02	n		2.5E-02	
Bis(2-chloroethyl)ether	111-44-4	1.1E+00	I	3.3E-04	I					V		1		5.1E+03	2.1E-01	c	1.0E+00	c	7.4E-03	c	3.7E-02	c	1.2E-02	c		3.1E-06	
Bis(2-ethylhexyl)phthalate	117-81-7	1.4E-02	I	2.4E-06	C	2.0E-02	I					1	0.1		3.5E+01	c*	1.2E+02	c	1.0E+00	c	5.1E+00	c	4.8E+00	c	6.0E+00	1.1E+00	1.4E+00
Bis(chloromethyl)ether	542-88-1	2.2E+02	I	6.2E-02	I					V		1		4.2E+03	7.7E-06	c	3.9E-04	c	3.9E-05	c	2.0E-04	c	6.2E-05	c		1.5E-08	
Bisphenol A	80-05-7					5.0E-02	I					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		1.4E+02	
Boron And Borates Only	7440-42-8					2.0E-01	I	2.0E-02	H			1			1.6E+04	n	2.0E+05	nm	2.1E+01	n	8.8E+01	n	7.3E+03	n		2.3E+01	
Boron Trifluoride	7637-07-2					4.0E-02	C	1.3E-02	C			1			3.1E+03	n	4.1E+04	n	1.4E+01	n	5.7E+01	n	1.5E+03	n			
Bromate	15541-45-4	7.0E-01	I			4.0E-03	I					1			9.1E-01	c	4.1E+00	c					9.6E-02	c	1.0E+01	7.4E-04	7.7E-02
Bromo-2-chloroethane, 1-	107-04-0	2.0E+00	X	6.0E-04	X					V		1		2.4E+03	2.4E-02	c	1.2E-01	c	4.1E-03	c	2.0E-02	c	6.5E-03	c		1.8E-06	
Bromobenzene	108-86-1					6.0E-03	I	6.0E-02	I	V		1		6.8E+02	3.0E+02	n	1.8E+03	ns	6.3E+01	n	2.6E+02	n	8.8E+01	n		5.9E-02	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ #29; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User's Guide); s = Concentration may exceed Csat (See User's Guide); SSL values are based on DAF=1

Contaminant		Toxicity and Chemical-specific Information													Screening Levels											Protection of Groundwater Soil	
		SFO	k	IUR	k	RfDo	k	RfCi	k	v				Csat	Residential Soil		Industrial Soil		Residential Air		Industrial Air		Tapwater		MCL	Risk-based SSL	MCL-based SSL
Analyte	CAS No.	(mg/kg-day)$^{-1}$	key	(ug/m^3)$^{-1}$	key	(mg/kg-day)	key	(mg/m^3)	key	voc	muta-gen	GIABS	ABS	mg/kg	mg/kg	key	mg/kg	key	ug/m^3	key	ug/m^3	key	ug/L	key	ug/L	mg/kg	mg/kg
Bromodichloromethane	75-27-4	6.2E-02	I	3.7E-05	C	2.0E-02	I			V		1		9.3E+02	2.7E-01	c	1.4E+00	c	6.6E-02	c	3.3E-01	c	1.2E-01	c		3.2E-05	
Bromoform	75-25-2	7.9E-03	I	1.1E-06	I	2.0E-02	I					1	0.1		6.1E+01	c*	2.2E+02	c*	2.2E+00	c	1.1E+01	c	8.5E+00	c*		2.3E-03	
Bromomethane	74-83-9					1.4E-03	I	5.0E-03	I	V		1		3.6E+03	7.3E+00	n	3.2E+01	n	5.2E+00	n	2.2E+01	n	8.7E+00	n		2.2E-03	
Bromophos	2104-96-3					5.0E-03	H					1	0.1		3.1E+02	n	3.1E+03	n					1.8E+02	n		7.7E-01	
Bromoxynil	1689-84-5					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		6.3E-01	
Bromoxynil Octanoate	1689-99-2					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		6.4E+00	
Butadiene, 1,3-	106-99-0	3.4E+00	C	3.0E-05	I			2.0E-03	I	V		1		6.7E+02	5.4E-02	c*	2.6E-01	c*	8.1E-02	c*	4.1E-01	c*	1.8E-02	c		9.7E-06	
Butanol, N-	71-36-3					1.0E-01	I					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n		7.6E-01	
Butyl Benzyl Phthlate	85-68-7	1.9E-03	P			2.0E-01	I					1	0.1		2.6E+02	c*	9.1E+02	c					3.5E+01	c		5.1E-01	
Butyl alcohol, sec-	78-92-2					2.0E+00	P	3.0E+01	P						1.6E+05	nm	2.0E+06	nm	3.1E+04	n	1.3E+05	n	7.3E+04	n		1.5E+01	
Butylate	2008-41-5					5.0E-02	I					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		1.8E+00	
Butylated hydroxyanisole	25013-16-5	2.0E-04	C	5.7E-08	C										3.2E+03	c	1.4E+04	c	4.3E+01	c	2.2E+02	c	3.4E+02	c		6.3E-01	
Butylphthalyl Butylglycolate	85-70-1					1.0E+00	I					1	0.1		6.1E+04	n	6.2E+05	nm					3.7E+04	n		6.3E+02	
Cacodylic Acid	75-60-5					2.0E-02	A					1	0.1		1.2E+03	n	1.2E+04	n					7 3E+02	n			
Cadmium (Diet)	7440-43-9			1.8E-03	I	1.0E-03	I	1.0E-05	A			0.025	0.001		7.0E+01	n	8.0E+02	n									
Cadmium (Water)	7440-43-9			1.8E-03	I	5.0E-04	I	1.0E-05	A			0.05	0.001						1.4E-03	c**	6.6E-03	c**	1.8E+01	n	5.0E+00	1.4E+00	3.8E-01
Caprolactam	105-60-2					5.0E-01	I					1	0.1		3 1E+04	n	3.1E+05	nm					1.8E+04	n		4.5E+00	
Captafol	2425-06-1	1.5E-01	C	4.3E-05	C	2.0E-03	I					1	0.1		3.2E+00	c*	1.1E+01	c	5.7E-02	c	2.9E-01	c	4.5E-01	c		7.9E-04	
Captan	133-06-2	2.3E-03	C	6.6E-07	C	1.3E-01	I					1	0.1		2.1E+02	c*	7.5E+02	c	3.7E+00	c	1.9E+01	c	2.9E+01	c		2.1E-02	
Carbaryl	63-25-2					1.0E-01	I					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n		3.3E+00	
Carbofuran	1563-66-2					5.0E-03	I					1	0.1		3.1E+02	n	3.1E+03	n					1.8E+02	n	4.0E+01	7.1E-02	1.6E-02
Carbon Disulfide	75-15-0					1.0E-01	I	7.0E-01	I	V		1		7.4E+02	8.2E+02	ns	3.7E+03	ns	7.3E+02	n	3.1E+03	n	1.0E+03	n		3.1E-01	
Carbon Tetrachloride	56-23-5	1.3E-01	I	1.5E-05	I	7.0E-04	I	1.9E-01	A	V		1		4.6E+02	2.5E-01	c	1.2E+00	c	1.6E-01	c	8.2E-01	c	2.0E-01	c	5.0E+00	7.7E-05	1.9E-03
Carbosulfan	55285-14-8					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		8.8E+00	
Carboxin	5234-68-4					1.0E-01	I					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n		2.0E+00	
Ceric oxide	1306-38-3							9.0E-04	I			1			1.3E+06	nm	5.4E+06	nm	9.4E-01	n	3.9E+00	n					
Chloral Hydrate	302-17-0					1.0E-01	I					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n		7.4E-01	
Chloramben	133-90-4					1.5E-02	I					1	0.1		9.2E+02	n	9.2E+03	n					5.5E+02	n		1.3E-01	
Chloranil	118-75-2	4.0E-01	H									1	0.1		1.2E+00	c	4.3E+00	c					1.7E-01	c		1.4E-04	
Chlordane	12789-03-6	3.5E-01	I	1.0E-04	I	5.0E-04	I	7.0E-04	I			1	0.04		1.6E+00	c*	6.5E+00	c*	2.4E-02	c*	1.2E-01	c*	1.9E-01	c*	2.0E+00	1.3E-02	1.4E-01
Chlordecone (Kepone)	143-50-0	1.0E+01	I	4.6E-03	C	3.0E-04	I					1	0.1		4.9E-02	c	1.7E-01	c	5.3E-04	c	2.7E-03	c	6.7E-03	c		2.4E-04	
Chlorfenvinphos	470-90-6					7.0E-04	A					1	0.1		4.3E+01	n	4.3E+02	n					2.6E+01	n		7.0E-02	
Chlorimuron, Ethyl-	90982-32-4					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		2.5E-01	
Chlorine	7782-50-5					1.0E-01	I	1.5E-04	A			1			7.5E+03	n	9.1E+04	n	1.5E-01	n	6.4E-01	n	3.7E+03	n		1.6E+00	
Chlorine Dioxide	10049-04-4					3.0E-02	I	2.0E-04	I			1			2.3E+03	n	3.0E+04	n	2.1E-01	n	8.8E-01	n	1.1E+03	n			
Chlorite (Sodium Salt)	7758-19-2					3.0E-02	I					1			2.3E+03	n	3.1E+04	n					1.1E+03	n			
Chloro-1,1-difluoroethane, 1-	75-68-3							5.0E+01	I	V		1		1.2E+03	5.6E+04	ns	2.4E+05	nms	5.2E+04	n	2.2E+05	n	1.0E+05	n		5.2E+01	
Chloro-1,3-butadiene, 2-	126-99-8					2.0E-02	H	7.0E-03	H	V		1		7.5E+02	8.4E+00	n	3.6E+01	n	7.3E+00	n	3.1E+01	n	1.4E+01	n		7.5E-03	
Chloro-2-methylaniline HCl, 4-	3165-93-3	4 6E-01	H									1	0.1		1.1E+00	c	3.7E+00	c					1.5E-01	c		8.3E-05	
Chloroacetic Acid	79-11-8					2.0E-03	H					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		1.5E-02	
Chloroacetophenone, 2-	532-27-4							3.0E-05	I			1	0.1		4.3E+04	n	1.8E+05	nm	3.1E-02	n	1 3E-01	n					
Chloroaniline, p-	106-47-8	2.0E-01	P			4.0E-03	I					1	0.1		2.4E+00	c	8.6E+00	c					3.4E-01	c		1.4E-04	
Chlorobenzene	108-90-7					2.0E-02	I	5.0E-02	P	V		1		7.6E+02	2.9E+02	n	1.4E+03	ns	5.2E+01	n	2.2E+02	n	9.1E+01	n	1.0E+02	6.2E-02	6.8E-02
Chlorobenzilate	510-15-6	1.1E-01	C	3.1E-05	C	2.0E-02	I					1	0.1		4.4E+00	c	1.6E+01	c	7.8E-02	c	4.0E-01	c	6.1E-01	c		2.0E-03	
Chlorobenzoic Acid, p-	74-11-3					3.0E-02	X					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n		2.8E-01	
Chlorobenzotrifluoride, 4-	98-56-6					3.0E-03	P	3.0E-01	P	V		1		1.2E+02	2.1E+02	ns	2.3E+03	ns	3.1E+02	n	1.3E+03	n	9.3E+01	n		3.3E-01	
Chlorobutane, 1-	109-69-3					4.0E-02	P			V		1		7.3E+02	3.1E+03	ns	4.1E+04	ns					1.5E+03	n		5.9E-01	
Chlorodifluoromethane	75-45-6							5.0E+01	I	V		1		1.7E+03	5.3E+04	ns	2.2E+05	nms	5.2E+04	n	2.2E+05	n	1.0E+05	n		4.3E+01	
Chloroform	67-66-3	3.1E-02	C	2.3E-05	I	1.0E-02	I	9.8E-02	A	V		1		2.5E+03	2.9E-01	c	1.5E+00	c	1.1E-01	c	5.3E-01	c	1.9E-01	c		5.3E-05	
Chloromethane	74-87-3							9.0E-02	I	V		1		1.3E+03	1.2E+02	n	5.0E+02	n	9.4E+01	n	3.9E+02	n	1.9E+02	n		4.9E-02	
Chloromethyl Methyl Ether	107-30-2	2.4E+00	C	6.9E-04	C					V		1		2.6E+04	1.9E-02	c	9.4E-02	c	3.5E-03	c	1.8E-02	c	5.6E-03	c		1.2E-06	
Chloronaphthalene, Beta-	91-58-7					8.0E-02	I			V		1		1.6E+02	6.3E+03	ns	8.2E+04	ns					2.9E+03	n		1.5E+01	
Chloronitrobenzene, o-	88-73-3	3.0E-01	P			3.0E-03	P	1.0E-05	X			1	0.1		1.6E+00	c	5.7E+00	c	1.0E-02	n	4.4E-02	n	2.2E-01	c		2 1E-04	
Chloronitrobenzene, p-	100-00-5	6.3E-03	P			1.0E-03	P	6.0E-04	P			1	0.1		6.1E+01	n	2.7E+02	c**	6.3E-01	n	2.6E+00	n	1.1E+01	c**		9.9E-03	
Chlorophenol, 2-	95-57-8					5.0E-03	I			V		1		2.2E+04	3.9E+02	n	5.1E+03	n					1.8E+02	n		1.5E-01	
Chloropicrin	76-06-2							4.0E-04	C						5.7E+05	nm	2.4E+06	nm	4.2E-01	n	1.8E+00	n					
Chlorothalonil	1897-45-6	3.1E-03	C	8.9E-07	C	1.5E-02	I					1	0.1		1.6E+02	c**	5.6E+02	c*	2.7E+00	c	1.4E+01	c	2.2E+01	c*		4.9E-02	
Chlorotoluene, o-	95-49-8					2.0E-02	I			V		1		9.1E+02	1.6E+03	ns	2.0E+04	ns					7.3E+02	n		7.1E-01	
Chlorotoluene, p-	106-43-4					7.0E-02	P			V		1		2.5E+02	5.5E+03	ns	7.2E+04	ns					2.6E+03	n		2.5E+00	
Chlorozotocin	54749-90-5	2.4E+02	C	6.9E-02	C										2.7E-03	c	1.2E-02	c	3.5E-05	c	1.8E-04	c	2.8E-04	c		6.2E-08	
Chlorpropham	101-21-3					2.0E-01	I					1	0.1		1.2E+04	n	1.2E+05	nm					7.3E+03	n		6.6E+00	
Chlorpyrifos	2921-88-2					3.0E-03	I					1	0.1		1.8E+02	n	1.8E+03	n					1.1E+02	n		1.6E+00	
Chlorpyrifos Methyl	5598-13-0					1.0E-02	H					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		1.7E+00	
Chlorsulfuron	64902-72-3					5.0E-02	I					1	0 1		3.1E+03	n	3.1E+04	n					1.8E+03	n		1.5E+00	
Chlorthiophos	60238-56-4					8.0E-04	H					1	0.1		4.9E+01	n	4.9E+02	n					2.9E+01	n		7.5E-01	
Chromium(III), Insoluble Salts	16065-83-1					1.5E+00	I					0.013			1.2E+05	nm	1.5E+06	nm					5.5E+04	n		9.9E+07	
Chromium(VI)	18540-29-9	5.0E-01	J	8.4E-02	I	3.0E-03	I	1.0E-04	I		M	0.025			2.9E-01	c	5.6E+00	c	1.1E-05	c	1.5E-04	c	4.3E-02	c		6.3E-04	
Chromium, Total	7440-47-3											0.013													1.0E+02		1.8E+05
Cobalt	7440-48-4			9.0E-03	P	3.0E-04	P	6.0E-06	P			1			2.3E+01	n	3.0E+02	n	2.7E-04	c*	1.4E-03	c*	1.1E+01	n		4.9E-01	
Coke Oven Emissions	8007-45-2			6.2E-04	I						M	1	0.1						1.5E-03	c	2.0E-02	c					
Copper	7440-50-8					4.0E-02	H					1			3.1E+03	n	4.1E+04	n					1.5E+03	n	1.3E+03	5.1E+01	4.6E+01
Cresol, m-	108-39-4					5.0E-02	I	6.0E-01	C			1	0.1		3.1E+03	n	3.1E+04	n	6.3E+02	n	2.6E+03	n	1.8E+03	n		1.5E+00	
Cresol, o-	95-48-7					5.0E-02	I	6.0E-01	C			1	0.1		3.1E+03	n	3.1E+04	n	6.3E+02	n	2.6E+03	n	1.8E+03	n		1.5E+00	
Cresol, p-	106-44-5					6.0E-03	H	6.0E-01	C			1	0.1		3.1E+02	n	3.1E+03	n	6.3E+02	n	2.6E+03	n	1.8E+02	n		1.5E-01	
Cresol, p-chloro-m-	59-50-7					1.0E-01	X					1	0.1		6.1E+03	n	6.2E+04	n					3 7E+03	n		4.3E+00	
Cresols	1319-77-3					1.0E-01	A	6.0E-01	C	V		1		5.0E+04	7.5E+03	n	9.1E+04	ns	6.3E+02	n	2.6E+03	n	9.3E+02	n		7.6E-01	
Crotonaldehyde, trans-	123-73-9	1.9E+00	H							V		1		1.7E+04	3.4E-01	c	1.5E+00	c					3.5E-02	c		7.2E-06	
Cumene	98-82-8					1.0E-01	I	4.0E-01	I	V		1		2.7E+02	2.1E+03	ns	1.1E+04	ns	4.2E+02	n	1.8E+03	n	6.8E+02	n		1.1E+00	
Cupferron	135-20-6	2.2E-01	C	6.3E-05	C										2.9E+00	c	1.3E+01	c	3.9E-02	c	1.9E-01	c	3.1E-01	c		5.3E-04	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ #29; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL, n = noncancer; m = Concentration may exceed ceiling limit (See User's Guide); s = Concentration may exceed Csat (See User's Guide); SSL values are based on DAF=1

Contaminant		Toxicity and Chemical-specific Information													Screening Levels											Protection of Groundwater Soil	
		SFO	key	IUR	key	RfDo	key	RfCi	key	voc	mutagen			Csat	Residential Soil		Industrial Soil		Residential Air		Industrial Air		Tapwater		MCL	Risk-based SSL	MCL-based SSL
Analyte	CAS No.	(mg/kg-day)$^{-1}$		(ug/m^3)$^{-1}$		(mg/kg-day)		(mg/m^3)				GIABS	ABS	mg/kg	mg/kg	key	mg/kg	key	ug/m^3	key	ug/m^3	key	ug/L	key	ug/L	mg/kg	mg/kg
Cyanazine	21725-46-2	8.4E-01	H			2.0E-03	H					1	0.1		5.8E-01	c	2.1E+00	c					8.0E-02	c		3.7E-05	
Cyanides																											
~Calcium Cyanide	592-01-8					4.0E-02	I					1			3.1E+03	n	4.1E+04	n					1.5E+03	n			
~Copper Cyanide	544-92-3					5.0E-03	I					1			3.9E+02	n	5.1E+03	n					1.8E+02	n			
~Cyanide (CN-)	57-12-5					2.0E-02	I			V		1		1.0E+07	1.6E+03	n	2.0E+04	n					7.3E+02	n	2.0E+02	7.4E+00	2.0E+00
~Cyanogen	460-19-5					4.0E-02	I			V		1		1.5E+03	3.1E+03	ns	4.1E+04	ns					1.5E+03	n		3.0E-01	
~Cyanogen Bromide	506-68-3					9.0E-02	I			V		1		1.0E+05	7.0E+03	n	9.2E+04	n					3.3E+03	n		6.9E-01	
~Cyanogen Chloride	506-77-4					5.0E-02	I			V		1		4.3E+03	3.9E+03	n	5.1E+04	ns					1.8E+03	n		3.8E-01	
~Hydrogen Cyanide	74-90-8					2.0E-02	I	3.0E-03	I	V		1		1.2E+05	1.9E+01	n	6.0E+01	n	3.1E+00	n	1.3E+01	n	6.2E+00	n		1.3E-03	
~Potassium Cyanide	151-50-8					5.0E-02	I					1			3.9E+03	n	5.1E+04	n					1.8E+03	n			
~Potassium Silver Cyanide	506-61-6					2.0E-01	I					0.04			1.6E+04	n	2.0E+05	nm					7.3E+03	n			
~Silver Cyanide	506-64-9					1.0E-01	I					0.04			7.8E+03	n	1.0E+05	nm					3.7E+03	n			
~Sodium Cyanide	143-33-9					4.0E-02	I					1			3.1E+03	n	4.1E+04	n					1.5E+03	n			
~Thiocyanate	463-56-9					2.0E-04	P			V		1		4.6E+03	1.6E+01	n	2.0E+02	n					7.3E+00	n		1.5E-03	
~Zinc Cyanide	557-21-1					5.0E-02	I					1			3.9E+03	n	5.1E+04	n					1.8E+03	n			
Cyclohexane	110-82-7							6.0E+00	I	V		1		1.2E+02	7.0E+03	ns	2.9E+04	ns	6.3E+03	n	2.6E+04	n	1.3E+04	n		1.3E+01	
Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro-	87-84-3	2.3E-02	H									1	0.1		2.1E+01	c	7.5E+01	c					2.9E+00	c		1.7E-02	
Cyclohexanone	108-94-1					5.0E+00	I					1	0.1		3.1E+05	nm	3.1E+06	nm					1.8E+05	n		4.3E+01	
Cyclohexylamine	108-91-8					2.0E-01	I					1	0.1		1.2E+04	n	1.2E+05	nm					7.3E+03	n		1.9E+00	
Cyhalothrin/karate	68085-85-8					5.0E-03	I					1	0.1		3.1E+02	n	3.1E+03	n					1.8E+02	n		1.2E+02	
Cypermethrin	52315-07-8					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		5.6E+01	
Cyromazine	66215-27-8					7.5E-03	I					1	0.1		4.6E+02	n	4.6E+03	n					2.7E+02	n		7.0E-02	
DDD	72-54-8	2.4E-01	I	6.9E-05	C							1	0.1		2.0E+00	c	7.2E+00	c	3.5E-02	c	1.8E-01	c	2.8E-01	c		6.6E-02	
DDE, p,p'-	72-55-9	3.4E-01	I	9.7E-05	C							1	0.1		1.4E+00	c	5.1E+00	c	2.5E-02	c	1.3E-01	c	2.0E-01	c		4.7E-02	
DDT	50-29-3	3.4E-01	I	9.7E-05	I	5.0E-04	I					1	0.03		1.7E+00	c*	7.0E+00	c*	2.5E-02	c	1.3E-01	c	2.0E-01	c*		6.7E-02	
Dacthal	1861-32-1					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		4.5E-01	
Dalapon	75-99-0					3.0E-02	I					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n	2.0E+02	2.3E-01	4.1E-02
Decabromodiphenyl ether, 2,2',3,3',4,4',5,5',6,6'- (BDE-209)	1163-19-5	7.0E-04	I			7.0E-03	I					1	0.1		4.3E+02	n	2.5E+03	c**					9.8E+01	c**		5.3E+01	
Demeton	8065-48-3					4.0E-05	I					1	0.1		2.4E+00	n	2.5E+01	n					1.5E+00	n			
Di(2-ethylhexyl)adipate	103-23-1	1.2E-03	I			6.0E-01	I					1	0.1		4.0E+02	c*	1.4E+03	c					5.6E+01	c	4.0E+02	4.0E+00	2.9E+01
Diallate	2303-16-4	6.1E-02	H									1	0.1		8.0E+00	c	2.8E+01	c					1.1E+00	c		1.6E-03	
Diazinon	333-41-5					7.0E-04	A					1	0.1		4.3E+01	n	4.3E+02	n					2.6E+01	n		1.6E-01	
Dibromo-3-chloropropane, 1,2-	96-12-8	6.0E-01	P	6.0E-03	P	2.0E-04	P	2.0E-04	I	V	M	1		9.8E+02	5.4E-03	c	6.9E-02	c	1.6E-04	c	2.0E-03	c	3.2E-04	c	2.0E-01	1.4E-07	8.8E-05
Dibromobenzene, 1,4-	106-37-6					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		3.5E-01	
Dibromochloromethane	124-48-1	8.4E-02	I	2.7E-05	C	2.0E-02	I			V		1	0.1	6.0E+02	6.8E-01	c	3.3E+00	c	9.0E-02	c	4.5E-01	c	1.5E-01	c		3.9E-05	
Dibromoethane, 1,2-	106-93-4	2.0E+00	I	6.0E-04	I	9.0E-03	I	9.0E-03	I	V		1		1.3E+03	3.4E-02	c	1.7E-01	c	4.1E-03	c	2.0E-02	c	6.5E-03	c	5.0E-02	1.8E-06	1.4E-05
Dibromomethane (Methylene Bromide)	74-95-3					1.0E-02	H	4.0E-03	X	V		1		2.8E+03	2.5E+01	n	1.1E+02	n	4.2E+00	n	1.8E+01	n	8.2E+00	n		2.0E-03	
Dibutyl Phthalate	84-74-2					1.0E-01	I					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n		9.2E+00	
Dibutyltin Compounds	NA					3.0E-04	P					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n			
Dicamba	1918-00-9					3.0E-02	I					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n		2.8E-01	
Dichloro-2-butene, 1,4-	764-41-0			4.2E-03	P					V		1		5.2E+02	6.5E-03	c	3.3E-02	c	5.8E-04	c	2.9E-03	c	1.2E-03	c		5.4E-07	
Dichloro-2-butene, cis-1,4-	1476-11-5			4.2E-03	P					V		1	0.1	5.2E+02	8.9E-03	c	3.5E-02	c	5.8E-04	c	2.9E-03	c	1.2E-03	c		5.4E-07	
Dichloro-2-butene, trans-1,4-	110-57-6			4.2E-03	P					V		1	0.1	7.6E+02	6.9E-03	c	3.5E-02	c	5.8E-04	c	2.9E-03	c	1.2E-03	c		5.4E-07	
Dichloroacetic Acid	79-43-6	5.0E-02	I			4.0E-03	I					1	0.1		9.7E+00	c*	3.4E+01	c*					1.3E+00	c		2.8E-04	
Dichlorobenzene, 1,2-	95-50-1					9.0E-02	I	2.0E-01	H	V		1		3.8E+02	1.9E+03	ns	9.8E+03	ns	2.1E+02	n	8.8E+02	n	3.7E+02	n	6.0E+02	3.6E-01	5.8E-01
Dichlorobenzene, 1,4-	106-46-7	5.4E-03	C	1.1E-05	C	7.0E-02	A	8.0E-01	I	V		1			2.4E+00	c	1.2E+01	c	2.2E-01	c	1.1E+00	c	4.3E-01	c	7.5E+01	4.1E-04	7.2E-02
Dichlorobenzidine, 3,3'-	91-94-1	4.5E-01	I	3.4E-04	C							1	0.1		1.1E+00	c	3.8E+00	c	7.2E-03	c	3.6E-02	c	1.5E-01	c		9.8E-04	
Dichlorobenzophenone, 4,4'-	90-98-2					9.0E-03	X					1	0.1		5.5E+02	n	5.5E+03	n					3.3E+02	n		2.0E+00	
Dichlorodifluoromethane	75-71-8					2.0E-01	I	2.0E-01	H	V		1		8.5E+02	1.8E+02	n	7.8E+02	n	2.1E+02	n	8.8E+02	n	3.9E+02	n		6.1E-01	
Dichloroethane, 1,1-	75-34-3	5.7E-03	C	1.6E-06	C	2.0E-01	P			V		1		1.7E+03	3.3E+00	c	1.7E+01	c	1.5E+00	c	7.7E+00	c	2.4E+00	c		6.9E-04	
Dichloroethane, 1,2-	107-06-2	9.1E-02	I	2.6E-05	I	2.0E-02	P	2.4E+00	A	V		1		3.0E+03	4.3E-01	c	2.2E+00	c	9.4E-02	c	4.7E-01	c	1.5E-01	c	5.0E+00	4.2E-05	1.4E-03
Dichloroethylene, 1,1-	75-35-4					5.0E-02	I	2.0E-01	I	V		1		1.2E+03	2.4E+02	n	1.1E+03	n	2.1E+02	n	8.8E+02	n	3.4E+02	n	7.0E+00	1.2E-01	2.5E-03
Dichloroethylene, 1,2- (Mixed Isomers)	540-59-0					9.0E-03	H			V		1		1.3E+03	7.0E+02	n	9.2E+03	ns					3.3E+02	n		9.7E-02	
Dichloroethylene, 1,2-cis-	156-59-2					1.0E-02	P			V		1		2.4E+03	7.8E+02	n	1.0E+04	ns					3.7E+02	n	7.0E+01	1.1E-01	2.1E-02
Dichloroethylene, 1,2-trans-	156-60-5					2.0E-02	I	6.0E-02	P	V		1		1.7E+03	1.5E+02	n	6.9E+02	n	6.3E+01	n	2.6E+02	n	1.1E+02	n	1.0E+02	3.1E-02	2.9E-02
Dichlorophenol, 2,4-	120-83-2					3.0E-03	I					1	0.1		1.8E+02	n	1.8E+03	n					1.1E+02	n		1.3E-01	
Dichlorophenoxy Acetic Acid, 2,4-	94-75-7					1.0E-02	I					1	0.05		6.9E+02	n	7.7E+03	n					3.7E+02	n	7.0E+01	9.5E-02	1.8E-02
Dichlorophenoxy)butyric Acid, 4-(2,4-	94-82-6					8.0E-03	I					1	0.1		4.9E+02	n	4.9E+03	n					2.9E+02	n		1.2E-01	
Dichloropropane, 1,2-	78-87-5	3.6E-02	C	1.0E-05	C	9.0E-02	A	4.0E-03	I	V		1		1.4E+03	8.9E-01	c*	4.5E+00	c*	2.4E-01	c*	1.2E+00	c*	3.9E-01	c*	5.0E+00	1.3E-04	1.7E-03
Dichloropropane, 1,3-	142-28-9					2.0E-02	P			V		1		1.5E+03	1.6E+03	ns	2.0E+04	ns					7.3E+02	n		2.5E-01	
Dichloropropanol, 2,3-	616-23-9					3.0E-03	I					1	0.1		1.8E+02	n	1.8E+03	n					1.1E+02	n		2.3E-02	
Dichloropropene, 1,3-	542-75-6	1.0E-01	I	4.0E-06	I	3.0E-02	I	2.0E-02	I	V		1		1.6E+03	1.7E+00	c*	8.1E+00	c*	6.1E-01	c*	3.1E+00	c*	4.3E-01	c*		1.5E-04	
Dichlorvos	62-73-7	2.9E-01	I	8.3E-05	C	5.0E-04	I	5.0E-04	I			1	0.1		1.7E+00	c*	5.9E+00	c*	2.9E-02	c*	1.5E-01	c*	2.3E-01	c*		7.1E-05	
Dicyclopentadiene	77-73-6					8.0E-03	P	7.0E-03	P	V		1		1.3E+02	2.7E+01	n	1.2E+02	n	7.3E+00	n	3.1E+01	n	1.4E+01	n		4.8E-02	
Dieldrin	60-57-1	1.6E+01	I	4.6E-03	I	5.0E-05	I					1	0.1		3.0E-02	c	1.1E-01	c	5.3E-04	c	2.7E-03	c	4.2E-03	c		1.7E-04	
Diesel Engine Exhaust	NA			3.0E-04	C			5.0E-03	I			1	0.1						8.1E-03	c	4.1E-02	c					
Diethanolamine	111-42-2							3.0E-03	C						4.3E+06	nm	1.8E+07	nm	3.1E+00	n	1.3E+01	n					
Diethyl Phthalate	84-66-2					8.0E-01	I					1	0.1		4.9E+04	n	4.9E+05	nm					2.9E+04	n		1.2E+01	
Diethylene Glycol Monobutyl Ether	112-34-5					3.0E-02	P	1.0E-04	P			1	0.1		1.8E+03	n	1.8E+04	n	1.0E-01	n	4.4E-01	n	1.1E+03	n		2.4E-01	
Diethylene Glycol Monoethyl Ether	111-90-0					6.0E-02	P	3.0E-04	P			1	0.1		3.6E+03	n	3.6E+04	n	3.1E-01	n	1.3E+00	n	2.2E+03	n		4.4E-01	
Diethylformamide	617-84-5					1.0E-03	P					1	0.1		6.1E+01	n	6.2E+02	n					3.7E+01	n		7.5E-03	
Diethylstilbestrol	56-53-1	3.5E+02	C	1.0E-01	C							1	0.1		1.4E-03	c	4.9E-03	c	2.4E-05	c	1.2E-04	c	1.9E-04	c		1.1E-04	
Difenzoquat	43222-48-6					8.0E-02	I					1	0.1		4.9E+03	n	4.9E+04	n					2.9E+03	n			
Diflubenzuron	35367-38-5					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		8.2E-01	
Difluoroethane, 1,1-	75-37-6							4.0E+01	I	V		1		1.4E+03	5.2E+04	ns	2.2E+05	nms	4.2E+04	n	1.8E+05	n	8.3E+04	n		2.6E+01	
Dihydrosafrole	94-58-6	4.4E-02	C	1.3E-05	C										1.5E+01	c	6.5E+01	c	1.9E-01	c	9.4E-01	c	1.5E+00	c		1.9E-03	
Diisopropyl Ether	108-20-3							4.0E-01	P	V		1		2.3E+03	1.4E+03	n	5.8E+03	ns	4.2E+02	n	1.8E+03	n	8.3E+02	n		2.1E-01	
Diisopropyl Methylphosphonate	1445-75-6					8.0E-02	I			V		1		5.3E+02	6.3E+03	ns	6.2E+04	ns					2.9E+03	n		8.3E-01	
Dimethipin	55290-64-7					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		1.6E-01	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAO #29; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User's Guide); s = Concentration may exceed Csat (See User's Guide); SSL values are based on DAF=1

Contaminant		Toxicity and Chemical-specific Information													Screening Levels											Protection of Groundwater Soil	
		SFO	key	IUR	key	RfDo	key	RfCi	key	voc	mutagen	GIABS	ABS	Csat	Residential Soil	key	Industrial Soil	key	Residential Air	key	Industrial Air	key	Tapwater	key	MCL	Risk-based SSL	MCL-based SSL
Analyte	CAS No.	$(\text{mg/kg-day})^{-1}$		$(\text{ug/m}^3)^{-1}$		(mg/kg-day)		(mg/m^3)						mg/kg	mg/kg	key	mg/kg	key	ug/m^3	key	ug/m^3	key	ug/L	key	ug/L	mg/kg	mg/kg
Dimethoate	60-51-5					2.0E-04	I					1	0.1		1.2E+01	n	1.2E+02	n					7.3E+00	n		1.6E-03	
Dimethoxybenzidine, 3,3'-	119-90-4	1.4E-02	H									1	0.1		3.5E+01	c	1.2E+02	c					4.8E+00	c		5.6E-03	
Dimethyl methylphosphonate	756-79-6	1.7E-03	P			6.0E-02	P					1	0.1		2.9E+02	c*	1.0E+03	c*					4.0E+01	c*		8.3E-03	
Dimethylamino azobenzene [p-]	60-11-7	4.6E+00	C	1.3E-03	C							1	0.1		1.1E-01	c	3.7E-01	c	1.9E-03	c	9.4E-03	c	1.5E-02	c		6.2E-05	
Dimethylaniline HCl, 2,4-	21436-96-4	5.8E-01	H									1	0.1		8.4E-01	c	3.0E+00	c					1.2E-01	c		6.6E-05	
Dimethylaniline, 2,4-	95-68-1	7.5E-01	H									1	0.1		6.5E-01	c	2.3E+00	c					9.0E-02	c		5.1E-05	
Dimethylaniline, N,N-	121-69-7					2.0E-03	I			V		1		8.3E+02	1.6E+02	n	2.0E+03	ns					7.3E+01	n		2.6E-02	
Dimethylbenzidine, 3,3'-	119-93-7	1.1E+01	P									1	0.1		4.4E-02	c	1.6E-01	c					6.1E-03	c		4.0E-05	
Dimethylformamide	68-12-2					1.0E-01	P	3.0E-02	I			1	0.1		6.1E+03	n	6.2E+04	n	3.1E+01	n	1.3E+02	n	3.7E+03	n		7.4E-01	
Dimethylhydrazine, 1,1-	57-14-7					1.0E-04	X	2.0E-06	X			1	0.1		6.1E+00	n	6.1E+01	n	2.1E-03	n	8.8E-03	n	3.7E+00	n		8.2E-04	
Dimethylhydrazine, 1,2-	540-73-8	5.5E+02	C	1.6E-01	C							1	0.1		8.8E-04	c	3.1E-03	c	1.5E-06	c	7.7E-05	c	1.2E-04	c		2.6E-08	
Dimethylphenol, 2,4-	105-67-9					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		8.6E-01	
Dimethylphenol, 2,6-	576-26-1					6.0E-04	I					1	0.1		3.7E+01	n	3.7E+02	n					2.2E+01	n		2.6E-02	
Dimethylphenol, 3,4-	95-65-8					1.0E-03	I					1	0.1		6.1E+01	n	6.2E+02	n					3.7E+01	n		4.3E-02	
Dimethylterephthalate	120-61-6					1.0E-01	I			V		1		5.5E+00	7.8E+03	ns	1.0E+05	nms					3.7E+03	n		9.6E-01	
Dimethylvinylchloride	513-37-1	4.5E-02	C	1.3E-05	C										1.4E+01	c	6.4E+01	c	1.9E-01	c	9.4E-01	c	1.5E+00	c		9.2E-04	
Dinitro-o-cresol, 4,6-	534-52-1					1.0E-04	P					1	0.1		6.1E+00	n	6.2E+01	n					3.7E+00	n		6.2E-03	
Dinitro-o-cyclohexyl Phenol, 4,6-	131-89-5					2.0E-03	I					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		2.4E+00	
Dinitrobenzene, 1,2-	528-29-0					1.0E-04	P					1	0.1		6.1E+00	n	6.2E+01	n					3.7E+00	n		3.3E-03	
Dinitrobenzene, 1,3-	99-65-0					1.0E-04	I					1	0.1		6.1E+00	n	6.2E+01	n					3.7E+00	n		3.3E-03	
Dinitrobenzene, 1,4-	100-25-4					1.0E-04	P					1	0.1		6.1E+00	n	6.2E+01	n					3.7E+00	n		3.3E-03	
Dinitrophenol, 2,4-	51-28-5					2.0E-03	I					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		8.2E-02	
Dinitrotoluene Mixture, 2,4/2,6-	25321-14-6	6.8E-01	I									1	0.1		7.1E-01	c	2.5E+00	c					9.9E-02	c		1.4E-04	
Dinitrotoluene, 2,4-	121-14-2	3.1E-01	C	8.9E-05	C	2.0E-03	I					1	0.102		1.6E+00	c*	5.5E+00	c	2.7E-02	c	1.4E-01	c	2.2E-01	c		2.9E-04	
Dinitrotoluene, 2,6-	606-20-2					1.0E-03	P					1	0.099		6.1E+01	n	6.2E+02	n					3.7E+01	n		5.0E-02	
Dinitrotoluene, 2-Amino-4,6-	35572-78-2					2.0E-03	S					1	0.006		1.5E+02	n	2.0E+03	n					7.3E+01	n		5.6E-02	
Dinitrotoluene, 4-Amino-2,6-	19406-51-0					2.0E-03	S					1	0.009		1.5E+02	n	1.9E+03	n					7.3E+01	n		5.6E-02	
Dinoseb	88-85-7					1.0E-03	I					1	0.1		6.1E+01	n	6.2E+02	n					3.7E+01	n	7.0E+00	3.2E-01	6.2E-02
Dioxane, 1,4-	123-91-1	1.1E-02	I	7.7E-00	C	1.0E-01	A	3.8E+00	A			1	0.1		4.4E+01	c	1.6E+02	c	3.2E-01	c	1.6E+00	c	6.1E+00	c		1.3E-03	
Dioxins																											
~Hexachlorodibenzo-p-dioxin, Mixture	NA	6.2E+03	I	1.3E+00	I							1	0.03		9.4E-05	c	3.9E-04	c	1.9E-06	c	9.4E-06	c	1.1E-05	c		9.0E-06	
~TCDD, 2,3,7,8-	1746-01-6	1.3E+05	C	3.8E+01	C	1.0E-09	A	4.0E-08	C			1	0.03		4.5E-06	c*	1.6E-05	c*	6.4E-08	c	3.2E-07	c	5.2E-07	c*	3.0E-05	2.6E-07	1.5E-05
Diphenamid	957-51-7					3.0E-02	I					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n		1.1E+01	
Diphenyl Sulfone	127-63-9					8.0E-04	X					1	0.1		4.9E+01	n	4.9E+02	n					2.9E+01	n		7.1E-02	
Diphenylamine	122-39-4					2.5E-02	I					1	0.1		1.5E+03	n	1.5E+04	n					9.1E+02	n		1.7E+00	
Diphenylhydrazine, 1,2-	122-66-7	8.0E-01	I	2.2E-04	I							1	0.1		6.1E-01	c	2.2E+00	c	1.1E-02	c	5.6E-02	c	8.4E-02	c		2.7E-04	
Diquat	85-00-7					2.2E-03	I					1	0.1		1.3E+02	n	1.4E+03	n					6.0E+01	n	2.0E+01	1.5E+00	3.7E-01
Direct Black 38	1937-37-7	7.4E+00	C	2.1E-03	C							1	0.1		6.6E-02	c	2.3E-01	c	1.2E-03	c	5.8E-03	c	9.1E-03	c		4.4E+00	
Direct Blue 6	2602-46-2	7.4E+00	C	2.1E-03	C							1	0.1		6.6E-02	c	2.3E-01	c	1.2E-03	c	5.8E-03	c	9.1E-03	c		1.4E+01	
Direct Brown 95	16071-86-6	6.7E+00	C	1.9E-03	C							1	0.1		7.2E-02	c	2.6E-01	c	1.3E-03	c	6.5E-03	c	1.0E-02	c			
Disulfoton	298-04-4					4.0E-05	I					1	0.1		2.4E+00	n	2.5E+01	n					1.5E+00	n		2.7E-03	
Dithiane, 1,4-	505-29-3					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		1.8E-01	
Diuron	330-54-1					2.0E-03	I					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		3.1E-02	
Dodine	2439-10-3					4.0E-03	I					1	0.1		2.4E+02	n	2.5E+03	n					1.5E+02	n		7.5E-01	
EPTC	759-94-4					2.5E-02	I			V		1		4.1E+02	2.0E+03	ns	2.6E+04	ns					9.1E+02	n		4.8E-01	
Endosulfan	115-29-7					6.0E-03	I					1	0.1		3.7E+02	n	3.7E+03	n					2.2E+02	n		3.0E+00	
Endothall	145-73-3					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n	1.0E+02	1.7E-01	2.4E-02
Endrin	72-20-8					3.0E-04	I					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n	2.0E+00	4.4E-01	8.1E-02
Epichlorohydrin	106-89-8	9.9E-03	I	1.2E-06	I	6.0E-03	P	1.0E-03	I	V		1		1.1E+04	2.0E+01	n	8.8E+01	n	1.0E+00	n	4.4E+00	n	2.1E+00	n		4.5E-04	
Epoxybutane, 1,2-	106-88-7							2.0E-02	I	V		1		1.5E+04	1.7E+02	n	7.2E+02	n	2.1E+01	n	8.8E+01	n	4.2E+01	n		9.2E-03	
Ethephon	16672-87-0					5.0E-03	I					1	0.1		3.1E+02	n	3.1E+03	n					1.8E+02	n		3.8E-02	
Ethion	563-12-2					5.0E-04	I					1	0.1		3.1E+01	n	3.1E+02	n					1.6E+01	n		3.6E-02	
Ethoxyethanol Acetate, 2-	111-15-9					3.0E-01	H	3.0E-01	C			1	0.1		1.8E+04	n	1.6E+05	nm	3.1E+02	n	1.3E+03	n	1.1E+04	n		2.3E+00	
Ethoxyethanol, 2-	110-80-5					4.0E-01	H	2.0E-01	I			1	0.1		2.4E+04	n	2.5E+05	nm	2.1E+02	n	8.8E+02	n	1.5E+04	n		2.9E+00	
Ethyl Acetate	141-78-6					9.0E-01	I			V		1		1.1E+04	7.0E+04	ns	9.2E+05	nms					3.3E+04	n		7.0E+00	
Ethyl Acrylate	140-88-5	4.8E-02	H							V		1		2.5E+03	1.3E+01	c	6.0E+01	c					1.4E+00	c		3.1E-04	
Ethyl Chloride	75-00-3							1.0E+01	I	V		1		2.1E+03	1.5E+04	ns	6.1E+04	ns	1.0E+04	n	4.4E+04	n	2.1E+04	n		5.9E+00	
Ethyl Ether	60-29-7					2.0E-01	I			V		1		1.0E+04	1.6E+04	ns	2.0E+05	nms					7.3E+03	n		1.6E+00	
Ethyl Methacrylate	97-63-2					9.0E-02	H			V		1		1.1E+03	7.0E+03	ns	9.2E+04	ns					3.3E+03	n		7.7E-01	
Ethyl-p-nitrophenyl Phosphonate	2104-64-5					1.0E-05	I					1	0.1		6.1E-01	n	6.2E+00	n					3.7E-01	n		1.1E-02	
Ethylbenzene	100-41-4	1.1E-02	C	2.5E-06	C	1.0E-01	I	1.0E+00	I	V		1		4.8E+02	5.4E+00	c	2.7E+01	c	9.7E-01	c	4.9E+00	c	1.5E+00	c	7.0E+02	1.7E-03	7.8E-01
Ethylene Cyanohydrin	109-78-4					3.0E-02	P					1	0.1		1.8E+03	n	1.6E+04	n					1.1E+03	n		2.2E-01	
Ethylene Diamine	107-15-3					9.0E-02	P					1	0.1		5.5E+03	n	5.5E+04	n					3.3E+03	n		7.5E-01	
Ethylene Glycol	107-21-1					2.0E+00	I	4.0E-01	C			1	0.1		1.2E+05	nm	1.2E+06	nm	4.2E+02	n	1.6E+03	n	7.3E+04	n		1.5E+01	
Ethylene Glycol Monobutyl Ether	111-76-2					5.0E-01	I	1.3E+01	I			1	0.1		3.1E+04	n	3.1E+05	nm	1.4E+04	n	5.7E+04	n	1.8E+04	n		3.6E+00	
Ethylene Oxide	75-21-8	3.1E-01	C	8.8E-05	C			3.0E-02	C	V		1		1.2E+05	1.7E-01	c	8.3E-01	c	2.8E-02	c	1.4E-01	c	4.4E-02	c		9.1E-06	
Ethylene Thiourea	96-45-7	4.5E-02	C	1.3E-05	C	8.0E-05	I					1	0.1		4.9E+00	n	3.8E+01	c**	1.9E-01	c	9.4E-01	c	1.5E+00	c**		3.4E-04	
Ethyleneimine	151-56-4	6.5E+01	C	1.9E-02	C										9.8E-03	c	4.4E-02	c	1.3E-04	c	6.5E-04	c	1.0E-03	c		2.3E-07	
Ethylphthalyl Ethyl Glycolate	84-72-0					3.0E+00	I					1	0.1		1.8E+05	nm	1.8E+06	nm					1.1E+05	n		2.5E+02	
Express	101200-48-0					8.0E-03	I					1	0.1		4.9E+02	n	4.9E+03	n					2.9E+02	n		1.1E-01	
Fenamiphos	22224-92-6					2.5E-04	I					1	0.1		1.5E+01	n	1.5E+02	n					9.1E+00	n		9.1E-03	
Fenpropathrin	39515-41-8					2.5E-02	I					1	0.1		1.5E+03	n	1.5E+04	n					9.1E+02	n		4.1E+01	
Fluometuron	2164-17-2					1.3E-02	I					1	0.1		7.9E+02	n	8.0E+03	n					4.7E+02	n		3.7E-01	
Fluoride	16984-48-8					4.0E-02	C	1.3E-02	C						3.1E+03	n	4.1E+04	n	1.4E+01	n	5.7E+01	n	1.5E+03	n			
Fluorine (Soluble Fluoride)	7782-41-4					6.0E-02	I	1.3E-02	C			1			4.7E+03	n	6.1E+04	n	1.4E+01	n	5.7E+01	n	2.2E+03	n	4.0E+03	3.3E+02	6.0E+02
Fluridone	59756-60-4					8.0E-02	I					1	0.1		4.9E+03	n	4.9E+04	n					2.9E+03	n		3.3E+02	
Flurprimidol	56425-91-3					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		3.3E+00	
Flutolanil	66332-96-5					6.0E-02	I					1	0.1		3.7E+03	n	3.7E+04	n					2.2E+03	n		1.2E+01	
Fluvalinate	69409-94-5					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		5.3E+02	

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Contaminant		Toxicity and Chemical-specific Information													Screening Levels											Protection of Groundwater Soil	
		SFO	key	IUR	key	RfDo	key	RfCi	key	voc	muta-gen	GIABS	ABS	Csat	Residential Soil		Industrial Soil		Residential Air		Industrial Air		Tapwater		MCL	Risk-based SSL	MCL-based SSL
Analyte	CAS No.	(mg/kg-day)$^{-1}$		(ug/m^3)$^{-1}$		(mg/kg-day)		(mg/m^3)						mg/kg	mg/kg	key	mg/kg	key	ug/m^3	key	ug/m^3	key	ug/L	key	ug/L	mg/kg	mg/kg
Folpet	133-07-3	3.5E-03	I			1.0E-01	I					1	0.1		1.4E+02	c*	4.9E+02	c					1.9E+01	c		4.5E-03	
Fomesafen	72178-02-0	1.9E-01	I									1	0.1		2.6E+00	c	9.1E+00	c					3.5E-01	c		1.2E-03	
Fonofos	944-22-9					2.0E-03	I					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		1.4E-01	
Formaldehyde	50-00-0			1.3E-05	I	2.0E-01	I	9.8E-03	A			1	0.1		1.2E+04	n	1.2E+05	nm	1.9E-01	c*	9.4E-01	c*	7.3E+03	n		1.6E+00	
Formic Acid	64-18-6					2.0E+00	H	3.0E-03	P			1	0.1		1.2E+05	nm	1.2E+06	nm	3.1E+00	n	1.3E+01	n	7.3E+04	n		1.5E+01	
Fosetyl-AL	39148-24-8					3.0E+00	I					1	0.1		1.8E+05	nm	1.8E+06	nm					1.1E+05	n			
Furans																											
~Dibenzofuran	132-64-9					1.0E-03	X			V		1		1.7E+02	7.8E+01	n	1.0E+03	ns					3.7E+01	n		6.8E-01	
~Furan	110-00-9					1.0E-03	I			V		1		6.2E+03	7.8E+01	n	1.0E+03	n					3.7E+01	n		1.4E-02	
Furazolidone	67-45-8	3.8E+00	H									1	0.1		1.3E-01	c	4.5E-01	c					1.8E-02	c		3.4E-05	
Furfural	98-01-1					3.0E-03	I	5.0E-02	H			1	0.1		1.8E+02	n	1.8E+03	n	5.2E+01	n	2 2E+02	n	1.1E+02	n		2.3E-02	
Furium	531-82-8	1.5E+00	C	4.3E-04	C							1	0.1		3.2E-01	c	1.1E+00	c	5.7E-03	c	2.9E-02	c	4.5E-02	c		6.1E-05	
Furmecyclox	60568-05-0	3.0E-02	I	8.6E-06	C							1	0.1		1.6E+01	c	5.7E+01	c	2.8E-01	c	1 4E+00	c	2.2E+00	c		2.4E-03	
Glufosinate, Ammonium	77182-82-2					4.0E-04	I					1	0.1		2.4E+01	n	2.5E+02	n					1.5E+01	n		3.2E-03	
Glutaraldehyde	111-30-8							8.0E-05	C						1.1E+05	nm	4.8E+05	nm	8.3E-02	n	3.5E-01	n					
Glycidyl	765-34-4					4.0E-04	I	1.0E-03	H			1	0.1		2.4E+01	n	2.5E+02	n	1.0E+00	n	4.4E+00	n	1.5E+01	n		2.9E-03	
Glyphosate	1071-83-6					1.0E-01	I					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n	7.0E+02	7.4E-01	1.4E-01
Goal	42874-03-3					3.0E-03	I					1	0.1		1.8E+02	n	1.8E+03	n					1.1E+02	n		8.8E+00	
Guthion	86-50-0					3.0E-03	A	1.0E-02	A			1	0.1		1.8E+02	n	1.8E+03	n	1.0E+01	n	4.4E+01	n	1.1E+02	n		3.3E-02	
Haloxyfop, Methyl	69806-40-2					5.0E-05	I					1	0.1		3.1E+00	n	3.1E+01	n					1.8E+00	n		2.0E-02	
Harmony	79277-27-3					1.3E-02	I					1	0.1		7.9E+02	n	8.0E+03	n					4.7E+02	n		1.4E-01	
Heptachlor	76-44-8	4.5E+00	I	1.3E-03	I	5.0E-04	I					1	0.1		1.1E-01	c	3.8E-01	c	1.9E-03	c	9.4E-03	c	1.5E-02	c	4.0E-01	1.2E-03	3.3E-02
Heptachlor Epoxide	1024-57-3	9.1E+00	I	2.6E-03	I	1.3E-05	I					1	0.1		5.3E-02	c*	1.9E-01	c*	9.4E-04	c	4.7E-03	c	7.4E-03	c*	2.0E-01	1.5E-04	4.1E-03
Hexabromobenzene	87-82-1					2.0E-03	I					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		4.2E-01	
Hexabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-153)	68631-49-2					2.0E-04	I								1.6E+01	n	2.0E+02	n					7.3E+00	n			
Hexachlorobenzene	118-74-1	1.6E+00	I	4.6E-04	I	8.0E-04	I					1	0.1		3.0E-01	c	1.1E+00	c	5.3E-03	c	2.7E-02	c	4.2E-02	c	1.0E+00	5.3E-04	1.3E-02
Hexachlorobutadiene	87-68-3	7.8E-02	I	2.2E-05	I	1.0E-03	P					1	0.1		6.2E+00	c**	2.2E+01	c*	1.1E-01	c	5.6E-01	c	8.6E-01	c*		1.7E-03	
Hexachlorocyclohexane, Alpha-	319-84-6	6.3E+00	I	1.8E-03	I	8.0E-03	A					1	0.1		7.7E-02	c	2.7E-01	c	1.4E-03	c	6.8E-03	c	1.1E-02	c		8.2E-05	
Hexachlorocyclohexane, Beta-	319-85-7	1.8E+00	I	5.3E-04	I							1	0.1		2.7E-01	c	9.6E-01	c	4.6E-03	c	2.3E-02	c	3.7E-02	c		2.2E-04	
Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	1.1E+00	C	3.1E-04	C	3.0E-04	I					1	0.04		5.2E-01	c*	2.1E+00	c	7 8E-03	c	4.0E-02	c	6.1E-02	c	2.0E-01	3.6E-04	1.2E-03
Hexachlorocyclohexane, Technical	608-73-1	1.8E+00	I	5.1E-04	I							1	0.1		2.7E-01	c	9.6E-01	c	4.8E-03	c	2.4E-02	c	3.7E-02	c		2.2E-04	
Hexachlorocyclopentadiene	77-47-4					6.0E-03	I	2.0E-04	I			1	0.1		3.7E+02	n	3.7E+03	n	2.1E-01	n	8.8E-01	n	2.2E+02	n	5.0E+01	6.8E-01	1.6E-01
Hexachloroethane	67-72-1	1.4E-02	I	4.0E-06	I	1.0E-03	I					1	0.1		3.5E+01	c**	1.2E+02	c**	6.1E-01	c	3.1E+00	c	4.8E+00	c**		2.9E-03	
Hexachlorophene	70-30-4					3.0E-04	I					1	0.1		1.6E+01	n	1.8E+02	n					1.1E+01	n		1.5E+01	
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	1.1E-01	I			3.0E-03	I					1	0.015		5.5E+00	c*	2.4E+01	c					6.1E-01	c		2.3E-04	
Hexamethylene Diisocyanate, 1,6-	822-06-0							1.0E-05	I	V		1		5.2E+03	3.4E+00	n	1.4E+01	n	1.0E-02	n	4.4E-02	n	2.1E-02	n		2.1E-04	
Hexane, N-	110-54-3					6.0E-02	H	7.0E-01	I	V		1		1.4E+02	5.7E+02	ns	2.6E+03	ns	7.3E+02	n	3.1E+03	n	8.8E+02	n		6.2E+00	
Hexanedioic Acid	124-04-9					2.0E+00	P					1	0.1		1.2E+05	nm	1.2E+06	nm					7.3E+04	n		1.8E+01	
Hexanone, 2-	591-78-6					5.0E-03	I	3.0E-02	I	V		1		3.3E+03	2.1E+02	n	1.4E+03	n	3.1E+01	n	1.3E+02	n	4.7E+01	n		1.1E-02	
Hexazinone	51235-04-2					3.3E-02	I					1	0.1		2.0E+03	n	2.0E+04	n					1.2E+03	n		5.5E-01	
Hydrazine	302-01-2	3.0E+00	I	4.9E-03	I			3.0E-05	P			1			2.1E-01	c	9.5E-01	c	5.0E-04	c*	2.5E-03	c*	2.2E-02	c			
Hydrazine Sulfate	10034-93-2	3.0E+00	I	4.9E-03	I							1			2.1E-01	c	9.5E-01	c	5.0E-04	c	2.5E-03	c	2.2E-02	c			
Hydrogen Chloride	7647-01-0							2.0E-02	I			1			2.8E+07	nm	1.2E+08	nm	2.1E+01	n	8.8E+01	n					
Hydrogen Fluoride	7664-39-3					4.0E-02	C	1.4E-02	C			1			3.1E+03	n	4.1E+04	n	1.5E+01	n	6.1E+01	n	1.5E+03	n			
Hydrogen Sulfide	7783-06-4							2.0E-03	I			1			2.8E+06	nm	1.2E+07	nm	2.1E+00	n	8.8E+00	n					
Hydroquinone	123-31-9	6.0E-02	P			4.0E-02	P					1	0.1		8.1E+00	c	2.9E+01	c					1.1E+00	c		7.6E-04	
Imazalil	35554-44-0					1.3E-02	I					1	0.1		7.9E+02	n	8.0E+03	n					4.7E+02	n		8.2E+00	
Imazaquin	81335-37-7					2.5E-01	I					1	0.1		1.5E+04	n	1.5E+05	nm					9.1E+03	n		4.5E+01	
Iodine	7553-56-2					1.0E-02	A								7.8E+02	n	1.0E+04	n					3.7E+02	n			
Iprodione	36734-19-7					4.0E-02	I					1	0.1		2.4E+03	n	2.5E+04	n					1.5E+03	n		4.5E-01	
Iron	7439-89-6					7.0E-01	P					1			5.5E+04	n	7.2E+05	nm					2.6E+04	n		6.4E+02	
Isobutyl Alcohol	78-83-1					3.0E-01	I			V		1		1 0E+04	2.3E+04	ns	3.1E+05	nms					1.1E+04	n		2.3E+00	
Isophorone	78-59-1	9.5E-04	I			2.0E-01	I	2.0E+00	C			1	0.1		5.1E+02	c*	1.8E+03	c*	2.1E+03	n	8.8E+03	n	7.1E+01	c		2.3E-02	
Isopropalin	33820-53-0					1.5E-02	I					1	0.1		9.2E+02	n	9.2E+03	n					5.5E+02	n		1.3E+01	
Isopropanol	67-63-0							7.0E+00	C			1	0.1		9.9E+09	nm	4.2E+10	nm	7.3E+03	n	3.1E+04	n					
Isopropyl Methyl Phosphonic Acid	1832-54-8					1.0E-01	I					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n		7.9E-01	
Isoxaben	82558-50-7					5.0E-02	I					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		5.0E+00	
JP-7	NA							3.0E-01	A	V		1			4.3E+08	nm	1.8E+09	nm	3.1E+02	n	1.3E+03	n	6.3E+02	n			
Kerb	23950-58-5					7.5E-02	I					1	0.1		4.6E+03	n	4.6E+04	n					2.7E+03	n		2.8E+00	
Lactofen	77501-63-4					2.0E-03	I					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		3.4E+00	
Lead Compounds																											
~Lead and Compounds	7439-92-1											1			4.0E+02	nL	8.0E+02	nL							1.5E+01		1.4E+01
~Tetraethyl Lead	78-00-2					1.0E-07	I					1	0.1		6.1E-03	n	6.2E-02	n					3.7E-03	n		1.3E-05	
Lead acetate	301-04-2	2.8E-01	C	8.0E-05	C										2.3E+00	c	1.0E+01	c	3.0E-02	c	1.5E-01	c	2.4E-01	c			
Lead subacetate	1335-32-6	3.8E-02	C	1.1E-05	C										1.7E+01	c	7.5E+01	c	2.2E-01	c	1.1E+00	c	1.8E+00	c			
Linuron	330-55-2					2.0E-03	I					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		6.4E-02	
Lithium	7439-93-2					2.0E-03	P					1			1.6E+02	n	2.0E+03	n					7.3E+01	n		2.2E+01	
Lithium Perchlorate	7791-03-9					7.0E-04	I					1			5.5E+01	n	7.2E+02	n					2.6E+01	n			
Londax	83055-99-6					2.0E-01	I					1	0.1		1.2E+04	n	1.2E+05	nm					7.3E+03	n		1.9E+00	
MCPA	94-74-6					5.0E-04	I					1	0.1		3.1E+01	n	3.1E+02	n					1.8E+01	n		4.7E-03	
MCPB	94-81-5					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		1.4E-01	
MCPP	93-65-2					1.0E-03	I					1	0.1		6.1E+01	n	6.2E+02	n					3.7E+01	n		1.1E-02	
Malathion	121-75-5					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		1.9E-01	
Maleic Anhydride	108-31-6					1.0E-01	I	7.0E-04	C			1	0.1		6.1E+03	n	6.1E+04	n	7.3E-01	n	3.1E+00	n	3.7E+03	n		7.4E-01	
Maleic Hydrazide	123-33-1					5.0E-01	I					1	0.1		3.1E+04	n	3.1E+05	nm					1.8E+04	n		3.8E+00	
Malononitrile	109-77-3					1.0E-04	P					1	0.1		6.1E+00	n	6.2E+01	n					3.7E+00	n		7.5E-04	
Mancozeb	8018-01-7					3.0E-02	H					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n		1.5E+00	
Maneb	12427-38-2					5.0E-03	I					1	0.1		3.1E+02	n	3.1E+03	n					1.8E+02	n		2.6E-01	
Manganese (Diet)	7439-96-5					1.4E-01	I	5.0E-05	I			1															

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Contaminant		Toxicity and Chemical-specific Information													Screening Levels											Protection of Groundwater Soil	
		SFO	key	IUR	key	RfDo	key	RfCi	key	voc	mutagen	GIABS	ABS	Csat	Residential Soil		Industrial Soil		Residential Air		Industrial Air		Tapwater		MCL	Risk-based SSL	MCL-based SSL
Analyte	CAS No.	(mg/kg-day)⁻¹		(ug/m³)⁻¹		(mg/kg-day)		(mg/m³)						mg/kg	mg/kg	key	mg/kg	key	ug/m³	key	ug/m³	key	ug/L	key	ug/L	mg/kg	mg/kg
Manganese (Water)	7439-96-5					2.4E-02	I	5.0E-05	I			0.04			1.8E+03	n	2.3E+04	n	5.2E-02	n	2.2E-01	n	8.8E+02	n		5.7E+01	
Mephosfolan	950-10-7					9.0E-05	H					1	0.1		5.5E+00	n	5.5E+01	n					3.3E+00	n		4.6E-03	
Mepiquat Chloride	24307-26-4					3.0E-02	I					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n		3.6E-01	
Mercury Compounds																											
~Mercuric Chloride	7467-94-7					3.0E-04	I	3.0E-05	C			0.07			2.3E+01	n	3.1E+02	n	3.1E-02	n	1.3E-01	n	1.1E+01	n			
~Mercuric Sulfide	1344-48-5					3.0E-04	S					1			2.3E+01	n	3.1E+02	n					1.1E+01	n			
~Mercury (elemental)	7439-97-6					1.6E-04	C	3.0E-04	I	V		1		3.1E+00	5.6E+00	ns	3.4E+01	ns	3.1E-01	n	1.3E+00	n	5.7E-01	n	2.0E+00	3.0E-02	1.0E-01
~Mercury, Inorganic Salts	NA					3.0E-04	S					0.07			2.3E+01	n	3.1E+02	n					1.1E+01	n		5.7E-01	
~Methyl Mercury	22967-92-6					1.0E-04	I					1			7.6E+00	n	1.0E+02	n					3.7E+00	n			
~Phenylmercuric Acetate	62-38-4					8.0E-05	I					1	0.1		4.9E+00	n	4.9E+01	n					2.9E+00	n		9.1E-04	
Merphos	150-50-5					3.0E-05	I					1	0.1		1.8E+00	n	1.8E+01	n					1.1E+00	n		1.1E-01	
Merphos Oxide	78-48-8					3.0E-05	I					1	0.1		1.6E+00	n	1.6E+01	n					1.1E+00	n		5.4E-03	
Metalaxyl	57837-19-1					6.0E-02	I					1	0.1		3.7E+03	n	3.7E+04	n					2.2E+03	n		6.1E-01	
Methacrylonitrile	126-98-7					1.0E-04	I	7.0E-04	H	V		1		4.6E+03	3.2E+00	n	1.8E+01	n	7.3E-01	n	3.1E+00	n	1.0E+00	n		2.4E-04	
Methamidophos	10265-92-6					5.0E-05	I					1	0.1		3.1E+00	n	3.1E+01	n					1.6E+00	n		3.8E-04	
Methanol	67-56-1					5.0E-01	I	4.0E+00	C			1	0.1		3.1E+04	n	3.1E+05	nm	4.2E+03	n	1.8E+04	n	1.8E+04	n		3.7E+00	
Methidathion	950-37-8					1.0E-03	I					1	0.1		6.1E+01	n	6.2E+02	n					3.7E+01	n		8.9E-03	
Methomyl	16752-77-5					2.5E-02	I					1	0.1		1.5E+03	n	1.5E+04	n					9.1E+02	n		2.0E-01	
Methoxy-5-nitroaniline, 2-	99-59-2	4.9E-02	C	1.4E-05	C							1	0.1		9.9E+00	c	3.5E+01	c	1.7E-01	c	8.8E-01	c	1.4E+00	c		4.7E-04	
Methoxychlor	72-43-5					5.0E-03	I					1	0.1		3.1E+02	n	3.1E+03	n					1.8E+02	n	4.0E+01	9.9E+00	2.2E+00
Methoxyethanol Acetate, 2-	110-49-6					2.0E-03	H	9.0E-02	C			1	0.1		1.2E+02	n	1.2E+03	n	9.4E+01	n	3.9E+02	n	7.3E+01	n		1.5E-02	
Methoxyethanol, 2-	109-86-4					3.0E-03	P	2.0E-02	I			1	0.1		1.8E+02	n	1.8E+03	n	2.1E+01	n	8.8E+01	n	1.1E+02	n		2.2E-02	
Methyl Acetate	79-20-9					1.0E+00	H			V		1		2.9E+04	7.8E+04	ns	1.0E+06	nms					3.7E+04	n		7.5E+00	
Methyl Acrylate	96-33-3					3.0E-02	H			V		1		6.8E+03	2.3E+03	n	3.1E+04	ns					1.1E+03	n		2.3E-01	
Methyl Ethyl Ketone (2-Butanone)	78-93-3					6.0E-01	I	5.0E+00	I	V		1		2.8E+04	2.8E+04	n	2.0E+05	nms	5.2E+03	n	2.2E+04	n	7.1E+03	n		1.5E+00	
Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1					8.0E-02	H	3.0E+00	I	V		1		3.4E+03	5.3E+03	ns	5.3E+04	ns	3.1E+03	n	1.3E+04	n	2.0E+03	n		4.5E-01	
Methyl Isocyanate	624-83-9							1.0E-03	C						1.4E+06	nm	6.0E+06	nm	1.0E+00	n	4.4E+00	n					
Methyl Methacrylate	80-62-6					1.4E+00	I	7.0E-01	I	V		1		2.4E+03	4.8E+03	ns	2.1E+04	ns	7.3E+02	n	3.1E+03	n	1.4E+03	n		3.1E-01	
Methyl Parathion	298-00-0					2.5E-04	I					1	0.1		1.5E+01	n	1.5E+02	n					9.1E+00	n		1.5E-02	
Methyl Phosphonic Acid	993-13-5					6.0E-02	X					1	0.1		3.7E+03	n	3.7E+04	n					2.2E+03	n		4.4E-01	
Methyl Styrene (Mixed Isomers)	25013-15-4					6.0E-03	H	4.0E-02	H	V		1		3.8E+02	2.5E+02	n	1.6E+03	ns	4.2E+01	n	1.8E+02	n	6.0E+01	n		9.7E-02	
Methyl methanesulfonate	66-27-3	9.9E-02	C	2.8E-05	C							1	0.1		4.9E+00	c	1.7E+01	c	8.7E-02	c	4.4E-01	c	6.8E-01	c		1.4E-04	
Methyl tert-Butyl Ether (MTBE)	1634-04-4	1.8E-03	C	2.6E-07	C			3.0E+00	I	V		1		6.9E+03	4.3E+01	c	2.2E+02	c	9.4E+00	c	4.7E+01	c	1.2E+01	c		2.8E-03	
Methyl-5-Nitroaniline, 2-	99-55-8	3.3E-02	H									1	0.1		1.5E+01	c	5.2E+01	c					2.0E+00	c		1.1E-03	
Methyl-N-nitro-N-nitrosoguanidine, N-	70-25-7	8.3E+00	C	2.4E-03	C										7.7E-02	c	3.4E-01	c	1.0E-03	c	5.1E-03	c	8.1E-03	c		2.8E-06	
Methylaniline Hydrochloride, 2-	636-21-5	1.3E-01	C	3.7E-05	C							1	0.1		3.7E+00	c	1.3E+01	c	6.6E-02	c	3.3E-01	c	5.2E-01	c		2.2E-04	
Methylarsonic acid	124-58-3					1.0E-02	A					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n			
Methylcholanthrene, 3-	56-49-5	2.2E+01	C	6.3E-03	C							1	0.1		2.2E-02	c	7.8E-02	c	3.9E-04	c	1.9E-03	c	3.1E-03	c		5.9E-03	
Methylene Chloride	75-09-2	7.5E-03	I	4.7E-07	I	6.0E-02	I	1.0E+00	A	V		1		3.3E+03	1.1E+01	c	5.3E+01	c	5.2E+00	c	2.6E+01	c	4.8E+00	c	5.0E+00	1.2E-03	1.3E-03
Methylene-bis(2-chloroaniline), 4,4'-	101-14-4	1.0E-01	P	4.3E-04	C	2.0E-03	P				M	1	0.1		1.2E+00	c	1.7E+01	c*	2.2E-03	c	2.9E-02	c	2.2E-01	c		2.5E-03	
Methylene-bis(N,N-dimethyl) Aniline, 4,4'-	101-61-1	4.6E-02	I	1.3E-05	C							1	0.1		1.1E+01	c	3.7E+01	c	1.9E-01	c	9.4E-01	c	1.5E+00	c		8.1E-03	
Methylenebisbenzenamine, 4,4'-	101-77-9	1.6E+00	C	4.6E-04	C			2.0E-02	C			1	0.1		3.0E-01	c	1.1E+00	c	5.3E-03	c	2.7E-02	c	4.2E-02	c		1.9E-04	
Methylenediphenyl Diisocyanate	101-68-8							6.0E-04	I			1	0.1		8.5E+05	nm	3.6E+06	nm	6.3E-01	n	2.6E+00	n					
Methylstyrene, Alpha-	98-83-9					7.0E-02	H			V		1		5.0E+02	5.5E+03	ns	7.2E+04	ns					2.6E+03	n		4.1E+00	
Metolachlor	51218-45-2					1.5E-01	I					1	0.1		9.2E+03	n	9.2E+04	n					5.5E+03	n		6.4E+00	
Metribuzin	21087-64-9					2.5E-02	I					1	0.1		1.5E+03	n	1.5E+04	n					9.1E+02	n		2.8E-01	
Mineral oils	8012-95-1					3.0E+00	P								2.3E+05	nm	3.1E+06	nm					1.1E+05	n		4.3E+03	
Mirex	2385-85-5	1.8E+01	C	5.1E-03	C	2.0E-04	I					1	0.1		2.7E-02	c	9.6E-02	c	4.6E-04	c	2.4E-03	c	3.7E-03	c		2.7E-03	
Molinate	2212-67-1					2.0E-03	I					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		4.1E-02	
Molybdenum	7439-98-7					5.0E-03	I					1			3.9E+02	n	5.1E+03	n					1.6E+02	n		3.7E+00	
Monochloramine	10599-90-3					1.0E-01	I					1			7.6E+03	n	1.0E+05	nm					3.7E+03	n			
Monomethylaniline	100-61-8					2.0E-03	P					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		2.7E-02	
N,N'-Diphenyl-1,4-benzenediamine	74-31-7					3.0E-04	X					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n		1.1E+00	
Naled	300-76-5					2.0E-03	I					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		3.3E-02	
Naphtha, High Flash Aromatic (HFAN)	64724-95-6					3.0E-02	X	1.0E-01	P	V					2.3E+03	n	3.1E+04	n	1.0E+02	n	4.4E+02	n	1.8E+02	n			
Naphthylamine, 2-	91-59-8	1.8E+00	C	0.0E+00	C							1	0.1		2.7E-01	c	9.6E-01	c					3.7E-02	c		1.9E-04	
Napropamide	15299-99-7					1.0E-01	I					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n		2.4E+01	
Nickel Carbonyl	13463-39-3					5.0E-02	C	5.0E-05	C			0.04			3.7E+03	n	4.4E+04	n	5.2E-02	n	2.2E-01	n	1.8E+03	n			
Nickel Oxide	1313-99-1					5.0E-02	C	1.0E-04	C						3.8E+03	n	4.7E+04	n	1.0E-01	n	4.4E-01	n	1.8E+03	n			
Nickel Refinery Dust	NA			2.4E-04	I	5.0E-02	C	5.0E-05	C			0.04			3.7E+03	n	4.4E+04	n	1.0E-02	c**	5.1E-02	c**	1.6E+03	n			
Nickel Soluble Salts	7440-02-0			2.6E-04	C	2.0E-02	I	9.0E-05	A			0.04			1.5E+03	n	2.0E+04	n	9.4E-03	c*	4.7E-02	c**	7.3E+02	n		4.8E+01	
Nickel Subsulfide	12035-72-2	1.7E+00	C	4.8E-04	I	5.0E-02	C	5.0E-05	C			0.04			3.8E-01	c	1.7E+00	c	5.1E-03	c*	2.6E-02	c**	4.0E-02	c			
Nitrate	14797-55-8					1.6E+00	I					1			1.3E+05	nm	1.6E+06	nm					5.6E+04	n	1.0E+04		
Nitrite	14797-65-0					1.0E-01	I					1			7.8E+03	n	1.0E+05	nm					3.7E+03	n	1.0E+03		
Nitroaniline, 2-	88-74-4					1.0E-02	X	5.0E-05	X			1	0.1		6.1E+02	n	6.0E+03	n	5.2E-02	n	2.2E-01	n	3.7E+02	n		1.5E-01	
Nitroaniline, 4-	100-01-6	2.0E-02	P			4.0E-03	P	6.0E-03	P			1	0.1		2.4E+01	c*	6.6E+01	c*	6.3E+00	n	2.6E+01	n	3.4E+00	c*		1.4E-03	
Nitrobenzene	98-95-3			4.0E-05	I	2.0E-03	I	9.0E-03	I	V		1		3.1E+03	4.8E+00	c*	2.4E+01	c*	6.1E-02	c	3.1E-01	c	1.2E-01	c		7.9E-05	
Nitrocellulose	9004-70-0					3.0E+03	P								2.3E+08	nm	3.1E+09	nm					1.1E+08	n		2.4E+04	
Nitrofurantoin	67-20-9					7.0E-02	H					1	0.1		4.3E+03	n	4.3E+04	n					2.6E+03	n		1.1E+00	
Nitrofurazone	59-87-0	1.3E+00	C	3.7E-04	C							1	0.1		3.7E-01	c	1.3E+00	c	6.6E-03	c	3.3E-02	c	5.2E-02	c		4.7E-05	
Nitroglycerin	55-63-0	1.7E-02	P			1.0E-04	P					1	0.1		6.1E+00	n	6.2E+01	n					3.7E+00	n		1.6E-03	
Nitroguanidine	556-88-7					1.0E-01	I					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n		8.8E-01	
Nitromethane	75-52-5			9.0E-06	P			2.0E-02	P	V		1		1.8E+04	4.9E+00	c*	2.5E+01	c*	2.7E-01	c*	1.4E+00	c*	5.4E-01	c*		1.2E-04	
Nitropropane, 2-	79-46-9			2.7E-03	H			2.0E-02	I	V		1		4.9E+03	1.3E-02	c	6.4E-02	c	9.0E-04	c	4.5E-03	c	1.8E-03	c		4.7E-07	
Nitroso-N-ethylurea, N-	759-73-9	2.7E+01	C	7.7E-03	C							1	0.1		1.6E-02	c	6.4E-02	c	3.2E-04	c	1.6E-03	c	2.5E-03	c		6.0E-07	
Nitroso-N-methylurea, N-	684-93-5	1.2E+02	C	3.4E-02	C							1	0.1		4.0E-03	c	1.4E-02	c	7.2E-05	c	3.6E-04	c	5.6E-04	c		1.2E-07	
Nitroso-di-N-butylamine, N-	924-16-3	5.4E+00	I	1.6E-03	I					V		1		7.1E+03	8.7E-02	c	4.0E-01	c	1.5E-03	c	7.7E-03	c	2.4E-03	c		5.0E-06	
Nitroso-di-N-propylamine, N-	621-64-7	7.0E+00	I	2.0E-03	C							1	0.1		6.9E-02	c	2.5E-01	c	1.2E-03	c	6.1E-03	c	9.6E-03	c		7.2E-06	
Nitrosodiethanolamine, N-	1116-54-7	2.8E+00	I	8.0E-04	C							1	0.1		1.7E-01	c	6.2E-01	c	3.0E-03	c	1.5E-02	c	2.4E-02	c		4.9E-06	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ #29; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User's Guide); s = Concentration may exceed Csat (See User's Guide); SSL values are based on DAF=1

Contaminant		Toxicity and Chemical-specific Information													Screening Levels											Protection of Groundwater Soil	
		SFO	key	IUR	key	RfDo	key	RfCi	key	voc	mutagen	GIABS	ABS	Csat	Residential Soil		Industrial Soil		Residential Air		Industrial Air		Tapwater		MCL	Risk-based SSL	MCL-based SSL
Analyte	CAS No.	(mg/kg-day)$^{-1}$		(ug/m^3)$^{-1}$		(mg/kg-day)		(mg/m^3)						mg/kg	mg/kg	key	mg/kg	key	ug/m^3	key	ug/m^3	key	ug/L	key	ug/L	mg/kg	mg/kg
Nitrosodiethylamine, N-	55-18-5	1.5E+02	I	4.3E-02	I						M	1	0.1		7.7E-04	c	1.1E-02	c	2.2E-05	c	2.9E-04	c	1.4E-04	c		5.3E-08	
Nitrosodimethylamine, N-	62-75-9	5.1E+01	I	1.4E-02	I	8.0E-06	P	4.0E-05	X		M	1	0.1		2.3E-03	c	3.4E-02	c	6.9E-05	c	8.8E-04	c	4.2E-04	c		1.0E-07	
Nitrosodiphenylamine, N-	86-30-6	4.9E-03	I	2.6E-06	C							1	0.1		9.9E+01	c	3.5E+02	c	9.4E-01	c	4.7E+00	c	1.4E+01	c		7.5E-02	
Nitrosomethylethylamine, N-	10595-95-6	2.2E+01	I	6.3E-03	C							1	0.1		2.2E-02	c	7.8E-02	c	3.9E-04	c	1.9E-03	c	3.1E-03	c		8.8E-07	
Nitrosomorpholine [N-]	59-89-2	6.7E+00	C	1.9E-03	C							1	0.1		7.2E-02	c	2.6E-01	c	1.3E-03	c	6.5E-03	c	1.0E-02	c		2.5E-06	
Nitrosopiperidine [N-]	100-75-4	9.4E+00	C	2.7E-03	C							1	0.1		5.2E-02	c	1.8E-01	c	9.0E-04	c	4.5E-03	c	7.2E-03	c		3.8E-06	
Nitrosopyrrolidine, N-	930-55-2	2.1E+00	I	6.1E-04	I							1	0.1		2.3E-01	c	8.2E-01	c	4.0E-03	c	2.0E-02	c	3.2E-02	c		1.2E-05	
Nitrotoluene, m-	99-08-1					1.0E-04	X					1	0.1		6.1E+00	n	6.2E+01	n					3.7E+00	n		3.4E-03	
Nitrotoluene, o-	88-72-2	2.2E-01	P			9.0E-04	P			V		1		1.5E+03	2.9E+00	c*	1.3E+01	c*					3.1E-01	c		2.9E-04	
Nitrotoluene, p-	99-99-0	1.6E-02	P			4.0E-03	P					1	0.1		3.0E+01	c**	1.1E+02	c*					4.2E+00	c*		3.9E-03	
Nonane, n-	111-84-2					3.0E-04	X	2.0E-01	P	V				6.9E+00	2.1E+01	ns	2.3E+02	ns	2.1E+02	n	8.8E+02	n	1.1E+01	n		1.5E-01	
Norflurazon	27314-13-2					4.0E-02	I					1	0.1		2.4E+03	n	2.5E+04	n					1.5E+03	n		9.4E+00	
Nustar	85509-19-9					7.0E-04	I					1	0.1		4.3E+01	n	4.3E+02	n					2.6E+01	n		4.1E+00	
Octabromodiphenyl Ether	32536-52-0					3.0E-03	I					1	0.1		1.8E+02	n	1.8E+03	n					1.1E+02	n		2.2E+01	
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetra (HMX)	2691-41-0					5.0E-02	I					1	0.006		3.8E+03	n	4.9E+04	n					1.8E+03	n		2.3E+00	
Octamethylpyrophosphoramide	152-16-9					2.0E-03	H					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		1.8E-02	
Oryzalin	19044-88-3					5.0E-02	I					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		3.4E+00	
Oxadiazon	19666-30-9					5.0E-03	I					1	0.1		3.1E+02	n	3.1E+03	n					1.8E+02	n		1.9E+00	
Oxamyl	23135-22-0					2.5E-02	I					1	0.1		1.5E+03	n	1.5E+04	n					9.1E+02	n	2.0E+02	2.0E-01	4.4E-02
Paclobutrazol	76738-62-0					1.3E-02	I					1	0.1		7.9E+02	n	8.0E+03	n					4.7E+02	n		9.7E-01	
Paraquat Dichloride	1910-42-5					4.5E-03	I					1	0.1		2.7E+02	n	2.8E+03	n					1.6E+02	n		2.3E+00	
Parathion	56-38-2					6.0E-03	H					1	0.1		3.7E+02	n	3.7E+03	n					2.2E+02	n		1.1E+00	
Pebulate	1114-71-2					5.0E-02	H					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		1.5E+00	
Pendimethalin	40487-42-1					4.0E-02	I					1	0.1		2.4E+03	n	2.5E+04	n					1.5E+03	n		1.7E+01	
Pentabromodiphenyl Ether	32534-81-9					2.0E-03	I					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		3.2E+00	
Pentabromodiphenyl ether, 2,2',4,4',5- (BDE-99)	60348-60-9					1.0E-04	I								7.8E+00	n	1.0E+02	n					3.7E+00	n		1.6E-01	
Pentachlorobenzene	608-93-5					8.0E-04	I					1	0.1		4.9E+01	n	4.9E+02	n					2.9E+01	n		2.2E-01	
Pentachloroethane	76-01-7	9.0E-02	P									1	0.1		5.4E+00	c	1.9E+01	c					7.5E-01	c		3.6E-04	
Pentachloronitrobenzene	82-68-8	2.6E-01	H			3.0E-03	I					1	0.1		1.9E+00	c*	6.6E+00	c					2.6E-01	c		3.2E-03	
Pentachlorophenol	87-86-5	1.2E-01	I	5.1E-06	C	3.0E-02	I					1	0.25		3.0E+00	c	9.0E+00	c	4.8E-01	c	2.4E+00	c	5.6E-01	c	1.0E+00	5.7E-03	1.0E-02
Pentane, n-	109-66-0							1.0E+00	P	V				3.9E+02	8.7E+02	ns	3.7E+03	ns	1.0E+03	n	4.4E+03	n	2.1E+03	n		1.0E+01	
Perchlorate and Perchlorate Salts	14797-73-0					7.0E-04	I					1			5.5E+01	n	7.2E+02	n					2.8E+01	n	15 (F)		
Permethrin	52645-53-1					5.0E-02	I					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		4.3E+02	
Phenacetin	62-44-2	2.2E-03	C	6.3E-07	C							1	0.1		2.2E+02	c	7.8E+02	c	3.9E+00	c	1.9E+01	c	3.1E+01	c		8.6E-03	
Phenmedipham	13684-63-4					2.5E-01	I					1	0.1		1.5E+04	n	1.5E+05	nm					9.1E+03	n		4.9E+01	
Phenol	108-95-2					3.0E-01	I	2.0E-01	C			1	0.1		1.8E+04	n	1.8E+05	nm	2.1E+02	n	8.8E+02	n	1.1E+04	n		6.3E+00	
Phenylenediamine, m-	108-45-2					6.0E-03	I					1	0.1		3.7E+02	n	3.7E+03	n					2.2E+02	n		5.9E-02	
Phenylenediamine, o-	95-54-5	4.7E-02	H									1	0.1		1.0E+01	c	3.7E+01	c					1.4E+00	c		3.6E-04	
Phenylenediamine, p-	106-50-3					1.9E-01	H					1	0.1		1.2E+04	n	1.2E+05	nm					6.9E+03	n		1.9E+00	
Phenylphenol, 2-	90-43-7	1.9E-03	H									1	0.1		2.5E+02	c	8.9E+02	c					3.5E+01	c		4.7E-01	
Phorate	298-02-2					2.0E-04	H					1	0.1		1.2E+01	n	1.2E+02	n					7.3E+00	n		8.2E-03	
Phosgene	75-44-5							3.0E-04	I	V		1		1.6E+03	3.3E-01	n	1.4E+00	n	3.1E-01	n	1.3E+00	n					
Phosmet	732-11-6					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		1.6E-01	
Phosphine	7803-51-2					3.0E-04	I	3.0E-04	I			1			2.3E+01	n	3.1E+02	n	3.1E-01	n	1.3E+00	n	1.1E+01	n			
Phosphoric Acid	7664-38-2							1.0E-02	I			1			1.4E+07	nm	6.0E+07	nm	1.0E+01	n	4.4E+01	n					
Phosphorus, White	7723-14-0					2.0E-05	I					1			1.6E+00	n	2.0E+01	n					7.3E-01	n		2.7E-03	
Phthalic Acid, P-	100-21-0					1.0E+00	H					1	0.1		6.1E+04	n	8.2E+05	nm					3.7E+04	n		1.3E+01	
Phthalic Anhydride	85-44-9					2.0E+00	I	2.0E-02	C			1	0.1		1.2E+05	nm	1.2E+06	nm	2.1E+01	n	8.8E+01	n	7.3E+04	n		1.6E+01	
Picloram	1918-02-1					7.0E-02	I					1	0.1		4.3E+03	n	4.3E+04	n					2.6E+03	n	5.0E+02	7.1E-01	1.4E-01
Picramic Acid (2-Amino-4,6-dinitrophenol)	96-91-3					1.0E-04	X					1	0.1		6.1E+00	n	6.2E+01	n					3.7E+00	n		2.4E-03	
Pirimiphos, Methyl	29232-93-7					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		3.5E-01	
Polybrominated Biphenyls	59536-65-1	3.0E+01	C	8.6E-03	C	7.0E-06	H					1	0.1		1.6E-02	c*	5.7E-02	c*	2.8E-04	c	1.4E-03	c	2.2E-03	c			
Polychlorinated Biphenyls (PCBs)																											
~Aroclor 1016	12674-11-2	7.0E-02	I	2.0E-05	I	7.0E-05	I					1	0.14		3.9E+00	n	2.1E+01	c**	1.2E-01	c	6.1E-01	c	9.6E-01	c**		9.2E-02	
~Aroclor 1221	11104-28-2	2.0E+00	I	5.7E-04	I					V		1	0.14	7.6E+02	1.4E-01	c	5.4E-01	c	4.3E-03	c	2.1E-02	c	6.8E-03	c		1.2E-04	
~Aroclor 1232	11141-16-5	2.0E+00	I	5.7E-04	I					V		1	0.14	7.3E+01	1.4E-01	c	5.4E-01	c	4.3E-03	c	2.1E-02	c	6.8E-03	c		1.2E-04	
~Aroclor 1242	53469-21-9	2.0E+00	I	5.7E-04	I							1	0.14		2.2E-01	c	7.4E-01	c	4.3E-03	c	2.1E-02	c	3.4E-02	c		5.3E-03	
~Aroclor 1248	12672-29-6	2.0E+00	I	5.7E-04	I							1	0.14		2.2E-01	c	7.4E-01	c	4.3E-03	c	2.1E-02	c	3.4E-02	c		5.2E-03	
~Aroclor 1254	11097-69-1	2.0E+00	I	5.7E-04	I	2.0E-05	I					1	0.14		2.2E-01	c**	7.4E-01	c*	4.3E-03	c	2.1E-02	c	3.4E-02	c*		8.8E-03	
~Aroclor 1260	11096-82-5	2.0E+00	I	5.7E-04	I							1	0.14		2.2E-01	c	7.4E-01	c	4.3E-03	c	2.1E-02	c	3.4E-02	c		2.4E-02	
~Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189)	39635-31-9	1.3E+01	C	3.8E-03	C							1	0.14		3.4E-02	c	1.1E-01	c	6.4E-04	c	3.2E-03	c	5.2E-03	c		3.6E-03	
~Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167)	52663-72-6	1.3E+00	C	3.8E-04	C							1	0.14		3.4E-01	c	1.1E+00	c	6.4E-03	c	3.2E-02	c	5.2E-02	c		2.2E-02	
~Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157)	69782-90-7	6.5E+01	C	1.9E-02	C							1	0.14		6.8E-03	c	2.3E-02	c	1.3E-04	c	6.5E-04	c	1.0E-03	c		4.4E-04	
~Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156)	38380-08-4	6.5E+01	C	1.9E-02	C							1	0.14		6.8E-03	c	2.3E-02	c	1.3E-04	c	6.5E-04	c	1.0E-03	c		4.4E-04	
~Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169)	32774-16-6	1.3E+03	C	3.8E-01	C							1	0.14		3.4E-04	c	1.1E-03	c	6.4E-06	c	3.2E-05	c	5.2E-05	c		2.2E-05	
~Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123)	65510-44-3	1.3E+01	C	3.8E-03	C							1	0.14		3.4E-02	c	1.1E-01	c	6.4E-04	c	3.2E-03	c	5.2E-03	c		1.4E-03	
~Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118)	31508-00-6	1.3E+01	C	3.8E-03	C							1	0.14		3.4E-02	c	1.1E-01	c	6.4E-04	c	3.2E-03	c	5.2E-03	c		1.3E-03	
~Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105)	32598-14-4	1.3E+01	C	3.8E-03	C							1	0.14		3.4E-02	c	1.1E-01	c	8.4E-04	c	3.2E-03	c	5.2E-03	c		1.4E-03	
~Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114)	74472-37-0	6.5E+02	C	1.9E-02	C							1	0.14		6.8E-04	c	2.3E-03	c	1.3E-04	c	6.5E-04	c	1.0E-04	c		2.7E-05	
~Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126)	57465-28-8	1.3E+04	C	3.8E+00	C							1	0.14		3.4E-05	c	1.1E-04	c	6.4E-07	c	3.2E-06	c	5.2E-06	c		1.3E-06	
~Polychlorinated Biphenyls (high risk)	1336-36-3	2.0E+00	I	5.7E-04	C							1	0.14		2.2E-01	c	7.4E-01	c	4.3E-03	c	2.2E-02	c					
~Polychlorinated Biphenyls (low risk)	1336-36-3	4.0E-01	I	1.0E-04	I							1	0.14						2.4E-02	c	1.2E-01	c	1.7E-01	c	5.0E-01	2.6E-02	7.8E-02
~Polychlorinated Biphenyls (lowest risk)	1336-36-3	7.0E-02	I	2.0E-05	C							1	0.14						1.2E-01	c	6.1E-01	c					
~Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77)	32598-13-3	1.3E+01	C	3.8E-03	C							1	0.14		3.4E-02	c	1.1E-01	c	6.4E-04	c	3.2E-03	c	5.2E-03	c		6.1E-04	
~Tetrachlorobiphenyl, 3,4,4',5- (PCB 81)	70362-50-4	1.3E+01	C	3.8E-03	C							1	0.14		3.4E-02	c	1.1E-01	c	6.4E-04	c	3.2E-03	c	5.2E-03	c		8.1E-04	
Polymeric Methylene Diphenyl Diisocyanate (PMDI)	9016-87-9							6.0E-04	I			1	0.1		8.5E+05	nm	3.6E+06	nm	6.3E-01	n	2.6E+00	n					
Polynuclear Aromatic Hydrocarbons (PAHs)																											
~Acenaphthene	83-32-9					6.0E-02	I			V		1	0.13		3.4E+03	n	3.3E+04	n					2.2E+03	n		2.2E+01	
~Anthracene	120-12-7					3.0E-01	I			V		1	0.13		1.7E+04	n	1.7E+05	nm					1.1E+04	n		3.6E+02	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ #29; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User's Guide); s = Concentration may exceed Csat (See User's Guide); SSL values are based on DAF=1

Contaminant		Toxicity and Chemical-specific Information													Screening Levels											Protection of Groundwater Soil	
		SFO	key	IUR	key	RfDo	key	RfCi	key	voc	mutagen			Csat	Residential Soil		Industrial Soil		Residential Air		Industrial Air		Tapwater		MCL	Risk-based SSL	MCL-based SSL
Analyte	CAS No.	(mg/kg-day)⁻¹		(ug/m³)⁻¹		(mg/kg-day)		(mg/m³)				GIABS	ABS	mg/kg	mg/kg	key	mg/kg	key	ug/m³	key	ug/m³	key	ug/L	key	ug/L	mg/kg	mg/kg
~Benz[a]anthracene	56-55-3	7.3E-01	E	1.1E-04	C						M	1	0.13		1.5E-01	c	2.1E+00	c	8.7E-03	c	1.1E-01	c	2.9E-02	c		1.0E-02	
~Benzo(j)fluoranthene	205-82-3	1.2E+00	C	1.1E-04	C										5.3E-01	c	2.4E+00	c	2.2E-02	c	1.1E-01	c	5.6E-02	c		6.7E-02	
~Benzo[a]pyrene	50-32-8	7.3E+00	I	1.1E-03	C						M	1	0.13		1.5E-02	c	2.1E-01	c	8.7E-04	c	1.1E-02	c	2.9E-03	c	2.0E-01	3.5E-03	2.4E-01
~Benzo[b]fluoranthene	205-99-2	7.3E-01	E	1.1E-04	C						M	1	0.13		1.5E-01	c	2.1E+00	c	8.7E-03	c	1.1E-01	c	2.9E-02	c		3.5E-02	
~Benzo[k]fluoranthene	207-08-9	7.3E-02	E	1.1E-04	C						M	1	0.13		1.5E+00	c	2.1E+01	c	8.7E-03	c	1.1E-01	c	2.9E-01	c		3.5E-01	
~Chrysene	218-01-9	7.3E-03	E	1.1E-05	C						M	1	0.13		1.5E+01	c	2.1E+02	c	8.7E-02	c	1.1E+00	c	2.9E+00	c		1.1E+00	
~Dibenz[a,h]anthracene	53-70-3	7.3E+00	E	1.2E-03	C						M	1	0.13		1.5E-02	c	2.1E-01	c	8.0E-04	c	1.0E-02	c	2.9E-03	c		1.1E-02	
~Dibenzo(a,e)pyrene	192-65-4	1.2E+01	C	1.1E-03	C										5.3E-02	c	2.4E-01	c	2.2E-03	c	1.1E-02	c	5.6E-03	c		7.3E-02	
~Dimethylbenz(a)anthracene, 7,12-	57-97-6	2.5E+02	C	7.1E-02	C							1	0.13		1.8E-03	c	6.2E-03	c	3.4E-05	c	1.7E-04	c	2.7E-04	c		2.7E-04	
~Fluoranthene	206-44-0					4.0E-02	I					1	0.13		2.3E+03	n	2.2E+04	n					1.5E+03	n		1.6E+02	
~Fluorene	86-73-7					4.0E-02	I			V		1	0.13		2.3E+03	n	2.2E+04	n					1.5E+03	n		2 7E+01	
~Indeno[1,2,3-cd]pyrene	193-39-5	7.3E-01	E	1.1E-04	C						M	1	0.13		1.5E-01	c	2.1E+00	c	8.7E-03	c	1.1E-01	c	2.9E-02	c		1.2E-01	
~Methylnaphthalene, 1-	90-12-0	2.9E-02	P			7.0E-02	A			V		1		3.9E+02	2.2E+01	c	9.9E+01	c					2.3E+00	c		1.2E-02	
~Methylnaphthalene, 2-	91-57-6					4.0E-03	I			V		1		3.7E+02	3.1E+02	n	4.1E+03	ns					1.5E+02	n		7.5E-01	
~Naphthalene	91-20-3			3.4E-05	C	2.0E-02	I	3.0E-03	I	V		1	0.13		3.6E+00	c*	1.8E+01	c*	7.2E-02	c*	3.6E-01	c*	1.4E-01	c*		4.7E-04	
~Nitropyrene, 4-	57835-92-4	1.2E+00	C	1.1E-04	C										5.3E-01	c	2.4E+00	c	2 2E-02	c	1.1E-01	c	5.6E-02	c		9.7E-03	
~Pyrene	129-00-0					3.0E-02	I			V		1	0.13		1.7E+03	n	1.7E+04	n					1.1E+03	n		1.2E+02	
Potassium Perchlorate	7778-74-7					7.0E-04	I					1			5.5E+01	n	7.2E+02	n					2.6E+01	n			
Prochloraz	67747-09-5	1.5E-01	I			9.0E-03	I					1	0.1		3.2E+00	c	1.1E+01	c					4.5E-01	c		2.3E-03	
Profluralin	26399-36-0					6.0E-03	H					1	0.1		3.7E+02	n	3.7E+03	n					2.2E+02	n		1.3E+01	
Prometon	1610-18-0					1.5E-02	I					1	0.1		9 2E+02	n	9.2E+03	n					5.5E+02	n		2.6E-01	
Prometryn	7287-19-6					4.0E-03	I					1	0.1		2.4E+02	n	2.5E+03	n					1.5E+02	n		2.2E-01	
Propachlor	1918-16-7					1.3E-02	I					1	0.1		7.9E+02	n	8.0E+03	n					4.7E+02	n		2.9E-01	
Propanil	709-98-8					5.0E-03	I					1	0.1		3.1E+02	n	3.1E+03	n					1.8E+02	n		1.0E-01	
Propargite	2312-35-8					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		5.4E+01	
Propargyl Alcohol	107-19-7					2.0E-03	I					1	0 1		1.2E+02	n	1.2E+03	n					7.3E+01	n		1.5E-02	
Propazine	139-40-2					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		6.5E-01	
Propham	122-42-9					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		4.7E-01	
Propiconazole	60207-90-1					1.3E-02	I					1	0.1		7.9E+02	n	8.0E+03	n					4.7E+02	n		1.6E+00	
Propionaldehyde	123-38-6							8.0E-03	I	V				3.3E+04	8.0E+01	n	3.4E+02	n	8.3E+00	n	3.5E+01	n	1.7E+01	n		3.4E-03	
Propyl benzene	103-65-1					1.0E-01	X	1.0E+00	X	V		1	0.1	2.6E+02	3.4E+03	ns	2.1E+04	ns	1.0E+03	n	4.4E+03	n	1.3E+03	n		2.5E+00	
Propylene	115-07-1							3.0E+00	C						4.3E+09	nm	1.8E+10	nm	3.1E+03	n	1 3E+04	n					
Propylene Glycol	57-55-6					2.0E+01	P					1	0.1		1.2E+06	nm	1.2E+07	nm					7.3E+05	n		1.5E+02	
Propylene Glycol Dinitrate	6423-43-4							2.7E-04	A	V		1		1.5E+03	5.7E+01	n	2.4E+02	n	2.6E-01	n	1.2E+00	n	5.7E-01	n		1.8E-04	
Propylene Glycol Monoethyl Ether	1569-02-4					7.0E-01	H					1	0.1		4.3E+04	n	4.3E+05	nm					2.6E+04	n		5.2E+00	
Propylene Glycol Monomethyl Ether	107-98-2					7.0E-01	H	2.0E+00	I			1	0.1		4.3E+04	n	4.3E+05	nm	2.1E+03	n	8.8E+03	n	2.6E+04	n		5.2E+00	
Propylene Oxide	75-56-9	2.4E-01	I	3.7E-06	I			3.0E-02	I	V		1		7.8E+04	1.9E+00	c	6.6E+00	c	6.6E-01	c*	3.3E+00	c*	2.3E-01	c		4.9E-05	
Pursuit	81335-77-5					2.5E-01	I					1	0.1		1.5E+04	n	1.5E+05	nm					9.1E+03	n		8.0E+00	
Pydrin	51630-58-1					2.5E-02	I					1	0.1		1.5E+03	n	1.5E+04	n					9.1E+02	n		5.8E+02	
Pyridine	110-86-1					1.0E-03	I			V		1		5.3E+05	7.8E+01	n	1.0E+03	n					3.7E+01	n		1.3E-02	
Quinalphos	13593-03-8					5.0E-04	I					1	0.1		3.1E+01	n	3.1E+02	n					1.8E+01	n		1.6E-01	
Quinoline	91-22-5	3.0E+00	I									1	0 1		1.6E-01	c	5 7E-01	c					2.2E-02	c		7.4E-05	
Refractory Ceramic Fibers	NA							3.0E-02	A			1			4.3E+07	nm	1.8E+08	nm	3.1E+01	n	1.3E+02	n					
Resmethrin	10453-86-8					3.0E-02	I					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n		6.8E+02	
Ronnel	299-84-3					5.0E-02	H					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		1.7E+01	
Rotenone	83-79-4					4.0E-03	I					1	0.1		2.4E+02	n	2.5E+03	n					1.5E+02	n		7 6E+01	
Safrole	94-59-7	2.2E-01	C	6.3E-05	C							1	0.1		2.2E+00	c	7.8E+00	c	3.9E-02	c	1 9E-01	c	3.1E-01	c		1.9E-04	
Savey	78587-05-0					2.5E-02	I					1	0.1		1.5E+03	n	1.5E+04	n					9.1E+02	n		4.1E+00	
Selenious Acid	7783-00-8					5.0E-03	I					1			3.9E+02	n	5.1E+03	n					1.8E+02	n			
Selenium	7782-49-2					5.0E-03	I	2.0E-02	C			1			3.9E+02	n	5.1E+03	n	2.1E+01	n	8.8E+01	n	1.8E+02	n	5.0E+01	9.5E-01	2.6E-01
Selenium Sulfide	7446-34-6					5.0E-03	C	2.0E-02	C			1			3.9E+02	n	5.1E+03	n	2.1E+01	n	8.8E+01	n	1.8E+02	n			
Sethoxydim	74051-80-2					9.0E-02	I					1	0.1		5.5E+03	n	5.5E+04	n					3.3E+03	n		2.9E+01	
Silica (crystalline, respirable)	7631-86-9							3.0E-03	C						4.3E+06	nm	1.8E+07	nm	3.1E+00	n	1.3E+01	n					
Silver	7440-22-4					5.0E-03	I					0.04			3.9E+02	n	5.1E+03	n					1.8E+02	n		1.6E+00	
Simazine	122-34-9	1.2E-01	H			5.0E-03	I					1	0.1		4.0E+00	c*	1.4E+01	c					5.5E-01	c	4.0E+00	2.8E-04	2.0E-03
Sodium Acifluorfen	62476-59-9					1.3E-02	I					1	0.1		7.9E+02	n	8.0E+03	n					4.7E+02	n		3.8E+00	
Sodium Azide	26628-22-8					4.0E-03	I					1			3.1E+02	n	4.1E+03	n					1.5E+02	n			
Sodium Diethyldithiocarbamate	148-18-5	2.7E-01	H			3.0E-02	I					1	0.1		1.6E+00	c	6.4E+00	c					2.5E-01	c			
Sodium Fluoride	7681-49-4					5.0E-02	A	1.3E-02	C			1			3.9E+03	n	5.1E+04	n	1.4E+01	n	5.7E+01	n	1.8E+03	n			
Sodium Fluoroacetate	62-74-8					2.0E-05	I					1	0 1		1.2E+00	n	1.2E+01	n					7.3E-01	n		1.5E-04	
Sodium Metavanadate	13718-26-8					1.0E-03	H					1			7.8E+01	n	1.0E+03	n					3.7E+01	n			
Sodium Perchlorate	7601-89-0					7.0E-04	I					1			5.5E+01	n	7.2E+02	n					2.6E+01	n			
Stirofos (Tetrachlorovinphos)	961-11-5	2 4E-02	H			3.0E-02	I					1	0.1		2.0E+01	c*	7.2E+01	c					2.8E+00	c		8.3E-03	
Strontium, Stable	7440-24-6					6.0E-01	I					1			4.7E+04	n	6.1E+05	nm					2.2E+04	n		7.7E+02	
Strychnine	57-24-9					3.0E-04	I					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n		1.2E-01	
Styrene	100-42-5					2.0E-01	I	1.0E+00	I	V		1		8.7E+02	6.3E+03	ns	3.6E+04	ns	1.0E+03	n	4.4E+03	n	1.6E+03	n	1.0E+02	1.8E+00	1.1E-01
Sulfonylbis(4-chlorobenzene), 1,1'-	80-07-9					8.0E-04	P					1	0.1		4.9E+01	n	4.9E+02	n					2.9E+01	n		1.7E-01	
Sulfuric Acid	7664-93-9							1.0E-03	C						1.4E+06	nm	6.0E+06	nm	1.0E+00	n	4.4E+00	n					
Systhane	88671-89-0					2.5E-02	I					1	0.1		1.5E+03	n	1.5E+04	n					9.1E+02	n		1.1E+01	
TCMTB	21564-17-0					3.0E-02	H					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n		7.8E+00	
Tebuthiuron	34014-18-1					7.0E-02	I					1	0.1		4.3E+03	n	4.3E+04	n					2.6E+03	n		7.3E-01	
Temephos	3383-96-8					2.0E-02	H					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		1.4E+02	
Terbacil	5902-51-2					1.3E-02	I					1	0.1		7.9E+02	n	8.0E+03	n					4.7E+02	n		1.4E-01	
Terbufos	13071-79-9					2.5E-05	H					1	0.1		1.5E+00	n	1.5E+01	n					9.1E-01	n		2.0E-03	
Terbutryn	886-50-0					1.0E-03	I					1	0.1		6.1E+01	n	6.2E+02	n					3.7E+01	n		5.2E-02	
Tetrabromodiphenyl ether, 2,2',4,4'- (BDE-47)	5436-43-1					1.0E-04	I								7.8E+00	n	1.0E+02	n					3.7E+00	n		9.7E-02	
Tetrachlorobenzene, 1,2,4,5-	95-94-3					3.0E-04	I					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n		5.1E-02	
Tetrachloroethane, 1,1,1,2-	630-20-6	2.6E-02	I	7.4E-06	I	3.0E-02	I			V		1		6.8E+02	1.9E+00	c	9.3E+00	c	3.3E-01	c	1.7E+00	c	5.2E-01	c		2.0E-04	
Tetrachloroethane, 1,1,2,2-	79-34-5	2.0E-01	I	5.8E-05	I	4.0E-03	P			V		1		1.9E+03	5.6E-01	c	2.8E+00	c	4.2E-02	c	2.1E-01	c	6.7E-02	c		2.6E-05	

Key I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ #29; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User's Guide); s = Concentration may exceed Csat (See User's Guide), SSL values are based on DAF=1

Contaminant		Toxicity and Chemical-specific Information													Screening Levels											Protection of Groundwater Soil	
		SFO	key	IUR	key	RfDo	key	RfCi	key	voc	mutagen	GIABS	ABS	Csat	Residential Soil		Industrial Soil		Residential Air		Industrial Air		Tapwater		MCL	Risk-based SSL	MCL-based SSL
Analyte	CAS No.	(mg/kg-day)$^{-1}$		(ug/m^3)$^{-1}$		(mg/kg-day)		(mg/m^3)						mg/kg	mg/kg	key	mg/kg	key	ug/m^3	key	ug/m^3	key	ug/L	key	ug/L	mg/kg	mg/kg
Tetrachloroethylene	127-18-4	5.4E-01	C	5.9E-06	C	1.0E-02	I	2.7E-01	A	V		1		1.7E+02	5.5E-01	c	2.6E+00	c	4.1E-01	c	2.1E+00	c	1.1E-01	c	5.0E+00	4.9E-05	2.3E-03
Tetrachlorophenol, 2,3,4,6-	58-90-2					3.0E-02	I					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n		6.7E+00	
Tetrachlorotoluene, p- alpha, alpha, alpha-	5216-25-1	2.0E+01	H									1	0.1		2.4E-02	c	6.6E-02	c					3.4E-03	c		1.1E-05	
Tetraethyl Dithiopyrophosphate	3689-24-5					5.0E-04	I					1	0.1		3.1E+01	n	3.1E+02	n					1.8E+01	n		1.3E-02	
Tetrafluoroethane, 1,1,1,2-	811-97-2							8.0E+01	I	V		1		1.1E+03	1.1E+05	nms	4.6E+05	nms	8.3E+04	n	3.5E+05	n	1.7E+05	n		9.3E+01	
Tetryl (Trinitrophenylmethylnitramine)	479-45-8					4.0E-03	P					1	0.1		2.4E+02	n	2.5E+03	n					1.5E+02	n		1.4E+00	
Thallium (Soluble Salts)	7440-28-0											1													2.0E+00		1.4E-01
Thiobencarb	28249-77-6					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		1.3E+00	
Thiodiglycol	111-48-8					7.0E-02	X					1	0.008		5.4E+03	n	6.8E+04	n					2.6E+03	n		5.2E-01	
Thiofanox	39196-18-4					3.0E-04	H					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n		3.8E-03	
Thiophanate, Methyl	23564-05-8					8.0E-02	I					1	0.1		4.9E+03	n	4.9E+04	n					2.9E+03	n		2.5E+00	
Thiram	137-26-8					5.0E-03	I					1	0.1		3.1E+02	n	3.1E+03	n					1.8E+02	n		2.6E-01	
Tin	7440-31-5					6.0E-01	H					1			4.7E+04	n	6.1E+05	nm					2.2E+04	n		5.5E+03	
Titanium Tetrachloride	7550-45-0							1.0E-04	A			1			1.4E+05	nm	6.0E+05	nm	1.0E-01	n	4.4E-01	n					
Toluene	108-88-3					8.0E-02	I	5.0E+00	I	V		1		8.2E+02	5.0E+03	ns	4.5E+04	ns	5.2E+03	n	2.2E+04	n	2.3E+03	n	1.0E+03	1.6E+00	6.9E-01
Toluidine, p-	106-49-0	1.9E-01	H									1	0.1		2.6E+00	c	9.1E+00	c					3.5E-01	c		1.5E-04	
Toxaphene	8001-35-2	1.1E+00	I	3.2E-04	I							1	0.1		4.4E-01	c	1.6E+00	c	7.6E-03	c	3.8E-02	c	6.1E-02	c	3.0E+00	9.4E-03	4.6E-01
Tralomethrin	66841-25-6					7.5E-03	I					1	0.1		4.6E+02	n	4.6E+03	n					2.7E+02	n		1.0E+02	
Tri-n-butyltin	688-73-3					3.0E-04	A					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n		2.4E-01	
Triallate	2303-17-5					1.3E-02	I					1	0.1		7.9E+02	n	8.0E+03	n					4.7E+02	n		1.1E+00	
Triasulfuron	82097-50-5					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		3.6E-01	
Tribromobenzene, 1,2,4-	615-54-3					5.0E-03	I					1	0.1		3.1E+02	n	3.1E+03	n					1.8E+02	n		2.6E-01	
Tributyl Phosphate	126-73-8	9.2E-03	P			2.0E-01	P					1	0.1		5.3E+01	c	1.9E+02	c					7.3E+00	c		3.6E-02	
Tributyltin Compounds	NA					3.0E-04	P					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n			
Tributyltin Oxide	56-35-9					3.0E-04	I					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n		5.7E+02	
Trichloro-1,2,2-trifluoroethane, 1,1,2-	76-13-1					3.0E+01	I	3.0E+01	H	V		1		9.1E+02	4.3E+04	ns	1.8E+05	nms	3.1E+04	n	1.3E+05	n	5.9E+04	n		1.5E+02	
Trichloroaniline HCl, 2,4,6-	33663-50-2	2.9E-02	H									1	0.1		1.7E+01	c	6.9E+01	c					2.3E+00	c		6.4E-03	
Trichloroaniline, 2,4,6-	634-93-5	3.4E-02	H									1	0.1		1.4E+01	c	5.1E+01	c					2.0E+00	c		1.8E-02	
Trichlorobenzene, 1,2,3-	87-61-6					8.0E-04	X			V		1	0.1	1.5E+02	4.9E+01	n	4.9E+02	ns					2.9E+01	n		8.7E-02	
Trichlorobenzene, 1,2,4-	120-82-1	2.9E-02	P			1.0E-02	I	2.0E-03	P	V		1		4.0E+02	2.2E+01	c**	9.9E+01	c**	2.1E+00	n	8.8E+00	n	2.3E+00	c**	7.0E+01	6.8E-03	2.0E-01
Trichloroethane, 1,1,1-	71-55-6					2.0E+00	I	5.0E+00	I	V		1		6.4E+02	8.7E+03	ns	3.8E+04	ns	5.2E+03	n	2.2E+04	n	9.1E+03	n	2.0E+02	3.2E+00	7.0E-02
Trichloroethane, 1,1,2-	79-00-5	5.7E-02	I	1.6E-05	I	4.0E-03	I			V		1		2.2E+03	1.1E+00	c	5.3E+00	c	1.5E-01	c	7.7E-01	c	2.4E-01	c	5.0E+00	7.8E-05	1.6E-03
Trichloroethylene	79-01-6	5.9E-03	C	2.0E-06	C					V		1		6.9E+02	2.6E+00	c	1.4E+01	c	1.2E+00	c	6.1E+00	c	2.0E+00	c	5.0E+00	7.2E-04	1.8E-03
Trichlorofluoromethane	75-69-4					3.0E-01	I	7.0E-01	H	V		1		1.2E+03	7.9E+02	n	3.4E+03	ns	7.3E+02	n	3.1E+03	n	1.3E+03	n		8.3E-01	
Trichlorophenol, 2,4,5-	95-95-4					1.0E-01	I					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n		1.4E+01	
Trichlorophenol, 2,4,6-	88-06-2	1.1E-02	I	3.1E-06	I	1.0E-03	P					1	0.1		4.4E+01	c**	1.6E+02	c**	7.8E-01	c	4.0E+00	c	6.1E+00	c**		2.3E-02	
Trichlorophenoxyacetic Acid, 2,4,5-	93-76-5					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		1.5E-01	
Trichlorophenoxypropionic acid, -2,4,5	93-72-1					8.0E-03	I					1	0.1		4.9E+02	n	4.9E+03	n					2.9E+02	n	5.0E+01	1.6E-01	2.8E-02
Trichloropropane, 1,1,2-	598-77-6					5.0E-03	I			V		1		1.3E+03	3.9E+02	n	5.1E+03	ns					1.6E+02	n		7.1E-02	
Trichloropropane, 1,2,3-	96-18-4	3.0E+01	I			4.0E-03	I	3.0E-04	I	V	M	1		1.4E+03	5.0E-03	c	9.5E-02	c	3.1E-01	n	1.3E+00	n	7.2E-04	c		3.1E-07	
Trichloropropene, 1,2,3-	96-19-5					3.0E-03	X	3.0E-04	P	V		1		4.5E+02	7.8E-01	n	3.3E+00	n	3.1E-01	n	1.3E+00	n	6.2E-01	n		3.1E-04	
Tridiphane	58138-08-2					3.0E-03	I					1	0.1		1.8E+02	n	1.8E+03	n					1.1E+02	n		7.8E-01	
Triethylamine	121-44-8							7.0E-03	I	V		1		2.8E+04	1.2E+02	n	5.2E+02	n	7.3E+00	n	3.1E+01	n	1.5E+01	n		4.4E-03	
Trifluralin	1582-09-8	7.7E-03	I			7.5E-03	I					1	0.1		6.3E+01	c**	2.2E+02	c*					8.7E+00	c*		2.9E-01	
Trimethyl Phosphate	512-56-1	3.7E-02	H									1	0.1		1.3E+01	c	4.7E+01	c					1.8E+00	c		4.0E-04	
Trimethylbenzene, 1,2,4-	95-63-6							7.0E-03	P	V		1		2.2E+02	6.2E+01	n	2.6E+02	ns	7.3E+00	n	3.1E+01	n	1.5E+01	n		2.1E-02	
Trimethylbenzene, 1,3,5-	108-67-8					1.0E-02	X			V		1		1.8E+02	7.8E+02	ns	1.0E+04	ns					3.7E+02	n		5.2E-01	
Trinitrobenzene, 1,3,5-	99-35-4					3.0E-02	I					1	0.019		2.2E+03	n	2.7E+04	n					1.1E+03	n		3.9E+00	
Trinitrotoluene, 2,4,6-	118-96-7	3.0E-02	I			5.0E-04	I					1	0.032		1.9E+01	c**	7.9E+01	c**					2.2E+00	c**		1.3E-02	
Triphenylphosphine Oxide	791-28-6					2.0E-02	P					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		3.0E+00	
Tris(2-chloroethyl)phosphate	115-96-8	2.0E-02	P			7.0E-03	P					1	0.1		2.4E+01	c*	8.6E+01	c*					3.4E+00	c*		3.3E-03	
Tris(2-ethylhexyl)phosphate	78-42-2	3.2E-03	P			1.0E-01	P					1	0.1		1.5E+02	c*	5.4E+02	c					2.1E+01	c		1.0E+02	
Uranium (Soluble Salts)	NA					3.0E-03	I	3.0E-04	A			1			2.3E+02	n	3.1E+03	n	3.1E-01	n	1.3E+00	n	1.1E+02	n		4.9E+01	
Urethane	51-79-6	1.0E+00	C	2.9E-04	C										6.4E-01	c	2.9E+00	c	8.4E-03	c	4.2E-02	c	6.7E-02	c		1.5E-05	
Vanadium Pentoxide	1314-62-1			8.3E-03	P	9.0E-03	I	7.0E-06	P			0.026			4.0E+02	c**	2.0E+03	c**	2.9E-04	c*	1.5E-03	c*	3.3E+02	n			
Vanadium Sulfate	36907-42-3					2.0E-02	H					0.026			1.6E+03	n	2.0E+04	n					7.3E+02	n			
Vanadium and Compounds	NA					5.0E-03	S					1			3.9E+02	n	5.2E+03	n					1.8E+02	n		1.6E+02	
Vanadium, Metallic	7440-62-2					7.0E-05	P					0.026			5.5E+00	n	7.2E+01	n					2.6E+00	n		2.6E+00	
Vernolate	1929-77-7					1.0E-03	I					1	0.1		6.1E+01	n	6.2E+02	n					3.7E+01	n		2.9E-02	
Vinclozolin	50471-44-8					2.5E-02	I					1	0.1		1.5E+03	n	1.5E+04	n					9.1E+02	n		7.0E-01	
Vinyl Acetate	108-05-4					1.0E+00	H	2.0E-01	I	V		1		2.8E+03	9.7E+02	n	4.1E+03	ns	2.1E+02	n	8.8E+02	n	4.1E+02	n		8.8E-02	
Vinyl Bromide	593-60-2			3.2E-05	H			3.0E-03	I	V		1		3.4E+03	1.1E-01	c*	5.6E-01	c*	7.6E-02	c*	3.8E-01	c*	1.5E-01	c*		4.4E-05	
Vinyl Chloride	75-01-4	7.2E-01	I	4.4E-06	I	3.0E-03	I	1.0E-01	I	V	M	1		3.9E+03	6.0E-02	c	1.7E+00	c	1.6E-01	c	2.6E+00	c	1.6E-02	c	2.0E+00	5.6E-06	6.9E-04
Warfarin	81-81-2					3.0E-04	I					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n		1.2E-02	
Xylene, Mixture	1330-20-7					2.0E-01	I	1.0E-01	I	V		1		2.6E+02	6.3E+02	ns	2.7E+03	ns	1.0E+02	n	4.4E+02	n	2.0E+02	n	1.0E+04	2.0E-01	9.8E+00
Xylene, P-	106-42-3					2.0E-01	I	7.0E-01	C	V		1		3.9E+02	3.4E+03	ns	1.7E+04	ns	7.3E+02	n	3.1E+03	n	1.2E+03	n		1.2E+00	
Xylene, m-	108-38-3					2.0E-01	I	7.0E-01	C	V		1		3.9E+02	3.4E+03	ns	1.7E+04	ns	7.3E+02	n	3.1E+03	n	1.2E+03	n		1.2E+00	
Xylene, o-	95-47-6					2.0E-01	I	7.0E-01	C	V		1		4.3E+02	3.8E+03	ns	1.9E+04	ns	7.3E+02	n	3.1E+03	n	1.2E+03	n		1.2E+00	
Zinc (Metallic)	7440-66-6					3.0E-01	I					1			2.3E+04	n	3.1E+05	nm					1.1E+04	n		6.8E+02	
Zinc Phosphide	1314-84-7					3.0E-04	I					1			2.3E+01	n	3.1E+02	n					1.1E+01	n			
Zineb	12122-67-7					5.0E-02	I					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		5.3E+00	
Xylene, Mixture	1330-20-7					2.0E-01	I	1.0E-01	I	V		1		2.6E+02	6.3E+02	ns	2.7E+03	ns	1.0E+02	n	4.4E+02	n	2.0E+02	n	1.0E+04	2.0E-01	9.8E+00
Xylene, P-	106-42-3					2.0E-01	I	7.0E-01	C	V		1		3.9E+02	3.4E+03	ns	1.7E+04	ns	7.3E+02	n	3.1E+03	n	1.2E+03	n		1.2E+00	
Xylene, m-	108-38-3					2.0E-01	I	7.0E-01	C	V		1		3.9E+02	3.4E+03	ns	1.7E+04	ns	7.3E+02	n	3.1E+03	n	1.2E+03	n		1.2E+00	
Xylene, o-	95-47-6					2.0E-01	I	7.0E-01	C	V		1		4.3E+02	3.8E+03	ns	1.9E+04	ns	7.3E+02	n	3.1E+03	n	1.2E+03	n		1.2E+00	
Zinc (Metallic)	7440-66-6					3.0E-01	I					1			2.3E+04	n	3.1E+05	nm					1.1E+04	n		6.8E+02	
Zinc Phosphide	1314-84-7					3.0E-04	I					1			2.3E+01	n	3.1E+02	n					1.1E+01	n			
Zineb	12122-67-7					5.0E-02	I					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		5.3E+00	

LANCE R. LEFLEUR
DIRECTOR

ADEM

KAY IVEY
GOVERNOR

Alabama Department of Environmental Management
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Montgomery, Alabama 36130-1463
(334) 271-7700 ▪ FAX (334) 271-7950

July 27, 2018

Honorable Woody Jacobs, Mayor
City of Cullman
Post Office Box 278
Cullman, Alabama 35056

Re: Former Greif Brothers, Inc.
409 2nd Avenue, N.E.
Cullman, Cullman County, Alabama
VCP No. 461-9496

Dear Mayor Townson:

The Alabama Department of Environmental Management (ADEM) has completed its review of the Modified Cleanup Plan submitted by Goodwyn, Mills, and Cawood, Inc. and dated June 12, 2018. Based on our review, the Modified Cleanup Plan appears to be programmatically adequate.

In accordance with ADEM Admin. Code 335-15-6-.02, the Cleanup Plan is required to be placed on public notice for 30 days. The comment period will begin on August 3, 2018, and will end on September 4 2018. Any person interested in commenting on the Plan must do so within the 30-day comment period discussed above.

As indicated in the report, an environmental covenant would be required to address the elevated concentrations of volatile organic compounds, petroleum aromatic hydrocarbons, and heavy metals in onsite soils and groundwater. Therefore, a draft covenant should be submitted to the Department which describes the appropriate use restrictions for the site. These restrictions should include the following institutional and engineering controls:

- a restriction on groundwater use for potable or irrigation purposes,
- soil areas identified in Section IV of the June, 2018 Modified Cleanup Plan are required to be capped by at least 2 feet of clean clay material or asphalt, and
- the property shall not be used for residential purposes.

If you have any questions or comments, please contact Pamela Luckie at (334) 394-4376 or by email at pwilson@adem.alabama.gov.

Sincerely,

Sonja B. Favors, Chief
Redevelopment Section
Industrial Hazardous Waste Branch

SBF/PWL/nbf

cc: Jof Mehaffey

Terracon

July 27, 2017

Alabama Department of Environmental Management
Redevelopment Section, Land Division
Post Office Box 301463
Montgomery, Alabama 36130-1463

Attention: Ms. Dixie Beatty, Project Manager

RE: **May 2017 Groundwater Monitoring Report**
Former Greif Brothers Property
Cullman, Cullman County, Alabama
ALRERA Site No. 461-9496
Terracon Project No. E117703

Dear Ms. Beatty:

On behalf of the City of Cullman (City), Terracon Consultants, Inc. (Terracon) has prepared this Groundwater Monitoring Report for the above-referenced site. Terracon and the City of Cullman would like to meet with you to discuss the next steps in the VCP process.

If you have any questions concerning this report, please call us at (205) 942-1289.

Sincerely,
Terracon Consultants, Inc.

Terrell W. Rippstein, AL-PG #8
Principal Geologist

Terracon Consultants, Inc. 110 12th Street North Birmingham, AL 35205
P [205] 942-1289 F [205] 443 5302 terracon.com

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May 2017 Groundwater Monitoring Report

FORMER GREIF BROTHERS PROPERTY
CULLMAN, CULLMAN COUNTY, ALABAMA
ALRERA SITE NO. 461-9496

Report Date: July 27, 2017
Project No. E1177003

Prepared for:
City of Cullman
Cullman, Alabama

Prepared by:
Terracon Consultants, Inc.
Birmingham, Alabama

Terracon

July 27, 2017

City of Cullman
204 Second Avenue Northeast
P.O. Box 278
Cullman, Alabama 35056

Attn: Mr. Tom Charney
P: (256) 775-7100

RE: **May 2017 Groundwater Monitoring Report**
Former Greif Brothers Property
Cullman, Cullman County, Alabama
ALRERA Site No. 461-9496
Terracon Project No. E117703

Dear Mr. Charney:

Terracon Consultants, Inc. has prepared this June 2017 Groundwater Monitoring Report for the above-referenced site. We have forwarded a copy of the report to ADEM on your behalf.

Terracon appreciates the opportunity of working with you on this project. If you have any questions concerning this report, please call us at (205) 942-1289.

Sincerely,
Terracon Consultants, Inc.

WILLIAM G. NOLAND, III
LIC. #1263

Trey G. Noland, AL-PG
Group Manager

TERRELL W. RIPPSTEIN

Terrell W. Rippstein, AL-PG
Principal Geologist

cc: Ms. Dixie Beatty, ADEM

Terracon Consultants, Inc. 110 12th Street North Birmingham, AL 35205
P [205] 942-1289 F [205] 443 5302 terracon.com

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CERTIFICATION PAGE

I certify under penalty of law that I am a registered professional geologist experienced in hydrogeologic investigations. The investigation described in this report was performed by a geologist(s) or registered engineer(s) experienced in hydrogeologic investigations. The information submitted herein, to the best of my knowledge and belief, is true, accurate, and complete. I am aware that there are significant penalties for submitting false information.

Terrell W. Rippstein, AL-PG #8
Principal Geologist
July 27, 2017

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MAY 2017 GROUNDWATER MONITORING REPORT
Former Greif Brothers Property
Cullman, Cullman County, Alabama
ALRERA Site No. 461-9496

Terracon Project No. E117703

July 27, 2017

1.0 INTRODUCTION

Site Name	Former Greif Brothers Property
Site Location/Address	2nd Avenue Northeast, Cullman, Cullman County, Alabama
Site Improvements	The site is developed with several municipal structures including the Street Department, the City Garage, the Sanitation Department, and the Police Department.
Anticipated Future Site Use	The site is to be developed into a Park for the City of Cullman

The site consists of approximately two city blocks from 8th Street Northeast on the north, 2nd Avenue Northeast on the east, Elizabeth Street Northeast on the south, and Railroad tracks on the west. Several structures are located on-site and include the Cullman City Garage, the Cullman Street Department and city storage, and the Cullman Police Department. The remaining portions of the site consist of paved parking areas and two single-family residences that are located on the northeast portion of the site.

The site location is depicted on Figure 1, which was reproduced from a portion of the USGS 7.5-minute series topographic map. A Site Map of the site is included as Figure 2.

2.0 SITE HISTORY AND STATUS

Terracon reviewed several documents regarding former environmental investigations and remediation activities at the site via ADEM's eFile website and through documents supplied directly to Terracon by ADEM. The following reports were reviewed:

- Phase III Remedial Investigation (RI) Report dated July 2002 prepared by Environmental Resources Management (ERM).
- Voluntary Cleanup Program Application, Assessment, & Cleanup Plan City of Cullman/Greif Property dated November 25, 2008 prepared by ERM.
- Passive Soil Gas Survey Data Report dated October 19, 2009 prepared by Beacon Environmental Services, Inc.
- Greif Brothers Phase II Report Annual Sampling 2010 dated March 2010 prepared by Goodwyn, Mills, and Cawood, Inc. (GMC).

- Environmental Information Document, Brownfield Cleanup Alternatives, Greif Facility, Cullman, Alabama dated June 2013 prepared by GMC.
- Brownfield Cleanup Report for EPA Region 4 Grant Activities, Cleanup Action Activities for Greif Facility, Cullman, Alabama, Final Report dated March 2015 and Revision 3 dated May 2015 prepared by GMC.

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Based on a review of these reports, there were/are 11 Areas of Concern (AOC) on the former Greif Brothers property. The AOCs include:

AOC 1	Scrap Metal and Equipment Storage Yard
AOC 2	Hazardous Material Storage Area
AOC 3	Trichloroethylene (TCE) Degreaser Area
AOC 4	Oil Stained Soil Along West Property Line, Adjacent to Railroad Track
AOC 5	Hazardous Waste Storage Area/Light Gauge Paint Room
AOC 6	Former UST – West Entrance of the Raible Division Heavy Gauge Assembly Area
AOC 7	Former UST - Southeast Corner of Cullman Supply Company Electric Shop
AOC 8	Dry Well and Adjacent Solvent Recovery Room
AOC 9	Basement Vault
AOC 10	Oil Drum Storage Rack – Cullman Supply
AOC 11	Former Hazardous Waste Storage Shed
AOC 12	Former Satellite Hazardous Waste Accumulation and Paint Storage Room

Of these 12 AOCs, Phase II investigation activities indicated concentrations of contaminants above federal and/or state screening levels in AOCs 1, 2, 3, 4, 5 and 11. Based on sampling conducted by GMC it appears that the Brownfield's Cleanup Grant was used to remediate soil and groundwater across the site. It appears that the majority of the site was remediated; however, GMC recommended additional sampling of some of the monitoring wells. There was no report indicating the sampling has been conducted.

ADEM has not issued a letter of concurrence for the site; therefore, the site remains in the Alabama Voluntary Cleanup Program without closure.

This report documents the sampling of the groundwater monitoring wells located on the site.

3.0 GROUNDWATER MEASUREMENTS

The uppermost aquifer in the vicinity of the subject site is represented by water in the unconsolidated residual soils. The monitoring well network sampled consists of eight monitoring wells designated MW-1, MW-2, MW-3, MW-4R, MW-6, MW-9, MW-10, and MW-11. Terracon has not been provided any monitoring well construction information nor was any found in the previous reports submitted to ADEM. Depths to groundwater and total well depths were measured from a designated point at the top of the well casings on May 23, 2017, using an electronic water level indicator.

Top of well casing elevations have not been provided to Terracon therefore the groundwater flow direction could not be determined; however, previous reports indicate groundwater flow is towards the south. Prior to any additional sampling, the wells will be surveyed to obtain top of casing elevations.

4.0 GROUNDWATER SAMPLING

During the May 23, 2017, groundwater monitoring event, monitoring wells MW-1, MW-2, MW-3, MW-4R, MW-6, MW-9, MW-10, and MW-11 were sampled. The depths to water and total well depths were recorded to calculate the volume of standing water (one well volume) in the wells to be purged. Prior to groundwater sample collection, the monitoring well is typically purged of either three well volumes of water or until the well goes dry.

Prior to sample collection, groundwater from each monitoring well was field-screened for dissolved oxygen (DO),oxidation/reduction potential (ORP), specific conductivity, pH, and temperature. Evaluation of these intrinsic parameters can be used as a secondary line of evidence that natural attenuation processes are occurring in the impacted groundwater. The collected parameter data are presented on the monitoring well sampling records included as Appendix A.

Groundwater samples were collected from monitoring wells MW-1, MW-2, MW-3, MW-4R, MW-6, MW-9, MW-10, and MW-11 with dedicated, disposable bailers, dispensed into labeled, laboratory-provided containers, and placed in a cooler containing ice.

The groundwater samples were shipped under chain-of-custody to ESC Lab Sciences (ESC) in Mount Juliet, Tennessee and analyzed for 8 Resource Conservation and Recovery Act (RCRA) metals by EPA Method 6010B and volatile organic compounds (VOCs) by EPA Method 8260B. Monitoring well sampling records are included as Appendix A.

COCs detected in the groundwater samples were compared to the EPA Maximum Contaminant Levels (MCLs) and the EPA Region 4 Regional Screening Levels (RSL's) for tapwater (TR=1E-06 and THQ=0.1). Comparisons of the detected concentrations are bulleted below:

4.1 Metals Analytical

The following metals were detected above the reported detection limits (RDL) in at least one of the groundwater samples collected during the May 2017 monitoring event:

- Arsenic
- Barium
- Chromium
- Copper
- Lead

The metals exceeding the MCL during the May 2017 event were:

- Arsenic (MW-2, MW-3, and MW-10),
- Cadmium (MW-2)
- Lead (MW-2, MW-3, and MW-10).

The metals exceeding the RSL during the May 2017 event were:

- Barium (MW-10),
- Cadmium (MW-3)

4.2 VOC Analytical

The following VOCs were detected in at least one of the groundwater samples collected during the May 2017 monitoring event:

- Benzene
- Sec-Butylbenzene
- 1,1-Dichloroethane (DCA)
- 1,2-DCA
- 1,1-Dichloroethene (DCE)
- cis-1,2-DCE
- trans-1,2-DCE
- Isopropylbenzene
- Tetrachloroethene (PCE)
- 1,1,2-Trichloroethane (TCA)
- Trichloroethene (TCE)
- Vinyl Chloride (VC)

Of the VOCs listed above, the VOCs exceeding the MCLs during the May 2017 event were:

- 1,1-DCE (MW-3, MW-6, and MW-10)
- cis-1,2-DCE (MW-3, MW-6, MW-9, and MW-10)
- PCE (MW-10)
- TCE (MW-1, MW-3, MW-6, MW-9, and MW-10)
- VC (MW-3, MW-6, MW-9, and MW-10)

The VOCs exceeding the tapwater RSLs during the May 2017 event were:

- Benzene (MW-6)
- 1,1-DCA (MW-1, MW-3, MW-6, and MW-10)
- 1,2-DCA (MW-6)
- Cis-1,2-DCE (MW-1 and MW-2)
- Trans-1,2-DCE (MW-6)
- 1,1,2-TCA (MW-6)
- TCE (MW-4R)

A summary of the groundwater sample laboratory analytical results is presented on Table 2. The groundwater sample laboratory analytical report is included as Appendix B.

5.0 CONCLUSIONS

Based on the analytical results, field observations, and findings, Terracon concludes the following:

- Arsenic, cadmium, and lead are present at concentrations above the MCL;
- The presence of these metals could be due to suspended sediment on the samples, in the future, we will analyze the samples for dissolved metals.
- Several VOCs were present at concentrations greater than the MCL and tapwater RSLs.

Table 1
Summary of Groundwater Measurements
Former Greif Brothers Property
Cullman, Cullman County, Alabama
Project No. E1177003

Monitoring Well	Date Measured	Top of Casing Elevation* (ft amsl)	Measured Depth to Water (ft btoc)	Groundwater Elevation* (ft amsl)
MW-1	05/23/17		1.40	
MW-2	04/01/16		0.65	
MW-3	04/01/16		1.92	
MW-4R	04/01/16		1.16	
MW-6	04/01/16		5.92	
MW-9	04/01/16		2.40	
MW-10	04/01/16		3.84	
MW-11	04/01/16		23.51	

ft amsl - feet above mean sea level
ft btoc- feet below top of casing

Table 2

Summary of Analytical Data

Former Greif Brothers Property

Cullman, Cullman County, Alabama

Project No. E1177003

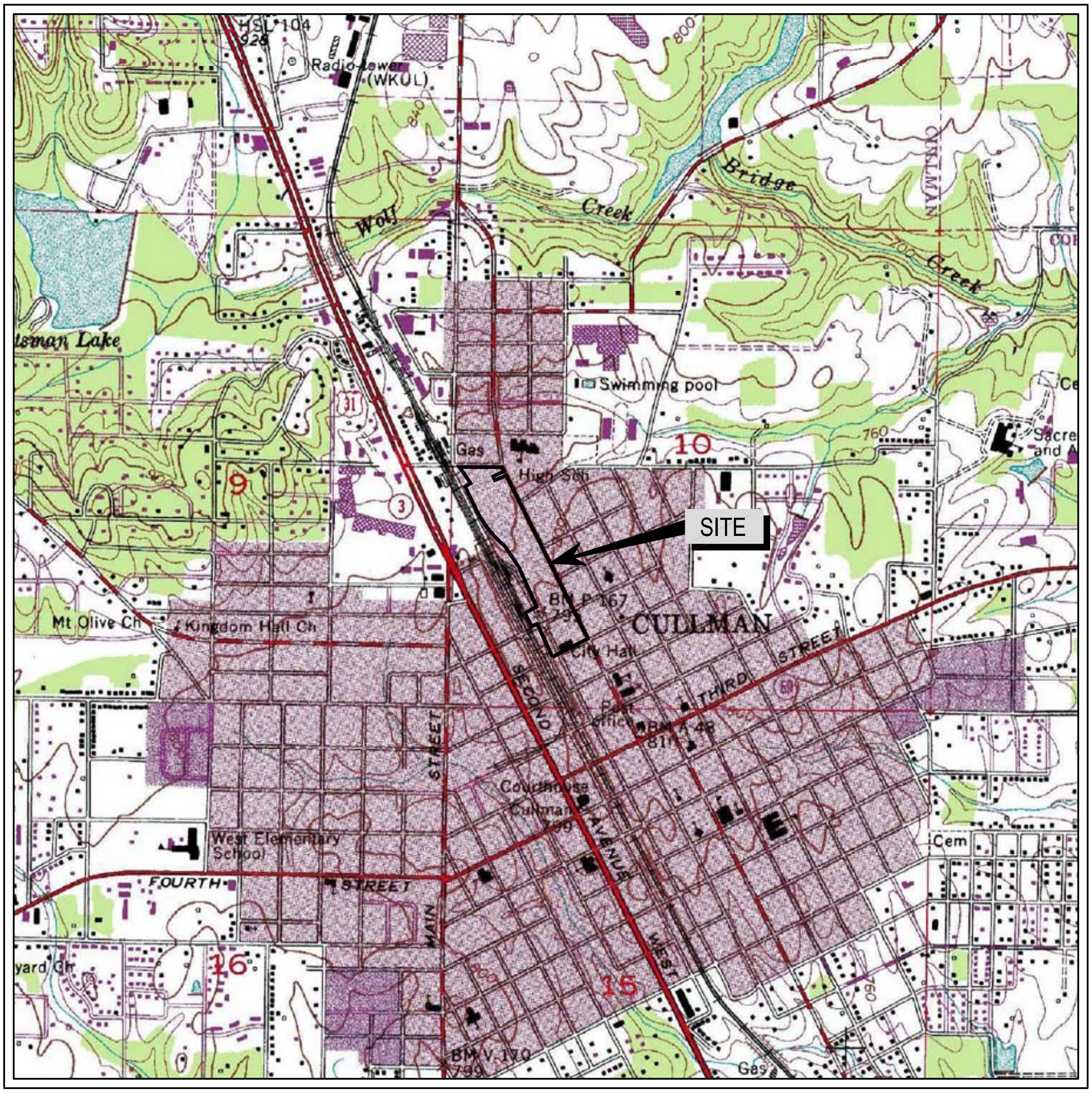
Project Sample ID			**MW-1**	**MW-2**	**MW-3**	**MW-4R**	**MW-6**	**MW-9**	**MW-10**	**MW-11**
Date Collected			05/23/2017	05/23/2017	05/23/2017	05/23/2017	05/23/2017	05/23/2017	05/23/2017	05/23/2017
Analyte	MCL	Tapwater RSL	Result	Result	Result	Result	Result	Result	Result	Result
Arsenic	0.01	0.000052	<0.01	**0.0202**	**0.0294**	<0.01	<0.01	<0.01	**0.0206**	<0.01
Barium	2	0.38	**0.0512**	**0.0855**	**0.194**	**0.0866**	**0.0623**	**0.124**	**0.431**	**0.209**
Cadmium	0.005	0.00092	<0.002	**0.0203**	**0.00242**	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium	0.1	2.2	<0.01	**0.0166**	**0.0919**	**0.0144**	<0.01	**0.0149**	**0.0743**	**0.0163**
Lead	0.015	0.015	<0.005	**0.0272**	**0.0485**	**0.00845**	<0.005	**0.00688**	**0.0677**	**0.0103**
Selenium	0.05	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Silver		0.0094	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Mercury	0.002	0.00057	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Acetone		1.4	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acrolein		0.0000042	<0.00887	<0.00887	<0.00887	<0.00887	<0.00887	<0.00887	<0.00887	<0.00887
Acrylonitrile		0.000052	<0.00187	<0.00187	<0.00187	<0.00187	<0.00187	<0.00187	<0.00187	<0.00187
Benzene	0.005	0.00046	<0.000331	<0.000331	<0.000331	<0.000331	**0.00429**	<0.000331	<0.000331	<0.000331
Bromobenzene		0.0062	<0.000352	<0.000352	<0.000352	<0.000352	<0.000352	<0.000352	<0.000352	<0.000352
Bromodichloromethane		0.00013	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038
Bromoform		0.0033	<0.000469	<0.000469	<0.000469	<0.000469	<0.000469	<0.000469	<0.000469	<0.000469
Bromomethane		0.00075	<0.000866	<0.000866	<0.000866	<0.000866	<0.000866	<0.000866	<0.000866	<0.000866
n-Butylbenzene		0.1	<0.000361	<0.000361	<0.000361	<0.000361	<0.000361	<0.000361	<0.000361	<0.000361
sec-Butylbenzene		0.2	<0.000365	<0.000365	<0.000365	<0.000365	<0.000365	<0.000365	**0.00158**	<0.000365
tert-Butylbenzene		0.069	<0.000399	<0.000399	<0.000399	<0.000399	<0.000399	<0.000399	<0.000399	<0.000399
Carbon tetrachloride	0.005	0.00046	<0.000379	<0.000379	<0.000379	<0.000379	<0.000379	<0.000379	<0.000379	<0.000379
Chlorobenzene	0.1	0.0078	<0.000348	<0.000348	<0.000348	<0.000348	<0.000348	<0.000348	<0.000348	<0.000348
Chlorodibromomethane		0.00087	<0.000327	<0.000327	<0.000327	<0.000327	<0.000327	<0.000327	<0.000327	<0.000327
Chloroethane		2.1	<0.000453	<0.000453	<0.000453	<0.000453	<0.000453	<0.000453	<0.000453	<0.000453
2-Chloroethyl vinyl ether			<0.00301	<0.00301	<0.00301	<0.00301	<0.00301	<0.00301	<0.00301	<0.00301
Chloroform		0.00022	<0.000324	<0.000324	<0.000324	<0.000324	<0.000324	<0.000324	<0.000324	<0.000324
Chloromethane		0.019	<0.000276	<0.000276	<0.000276	<0.000276	<0.000276	<0.000276	<0.000276	<0.000276
2-Chlorotoluene		0.024	<0.000375	<0.000375	<0.000375	<0.000375	<0.000375	<0.000375	<0.000375	<0.000375
4-Chlorotoluene		0.025	<0.000351	<0.000351	<0.000351	<0.000351	<0.000351	<0.000351	<0.000351	<0.000351
1,2-Dibromo-3-Chloropropane	0.0002	3.3E-07	<0.00133	<0.00133	<0.00133	<0.00133	<0.00133	<0.00133	<0.00133	<0.00133
1,2-Dibromoethane	0.00005	0.0000075	<0.000381	<0.000381	<0.000381	<0.000381	<0.000381	<0.000381	<0.000381	<0.000381
Dibromomethane		0.00083	<0.000346	<0.000346	<0.000346	<0.000346	<0.000346	<0.000346	<0.000346	<0.000346
1,2-Dichlorobenzene	0.6	0.03	<0.000349	<0.000349	<0.000349	<0.000349	<0.000349	<0.000349	**0.00307**	<0.000349
1,3-Dichlorobenzene			<0.00022	<0.00022	<0.00022	<0.00022	<0.00022	<0.00022	<0.00022	<0.00022
1,4-Dichlorobenzene	0.075	0.00048	<0.000274	<0.000274	<0.000274	<0.000274	<0.000274	<0.000274	<0.000274	<0.000274
Dichlorodifluoromethane		0.02	<0.000551	<0.000551	<0.000551	<0.000551	<0.000551	<0.000551	<0.000551	<0.000551
1,1-Dichloroethane		0.0028	**0.00326**	<0.000259	**0.0732**	<0.000259	**0.0107**	<0.000259	**0.00376**	<0.000259
1,2-Dichloroethane	0.005	0.00017	<0.000361	<0.000361	<0.000361	<0.000361	**0.00446**	<0.000361	<0.000361	<0.000361
1,1-Dichloroethene	0.007	0.028	**0.0027**	<0.000398	**0.105**	<0.000398	**0.0247**	**0.00347**	**0.0421**	<0.000398
cis-1,2-Dichloroethene	0.07	0.0036	**0.0441**	**0.00633**	**0.882**	<0.00026	**11.5**	**0.146**	**0.38**	<0.00026
trans-1,2-Dichloroethene	0.1	0.036	<0.000396	<0.000396	**0.0059**	<0.000396	**0.0445**	**0.00215**	**0.00244**	<0.000396
1,2-Dichloropropane	0.005	0.00014	<0.000306	<0.000306	<0.000306	<0.000306	<0.000306	<0.000306	<0.000306	<0.000306
1,1-Dichloropropene			<0.000352	<0.000352	<0.000352	<0.000352	<0.000352	<0.000352	<0.000352	<0.000352
1,3-Dichloropropane		0.037	<0.000366	<0.000366	<0.000366	<0.000366	<0.000366	<0.000366	<0.000366	<0.000366
cis-1,3-Dichloropropene		0.00047	<0.000418	<0.000418	<0.000418	<0.000418	<0.000418	<0.000418	<0.000418	<0.000418
trans-1,3-Dichloropropene		0.00047	<0.000419	<0.000419	<0.000419	<0.000419	<0.000419	<0.000419	<0.000419	<0.000419
2,2-Dichloropropane			<0.000321	<0.000321	<0.000321	<0.000321	<0.000321	<0.000321	<0.000321	<0.000321
Di-isopropyl ether		0.15	<0.00032	<0.00032	<0.00032	<0.00032	<0.00032	<0.00032	<0.00032	<0.00032
Ethylbenzene	0.7	0.0015	<0.000384	<0.000384	<0.000384	<0.000384	<0.000384	<0.000384	<0.000384	<0.000384
Hexachloro-1,3-butadiene		0.00014	<0.000256	<0.000256	<0.000256	<0.000256	<0.000256	<0.000256	<0.000256	<0.000256
Isopropylbenzene		0.045	<0.000326	<0.000326	<0.000326	<0.000326	**0.00258**	<0.000326	**0.00117**	<0.000326
p-Isopropyltoluene			<0.00035	<0.00035	<0.00035	<0.00035	<0.00035	<0.00035	<0.00035	<0.00035
2-Butanone (MEK)		0.56	<0.00393	<0.00393	<0.00393	<0.00393	<0.00393	<0.00393	<0.00393	<0.00393
Methylene Chloride	0.005	0.011	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-Methyl-2-pentanone (MIBK)		0.63	<0.00214	<0.00214	<0.00214	<0.00214	<0.00214	<0.00214	<0.00214	<0.00214
Methyl tert-butyl ether		0.014	<0.000367	<0.000367	<0.000367	<0.000367	<0.000367	<0.000367	<0.000367	<0.000367
Naphthalene		0.00017	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
n-Propylbenzene		0.066	<0.000349	<0.000349	<0.000349	<0.000349	<0.000349	<0.000349	<0.000349	<0.000349
Styrene	0.1	0.12	<0.000307	<0.000307	<0.000307	<0.000307	<0.000307	<0.000307	<0.000307	<0.000307
1,1,1,2-Tetrachloroethane		0.00057	<0.000385	<0.000385	<0.000385	<0.000385	<0.000385	<0.000385	<0.000385	<0.000385
1,1,2,2-Tetrachloroethane		0.000076	<0.00013	<0.00013	<0.00013	<0.00013	<0.00013	<0.00013	<0.00013	<0.00013
1,1,2-Trichlorotrifluoroethane		0.1	<0.000303	<0.000303	<0.000303	<0.000303	<0.000303	<0.000303	<0.000303	<0.000303
Tetrachloroethene	0.005	0.0041	<0.000372	<0.000372	<0.000372	<0.000372	<0.000372	<0.000372	**0.0189**	<0.000372
Toluene	1	0.11	<0.000412	<0.000412	<0.000412	<0.000412	<0.000412	<0.000412	<0.000412	<0.000412
1,2,3-Trichlorobenzene		0.0007	<0.00023	<0.00023	<0.00023	<0.00023	<0.00023	<0.00023	<0.00023	<0.00023
1,2,4-Trichlorobenzene	0.07	0.0004	<0.000355	<0.000355	<0.000355	<0.000355	<0.000355	<0.000355	<0.000355	<0.000355
1,1,1-Trichloroethane	0.2	0.8	<0.000319	<0.000319	<0.000319	<0.000319	<0.000319	<0.000319	<0.000319	<0.000319
1,1,2-Trichloroethane	0.005	0.000041	<0.000383	<0.000383	<0.000383	<0.000383	**0.00154**	<0.000383	<0.000383	<0.000383
Trichloroethene	0.005	0.00028	**0.0427**	<0.000398	**0.254**	**0.00102**	**0.429**	**0.109**	**1.4**	<0.000398
Trichlorofluoromethane		0.52	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012	<0.0012
1,2,3-Trichloropropane		7.5E-07	<0.000807	<0.000807	<0.000807	<0.000807	<0.000807	<0.000807	<0.000807	<0.000807
1,2,4-Trimethylbenzene		0.0056	<0.000373	<0.000373	<0.000373	<0.000373	<0.000373	<0.000373	<0.000373	<0.000373
1,2,3-Trimethylbenzene		0.0055	<0.000321	<0.000321	<0.000321	<0.000321	<0.000321	<0.000321	<0.000321	<0.000321
1,3,5-Trimethylbenzene		0.006	<0.000387	<0.000387	<0.000387	<0.000387	<0.000387	<0.000387	<0.000387	<0.000387
Vinyl chloride	0.002	0.000019	<0.000259	<0.000259	**0.0157**	<0.000259	**1.57**	**0.0148**	**0.00728**	<0.000259
Xylenes, Total	10	0.019	<0.00106	<0.00106	<0.00106	<0.00106	<0.00106	<0.00106	<0.00106	<0.00106

MCL = EPA Maximum Contaminant Level

Tapwater RSL -= Region 4 Regional Screening Levels for tapwater (June 2017, TR=1E-06 and THQ=0.1)

Results are in milligrams per liter (mg/L)

UNITED STATES — DEPARTMENT OF THE INTERIOR — GEOLOGICAL SURVEY



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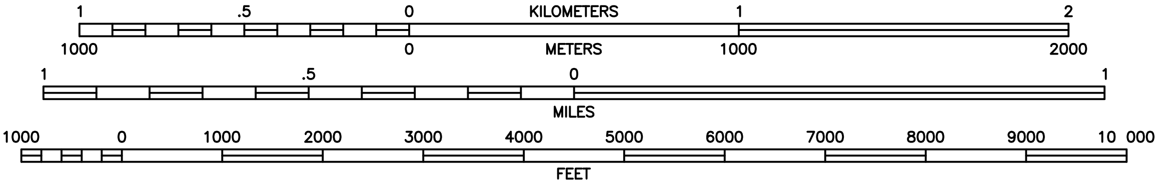


CONTOUR INTERVAL 20 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

QUADRANGLE
CULLMAN, AL
1997

7.5 MINUTE SERIES (TOPOGRAPHIC)

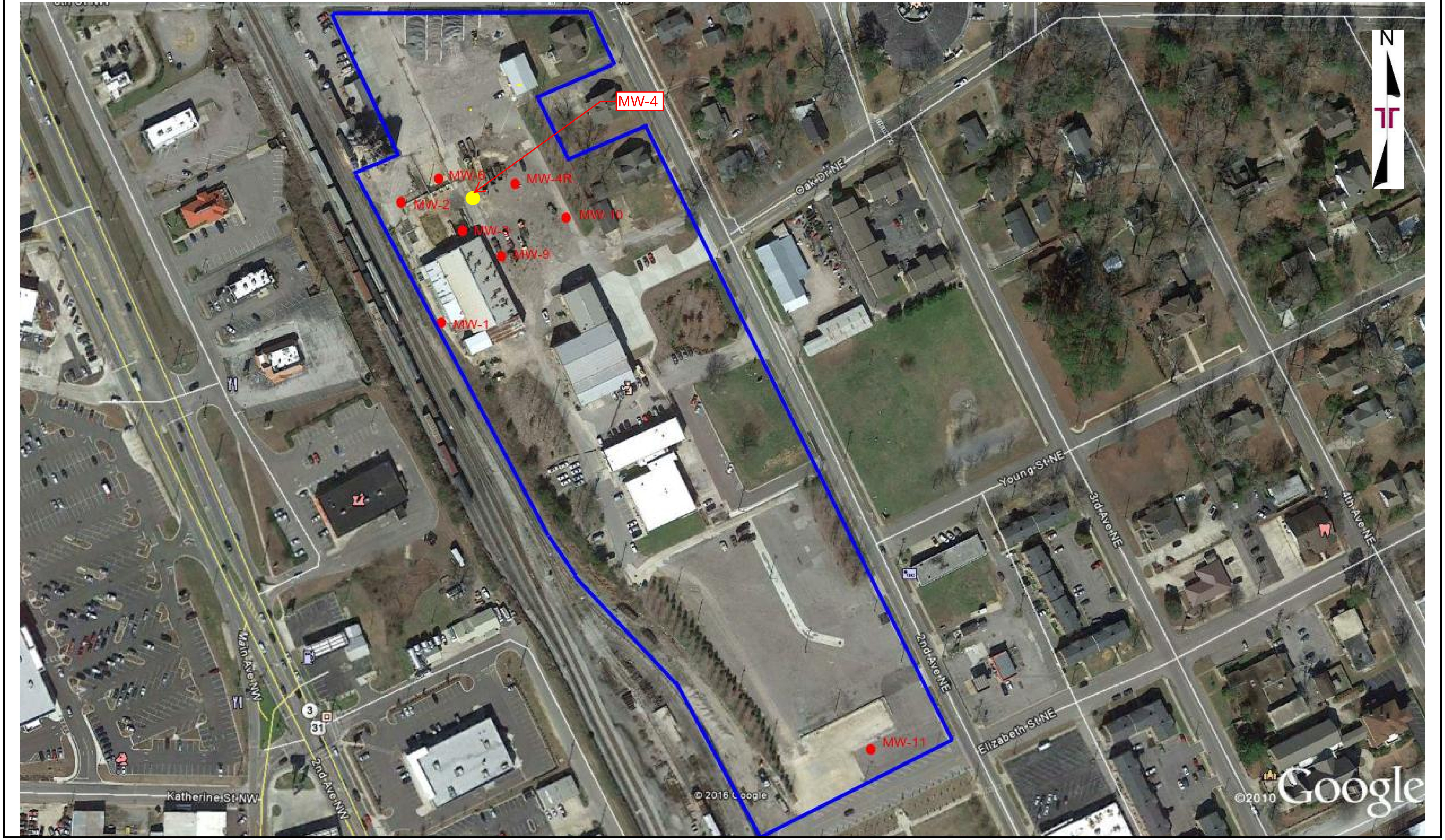
Project Mngr:	JEN	Project No.	E1177003
Drawn By:	TLY	Scale:	AS SHOWN
Checked By:	JEN/MRF	File No.	ESAE1177003-1
Approved By:	TWR	Date:	MARCH 2017

Terracon
Consulting Engineers and Scientists
110 12th Street North Birmingham, Alabama 35203
(205) 942-1289 (205) 443-5302

TOPOGRAPHIC VICINITY MAP

May 2017 Groundwater Monitoring Report
Former Greif Brothers Site
2ND AVENUE NORTHEAST
CULLMAN, CULLMAN COUNTY, AL

Figure
1



Project Manager:	TWR
Drawn By:	TWR
Checked By:	TWR
Approved By:	TWR

Project No.	E1177003
Scale:	1" ≈ 215'
File Name:	
Date:	6/6/17

Terracon
Consulting Engineers & Scientists
110 12th Street North Birmingham, Alabama 35203
PH. (205) 942-1289 FAX. (205) 443-5302

Site Map

Former Greif Brothers Site
Cullman, Cullman County, Alabama

FIGURE

2

Office Location: Birmingham, AL.

Terracon provides Geotechnical, Environmental, Construction Materials, and Facilities Consulting Engineering Services delivered with responsiveness, resourcefulness, and reliability.

SITE: Former Greif Brothers Site

PROJECT #: E1177003

WELL ID: **MW-1**

DATE: 05/23/17

SAMPLE TYPE: Grab

CITY, STATE Cullman, Al

SAMPLED BY: Kyle Haggard

WEATHER: Cloudy, 70's

MONITORING WELL SAMPLING RECORD

WELL MEASUREMENT TIME:	1520
DEPTH TO WATER (feet):	1.40
TOTAL DEPTH OF WELL (feet):	7.63
WATER COLUMN (feet):	6.23
ONE WELL VOLUME (gal):	1.02
THREE WELL VOLUMES (gal):	3.05
ACTUAL GALLONS PURGED:	3.0
PURGE TIME:	1529
METHOD OF PURGING:	Bailer
METHOD OF SAMPLING:	Bailer
SAMPLE COLLECTION TIME:	1538

INTRINSIC GROUNDWATER PARAMETERS

TIME:	1529	1531	1533	1536
TEMPERATURE (°C):	22.20	21.67	21.70	21.68
SPECIFIC CONDUCTANCE (µs/cm):	106	103.0	104	104
pH (Standard Units):	8.67	8.46	8.39	8.34
DISSOLVED OXYGEN (mg/L)	2.30	2.51	2.57	2.63
ORP (mV):	234	225	222	222

REASON FOR SAMPLING:	Post Remediation
METHOD OF SHIPMENT:	FedEx to ESC Lab Sciences in Mt. Juliet, TN.
ANALYSIS:	VOCs by EPA Method 8260B and RCRA Metals by EPA Method 6010
CONTAINERS:	2 x 40 mL amber glass and 250 ml Plastic
PRESERVATIVE:	HCl

REMARKS

ESC - Environmental Science Corp.

^{o}C - degrees Celsius, µs/cm - micro Siemens per centimeter, mg/L - milligrams per Liter, mV - millivolts

ORP - Oxidation-Reduction Potential

SITE: Former Greif Brothers Site

PROJECT #: E1177003

WELL ID: **MW-2**

DATE: 05/23/17

SAMPLE TYPE: Grab

CITY, STATE Cullman, Al

SAMPLED BY: Kyle Haggard

WEATHER: Cloudy, 70's

MONITORING WELL SAMPLING RECORD

WELL MEASUREMENT TIME:	1417
DEPTH TO WATER (feet):	0.65
TOTAL DEPTH OF WELL (feet):	8.30
WATER COLUMN (feet):	7.65
ONE WELL VOLUME (gal):	1.25
THREE WELL VOLUMES (gal):	3.74
ACTUAL GALLONS PURGED:	3.75
PURGE TIME:	1422
METHOD OF PURGING:	Bailer
METHOD OF SAMPLING:	Bailer
SAMPLE COLLECTION TIME:	1433

INTRINSIC GROUNDWATER PARAMETERS

TIME:	1422	1425	1428	1431
TEMPERATURE (°C):	23.54	22.33	21.57	21.51
SPECIFIC CONDUCTANCE (µs/cm):	85	105	102	106
pH (Standard Units):	7.96	7.73	7.69	7.68
DISSOLVED OXYGEN (mg/L)	2.34	1.78	1.69	1.70
ORP (mV):	272	268	257	253

REASON FOR SAMPLING: Post Remediation

METHOD OF SHIPMENT: FedEx to ESC Lab Sciences in Mt. Juliet, TN.

ANALYSIS: VOCs by EPA Method 8260B and RCRA Metals by EPA Method 6010

CONTAINERS: 2 x 40 mL amber glass and 250 ml Plastic

PRESERVATIVE: HCl

REMARKS

ESC - Environmental Science Corp.

°C - degrees Celsius, µs/cm - micro Siemens per centimeter, mg/L - milligrams per Liter, mV - millivolts

ORP - Oxidation-Reduction Potential

Terracon

Office Location: Birmingham, AL.

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SITE: Former Greif Brothers Site

PROJECT #: E1177003

WELL ID: **MW-3**

DATE: 05/23/17

SAMPLE TYPE: Grab

CITY, STATE Cullman, Al

SAMPLED BY: Kyle Haggard

WEATHER: Cloudy, 70's

MONITORING WELL SAMPLING RECORD

WELL MEASUREMENT TIME:	1450
DEPTH TO WATER (feet):	1.92
TOTAL DEPTH OF WELL (feet):	5.75
WATER COLUMN (feet):	3.83
ONE WELL VOLUME (gal):	0.62
THREE WELL VOLUMES (gal):	1.87
ACTUAL GALLONS PURGED:	2.0
PURGE TIME:	1455
METHOD OF PURGING:	Bailer
METHOD OF SAMPLING:	Bailer
SAMPLE COLLECTION TIME:	1503

INTRINSIC GROUNDWATER PARAMETERS

TIME:	1455	1457	1459	1501
TEMPERATURE (°C):	20.75	21.72	21.84	21.82
SPECIFIC CONDUCTANCE (µs/cm):	161	147	151	152
pH (Standard Units):	7.93	8.15	8.23	8.22
DISSOLVED OXYGEN (mg/L)	2.15	1.87	1.31	1.25
ORP (mV):	256	238	230	231

REASON FOR SAMPLING:	Post Remediation
METHOD OF SHIPMENT:	FedEx to ESC Lab Sciences in Mt. Juliet, TN.
ANALYSIS:	VOCs by EPA Method 8260B and RCRA Metals by EPA Method 6010
CONTAINERS:	2 x 40 mL amber glass and 250 ml Plastic
PRESERVATIVE:	HCl

REMARKS

ESC - Environmental Science Corp.

^{o}C - degrees Celsius, µs/cm - micro Siemens per centimeter, mg/L - milligrams per Liter, mV - millivolts

ORP - Oxidation-Reduction Potential

Terracon

Office Location: Birmingham, AL.

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SITE:	Former Greif Brothers Site	PROJECT #:	E1177003
WELL ID:	**MW-4R**	DATE:	05/23/17
SAMPLE TYPE:	Grab	CITY, STATE	Cullman, Al
SAMPLED BY:	Kyle Haggard	WEATHER:	Cloudy, 70's

MONITORING WELL SAMPLING RECORD

WELL MEASUREMENT TIME:	1114
DEPTH TO WATER (feet):	1.16
TOTAL DEPTH OF WELL (feet):	11.10
WATER COLUMN (feet):	9.94
ONE WELL VOLUME (gal):	1.62
THREE WELL VOLUMES (gal):	4.86
ACTUAL GALLONS PURGED:	5.00
PURGE TIME:	1129
METHOD OF PURGING:	Bailer
METHOD OF SAMPLING:	Bailer
SAMPLE COLLECTION TIME:	1143

INTRINSIC GROUNDWATER PARAMETERS

TIME:	1129	1133	1137	1141
TEMPERATURE (°C):	24.44	24.26	24.25	24.19
SPECIFIC CONDUCTANCE (µs/cm):	775	233	219	194
pH (Standard Units):	7.75	7.83	7.88	7.93
DISSOLVED OXYGEN (mg/L)	2.38	2.26	2.39	2.34
ORP (mV):	343	295	278	274

REASON FOR SAMPLING:	Post Remediation
METHOD OF SHIPMENT:	FedEx to ESC Lab Sciences in Mt. Juliet, TN.
ANALYSIS:	VOCs by EPA Method 8260B and RCRA Metals by EPA Method 6010
CONTAINERS:	2 x 40 mL amber glass and 250 ml Plastic
PRESERVATIVE:	HCl

REMARKS

ESC - Environmental Science Corp.

^{o}C - degrees Celsius, µs/cm - micro Siemens per centimeter, mg/L - milligrams per Liter, mV - millivolts

ORP - Oxidation-Reduction Potential

Terracon

Office Location: Birmingham, AL.

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SITE: Former Greif Brothers Site
PROJECT #: E1177003
WELL ID: **MW-6**
DATE: 05/23/17
SAMPLE TYPE: Grab
CITY, STATE Cullman, Al
SAMPLED BY: Kyle Haggard
WEATHER: Cloudy, 70's

MONITORING WELL SAMPLING RECORD

WELL MEASUREMENT TIME: 1348
DEPTH TO WATER (feet): 5.92
TOTAL DEPTH OF WELL (feet): 9.06
WATER COLUMN (feet): 3.14
ONE WELL VOLUME (gal): 0.51
THREE WELL VOLUMES (gal): 1.54
ACTUAL GALLONS PURGED: 1.50
PURGE TIME: 1351
METHOD OF PURGING: Bailer
METHOD OF SAMPLING: Bailer
SAMPLE COLLECTION TIME: 1400

INTRINSIC GROUNDWATER PARAMETERS

TIME:	1351	1353	1355	1358
TEMPERATURE (°C):	23.90	23.75	23.70	23.65
SPECIFIC CONDUCTANCE (µs/cm):	227	243	229	217
pH (Standard Units):	6.83	7.11	7.18	7.21
DISSOLVED OXYGEN (mg/L)	3.93	3.84	3.62	3.57
ORP (mV):	295	277	263	257

REASON FOR SAMPLING: Post Remediation
METHOD OF SHIPMENT: FedEx to ESC Lab Sciences in Mt. Juliet, TN.
ANALYSIS: VOCs by EPA Method 8260B and RCRA Metals by EPA Method 6010
CONTAINERS: 2 x 40 mL amber glass and 250 ml Plastic
PRESERVATIVE: HCl

REMARKS

ESC - Environmental Science Corp.

°C - degrees Celsius, µs/cm - micro Siemens per centimeter, mg/L - milligrams per Liter, mV - millivolts

ORP - Oxidation-Reduction Potential

Terracon

Office Location: Birmingham, AL.

Terracon provides Geotechnical, Environmental, Construction Materials, and Facilities Consulting Engineering Services delivered with responsiveness, resourcefulness, and reliability.

SITE: Former Greif Brothers Site
PROJECT #: E1177003
WELL ID: **MW-9**
DATE: 05/23/17
SAMPLE TYPE: Grab
CITY, STATE Cullman, Al
SAMPLED BY: Kyle Haggard
WEATHER: Cloudy, 70's

MONITORING WELL SAMPLING RECORD

WELL MEASUREMENT TIME: 1310
DEPTH TO WATER (feet): 2.40
TOTAL DEPTH OF WELL (feet): 9.60
WATER COLUMN (feet): 7.20
ONE WELL VOLUME (gal): 1.17
THREE WELL VOLUMES (gal): 3.52
ACTUAL GALLONS PURGED: 3.50
PURGE TIME: 1318
METHOD OF PURGING: Bailer
METHOD OF SAMPLING: Bailer
SAMPLE COLLECTION TIME: 1324

INTRINSIC GROUNDWATER PARAMETERS

TIME:	1318	1320	1322	
TEMPERATURE (°C):	21.62	20.22	20.11	
SPECIFIC CONDUCTANCE (µs/cm):	49	44	55	
pH (Standard Units):	6.12	5.91	5.98	
DISSOLVED OXYGEN (mg/L)	3.97	3.03	3.16	
ORP (mV):	302	299	300	

REASON FOR SAMPLING: Post Remediation
METHOD OF SHIPMENT: FedEx to ESC Lab Sciences in Mt. Juliet, TN.
ANALYSIS: VOCs by EPA Method 8260B and RCRA Metals by EPA Method 6010
CONTAINERS: 2 x 40 mL amber glass and 250 ml Plastic
PRESERVATIVE: HCl

REMARKS

ESC - Environmental Science Corp.

^{o}C - degrees Celsius, µs/cm - micro Siemens per centimeter, mg/L - milligrams per Liter, mV - millivolts

ORP - Oxidation-Reduction Potential

SITE: Former Greif Brothers Site

PROJECT #: E1177003

WELL ID: **MW-10**

DATE: 05/23/17

SAMPLE TYPE: Grab

CITY, STATE Cullman, Al

SAMPLED BY: Kyle Haggard

WEATHER: Cloudy, 70's

MONITORING WELL SAMPLING RECORD

WELL MEASUREMENT TIME: 1228

DEPTH TO WATER (feet): 3.84

TOTAL DEPTH OF WELL (feet): 18.07

WATER COLUMN (feet): 14.23

ONE WELL VOLUME (gal): 2.32

THREE WELL VOLUMES (gal): 6.96

ACTUAL GALLONS PURGED: 7.0

PURGE TIME: 1239

METHOD OF PURGING: Bailer

METHOD OF SAMPLING: Bailer

SAMPLE COLLECTION TIME: 1252

INTRINSIC GROUNDWATER PARAMETERS

TIME:	1239	1242	1246	1250
TEMPERATURE (°C):	19.55	19.24	19.36	19.33
SPECIFIC CONDUCTANCE (µs/cm):	124	86.0	78	67
pH (Standard Units):	7.37	7.1	6.51	6.48
DISSOLVED OXYGEN (mg/L)	3.52	3.7	4.34	4.3
ORP (mV):	292	273	271	276

REASON FOR SAMPLING: Post Remediation

METHOD OF SHIPMENT: FedEx to ESC Lab Sciences in Mt. Juliet, TN.

ANALYSIS: VOCs by EPA Method 8260B and RCRA Metals by EPA Method 6010

CONTAINERS: 2 x 40 mL amber glass and 250 ml Plastic

PRESERVATIVE: HCl

REMARKS

ESC - Environmental Science Corp.

^{o}C - degrees Celsius, µs/cm - micro Siemens per centimeter, mg/L - milligrams per Liter, mV - millivolts

ORP - Oxidation-Reduction Potential

SITE: Former Greif Brothers Site
PROJECT #: E1177003
WELL ID: **MW-11**
DATE: 05/23/17
SAMPLE TYPE: Grab
CITY, STATE Cullman, Al
SAMPLED BY: Kyle Haggard
WEATHER: Cloudy, 70's

MONITORING WELL SAMPLING RECORD

WELL MEASUREMENT TIME:	1615
DEPTH TO WATER (feet):	23.51
TOTAL DEPTH OF WELL (feet):	35.02
WATER COLUMN (feet):	11.51
ONE WELL VOLUME (gal):	1.88
THREE WELL VOLUMES (gal):	5.63
ACTUAL GALLONS PURGED:	5.7
PURGE TIME:	1618
METHOD OF PURGING:	Bailer
METHOD OF SAMPLING:	Bailer
SAMPLE COLLECTION TIME:	1640

INTRINSIC GROUNDWATER PARAMETERS

TIME:	1618	1625	1631	1637
TEMPERATURE (°C):	20.75	20.70	20.68	20.66
SPECIFIC CONDUCTANCE (µs/cm):	87	72	69	67
pH (Standard Units):	7.68	7.57	7.49	7.46
DISSOLVED OXYGEN (mg/L)	1.94	2.50	2.44	2.41
ORP (mV):	219	209	206	202

REASON FOR SAMPLING: Post Remediation
METHOD OF SHIPMENT: FedEx to ESC Lab Sciences in Mt. Juliet, TN.
ANALYSIS: VOCs by EPA Method 8260B and RCRA Metals by EPA Method 6010
CONTAINERS: 2 x 40 mL amber glass and 250 ml Plastic
PRESERVATIVE: HCl

REMARKS

ESC - Environmental Science Corp.

^{o}C - degrees Celsius, µs/cm - micro Siemens per centimeter, mg/L - milligrams per Liter, mV - millivolts

ORP - Oxidation-Reduction Potential

L·A·B S·C·I·E·N·C·E·S
YOUR LAB OF CHOICE

ANALYTICAL REPORT

June 06, 2017

REAL TIME DATA ACCESS

Terracon - B-Ham, AL

Sample Delivery Group:	L911936
Samples Received:	05/25/2017
Project Number:	E1177003
Description:	Greif Property
Report To:	Terry Rippstein 110 12th Street North Birmingham, AL 35203

Entire Report Reviewed By: Jimmy Hunt

Jimmy Hunt
Technical Service Representative

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by ESC is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.

TABLE OF CONTENTS

SAMPLE SUMMARY

MW-1 L911936-01 GW

Collected by	Collected date/time	Received date/time
Kyle Haggard	05/23/17 15:38	05/25/17 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Mercury by Method 7470A	WG983653	1	05/27/17 06:25	05/30/17 11:39	EL
Metals (ICP) by Method 6010B	WG984463	1	06/01/17 12:58	06/01/17 15:39	ST
Volatile Organic Compounds (GC/MS) by Method 8260B	WG985377	1	06/02/17 17:29	06/02/17 17:29	JHH

MW-2 L911936-02 GW

Collected by	Collected date/time	Received date/time
Kyle Haggard	05/23/17 14:33	05/25/17 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Mercury by Method 7470A	WG983653	1	05/27/17 06:25	05/30/17 11:46	EL
Metals (ICP) by Method 6010B	WG984463	1	06/01/17 12:58	06/01/17 15:42	ST
Volatile Organic Compounds (GC/MS) by Method 8260B	WG985377	1	06/02/17 17:53	06/02/17 17:53	JHH

MW-3 L911936-03 GW

Collected by	Collected date/time	Received date/time
Kyle Haggard	05/23/17 13:03	05/25/17 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Mercury by Method 7470A	WG983653	1	05/27/17 06:25	05/30/17 11:48	EL
Metals (ICP) by Method 6010B	WG984463	1	06/01/17 12:58	06/01/17 15:44	ST
Volatile Organic Compounds (GC/MS) by Method 8260B	WG985377	1	06/02/17 18:16	06/02/17 18:16	JHH
Volatile Organic Compounds (GC/MS) by Method 8260B	WG985377	20	06/05/17 01:50	06/05/17 01:50	JHH

MW-4R L911936-04 GW

Collected by	Collected date/time	Received date/time
Kyle Haggard	05/23/17 11:43	05/25/17 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Mercury by Method 7470A	WG983653	1	05/27/17 06:25	05/30/17 11:50	EL
Metals (ICP) by Method 6010B	WG984463	1	06/01/17 12:58	06/01/17 15:47	ST
Volatile Organic Compounds (GC/MS) by Method 8260B	WG985379	1	06/05/17 01:22	06/05/17 01:22	JHH

MW-6 L911936-05 GW

Collected by	Collected date/time	Received date/time
Kyle Haggard	05/23/17 14:00	05/25/17 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Mercury by Method 7470A	WG983653	1	05/27/17 06:25	05/30/17 11:52	EL
Metals (ICP) by Method 6010B	WG984463	1	06/01/17 12:58	06/01/17 15:56	ST
Volatile Organic Compounds (GC/MS) by Method 8260B	WG985379	1	06/02/17 15:00	06/02/17 15:00	JHH
Volatile Organic Compounds (GC/MS) by Method 8260B	WG985379	250	06/05/17 01:37	06/05/17 01:37	JHH

MW-9 L911936-06 GW

Collected by	Collected date/time	Received date/time
Kyle Haggard	05/23/17 13:24	05/25/17 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Mercury by Method 7470A	WG983653	1	05/27/17 06:25	05/30/17 11:55	EL
Metals (ICP) by Method 6010B	WG984463	1	06/01/17 12:58	06/01/17 15:58	ST
Volatile Organic Compounds (GC/MS) by Method 8260B	WG985379	1	06/02/17 15:22	06/02/17 15:22	JHH
Volatile Organic Compounds (GC/MS) by Method 8260B	WG985379	1	06/05/17 01:53	06/05/17 01:53	JHH

MW-10 L911936-07 GW

Collected by	Collected date/time	Received date/time
Kyle Haggard	05/23/17 12:52	05/25/17 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Mercury by Method 7470A	WG983653	1	05/27/17 06:25	05/30/17 11:57	EL
Metals (ICP) by Method 6010B	WG984463	1	06/01/17 12:58	06/01/17 16:01	ST
Volatile Organic Compounds (GC/MS) by Method 8260B	WG985379	1	06/02/17 18:15	06/02/17 18:15	JHH
Volatile Organic Compounds (GC/MS) by Method 8260B	WG985379	50	06/05/17 02:09	06/05/17 02:09	JHH

MW-11 L911936-08 GW

Collected by	Collected date/time	Received date/time
Kyle Haggard	05/23/17 16:40	05/25/17 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Mercury by Method 7470A	WG983653	1	05/27/17 06:25	05/30/17 11:59	EL
Metals (ICP) by Method 6010B	WG984463	1	06/01/17 12:58	06/01/17 16:04	ST
Volatile Organic Compounds (GC/MS) by Method 8260B	WG985379	1	06/02/17 18:28	06/02/17 18:28	JHH
Volatile Organic Compounds (GC/MS) by Method 8260B	WG985379	1	06/05/17 02:24	06/05/17 02:24	JHH

DUPLICATE L911936-09 GW

Collected by	Collected date/time	Received date/time
Kyle Haggard	05/23/17 00:00	05/25/17 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Mercury by Method 7470A	WG983653	1	05/27/17 06:25	05/30/17 12:07	EL
Metals (ICP) by Method 6010B	WG984463	1	06/01/17 12:58	06/01/17 16:07	ST
Volatile Organic Compounds (GC/MS) by Method 8260B	WG985379	1	06/02/17 18:42	06/02/17 18:42	JHH

TRIP BLANK L911936-10 GW

Collected by	Collected date/time	Received date/time
Kyle Haggard	05/23/17 00:00	05/25/17 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC/MS) by Method 8260B	WG985379	1	06/02/17 14:33	06/02/17 14:33	JHH

All MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Jimmy Hunt

Jimmy Hunt
Technical Service Representative

Sample Handling and Receiving

The analysis for 2-Chloroethyl Vinyl Ether was conducted from a chemically preserved container.

ESC Sample ID	Project Sample ID	Method
L911936-01	MW-1	8260B
L911936-02	MW-2	8260B
L911936-04	MW-4R	8260B
L911936-05	MW-6	8260B
L911936-06	MW-9	8260B
L911936-07	MW-10	8260B
L911936-08	MW-11	8260B
L911936-09	DUPLICATE	8260B
L911936-10	TRIP BLANK	8260B

VOC pH outside of method requirement.

ESC Sample ID	Project Sample ID	Method
L911936-03	MW-3	8260B

MW-1

SAMPLE RESULTS - 01

Collected date/time: 05/23/17 15:38

L911936

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Mercury by Method 7470A

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Mercury	ND		0.000200	1	05/30/2017 11:39	WG983653

Metals (ICP) by Method 6010B

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Arsenic	ND		0.0100	1	06/01/2017 15:39	WG984463
Barium	0.0512		0.00500	1	06/01/2017 15:39	WG984463
Cadmium	ND		0.00200	1	06/01/2017 15:39	WG984463
Chromium	ND		0.0100	1	06/01/2017 15:39	WG984463
Lead	ND		0.00500	1	06/01/2017 15:39	WG984463
Selenium	ND		0.0100	1	06/01/2017 15:39	WG984463
Silver	ND		0.00500	1	06/01/2017 15:39	WG984463

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Acetone	ND		0.0500	1	06/02/2017 17:29	WG985377
Acrolein	ND	J4	0.0500	1	06/02/2017 17:29	WG985377
Acrylonitrile	ND		0.0100	1	06/02/2017 17:29	WG985377
Benzene	ND		0.00100	1	06/02/2017 17:29	WG985377
Bromobenzene	ND		0.00100	1	06/02/2017 17:29	WG985377
Bromodichloromethane	ND		0.00100	1	06/02/2017 17:29	WG985377
Bromoform	ND		0.00100	1	06/02/2017 17:29	WG985377
Bromomethane	ND	J3	0.00500	1	06/02/2017 17:29	WG985377
n-Butylbenzene	ND		0.00100	1	06/02/2017 17:29	WG985377
sec-Butylbenzene	ND		0.00100	1	06/02/2017 17:29	WG985377
tert-Butylbenzene	ND		0.00100	1	06/02/2017 17:29	WG985377
Carbon tetrachloride	ND		0.00100	1	06/02/2017 17:29	WG985377
Chlorobenzene	ND		0.00100	1	06/02/2017 17:29	WG985377
Chlorodibromomethane	ND		0.00100	1	06/02/2017 17:29	WG985377
Chloroethane	ND		0.00500	1	06/02/2017 17:29	WG985377
2-Chloroethyl vinyl ether	ND		0.0500	1	06/02/2017 17:29	WG985377
Chloroform	ND		0.00500	1	06/02/2017 17:29	WG985377
Chloromethane	ND		0.00250	1	06/02/2017 17:29	WG985377
2-Chlorotoluene	ND		0.00100	1	06/02/2017 17:29	WG985377
4-Chlorotoluene	ND		0.00100	1	06/02/2017 17:29	WG985377
1,2-Dibromo-3-Chloropropane	ND		0.00500	1	06/02/2017 17:29	WG985377
1,2-Dibromoethane	ND		0.00100	1	06/02/2017 17:29	WG985377
Dibromomethane	ND		0.00100	1	06/02/2017 17:29	WG985377
1,2-Dichlorobenzene	ND		0.00100	1	06/02/2017 17:29	WG985377
1,3-Dichlorobenzene	ND		0.00100	1	06/02/2017 17:29	WG985377
1,4-Dichlorobenzene	ND		0.00100	1	06/02/2017 17:29	WG985377
Dichlorodifluoromethane	ND		0.00500	1	06/02/2017 17:29	WG985377
1,1-Dichloroethane	0.00326		0.00100	1	06/02/2017 17:29	WG985377
1,2-Dichloroethane	ND		0.00100	1	06/02/2017 17:29	WG985377
1,1-Dichloroethene	0.00270		0.00100	1	06/02/2017 17:29	WG985377
cis-1,2-Dichloroethene	0.0441		0.00100	1	06/02/2017 17:29	WG985377
trans-1,2-Dichloroethene	ND		0.00100	1	06/02/2017 17:29	WG985377
1,2-Dichloropropane	ND		0.00100	1	06/02/2017 17:29	WG985377
1,1-Dichloropropene	ND		0.00100	1	06/02/2017 17:29	WG985377
1,3-Dichloropropane	ND		0.00100	1	06/02/2017 17:29	WG985377
cis-1,3-Dichloropropene	ND		0.00100	1	06/02/2017 17:29	WG985377
trans-1,3-Dichloropropene	ND		0.00100	1	06/02/2017 17:29	WG985377
2,2-Dichloropropane	ND		0.00100	1	06/02/2017 17:29	WG985377
Di-isopropyl ether	ND		0.00100	1	06/02/2017 17:29	WG985377

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Ethylbenzene	ND		0.00100	1	06/02/2017 17:29	WG985377
Hexachloro-1,3-butadiene	ND		0.00100	1	06/02/2017 17:29	WG985377
Isopropylbenzene	ND		0.00100	1	06/02/2017 17:29	WG985377
p-Isopropyltoluene	ND		0.00100	1	06/02/2017 17:29	WG985377
2-Butanone (MEK)	ND		0.0100	1	06/02/2017 17:29	WG985377
Methylene Chloride	ND		0.00500	1	06/02/2017 17:29	WG985377
4-Methyl-2-pentanone (MIBK)	ND		0.0100	1	06/02/2017 17:29	WG985377
Methyl tert-butyl ether	ND		0.00100	1	06/02/2017 17:29	WG985377
Naphthalene	ND		0.00500	1	06/02/2017 17:29	WG985377
n-Propylbenzene	ND		0.00100	1	06/02/2017 17:29	WG985377
Styrene	ND		0.00100	1	06/02/2017 17:29	WG985377
1,1,1,2-Tetrachloroethane	ND		0.00100	1	06/02/2017 17:29	WG985377
1,1,2,2-Tetrachloroethane	ND		0.00100	1	06/02/2017 17:29	WG985377
1,1,2-Trichlorotrifluoroethane	ND		0.00100	1	06/02/2017 17:29	WG985377
Tetrachloroethene	ND		0.00100	1	06/02/2017 17:29	WG985377
Toluene	ND		0.00100	1	06/02/2017 17:29	WG985377
1,2,3-Trichlorobenzene	ND		0.00100	1	06/02/2017 17:29	WG985377
1,2,4-Trichlorobenzene	ND		0.00100	1	06/02/2017 17:29	WG985377
1,1,1-Trichloroethane	ND		0.00100	1	06/02/2017 17:29	WG985377
1,1,2-Trichloroethane	ND		0.00100	1	06/02/2017 17:29	WG985377
Trichloroethene	0.0427		0.00100	1	06/02/2017 17:29	WG985377
Trichlorofluoromethane	ND		0.00500	1	06/02/2017 17:29	WG985377
1,2,3-Trichloropropane	ND		0.00250	1	06/02/2017 17:29	WG985377
1,2,4-Trimethylbenzene	ND		0.00100	1	06/02/2017 17:29	WG985377
1,2,3-Trimethylbenzene	ND		0.00100	1	06/02/2017 17:29	WG985377
1,3,5-Trimethylbenzene	ND		0.00100	1	06/02/2017 17:29	WG985377
Vinyl chloride	ND		0.00100	1	06/02/2017 17:29	WG985377
Xylenes, Total	ND		0.00300	1	06/02/2017 17:29	WG985377
(S) Toluene-d8	*100*		*80.0-120*		*06/02/2017 17:29*	WG985377
(S) Dibromofluoromethane	*90.0*		*76.0-123*		*06/02/2017 17:29*	WG985377
(S) 4-Bromofluorobenzene	*98.8*		*80.0-120*		*06/02/2017 17:29*	WG985377

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Mercury by Method 7470A

	Result	Qualifier	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l		date / time	
Mercury	ND		0.000200	1	05/30/2017 11:46	WG983653

Metals (ICP) by Method 6010B

	Result	Qualifier	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l		date / time	
Arsenic	0.0202		0.0100	1	06/01/2017 15:42	WG984463
Barium	0.0855		0.00500	1	06/01/2017 15:42	WG984463
Cadmium	0.0203		0.00200	1	06/01/2017 15:42	WG984463
Chromium	0.0166		0.0100	1	06/01/2017 15:42	WG984463
Lead	0.0272		0.00500	1	06/01/2017 15:42	WG984463
Selenium	ND		0.0100	1	06/01/2017 15:42	WG984463
Silver	ND		0.00500	1	06/01/2017 15:42	WG984463

Volatile Organic Compounds (GC/MS) by Method 8260B

	Result	Qualifier	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l		date / time	
Acetone	ND		0.0500	1	06/02/2017 17:53	WG985377
Acrolein	ND	J4	0.0500	1	06/02/2017 17:53	WG985377
Acrylonitrile	ND		0.0100	1	06/02/2017 17:53	WG985377
Benzene	ND		0.00100	1	06/02/2017 17:53	WG985377
Bromobenzene	ND		0.00100	1	06/02/2017 17:53	WG985377
Bromodichloromethane	ND		0.00100	1	06/02/2017 17:53	WG985377
Bromoform	ND		0.00100	1	06/02/2017 17:53	WG985377
Bromomethane	ND	J3	0.00500	1	06/02/2017 17:53	WG985377
n-Butylbenzene	ND		0.00100	1	06/02/2017 17:53	WG985377
sec-Butylbenzene	ND		0.00100	1	06/02/2017 17:53	WG985377
tert-Butylbenzene	ND		0.00100	1	06/02/2017 17:53	WG985377
Carbon tetrachloride	ND		0.00100	1	06/02/2017 17:53	WG985377
Chlorobenzene	ND		0.00100	1	06/02/2017 17:53	WG985377
Chlorodibromomethane	ND		0.00100	1	06/02/2017 17:53	WG985377
Chloroethane	ND		0.00500	1	06/02/2017 17:53	WG985377
2-Chloroethyl vinyl ether	ND		0.0500	1	06/02/2017 17:53	WG985377
Chloroform	ND		0.00500	1	06/02/2017 17:53	WG985377
Chloromethane	ND		0.00250	1	06/02/2017 17:53	WG985377
2-Chlorotoluene	ND		0.00100	1	06/02/2017 17:53	WG985377
4-Chlorotoluene	ND		0.00100	1	06/02/2017 17:53	WG985377
1,2-Dibromo-3-Chloropropane	ND		0.00500	1	06/02/2017 17:53	WG985377
1,2-Dibromoethane	ND		0.00100	1	06/02/2017 17:53	WG985377
Dibromomethane	ND		0.00100	1	06/02/2017 17:53	WG985377
1,2-Dichlorobenzene	ND		0.00100	1	06/02/2017 17:53	WG985377
1,3-Dichlorobenzene	ND		0.00100	1	06/02/2017 17:53	WG985377
1,4-Dichlorobenzene	ND		0.00100	1	06/02/2017 17:53	WG985377
Dichlorodifluoromethane	ND		0.00500	1	06/02/2017 17:53	WG985377
1,1-Dichloroethane	ND		0.00100	1	06/02/2017 17:53	WG985377
1,2-Dichloroethane	ND		0.00100	1	06/02/2017 17:53	WG985377
1,1-Dichloroethene	ND		0.00100	1	06/02/2017 17:53	WG985377
cis-1,2-Dichloroethene	0.00633		0.00100	1	06/02/2017 17:53	WG985377
trans-1,2-Dichloroethene	ND		0.00100	1	06/02/2017 17:53	WG985377
1,2-Dichloropropane	ND		0.00100	1	06/02/2017 17:53	WG985377
1,1-Dichloropropene	ND		0.00100	1	06/02/2017 17:53	WG985377
1,3-Dichloropropane	ND		0.00100	1	06/02/2017 17:53	WG985377
cis-1,3-Dichloropropene	ND		0.00100	1	06/02/2017 17:53	WG985377
trans-1,3-Dichloropropene	ND		0.00100	1	06/02/2017 17:53	WG985377
2,2-Dichloropropane	ND		0.00100	1	06/02/2017 17:53	WG985377
Di-isopropyl ether	ND		0.00100	1	06/02/2017 17:53	WG985377

Volatile Organic Compounds (GC/MS) by Method 8260B

	Result	Qualifier	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l		date / time	
Ethylbenzene	ND		0.00100	1	06/02/2017 17:53	WG985377
Hexachloro-1,3-butadiene	ND		0.00100	1	06/02/2017 17:53	WG985377
Isopropylbenzene	ND		0.00100	1	06/02/2017 17:53	WG985377
p-Isopropyltoluene	ND		0.00100	1	06/02/2017 17:53	WG985377
2-Butanone (MEK)	ND		0.0100	1	06/02/2017 17:53	WG985377
Methylene Chloride	ND		0.00500	1	06/02/2017 17:53	WG985377
4-Methyl-2-pentanone (MIBK)	ND		0.0100	1	06/02/2017 17:53	WG985377
Methyl tert-butyl ether	ND		0.00100	1	06/02/2017 17:53	WG985377
Naphthalene	ND		0.00500	1	06/02/2017 17:53	WG985377
n-Propylbenzene	ND		0.00100	1	06/02/2017 17:53	WG985377
Styrene	ND		0.00100	1	06/02/2017 17:53	WG985377
1,1,1,2-Tetrachloroethane	ND		0.00100	1	06/02/2017 17:53	WG985377
1,1,2,2-Tetrachloroethane	ND		0.00100	1	06/02/2017 17:53	WG985377
1,1,2-Trichlorotrifluoroethane	ND		0.00100	1	06/02/2017 17:53	WG985377
Tetrachloroethene	ND		0.00100	1	06/02/2017 17:53	WG985377
Toluene	ND		0.00100	1	06/02/2017 17:53	WG985377
1,2,3-Trichlorobenzene	ND		0.00100	1	06/02/2017 17:53	WG985377
1,2,4-Trichlorobenzene	ND		0.00100	1	06/02/2017 17:53	WG985377
1,1,1-Trichloroethane	ND		0.00100	1	06/02/2017 17:53	WG985377
1,1,2-Trichloroethane	ND		0.00100	1	06/02/2017 17:53	WG985377
Trichloroethene	ND		0.00100	1	06/02/2017 17:53	WG985377
Trichlorofluoromethane	ND		0.00500	1	06/02/2017 17:53	WG985377
1,2,3-Trichloropropane	ND		0.00250	1	06/02/2017 17:53	WG985377
1,2,4-Trimethylbenzene	ND		0.00100	1	06/02/2017 17:53	WG985377
1,2,3-Trimethylbenzene	ND		0.00100	1	06/02/2017 17:53	WG985377
1,3,5-Trimethylbenzene	ND		0.00100	1	06/02/2017 17:53	WG985377
Vinyl chloride	ND		0.00100	1	06/02/2017 17:53	WG985377
Xylenes, Total	ND		0.00300	1	06/02/2017 17:53	WG985377
(S) Toluene-d8	*101*		*80.0-120*		*06/02/2017 17:53*	WG985377
(S) Dibromofluoromethane	*88.7*		*76.0-123*		*06/02/2017 17:53*	WG985377
(S) 4-Bromofluorobenzene	*98.6*		*80.0-120*		*06/02/2017 17:53*	WG985377

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Mercury by Method 7470A

	Result	Qualifier	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l		date / time	
Mercury	ND		0.000200	1	05/30/2017 11:48	WG983653

Metals (ICP) by Method 6010B

	Result	Qualifier	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l		date / time	
Arsenic	0.0294		0.0100	1	06/01/2017 15:44	WG984463
Barium	0.194		0.00500	1	06/01/2017 15:44	WG984463
Cadmium	0.00242		0.00200	1	06/01/2017 15:44	WG984463
Chromium	0.0919		0.0100	1	06/01/2017 15:44	WG984463
Lead	0.0485		0.00500	1	06/01/2017 15:44	WG984463
Selenium	ND		0.0100	1	06/01/2017 15:44	WG984463
Silver	ND		0.00500	1	06/01/2017 15:44	WG984463

Volatile Organic Compounds (GC/MS) by Method 8260B

	Result	Qualifier	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l		date / time	
Acetone	ND		0.0500	1	06/02/2017 18:16	WG985377
Acrolein	ND	J4	0.0500	1	06/02/2017 18:16	WG985377
Acrylonitrile	ND		0.0100	1	06/02/2017 18:16	WG985377
Benzene	ND		0.00100	1	06/02/2017 18:16	WG985377
Bromobenzene	ND		0.00100	1	06/02/2017 18:16	WG985377
Bromodichloromethane	ND		0.00100	1	06/02/2017 18:16	WG985377
Bromoform	ND		0.00100	1	06/02/2017 18:16	WG985377
Bromomethane	ND	J3	0.00500	1	06/02/2017 18:16	WG985377
n-Butylbenzene	ND		0.00100	1	06/02/2017 18:16	WG985377
sec-Butylbenzene	ND		0.00100	1	06/02/2017 18:16	WG985377
tert-Butylbenzene	ND		0.00100	1	06/02/2017 18:16	WG985377
Carbon tetrachloride	ND		0.00100	1	06/02/2017 18:16	WG985377
Chlorobenzene	ND		0.00100	1	06/02/2017 18:16	WG985377
Chlorodibromomethane	ND		0.00100	1	06/02/2017 18:16	WG985377
Chloroethane	ND		0.00500	1	06/02/2017 18:16	WG985377
2-Chloroethyl vinyl ether	ND		0.0500	1	06/02/2017 18:16	WG985377
Chloroform	ND		0.00500	1	06/02/2017 18:16	WG985377
Chloromethane	ND		0.00250	1	06/02/2017 18:16	WG985377
2-Chlorotoluene	ND		0.00100	1	06/02/2017 18:16	WG985377
4-Chlorotoluene	ND		0.00100	1	06/02/2017 18:16	WG985377
1,2-Dibromo-3-Chloropropane	ND		0.00500	1	06/02/2017 18:16	WG985377
1,2-Dibromoethane	ND		0.00100	1	06/02/2017 18:16	WG985377
Dibromomethane	ND		0.00100	1	06/02/2017 18:16	WG985377
1,2-Dichlorobenzene	ND		0.00100	1	06/02/2017 18:16	WG985377
1,3-Dichlorobenzene	ND		0.00100	1	06/02/2017 18:16	WG985377
1,4-Dichlorobenzene	ND		0.00100	1	06/02/2017 18:16	WG985377
Dichlorodifluoromethane	ND		0.00500	1	06/02/2017 18:16	WG985377
1,1-Dichloroethane	0.0732		0.00100	1	06/02/2017 18:16	WG985377
1,2-Dichloroethane	ND		0.00100	1	06/02/2017 18:16	WG985377
1,1-Dichloroethene	0.105		0.00100	1	06/02/2017 18:16	WG985377
cis-1,2-Dichloroethene	0.882		0.0200	20	06/05/2017 01:50	WG985377
trans-1,2-Dichloroethene	0.00590		0.00100	1	06/02/2017 18:16	WG985377
1,2-Dichloropropane	ND		0.00100	1	06/02/2017 18:16	WG985377
1,1-Dichloropropene	ND		0.00100	1	06/02/2017 18:16	WG985377
1,3-Dichloropropane	ND		0.00100	1	06/02/2017 18:16	WG985377
cis-1,3-Dichloropropene	ND		0.00100	1	06/02/2017 18:16	WG985377
trans-1,3-Dichloropropene	ND		0.00100	1	06/02/2017 18:16	WG985377
2,2-Dichloropropane	ND		0.00100	1	06/02/2017 18:16	WG985377
Di-isopropyl ether	ND		0.00100	1	06/02/2017 18:16	WG985377

MW-3
Collected date/time: 05/23/17 13:03

SAMPLE RESULTS - 03

L911936

Volatile Organic Compounds (GC/MS) by Method 8260B

	Result	Qualifier	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l		date / time	
Ethylbenzene	ND		0.00100	1	06/02/2017 18:16	WG985377
Hexachloro-1,3-butadiene	ND		0.00100	1	06/02/2017 18:16	WG985377
Isopropylbenzene	ND		0.00100	1	06/02/2017 18:16	WG985377
p-Isopropyltoluene	ND		0.00100	1	06/02/2017 18:16	WG985377
2-Butanone (MEK)	ND		0.0100	1	06/02/2017 18:16	WG985377
Methylene Chloride	ND		0.00500	1	06/02/2017 18:16	WG985377
4-Methyl-2-pentanone (MIBK)	ND		0.0100	1	06/02/2017 18:16	WG985377
Methyl tert-butyl ether	ND		0.00100	1	06/02/2017 18:16	WG985377
Naphthalene	ND		0.00500	1	06/02/2017 18:16	WG985377
n-Propylbenzene	ND		0.00100	1	06/02/2017 18:16	WG985377
Styrene	ND		0.00100	1	06/02/2017 18:16	WG985377
1,1,1,2-Tetrachloroethane	ND		0.00100	1	06/02/2017 18:16	WG985377
1,1,2,2-Tetrachloroethane	ND		0.00100	1	06/02/2017 18:16	WG985377
1,1,2-Trichlorotrifluoroethane	ND		0.00100	1	06/02/2017 18:16	WG985377
Tetrachloroethene	ND		0.00100	1	06/02/2017 18:16	WG985377
Toluene	ND		0.00100	1	06/02/2017 18:16	WG985377
1,2,3-Trichlorobenzene	ND		0.00100	1	06/02/2017 18:16	WG985377
1,2,4-Trichlorobenzene	ND		0.00100	1	06/02/2017 18:16	WG985377
1,1,1-Trichloroethane	ND		0.00100	1	06/02/2017 18:16	WG985377
1,1,2-Trichloroethane	ND		0.00100	1	06/02/2017 18:16	WG985377
Trichloroethene	0.254		0.0200	20	06/05/2017 01:50	WG985377
Trichlorofluoromethane	ND		0.00500	1	06/02/2017 18:16	WG985377
1,2,3-Trichloropropane	ND		0.00250	1	06/02/2017 18:16	WG985377
1,2,4-Trimethylbenzene	ND		0.00100	1	06/02/2017 18:16	WG985377
1,2,3-Trimethylbenzene	ND		0.00100	1	06/02/2017 18:16	WG985377
1,3,5-Trimethylbenzene	ND		0.00100	1	06/02/2017 18:16	WG985377
Vinyl chloride	0.0157		0.00100	1	06/02/2017 18:16	WG985377
Xylenes, Total	ND		0.00300	1	06/02/2017 18:16	WG985377
(S) Toluene-d8	*100*		*80.0-120*		*06/02/2017 18:16*	WG985377
(S) Toluene-d8	*104*		*80.0-120*		*06/05/2017 01:50*	WG985377
(S) Dibromofluoromethane	*88.2*		*76.0-123*		*06/02/2017 18:16*	WG985377
(S) Dibromofluoromethane	*97.0*		*76.0-123*		*06/05/2017 01:50*	WG985377
(S) 4-Bromofluorobenzene	*98.2*		*80.0-120*		*06/02/2017 18:16*	WG985377
(S) 4-Bromofluorobenzene	*100*		*80.0-120*		*06/05/2017 01:50*	WG985377

Mercury by Method 7470A

	Result	Qualifier	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l		date / time	
Mercury	ND		0.000200	1	05/30/2017 11:50	WG983653

Metals (ICP) by Method 6010B

	Result	Qualifier	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l		date / time	
Arsenic	ND		0.0100	1	06/01/2017 15:47	WG984463
Barium	0.0866		0.00500	1	06/01/2017 15:47	WG984463
Cadmium	ND		0.00200	1	06/01/2017 15:47	WG984463
Chromium	0.0144		0.0100	1	06/01/2017 15:47	WG984463
Lead	0.00845		0.00500	1	06/01/2017 15:47	WG984463
Selenium	ND		0.0100	1	06/01/2017 15:47	WG984463
Silver	ND		0.00500	1	06/01/2017 15:47	WG984463

Volatile Organic Compounds (GC/MS) by Method 8260B

	Result	Qualifier	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l		date / time	
Acetone	ND		0.0500	1	06/05/2017 01:22	WG985379
Acrolein	ND	J4	0.0500	1	06/05/2017 01:22	WG985379
Acrylonitrile	ND		0.0100	1	06/05/2017 01:22	WG985379
Benzene	ND		0.00100	1	06/05/2017 01:22	WG985379
Bromobenzene	ND		0.00100	1	06/05/2017 01:22	WG985379
Bromodichloromethane	ND		0.00100	1	06/05/2017 01:22	WG985379
Bromoform	ND		0.00100	1	06/05/2017 01:22	WG985379
Bromomethane	ND		0.00500	1	06/05/2017 01:22	WG985379
n-Butylbenzene	ND		0.00100	1	06/05/2017 01:22	WG985379
sec-Butylbenzene	ND		0.00100	1	06/05/2017 01:22	WG985379
tert-Butylbenzene	ND		0.00100	1	06/05/2017 01:22	WG985379
Carbon tetrachloride	ND		0.00100	1	06/05/2017 01:22	WG985379
Chlorobenzene	ND		0.00100	1	06/05/2017 01:22	WG985379
Chlorodibromomethane	ND		0.00100	1	06/05/2017 01:22	WG985379
Chloroethane	ND		0.00500	1	06/05/2017 01:22	WG985379
2-Chloroethyl vinyl ether	ND		0.0500	1	06/05/2017 01:22	WG985379
Chloroform	ND		0.00500	1	06/05/2017 01:22	WG985379
Chloromethane	ND		0.00250	1	06/05/2017 01:22	WG985379
2-Chlorotoluene	ND		0.00100	1	06/05/2017 01:22	WG985379
4-Chlorotoluene	ND		0.00100	1	06/05/2017 01:22	WG985379
1,2-Dibromo-3-Chloropropane	ND		0.00500	1	06/05/2017 01:22	WG985379
1,2-Dibromoethane	ND		0.00100	1	06/05/2017 01:22	WG985379
Dibromomethane	ND		0.00100	1	06/05/2017 01:22	WG985379
1,2-Dichlorobenzene	ND		0.00100	1	06/05/2017 01:22	WG985379
1,3-Dichlorobenzene	ND		0.00100	1	06/05/2017 01:22	WG985379
1,4-Dichlorobenzene	ND		0.00100	1	06/05/2017 01:22	WG985379
Dichlorodifluoromethane	ND	J4	0.00500	1	06/05/2017 01:22	WG985379
1,1-Dichloroethane	ND		0.00100	1	06/05/2017 01:22	WG985379
1,2-Dichloroethane	ND		0.00100	1	06/05/2017 01:22	WG985379
1,1-Dichloroethene	ND		0.00100	1	06/05/2017 01:22	WG985379
cis-1,2-Dichloroethene	ND		0.00100	1	06/05/2017 01:22	WG985379
trans-1,2-Dichloroethene	ND		0.00100	1	06/05/2017 01:22	WG985379
1,2-Dichloropropane	ND		0.00100	1	06/05/2017 01:22	WG985379
1,1-Dichloropropene	ND		0.00100	1	06/05/2017 01:22	WG985379
1,3-Dichloropropane	ND		0.00100	1	06/05/2017 01:22	WG985379
cis-1,3-Dichloropropene	ND		0.00100	1	06/05/2017 01:22	WG985379
trans-1,3-Dichloropropene	ND		0.00100	1	06/05/2017 01:22	WG985379
2,2-Dichloropropane	ND		0.00100	1	06/05/2017 01:22	WG985379
Di-isopropyl ether	ND		0.00100	1	06/05/2017 01:22	WG985379

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Ethylbenzene	ND		0.00100	1	06/05/2017 01:22	WG985379
Hexachloro-1,3-butadiene	ND		0.00100	1	06/05/2017 01:22	WG985379
Isopropylbenzene	ND		0.00100	1	06/05/2017 01:22	WG985379
p-Isopropyltoluene	ND		0.00100	1	06/05/2017 01:22	WG985379
2-Butanone (MEK)	ND		0.0100	1	06/05/2017 01:22	WG985379
Methylene Chloride	ND		0.00500	1	06/05/2017 01:22	WG985379
4-Methyl-2-pentanone (MIBK)	ND		0.0100	1	06/05/2017 01:22	WG985379
Methyl tert-butyl ether	ND		0.00100	1	06/05/2017 01:22	WG985379
Naphthalene	ND		0.00500	1	06/05/2017 01:22	WG985379
n-Propylbenzene	ND		0.00100	1	06/05/2017 01:22	WG985379
Styrene	ND		0.00100	1	06/05/2017 01:22	WG985379
1,1,1,2-Tetrachloroethane	ND		0.00100	1	06/05/2017 01:22	WG985379
1,1,2,2-Tetrachloroethane	ND		0.00100	1	06/05/2017 01:22	WG985379
1,1,2-Trichlorotrifluoroethane	ND		0.00100	1	06/05/2017 01:22	WG985379
Tetrachloroethene	ND		0.00100	1	06/05/2017 01:22	WG985379
Toluene	ND		0.00100	1	06/05/2017 01:22	WG985379
1,2,3-Trichlorobenzene	ND		0.00100	1	06/05/2017 01:22	WG985379
1,2,4-Trichlorobenzene	ND		0.00100	1	06/05/2017 01:22	WG985379
1,1,1-Trichloroethane	ND		0.00100	1	06/05/2017 01:22	WG985379
1,1,2-Trichloroethane	ND		0.00100	1	06/05/2017 01:22	WG985379
Trichloroethene	0.00102		0.00100	1	06/05/2017 01:22	WG985379
Trichlorofluoromethane	ND		0.00500	1	06/05/2017 01:22	WG985379
1,2,3-Trichloropropane	ND		0.00250	1	06/05/2017 01:22	WG985379
1,2,4-Trimethylbenzene	ND		0.00100	1	06/05/2017 01:22	WG985379
1,2,3-Trimethylbenzene	ND		0.00100	1	06/05/2017 01:22	WG985379
1,3,5-Trimethylbenzene	ND		0.00100	1	06/05/2017 01:22	WG985379
Vinyl chloride	ND		0.00100	1	06/05/2017 01:22	WG985379
Xylenes, Total	ND		0.00300	1	06/05/2017 01:22	WG985379
(S) Toluene-d8	*101*		*80.0-120*		*06/05/2017 01:22*	WG985379
(S) Dibromofluoromethane	*97.4*		*76.0-123*		*06/05/2017 01:22*	WG985379
(S) 4-Bromofluorobenzene	*109*		*80.0-120*		*06/05/2017 01:22*	WG985379

Mercury by Method 7470A

	Result	Qualifier	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l		date / time	
Mercury	ND		0.000200	1	05/30/2017 11:52	WG983653

Metals (ICP) by Method 6010B

	Result	Qualifier	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l		date / time	
Arsenic	ND		0.0100	1	06/01/2017 15:56	WG984463
Barium	0.0623		0.00500	1	06/01/2017 15:56	WG984463
Cadmium	ND		0.00200	1	06/01/2017 15:56	WG984463
Chromium	ND		0.0100	1	06/01/2017 15:56	WG984463
Lead	ND		0.00500	1	06/01/2017 15:56	WG984463
Selenium	ND		0.0100	1	06/01/2017 15:56	WG984463
Silver	ND		0.00500	1	06/01/2017 15:56	WG984463

Volatile Organic Compounds (GC/MS) by Method 8260B

	Result	Qualifier	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l		date / time	
Acetone	ND		0.0500	1	06/02/2017 15:00	WG985379
Acrolein	ND	J4	0.0500	1	06/02/2017 15:00	WG985379
Acrylonitrile	ND		0.0100	1	06/02/2017 15:00	WG985379
Benzene	0.00429		0.00100	1	06/02/2017 15:00	WG985379
Bromobenzene	ND		0.00100	1	06/02/2017 15:00	WG985379
Bromodichloromethane	ND		0.00100	1	06/02/2017 15:00	WG985379
Bromoform	ND		0.00100	1	06/02/2017 15:00	WG985379
Bromomethane	ND		0.00500	1	06/02/2017 15:00	WG985379
n-Butylbenzene	ND		0.00100	1	06/02/2017 15:00	WG985379
sec-Butylbenzene	ND		0.00100	1	06/02/2017 15:00	WG985379
tert-Butylbenzene	ND		0.00100	1	06/02/2017 15:00	WG985379
Carbon tetrachloride	ND		0.00100	1	06/02/2017 15:00	WG985379
Chlorobenzene	ND		0.00100	1	06/02/2017 15:00	WG985379
Chlorodibromomethane	ND		0.00100	1	06/02/2017 15:00	WG985379
Chloroethane	ND		0.00500	1	06/02/2017 15:00	WG985379
2-Chloroethyl vinyl ether	ND		0.0500	1	06/02/2017 15:00	WG985379
Chloroform	ND		0.00500	1	06/02/2017 15:00	WG985379
Chloromethane	ND		0.00250	1	06/02/2017 15:00	WG985379
2-Chlorotoluene	ND		0.00100	1	06/02/2017 15:00	WG985379
4-Chlorotoluene	ND		0.00100	1	06/02/2017 15:00	WG985379
1,2-Dibromo-3-Chloropropane	ND		0.00500	1	06/02/2017 15:00	WG985379
1,2-Dibromoethane	ND		0.00100	1	06/02/2017 15:00	WG985379
Dibromomethane	ND		0.00100	1	06/02/2017 15:00	WG985379
1,2-Dichlorobenzene	ND		0.00100	1	06/02/2017 15:00	WG985379
1,3-Dichlorobenzene	ND		0.00100	1	06/02/2017 15:00	WG985379
1,4-Dichlorobenzene	ND		0.00100	1	06/02/2017 15:00	WG985379
Dichlorodifluoromethane	ND	J4	0.00500	1	06/02/2017 15:00	WG985379
1,1-Dichloroethane	0.0107		0.00100	1	06/02/2017 15:00	WG985379
1,2-Dichloroethane	0.00446		0.00100	1	06/02/2017 15:00	WG985379
1,1-Dichloroethene	0.0247		0.00100	1	06/02/2017 15:00	WG985379
cis-1,2-Dichloroethene	11.5		0.250	250	06/05/2017 01:37	WG985379
trans-1,2-Dichloroethene	0.0445		0.00100	1	06/02/2017 15:00	WG985379
1,2-Dichloropropane	ND		0.00100	1	06/02/2017 15:00	WG985379
1,1-Dichloropropene	ND		0.00100	1	06/02/2017 15:00	WG985379
1,3-Dichloropropane	ND		0.00100	1	06/02/2017 15:00	WG985379
cis-1,3-Dichloropropene	ND		0.00100	1	06/02/2017 15:00	WG985379
trans-1,3-Dichloropropene	ND		0.00100	1	06/02/2017 15:00	WG985379
2,2-Dichloropropane	ND		0.00100	1	06/02/2017 15:00	WG985379
Di-isopropyl ether	ND		0.00100	1	06/02/2017 15:00	WG985379

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Ethylbenzene	ND		0.00100	1	06/02/2017 15:00	WG985379
Hexachloro-1,3-butadiene	ND		0.00100	1	06/02/2017 15:00	WG985379
Isopropylbenzene	0.00258		0.00100	1	06/02/2017 15:00	WG985379
p-Isopropyltoluene	ND		0.00100	1	06/02/2017 15:00	WG985379
2-Butanone (MEK)	ND		0.0100	1	06/02/2017 15:00	WG985379
Methylene Chloride	ND		0.00500	1	06/02/2017 15:00	WG985379
4-Methyl-2-pentanone (MIBK)	ND		0.0100	1	06/02/2017 15:00	WG985379
Methyl tert-butyl ether	ND		0.00100	1	06/02/2017 15:00	WG985379
Naphthalene	ND		0.00500	1	06/02/2017 15:00	WG985379
n-Propylbenzene	ND		0.00100	1	06/02/2017 15:00	WG985379
Styrene	ND		0.00100	1	06/02/2017 15:00	WG985379
1,1,1,2-Tetrachloroethane	ND		0.00100	1	06/02/2017 15:00	WG985379
1,1,2,2-Tetrachloroethane	ND		0.00100	1	06/02/2017 15:00	WG985379
1,1,2-Trichlorotrifluoroethane	ND		0.00100	1	06/02/2017 15:00	WG985379
Tetrachloroethene	ND		0.00100	1	06/02/2017 15:00	WG985379
Toluene	ND		0.00100	1	06/02/2017 15:00	WG985379
1,2,3-Trichlorobenzene	ND		0.00100	1	06/02/2017 15:00	WG985379
1,2,4-Trichlorobenzene	ND		0.00100	1	06/02/2017 15:00	WG985379
1,1,1-Trichloroethane	ND		0.00100	1	06/02/2017 15:00	WG985379
1,1,2-Trichloroethane	0.00154		0.00100	1	06/02/2017 15:00	WG985379
Trichloroethene	0.429		0.250	250	06/05/2017 01:37	WG985379
Trichlorofluoromethane	ND		0.00500	1	06/02/2017 15:00	WG985379
1,2,3-Trichloropropane	ND		0.00250	1	06/02/2017 15:00	WG985379
1,2,4-Trimethylbenzene	ND		0.00100	1	06/02/2017 15:00	WG985379
1,2,3-Trimethylbenzene	ND		0.00100	1	06/02/2017 15:00	WG985379
1,3,5-Trimethylbenzene	ND		0.00100	1	06/02/2017 15:00	WG985379
Vinyl chloride	1.57		0.250	250	06/05/2017 01:37	WG985379
Xylenes, Total	ND		0.00300	1	06/02/2017 15:00	WG985379
(S) Toluene-d8	*101*		*80.0-120*		*06/05/2017 01:37*	WG985379
(S) Toluene-d8	*116*		*80.0-120*		*06/02/2017 15:00*	WG985379
(S) Dibromofluoromethane	*83.5*		*76.0-123*		*06/02/2017 15:00*	WG985379
(S) Dibromofluoromethane	*101*		*76.0-123*		*06/05/2017 01:37*	WG985379
(S) 4-Bromofluorobenzene	*100*		*80.0-120*		*06/02/2017 15:00*	WG985379
(S) 4-Bromofluorobenzene	*110*		*80.0-120*		*06/05/2017 01:37*	WG985379

MW-9

Collected date/time: 05/23/17 13:24

SAMPLE RESULTS - 06

L911936

Mercury by Method 7470A

	Result	Qualifier	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l		date / time	
Mercury	ND		0.000200	1	05/30/2017 11:55	WG983653

Metals (ICP) by Method 6010B

	Result	Qualifier	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l		date / time	
Arsenic	ND		0.0100	1	06/01/2017 15:58	WG984463
Barium	0.124		0.00500	1	06/01/2017 15:58	WG984463
Cadmium	ND		0.00200	1	06/01/2017 15:58	WG984463
Chromium	0.0149		0.0100	1	06/01/2017 15:58	WG984463
Lead	0.00688		0.00500	1	06/01/2017 15:58	WG984463
Selenium	ND		0.0100	1	06/01/2017 15:58	WG984463
Silver	ND		0.00500	1	06/01/2017 15:58	WG984463

Volatile Organic Compounds (GC/MS) by Method 8260B

	Result	Qualifier	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l		date / time	
Acetone	ND		0.0500	1	06/02/2017 15:22	WG985379
Acrolein	ND	J4	0.0500	1	06/02/2017 15:22	WG985379
Acrylonitrile	ND		0.0100	1	06/02/2017 15:22	WG985379
Benzene	ND		0.00100	1	06/02/2017 15:22	WG985379
Bromobenzene	ND		0.00100	1	06/02/2017 15:22	WG985379
Bromodichloromethane	ND		0.00100	1	06/02/2017 15:22	WG985379
Bromoform	ND		0.00100	1	06/02/2017 15:22	WG985379
Bromomethane	ND		0.00500	1	06/02/2017 15:22	WG985379
n-Butylbenzene	ND		0.00100	1	06/02/2017 15:22	WG985379
sec-Butylbenzene	ND		0.00100	1	06/02/2017 15:22	WG985379
tert-Butylbenzene	ND		0.00100	1	06/02/2017 15:22	WG985379
Carbon tetrachloride	ND		0.00100	1	06/02/2017 15:22	WG985379
Chlorobenzene	ND		0.00100	1	06/02/2017 15:22	WG985379
Chlorodibromomethane	ND		0.00100	1	06/02/2017 15:22	WG985379
Chloroethane	ND		0.00500	1	06/02/2017 15:22	WG985379
2-Chloroethyl vinyl ether	ND		0.0500	1	06/02/2017 15:22	WG985379
Chloroform	ND		0.00500	1	06/02/2017 15:22	WG985379
Chloromethane	ND		0.00250	1	06/02/2017 15:22	WG985379
2-Chlorotoluene	ND		0.00100	1	06/02/2017 15:22	WG985379
4-Chlorotoluene	ND		0.00100	1	06/02/2017 15:22	WG985379
1,2-Dibromo-3-Chloropropane	ND		0.00500	1	06/02/2017 15:22	WG985379
1,2-Dibromoethane	ND		0.00100	1	06/02/2017 15:22	WG985379
Dibromomethane	ND		0.00100	1	06/02/2017 15:22	WG985379
1,2-Dichlorobenzene	ND		0.00100	1	06/02/2017 15:22	WG985379
1,3-Dichlorobenzene	ND		0.00100	1	06/02/2017 15:22	WG985379
1,4-Dichlorobenzene	ND		0.00100	1	06/02/2017 15:22	WG985379
Dichlorodifluoromethane	ND	J4	0.00500	1	06/02/2017 15:22	WG985379
1,1-Dichloroethane	ND		0.00100	1	06/02/2017 15:22	WG985379
1,2-Dichloroethane	ND		0.00100	1	06/02/2017 15:22	WG985379
1,1-Dichloroethene	0.00347		0.00100	1	06/02/2017 15:22	WG985379
cis-1,2-Dichloroethene	0.146		0.00100	1	06/02/2017 15:22	WG985379
trans-1,2-Dichloroethene	0.00215		0.00100	1	06/02/2017 15:22	WG985379
1,2-Dichloropropane	ND		0.00100	1	06/02/2017 15:22	WG985379
1,1-Dichloropropene	ND		0.00100	1	06/02/2017 15:22	WG985379
1,3-Dichloropropane	ND		0.00100	1	06/02/2017 15:22	WG985379
cis-1,3-Dichloropropene	ND		0.00100	1	06/02/2017 15:22	WG985379
trans-1,3-Dichloropropene	ND		0.00100	1	06/02/2017 15:22	WG985379
2,2-Dichloropropane	ND		0.00100	1	06/02/2017 15:22	WG985379
Di-isopropyl ether	ND		0.00100	1	06/02/2017 15:22	WG985379

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Ethylbenzene	ND		0.00100	1	06/02/2017 15:22	WG985379
Hexachloro-1,3-butadiene	ND		0.00100	1	06/02/2017 15:22	WG985379
Isopropylbenzene	ND		0.00100	1	06/02/2017 15:22	WG985379
p-Isopropyltoluene	ND		0.00100	1	06/02/2017 15:22	WG985379
2-Butanone (MEK)	ND		0.0100	1	06/02/2017 15:22	WG985379
Methylene Chloride	ND		0.00500	1	06/02/2017 15:22	WG985379
4-Methyl-2-pentanone (MIBK)	ND		0.0100	1	06/02/2017 15:22	WG985379
Methyl tert-butyl ether	ND		0.00100	1	06/02/2017 15:22	WG985379
Naphthalene	ND		0.00500	1	06/02/2017 15:22	WG985379
n-Propylbenzene	ND		0.00100	1	06/02/2017 15:22	WG985379
Styrene	ND		0.00100	1	06/02/2017 15:22	WG985379
1,1,1,2-Tetrachloroethane	ND		0.00100	1	06/02/2017 15:22	WG985379
1,1,2,2-Tetrachloroethane	ND		0.00100	1	06/02/2017 15:22	WG985379
1,1,2-Trichlorotrifluoroethane	ND		0.00100	1	06/02/2017 15:22	WG985379
Tetrachloroethene	ND		0.00100	1	06/02/2017 15:22	WG985379
Toluene	ND		0.00100	1	06/02/2017 15:22	WG985379
1,2,3-Trichlorobenzene	ND		0.00100	1	06/02/2017 15:22	WG985379
1,2,4-Trichlorobenzene	ND		0.00100	1	06/02/2017 15:22	WG985379
1,1,1-Trichloroethane	ND		0.00100	1	06/02/2017 15:22	WG985379
1,1,2-Trichloroethane	ND		0.00100	1	06/02/2017 15:22	WG985379
Trichloroethene	0.109		0.00100	1	06/02/2017 15:22	WG985379
Trichlorofluoromethane	ND		0.00500	1	06/02/2017 15:22	WG985379
1,2,3-Trichloropropane	ND		0.00250	1	06/02/2017 15:22	WG985379
1,2,4-Trimethylbenzene	ND		0.00100	1	06/02/2017 15:22	WG985379
1,2,3-Trimethylbenzene	ND		0.00100	1	06/02/2017 15:22	WG985379
1,3,5-Trimethylbenzene	ND		0.00100	1	06/02/2017 15:22	WG985379
Vinyl chloride	0.0148		0.00100	1	06/05/2017 01:53	WG985379
Xylenes, Total	ND		0.00300	1	06/02/2017 15:22	WG985379
(S) Toluene-d8	*102*		*80.0-120*		*06/02/2017 15:22*	WG985379
(S) Toluene-d8	*102*		*80.0-120*		*06/05/2017 01:53*	WG985379
(S) Dibromofluoromethane	*92.5*		*76.0-123*		*06/02/2017 15:22*	WG985379
(S) Dibromofluoromethane	*96.5*		*76.0-123*		*06/05/2017 01:53*	WG985379
(S) 4-Bromofluorobenzene	*104*		*80.0-120*		*06/02/2017 15:22*	WG985379
(S) 4-Bromofluorobenzene	*106*		*80.0-120*		*06/05/2017 01:53*	WG985379

Mercury by Method 7470A

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Mercury	ND		0.000200	1	05/30/2017 11:57	WG983653

Metals (ICP) by Method 6010B

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Arsenic	0.0206		0.0100	1	06/01/2017 16:01	WG984463
Barium	0.431		0.00500	1	06/01/2017 16:01	WG984463
Cadmium	ND		0.00200	1	06/01/2017 16:01	WG984463
Chromium	0.0743		0.0100	1	06/01/2017 16:01	WG984463
Lead	0.0677		0.00500	1	06/01/2017 16:01	WG984463
Selenium	ND		0.0100	1	06/01/2017 16:01	WG984463
Silver	ND		0.00500	1	06/01/2017 16:01	WG984463

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Acetone	ND		0.0500	1	06/02/2017 18:15	WG985379
Acrolein	ND	J4	0.0500	1	06/02/2017 18:15	WG985379
Acrylonitrile	ND		0.0100	1	06/02/2017 18:15	WG985379
Benzene	ND		0.00100	1	06/02/2017 18:15	WG985379
Bromobenzene	ND		0.00100	1	06/02/2017 18:15	WG985379
Bromodichloromethane	ND		0.00100	1	06/02/2017 18:15	WG985379
Bromoform	ND		0.00100	1	06/02/2017 18:15	WG985379
Bromomethane	ND		0.00500	1	06/02/2017 18:15	WG985379
n-Butylbenzene	ND		0.00100	1	06/02/2017 18:15	WG985379
sec-Butylbenzene	0.00158		0.00100	1	06/02/2017 18:15	WG985379
tert-Butylbenzene	ND		0.00100	1	06/02/2017 18:15	WG985379
Carbon tetrachloride	ND		0.00100	1	06/02/2017 18:15	WG985379
Chlorobenzene	ND		0.00100	1	06/02/2017 18:15	WG985379
Chlorodibromomethane	ND		0.00100	1	06/02/2017 18:15	WG985379
Chloroethane	ND		0.00500	1	06/02/2017 18:15	WG985379
2-Chloroethyl vinyl ether	ND		0.0500	1	06/02/2017 18:15	WG985379
Chloroform	ND		0.00500	1	06/02/2017 18:15	WG985379
Chloromethane	ND		0.00250	1	06/02/2017 18:15	WG985379
2-Chlorotoluene	ND		0.00100	1	06/02/2017 18:15	WG985379
4-Chlorotoluene	ND		0.00100	1	06/02/2017 18:15	WG985379
1,2-Dibromo-3-Chloropropane	ND		0.00500	1	06/02/2017 18:15	WG985379
1,2-Dibromoethane	ND		0.00100	1	06/02/2017 18:15	WG985379
Dibromomethane	ND		0.00100	1	06/02/2017 18:15	WG985379
1,2-Dichlorobenzene	0.00307		0.00100	1	06/02/2017 18:15	WG985379
1,3-Dichlorobenzene	ND		0.00100	1	06/02/2017 18:15	WG985379
1,4-Dichlorobenzene	ND		0.00100	1	06/02/2017 18:15	WG985379
Dichlorodifluoromethane	ND	J4	0.00500	1	06/02/2017 18:15	WG985379
1,1-Dichloroethane	0.00376		0.00100	1	06/02/2017 18:15	WG985379
1,2-Dichloroethane	ND		0.00100	1	06/02/2017 18:15	WG985379
1,1-Dichloroethene	0.0421		0.00100	1	06/02/2017 18:15	WG985379
cis-1,2-Dichloroethene	0.380		0.0500	50	06/05/2017 02:09	WG985379
trans-1,2-Dichloroethene	0.00244		0.00100	1	06/02/2017 18:15	WG985379
1,2-Dichloropropane	ND		0.00100	1	06/02/2017 18:15	WG985379
1,1-Dichloropropene	ND		0.00100	1	06/02/2017 18:15	WG985379
1,3-Dichloropropane	ND		0.00100	1	06/02/2017 18:15	WG985379
cis-1,3-Dichloropropene	ND		0.00100	1	06/02/2017 18:15	WG985379
trans-1,3-Dichloropropene	ND		0.00100	1	06/02/2017 18:15	WG985379
2,2-Dichloropropane	ND		0.00100	1	06/02/2017 18:15	WG985379
Di-isopropyl ether	ND		0.00100	1	06/02/2017 18:15	WG985379

Volatile Organic Compounds (GC/MS) by Method 8260B

	Result	Qualifier	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l		date / time	
Ethylbenzene	ND		0.00100	1	06/02/2017 18:15	WG985379
Hexachloro-1,3-butadiene	ND		0.00100	1	06/02/2017 18:15	WG985379
Isopropylbenzene	0.00117		0.00100	1	06/02/2017 18:15	WG985379
p-Isopropyltoluene	ND		0.00100	1	06/02/2017 18:15	WG985379
2-Butanone (MEK)	ND		0.0100	1	06/02/2017 18:15	WG985379
Methylene Chloride	ND		0.00500	1	06/02/2017 18:15	WG985379
4-Methyl-2-pentanone (MIBK)	ND		0.0100	1	06/02/2017 18:15	WG985379
Methyl tert-butyl ether	ND		0.00100	1	06/02/2017 18:15	WG985379
Naphthalene	ND		0.00500	1	06/02/2017 18:15	WG985379
n-Propylbenzene	ND		0.00100	1	06/02/2017 18:15	WG985379
Styrene	ND		0.00100	1	06/02/2017 18:15	WG985379
1,1,1,2-Tetrachloroethane	ND		0.00100	1	06/02/2017 18:15	WG985379
1,1,2,2-Tetrachloroethane	ND		0.00100	1	06/02/2017 18:15	WG985379
1,1,2-Trichlorotrifluoroethane	ND		0.00100	1	06/02/2017 18:15	WG985379
Tetrachloroethene	0.0189		0.00100	1	06/02/2017 18:15	WG985379
Toluene	ND		0.00100	1	06/02/2017 18:15	WG985379
1,2,3-Trichlorobenzene	ND		0.00100	1	06/02/2017 18:15	WG985379
1,2,4-Trichlorobenzene	ND		0.00100	1	06/02/2017 18:15	WG985379
1,1,1-Trichloroethane	ND		0.00100	1	06/02/2017 18:15	WG985379
1,1,2-Trichloroethane	ND		0.00100	1	06/02/2017 18:15	WG985379
Trichloroethene	1.40		0.0500	50	06/05/2017 02:09	WG985379
Trichlorofluoromethane	ND		0.00500	1	06/02/2017 18:15	WG985379
1,2,3-Trichloropropane	ND		0.00250	1	06/02/2017 18:15	WG985379
1,2,4-Trimethylbenzene	ND		0.00100	1	06/02/2017 18:15	WG985379
1,2,3-Trimethylbenzene	ND		0.00100	1	06/02/2017 18:15	WG985379
1,3,5-Trimethylbenzene	ND		0.00100	1	06/02/2017 18:15	WG985379
Vinyl chloride	0.00728		0.00100	1	06/02/2017 18:15	WG985379
Xylenes, Total	ND		0.00300	1	06/02/2017 18:15	WG985379
(S) Toluene-d8	*101*		*80.0-120*		*06/05/2017 02:09*	WG985379
(S) Toluene-d8	*169*	J1	*80.0-120*		*06/02/2017 18:15*	WG985379
(S) Dibromofluoromethane	*94.5*		*76.0-123*		*06/02/2017 18:15*	WG985379
(S) Dibromofluoromethane	*99.0*		*76.0-123*		*06/05/2017 02:09*	WG985379
(S) 4-Bromofluorobenzene	*105*		*80.0-120*		*06/02/2017 18:15*	WG985379
(S) 4-Bromofluorobenzene	*109*		*80.0-120*		*06/05/2017 02:09*	WG985379

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Mercury by Method 7470A

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Mercury	ND		0.000200	1	05/30/2017 11:59	WG983653

Metals (ICP) by Method 6010B

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Arsenic	ND		0.0100	1	06/01/2017 16:04	WG984463
Barium	0.209		0.00500	1	06/01/2017 16:04	WG984463
Cadmium	ND		0.00200	1	06/01/2017 16:04	WG984463
Chromium	0.0163		0.0100	1	06/01/2017 16:04	WG984463
Lead	0.0103		0.00500	1	06/01/2017 16:04	WG984463
Selenium	ND		0.0100	1	06/01/2017 16:04	WG984463
Silver	ND		0.00500	1	06/01/2017 16:04	WG984463

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Acetone	ND		0.0500	1	06/02/2017 18:28	WG985379
Acrolein	ND	J4	0.0500	1	06/02/2017 18:28	WG985379
Acrylonitrile	ND		0.0100	1	06/02/2017 18:28	WG985379
Benzene	ND		0.00100	1	06/02/2017 18:28	WG985379
Bromobenzene	ND		0.00100	1	06/02/2017 18:28	WG985379
Bromodichloromethane	ND		0.00100	1	06/02/2017 18:28	WG985379
Bromoform	ND		0.00100	1	06/02/2017 18:28	WG985379
Bromomethane	ND		0.00500	1	06/02/2017 18:28	WG985379
n-Butylbenzene	ND		0.00100	1	06/02/2017 18:28	WG985379
sec-Butylbenzene	ND		0.00100	1	06/02/2017 18:28	WG985379
tert-Butylbenzene	ND		0.00100	1	06/02/2017 18:28	WG985379
Carbon tetrachloride	ND		0.00100	1	06/02/2017 18:28	WG985379
Chlorobenzene	ND		0.00100	1	06/02/2017 18:28	WG985379
Chlorodibromomethane	ND		0.00100	1	06/02/2017 18:28	WG985379
Chloroethane	ND		0.00500	1	06/02/2017 18:28	WG985379
2-Chloroethyl vinyl ether	ND		0.0500	1	06/02/2017 18:28	WG985379
Chloroform	ND		0.00500	1	06/02/2017 18:28	WG985379
Chloromethane	ND		0.00250	1	06/02/2017 18:28	WG985379
2-Chlorotoluene	ND		0.00100	1	06/02/2017 18:28	WG985379
4-Chlorotoluene	ND		0.00100	1	06/02/2017 18:28	WG985379
1,2-Dibromo-3-Chloropropane	ND		0.00500	1	06/02/2017 18:28	WG985379
1,2-Dibromoethane	ND		0.00100	1	06/02/2017 18:28	WG985379
Dibromomethane	ND		0.00100	1	06/02/2017 18:28	WG985379
1,2-Dichlorobenzene	ND		0.00100	1	06/02/2017 18:28	WG985379
1,3-Dichlorobenzene	ND		0.00100	1	06/02/2017 18:28	WG985379
1,4-Dichlorobenzene	ND		0.00100	1	06/02/2017 18:28	WG985379
Dichlorodifluoromethane	ND	J4	0.00500	1	06/02/2017 18:28	WG985379
1,1-Dichloroethane	ND		0.00100	1	06/02/2017 18:28	WG985379
1,2-Dichloroethane	ND		0.00100	1	06/02/2017 18:28	WG985379
1,1-Dichloroethene	ND		0.00100	1	06/02/2017 18:28	WG985379
cis-1,2-Dichloroethene	ND		0.00100	1	06/02/2017 18:28	WG985379
trans-1,2-Dichloroethene	ND		0.00100	1	06/02/2017 18:28	WG985379
1,2-Dichloropropane	ND		0.00100	1	06/02/2017 18:28	WG985379
1,1-Dichloropropene	ND		0.00100	1	06/02/2017 18:28	WG985379
1,3-Dichloropropane	ND		0.00100	1	06/02/2017 18:28	WG985379
cis-1,3-Dichloropropene	ND		0.00100	1	06/02/2017 18:28	WG985379
trans-1,3-Dichloropropene	ND		0.00100	1	06/02/2017 18:28	WG985379
2,2-Dichloropropane	ND		0.00100	1	06/02/2017 18:28	WG985379
Di-isopropyl ether	ND		0.00100	1	06/02/2017 18:28	WG985379

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Ethylbenzene	ND		0.00100	1	06/02/2017 18:28	WG985379
Hexachloro-1,3-butadiene	ND		0.00100	1	06/02/2017 18:28	WG985379
Isopropylbenzene	ND		0.00100	1	06/02/2017 18:28	WG985379
p-Isopropyltoluene	ND		0.00100	1	06/02/2017 18:28	WG985379
2-Butanone (MEK)	ND		0.0100	1	06/02/2017 18:28	WG985379
Methylene Chloride	ND		0.00500	1	06/02/2017 18:28	WG985379
4-Methyl-2-pentanone (MIBK)	ND		0.0100	1	06/02/2017 18:28	WG985379
Methyl tert-butyl ether	ND		0.00100	1	06/02/2017 18:28	WG985379
Naphthalene	ND		0.00500	1	06/02/2017 18:28	WG985379
n-Propylbenzene	ND		0.00100	1	06/02/2017 18:28	WG985379
Styrene	ND		0.00100	1	06/02/2017 18:28	WG985379
1,1,1,2-Tetrachloroethane	ND		0.00100	1	06/02/2017 18:28	WG985379
1,1,2,2-Tetrachloroethane	ND		0.00100	1	06/02/2017 18:28	WG985379
1,1,2-Trichlorotrifluoroethane	ND		0.00100	1	06/02/2017 18:28	WG985379
Tetrachloroethene	ND		0.00100	1	06/02/2017 18:28	WG985379
Toluene	ND		0.00100	1	06/02/2017 18:28	WG985379
1,2,3-Trichlorobenzene	ND		0.00100	1	06/02/2017 18:28	WG985379
1,2,4-Trichlorobenzene	ND		0.00100	1	06/02/2017 18:28	WG985379
1,1,1-Trichloroethane	ND		0.00100	1	06/02/2017 18:28	WG985379
1,1,2-Trichloroethane	ND		0.00100	1	06/02/2017 18:28	WG985379
Trichloroethene	ND		0.00100	1	06/05/2017 02:24	WG985379
Trichlorofluoromethane	ND		0.00500	1	06/02/2017 18:28	WG985379
1,2,3-Trichloropropane	ND		0.00250	1	06/02/2017 18:28	WG985379
1,2,4-Trimethylbenzene	ND		0.00100	1	06/02/2017 18:28	WG985379
1,2,3-Trimethylbenzene	ND		0.00100	1	06/02/2017 18:28	WG985379
1,3,5-Trimethylbenzene	ND		0.00100	1	06/02/2017 18:28	WG985379
Vinyl chloride	ND		0.00100	1	06/02/2017 18:28	WG985379
Xylenes, Total	ND		0.00300	1	06/02/2017 18:28	WG985379
(S) Toluene-d8	*101*		*80.0-120*		*06/05/2017 02:24*	WG985379
(S) Toluene-d8	*101*		*80.0-120*		*06/02/2017 18:28*	WG985379
(S) Dibromofluoromethane	*91.3*		*76.0-123*		*06/02/2017 18:28*	WG985379
(S) Dibromofluoromethane	*97.7*		*76.0-123*		*06/05/2017 02:24*	WG985379
(S) 4-Bromofluorobenzene	*108*		*80.0-120*		*06/02/2017 18:28*	WG985379
(S) 4-Bromofluorobenzene	*108*		*80.0-120*		*06/05/2017 02:24*	WG985379

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Mercury by Method 7470A

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Mercury	ND		0.000200	1	05/30/2017 12:07	WG983653

Metals (ICP) by Method 6010B

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Arsenic	ND		0.0100	1	06/01/2017 16:07	WG984463
Barium	0.173		0.00500	1	06/01/2017 16:07	WG984463
Cadmium	ND		0.00200	1	06/01/2017 16:07	WG984463
Chromium	0.0135		0.0100	1	06/01/2017 16:07	WG984463
Lead	0.00612		0.00500	1	06/01/2017 16:07	WG984463
Selenium	ND		0.0100	1	06/01/2017 16:07	WG984463
Silver	ND		0.00500	1	06/01/2017 16:07	WG984463

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Acetone	ND		0.0500	1	06/02/2017 18:42	WG985379
Acrolein	ND	J4	0.0500	1	06/02/2017 18:42	WG985379
Acrylonitrile	ND		0.0100	1	06/02/2017 18:42	WG985379
Benzene	ND		0.00100	1	06/02/2017 18:42	WG985379
Bromobenzene	ND		0.00100	1	06/02/2017 18:42	WG985379
Bromodichloromethane	ND		0.00100	1	06/02/2017 18:42	WG985379
Bromoform	ND		0.00100	1	06/02/2017 18:42	WG985379
Bromomethane	ND		0.00500	1	06/02/2017 18:42	WG985379
n-Butylbenzene	ND		0.00100	1	06/02/2017 18:42	WG985379
sec-Butylbenzene	ND		0.00100	1	06/02/2017 18:42	WG985379
tert-Butylbenzene	ND		0.00100	1	06/02/2017 18:42	WG985379
Carbon tetrachloride	ND		0.00100	1	06/02/2017 18:42	WG985379
Chlorobenzene	ND		0.00100	1	06/02/2017 18:42	WG985379
Chlorodibromomethane	ND		0.00100	1	06/02/2017 18:42	WG985379
Chloroethane	ND		0.00500	1	06/02/2017 18:42	WG985379
2-Chloroethyl vinyl ether	ND		0.0500	1	06/02/2017 18:42	WG985379
Chloroform	ND		0.00500	1	06/02/2017 18:42	WG985379
Chloromethane	ND		0.00250	1	06/02/2017 18:42	WG985379
2-Chlorotoluene	ND		0.00100	1	06/02/2017 18:42	WG985379
4-Chlorotoluene	ND		0.00100	1	06/02/2017 18:42	WG985379
1,2-Dibromo-3-Chloropropane	ND		0.00500	1	06/02/2017 18:42	WG985379
1,2-Dibromoethane	ND		0.00100	1	06/02/2017 18:42	WG985379
Dibromomethane	ND		0.00100	1	06/02/2017 18:42	WG985379
1,2-Dichlorobenzene	ND		0.00100	1	06/02/2017 18:42	WG985379
1,3-Dichlorobenzene	ND		0.00100	1	06/02/2017 18:42	WG985379
1,4-Dichlorobenzene	ND		0.00100	1	06/02/2017 18:42	WG985379
Dichlorodifluoromethane	ND	J4	0.00500	1	06/02/2017 18:42	WG985379
1,1-Dichloroethane	ND		0.00100	1	06/02/2017 18:42	WG985379
1,2-Dichloroethane	ND		0.00100	1	06/02/2017 18:42	WG985379
1,1-Dichloroethene	ND		0.00100	1	06/02/2017 18:42	WG985379
cis-1,2-Dichloroethene	ND		0.00100	1	06/02/2017 18:42	WG985379
trans-1,2-Dichloroethene	ND		0.00100	1	06/02/2017 18:42	WG985379
1,2-Dichloropropane	ND		0.00100	1	06/02/2017 18:42	WG985379
1,1-Dichloropropene	ND		0.00100	1	06/02/2017 18:42	WG985379
1,3-Dichloropropane	ND		0.00100	1	06/02/2017 18:42	WG985379
cis-1,3-Dichloropropene	ND		0.00100	1	06/02/2017 18:42	WG985379
trans-1,3-Dichloropropene	ND		0.00100	1	06/02/2017 18:42	WG985379
2,2-Dichloropropane	ND		0.00100	1	06/02/2017 18:42	WG985379
Di-isopropyl ether	ND		0.00100	1	06/02/2017 18:42	WG985379

Volatile Organic Compounds (GC/MS) by Method 8260B

	Result	Qualifier	RDL	Dilution	Analysis	Batch
Analyte	mg/l		mg/l		date / time	
Ethylbenzene	ND		0.00100	1	06/02/2017 18:42	WG985379
Hexachloro-1,3-butadiene	ND		0.00100	1	06/02/2017 18:42	WG985379
Isopropylbenzene	ND		0.00100	1	06/02/2017 18:42	WG985379
p-Isopropyltoluene	ND		0.00100	1	06/02/2017 18:42	WG985379
2-Butanone (MEK)	ND		0.0100	1	06/02/2017 18:42	WG985379
Methylene Chloride	ND		0.00500	1	06/02/2017 18:42	WG985379
4-Methyl-2-pentanone (MIBK)	ND		0.0100	1	06/02/2017 18:42	WG985379
Methyl tert-butyl ether	ND		0.00100	1	06/02/2017 18:42	WG985379
Naphthalene	ND		0.00500	1	06/02/2017 18:42	WG985379
n-Propylbenzene	ND		0.00100	1	06/02/2017 18:42	WG985379
Styrene	ND		0.00100	1	06/02/2017 18:42	WG985379
1,1,1,2-Tetrachloroethane	ND		0.00100	1	06/02/2017 18:42	WG985379
1,1,2,2-Tetrachloroethane	ND		0.00100	1	06/02/2017 18:42	WG985379
1,1,2-Trichlorotrifluoroethane	ND		0.00100	1	06/02/2017 18:42	WG985379
Tetrachloroethene	ND		0.00100	1	06/02/2017 18:42	WG985379
Toluene	ND		0.00100	1	06/02/2017 18:42	WG985379
1,2,3-Trichlorobenzene	ND		0.00100	1	06/02/2017 18:42	WG985379
1,2,4-Trichlorobenzene	ND		0.00100	1	06/02/2017 18:42	WG985379
1,1,1-Trichloroethane	ND		0.00100	1	06/02/2017 18:42	WG985379
1,1,2-Trichloroethane	ND		0.00100	1	06/02/2017 18:42	WG985379
Trichloroethene	ND		0.00100	1	06/02/2017 18:42	WG985379
Trichlorofluoromethane	ND		0.00500	1	06/02/2017 18:42	WG985379
1,2,3-Trichloropropane	ND		0.00250	1	06/02/2017 18:42	WG985379
1,2,4-Trimethylbenzene	ND		0.00100	1	06/02/2017 18:42	WG985379
1,2,3-Trimethylbenzene	ND		0.00100	1	06/02/2017 18:42	WG985379
1,3,5-Trimethylbenzene	ND		0.00100	1	06/02/2017 18:42	WG985379
Vinyl chloride	ND		0.00100	1	06/02/2017 18:42	WG985379
Xylenes, Total	ND		0.00300	1	06/02/2017 18:42	WG985379
(S) Toluene-d8	*100*		*80.0-120*		*06/02/2017 18:42*	WG985379
(S) Dibromofluoromethane	*91.7*		*76.0-123*		*06/02/2017 18:42*	WG985379
(S) 4-Bromofluorobenzene	*107*		*80.0-120*		*06/02/2017 18:42*	WG985379

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Acetone	ND		0.0500	1	06/02/2017 14:33	WG985379
Acrolein	ND	J4	0.0500	1	06/02/2017 14:33	WG985379
Acrylonitrile	ND		0.0100	1	06/02/2017 14:33	WG985379
Benzene	ND		0.00100	1	06/02/2017 14:33	WG985379
Bromobenzene	ND		0.00100	1	06/02/2017 14:33	WG985379
Bromodichloromethane	ND		0.00100	1	06/02/2017 14:33	WG985379
Bromoform	ND		0.00100	1	06/02/2017 14:33	WG985379
Bromomethane	ND		0.00500	1	06/02/2017 14:33	WG985379
n-Butylbenzene	ND		0.00100	1	06/02/2017 14:33	WG985379
sec-Butylbenzene	ND		0.00100	1	06/02/2017 14:33	WG985379
tert-Butylbenzene	ND		0.00100	1	06/02/2017 14:33	WG985379
Carbon tetrachloride	ND		0.00100	1	06/02/2017 14:33	WG985379
Chlorobenzene	ND		0.00100	1	06/02/2017 14:33	WG985379
Chlorodibromomethane	ND		0.00100	1	06/02/2017 14:33	WG985379
Chloroethane	ND		0.00500	1	06/02/2017 14:33	WG985379
2-Chloroethyl vinyl ether	ND		0.0500	1	06/02/2017 14:33	WG985379
Chloroform	ND		0.00500	1	06/02/2017 14:33	WG985379
Chloromethane	ND		0.00250	1	06/02/2017 14:33	WG985379
2-Chlorotoluene	ND		0.00100	1	06/02/2017 14:33	WG985379
4-Chlorotoluene	ND		0.00100	1	06/02/2017 14:33	WG985379
1,2-Dibromo-3-Chloropropane	ND		0.00500	1	06/02/2017 14:33	WG985379
1,2-Dibromoethane	ND		0.00100	1	06/02/2017 14:33	WG985379
Dibromomethane	ND		0.00100	1	06/02/2017 14:33	WG985379
1,2-Dichlorobenzene	ND		0.00100	1	06/02/2017 14:33	WG985379
1,3-Dichlorobenzene	ND		0.00100	1	06/02/2017 14:33	WG985379
1,4-Dichlorobenzene	ND		0.00100	1	06/02/2017 14:33	WG985379
Dichlorodifluoromethane	ND	J4	0.00500	1	06/02/2017 14:33	WG985379
1,1-Dichloroethane	ND		0.00100	1	06/02/2017 14:33	WG985379
1,2-Dichloroethane	ND		0.00100	1	06/02/2017 14:33	WG985379
1,1-Dichloroethene	ND		0.00100	1	06/02/2017 14:33	WG985379
cis-1,2-Dichloroethene	ND		0.00100	1	06/02/2017 14:33	WG985379
trans-1,2-Dichloroethene	ND		0.00100	1	06/02/2017 14:33	WG985379
1,2-Dichloropropane	ND		0.00100	1	06/02/2017 14:33	WG985379
1,1-Dichloropropene	ND		0.00100	1	06/02/2017 14:33	WG985379
1,3-Dichloropropane	ND		0.00100	1	06/02/2017 14:33	WG985379
cis-1,3-Dichloropropene	ND		0.00100	1	06/02/2017 14:33	WG985379
trans-1,3-Dichloropropene	ND		0.00100	1	06/02/2017 14:33	WG985379
2,2-Dichloropropane	ND		0.00100	1	06/02/2017 14:33	WG985379
Di-isopropyl ether	ND		0.00100	1	06/02/2017 14:33	WG985379
Ethylbenzene	ND		0.00100	1	06/02/2017 14:33	WG985379
Hexachloro-1,3-butadiene	ND		0.00100	1	06/02/2017 14:33	WG985379
Isopropylbenzene	ND		0.00100	1	06/02/2017 14:33	WG985379
p-Isopropyltoluene	ND		0.00100	1	06/02/2017 14:33	WG985379
2-Butanone (MEK)	ND		0.0100	1	06/02/2017 14:33	WG985379
Methylene Chloride	ND		0.00500	1	06/02/2017 14:33	WG985379
4-Methyl-2-pentanone (MIBK)	ND		0.0100	1	06/02/2017 14:33	WG985379
Methyl tert-butyl ether	ND		0.00100	1	06/02/2017 14:33	WG985379
Naphthalene	ND		0.00500	1	06/02/2017 14:33	WG985379
n-Propylbenzene	ND		0.00100	1	06/02/2017 14:33	WG985379
Styrene	ND		0.00100	1	06/02/2017 14:33	WG985379
1,1,1,2-Tetrachloroethane	ND		0.00100	1	06/02/2017 14:33	WG985379
1,1,2,2-Tetrachloroethane	ND		0.00100	1	06/02/2017 14:33	WG985379
1,1,2-Trichlorotrifluoroethane	ND		0.00100	1	06/02/2017 14:33	WG985379
Tetrachloroethene	ND		0.00100	1	06/02/2017 14:33	WG985379
Toluene	ND		0.00100	1	06/02/2017 14:33	WG985379
1,2,3-Trichlorobenzene	ND		0.00100	1	06/02/2017 14:33	WG985379

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
1,2,4-Trichlorobenzene	ND		0.00100	1	06/02/2017 14:33	WG985379
1,1,1-Trichloroethane	ND		0.00100	1	06/02/2017 14:33	WG985379
1,1,2-Trichloroethane	ND		0.00100	1	06/02/2017 14:33	WG985379
Trichloroethene	ND		0.00100	1	06/02/2017 14:33	WG985379
Trichlorofluoromethane	ND		0.00500	1	06/02/2017 14:33	WG985379
1,2,3-Trichloropropane	ND		0.00250	1	06/02/2017 14:33	WG985379
1,2,4-Trimethylbenzene	ND		0.00100	1	06/02/2017 14:33	WG985379
1,2,3-Trimethylbenzene	ND		0.00100	1	06/02/2017 14:33	WG985379
1,3,5-Trimethylbenzene	ND		0.00100	1	06/02/2017 14:33	WG985379
Vinyl chloride	ND		0.00100	1	06/02/2017 14:33	WG985379
Xylenes, Total	ND		0.00300	1	06/02/2017 14:33	WG985379
(S) Toluene-d8	*99.7*		*80.0-120*		*06/02/2017 14:33*	WG985379
(S) Dibromofluoromethane	*89.0*		*76.0-123*		*06/02/2017 14:33*	WG985379
(S) 4-Bromofluorobenzene	*102*		*80.0-120*		*06/02/2017 14:33*	WG985379

Method Blank (MB)

(MB) R3221865-1 05/30/17 11:15

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Mercury	U		0.000049	0.000200

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3221865-2 05/30/17 11:18 • (LCSD) R3221865-3 05/30/17 11:20

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Mercury	0.00300	0.00294	0.00286	98	95	80-120			3	20

L911936-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L911936-01 05/30/17 11:39 • (MS) R3221865-4 05/30/17 11:41 • (MSD) R3221865-5 05/30/17 11:43

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Mercury	0.00300	ND	0.00285	0.00281	95	94	1	75-125			1	20

Method Blank (MB)

(MB) R3222508-1 06/01/17 14:40

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Arsenic	U		0.0065	0.0100
Barium	U		0.0017	0.00500
Cadmium	U		0.0007	0.00200
Chromium	U		0.0014	0.0100
Lead	U		0.0019	0.00500
Selenium	U		0.0074	0.0100
Silver	U		0.0028	0.00500

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3222508-2 06/01/17 14:43 • (LCSD) R3222508-3 06/01/17 14:45

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Arsenic	1.00	0.986	0.999	99	100	80-120			1	20
Barium	1.00	1.02	1.03	102	103	80-120			1	20
Cadmium	1.00	0.993	1.00	99	100	80-120			1	20
Chromium	1.00	0.995	1.01	100	101	80-120			1	20
Lead	1.00	1.01	1.01	101	101	80-120			1	20
Selenium	1.00	1.01	1.02	101	102	80-120			1	20
Silver	0.200	0.181	0.183	90	92	80-120			1	20

L911980-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L911980-01 06/01/17 14:58 • (MS) R3222508-5 06/01/17 15:03 • (MSD) R3222508-6 06/01/17 15:05

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Arsenic	1.00	U	1.00	1.00	100	100	1	75-125			0	20
Barium	1.00	0.138	1.14	1.13	100	100	1	75-125			0	20
Cadmium	1.00	U	1.00	0.998	100	100	1	75-125			0	20
Chromium	1.00	U	0.996	0.981	100	98	1	75-125			1	20
Lead	1.00	U	1.02	1.01	102	101	1	75-125			0	20
Selenium	1.00	U	1.02	1.03	102	103	1	75-125			0	20
Silver	0.200	U	0.182	0.180	91	90	1	75-125			1	20

Method Blank (MB)

(MB) R3222994-4 06/02/17 11:59

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Acetone	U		0.0100	0.0500
Acrolein	U		0.00887	0.0500
Acrylonitrile	U		0.00187	0.0100
Benzene	U		0.000331	0.00100
Bromobenzene	U		0.000352	0.00100
Bromodichloromethane	U		0.000380	0.00100
Bromoform	U		0.000469	0.00100
Bromomethane	U		0.000866	0.00500
n-Butylbenzene	U		0.000361	0.00100
sec-Butylbenzene	U		0.000365	0.00100
tert-Butylbenzene	U		0.000399	0.00100
Carbon tetrachloride	U		0.000379	0.00100
Chlorobenzene	U		0.000348	0.00100
Chlorodibromomethane	U		0.000327	0.00100
Chloroethane	U		0.000453	0.00500
2-Chloroethyl vinyl ether	U		0.00301	0.0500
Chloroform	U		0.000324	0.00500
Chloromethane	U		0.000276	0.00250
2-Chlorotoluene	U		0.000375	0.00100
4-Chlorotoluene	U		0.000351	0.00100
1,2-Dibromo-3-Chloropropane	U		0.00133	0.00500
1,2-Dibromoethane	U		0.000381	0.00100
Dibromomethane	U		0.000346	0.00100
1,2-Dichlorobenzene	U		0.000349	0.00100
1,3-Dichlorobenzene	U		0.000220	0.00100
1,4-Dichlorobenzene	U		0.000274	0.00100
Dichlorodifluoromethane	U		0.000551	0.00500
1,1-Dichloroethane	U		0.000259	0.00100
1,2-Dichloroethane	U		0.000361	0.00100
1,1-Dichloroethene	U		0.000398	0.00100
cis-1,2-Dichloroethene	U		0.000260	0.00100
trans-1,2-Dichloroethene	U		0.000396	0.00100
1,2-Dichloropropane	U		0.000306	0.00100
1,1-Dichloropropene	U		0.000352	0.00100
1,3-Dichloropropane	U		0.000366	0.00100
cis-1,3-Dichloropropene	U		0.000418	0.00100
trans-1,3-Dichloropropene	U		0.000419	0.00100
2,2-Dichloropropane	U		0.000321	0.00100
Di-isopropyl ether	U		0.000320	0.00100
Ethylbenzene	U		0.000384	0.00100

Method Blank (MB)

(MB) R3222994-4 06/02/17 11:59

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Hexachloro-1,3-butadiene	U		0.000256	0.00100
Isopropylbenzene	U		0.000326	0.00100
p-Isopropyltoluene	U		0.000350	0.00100
2-Butanone (MEK)	U		0.00393	0.0100
Methylene Chloride	U		0.00100	0.00500
4-Methyl-2-pentanone (MIBK)	U		0.00214	0.0100
Methyl tert-butyl ether	U		0.000367	0.00100
Naphthalene	U		0.00100	0.00500
n-Propylbenzene	U		0.000349	0.00100
Styrene	U		0.000307	0.00100
1,1,1,2-Tetrachloroethane	U		0.000385	0.00100
1,1,2,2-Tetrachloroethane	U		0.000130	0.00100
Tetrachloroethene	U		0.000372	0.00100
Toluene	U		0.000412	0.00100
1,1,2-Trichlorotrifluoroethane	U		0.000303	0.00100
1,2,3-Trichlorobenzene	U		0.000230	0.00100
1,2,4-Trichlorobenzene	U		0.000355	0.00100
1,1,1-Trichloroethane	U		0.000319	0.00100
1,1,2-Trichloroethane	U		0.000383	0.00100
Trichloroethene	U		0.000398	0.00100
Trichlorofluoromethane	U		0.00120	0.00500
1,2,3-Trichloropropane	U		0.000807	0.00250
1,2,3-Trimethylbenzene	U		0.000321	0.00100
1,2,4-Trimethylbenzene	U		0.000373	0.00100
1,3,5-Trimethylbenzene	U		0.000387	0.00100
Vinyl chloride	U		0.000259	0.00100
Xylenes, Total	U		0.00106	0.00300
(S) Toluene-d8	*101*			*80.0-120*
(S) Dibromofluoromethane	*89.1*			*76.0-123*
(S) 4-Bromofluorobenzene	*97.7*			*80.0-120*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3222994-1 06/02/17 10:25 • (LCSD) R3222994-2 06/02/17 10:48

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Acetone	0.125	0.165	0.170	132	136	10.0-160			3.09	23
Acrolein	0.125	0.379	0.389	303	311	10.0-160	J4	J4	2.75	20
Acrylonitrile	0.125	0.135	0.137	108	109	60.0-142			1.04	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3222994-1 06/02/17 10:25 • (LCSD) R3222994-2 06/02/17 10:48

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Benzene	0.0250	0.0226	0.0230	90.4	92.2	69.0-123			1.95	20
Bromobenzene	0.0250	0.0258	0.0257	103	103	79.0-120			0.0900	20
Bromodichloromethane	0.0250	0.0253	0.0249	101	99.7	76.0-120			1.35	20
Bromoform	0.0250	0.0289	0.0290	116	116	67.0-132			0.200	20
Bromomethane	0.0250	0.0160	0.0213	64.0	85.3	18.0-160		J3	28.5	20
n-Butylbenzene	0.0250	0.0252	0.0249	101	99.5	72.0-126			1.17	20
sec-Butylbenzene	0.0250	0.0265	0.0265	106	106	74.0-121			0.0600	20
tert-Butylbenzene	0.0250	0.0259	0.0259	104	104	75.0-122			0.0800	20
Carbon tetrachloride	0.0250	0.0214	0.0213	85.6	85.0	63.0-122			0.740	20
Chlorobenzene	0.0250	0.0256	0.0258	102	103	79.0-121			0.780	20
Chlorodibromomethane	0.0250	0.0264	0.0266	105	107	75.0-125			1.04	20
Chloroethane	0.0250	0.0273	0.0276	109	111	47.0-152			1.31	20
2-Chloroethyl vinyl ether	0.125	0.124	0.123	99.1	98.4	10.0-160			0.800	22
Chloroform	0.0250	0.0226	0.0224	90.3	89.7	72.0-121			0.730	20
Chloromethane	0.0250	0.0188	0.0193	75.4	77.3	48.0-139			2.53	20
2-Chlorotoluene	0.0250	0.0257	0.0257	103	103	74.0-122			0.180	20
4-Chlorotoluene	0.0250	0.0252	0.0250	101	99.9	79.0-120			1.04	20
1,2-Dibromo-3-Chloropropane	0.0250	0.0266	0.0269	107	107	64.0-127			0.870	20
1,2-Dibromoethane	0.0250	0.0254	0.0253	101	101	77.0-123			0.180	20
Dibromomethane	0.0250	0.0248	0.0246	99.3	98.3	78.0-120			1.09	20
1,2-Dichlorobenzene	0.0250	0.0253	0.0250	101	100	80.0-120			1.22	20
1,3-Dichlorobenzene	0.0250	0.0267	0.0266	107	106	72.0-123			0.180	20
1,4-Dichlorobenzene	0.0250	0.0249	0.0247	99.5	98.9	77.0-120			0.580	20
Dichlorodifluoromethane	0.0250	0.0229	0.0231	91.6	92.2	49.0-155			0.690	20
1,1-Dichloroethane	0.0250	0.0227	0.0228	90.7	91.2	70.0-126			0.560	20
1,2-Dichloroethane	0.0250	0.0214	0.0216	85.7	86.3	67.0-126			0.700	20
1,1-Dichloroethene	0.0250	0.0206	0.0209	82.4	83.5	64.0-129			1.30	20
cis-1,2-Dichloroethene	0.0250	0.0213	0.0214	85.4	85.4	73.0-120			0.0600	20
trans-1,2-Dichloroethene	0.0250	0.0213	0.0217	85.2	86.9	71.0-121			2.00	20
1,2-Dichloropropane	0.0250	0.0260	0.0256	104	102	75.0-125			1.43	20
1,1-Dichloropropene	0.0250	0.0221	0.0217	88.4	86.7	71.0-129			1.95	20
1,3-Dichloropropane	0.0250	0.0255	0.0254	102	102	80.0-121			0.350	20
cis-1,3-Dichloropropene	0.0250	0.0246	0.0245	98.5	98.1	79.0-123			0.500	20
trans-1,3-Dichloropropene	0.0250	0.0256	0.0253	103	101	74.0-127			1.30	20
2,2-Dichloropropane	0.0250	0.0207	0.0207	82.6	82.9	60.0-125			0.410	20
Di-isopropyl ether	0.0250	0.0243	0.0239	97.1	95.8	59.0-133			1.42	20
Ethylbenzene	0.0250	0.0254	0.0256	102	103	77.0-120			0.950	20
Hexachloro-1,3-butadiene	0.0250	0.0274	0.0278	110	111	64.0-131			1.29	20
Isopropylbenzene	0.0250	0.0253	0.0255	101	102	75.0-120			0.720	20
p-Isopropyltoluene	0.0250	0.0268	0.0271	107	108	74.0-126			0.790	20

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3222994-1 06/02/17 10:25 • (LCSD) R3222994-2 06/02/17 10:48

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
2-Butanone (MEK)	0.125	0.132	0.132	106	106	37.0-158			0.0400	20
Methylene Chloride	0.0250	0.0213	0.0213	85.2	85.2	66.0-121			0.0200	20
4-Methyl-2-pentanone (MIBK)	0.125	0.145	0.145	116	116	59.0-143			0.110	20
Methyl tert-butyl ether	0.0250	0.0226	0.0225	90.2	90.0	64.0-123			0.240	20
Naphthalene	0.0250	0.0249	0.0249	99.7	99.5	62.0-128			0.210	20
n-Propylbenzene	0.0250	0.0261	0.0263	104	105	79.0-120			0.830	20
Styrene	0.0250	0.0271	0.0277	109	111	78.0-124			1.95	20
1,1,1,2-Tetrachloroethane	0.0250	0.0257	0.0259	103	103	75.0-122			0.580	20
1,1,2,2-Tetrachloroethane	0.0250	0.0275	0.0277	110	111	71.0-122			0.830	20
Tetrachloroethene	0.0250	0.0257	0.0259	103	104	70.0-127			0.680	20
Toluene	0.0250	0.0247	0.0251	98.7	100	77.0-120			1.54	20
1,1,2-Trichlorotrifluoroethane	0.0250	0.0221	0.0220	88.5	87.9	61.0-136			0.600	20
1,2,3-Trichlorobenzene	0.0250	0.0265	0.0262	106	105	61.0-133			1.08	20
1,2,4-Trichlorobenzene	0.0250	0.0266	0.0263	106	105	69.0-129			1.35	20
1,1,1-Trichloroethane	0.0250	0.0214	0.0216	85.4	86.5	68.0-122			1.32	20
1,1,2-Trichloroethane	0.0250	0.0248	0.0251	99.2	100	78.0-120			1.15	20
Trichloroethene	0.0250	0.0253	0.0257	101	103	78.0-120			1.48	20
Trichlorofluoromethane	0.0250	0.0241	0.0241	96.4	96.5	56.0-137			0.180	20
1,2,3-Trichloropropane	0.0250	0.0256	0.0254	102	102	72.0-124			0.600	20
1,2,3-Trimethylbenzene	0.0250	0.0243	0.0242	97.1	96.7	75.0-120			0.430	20
1,2,4-Trimethylbenzene	0.0250	0.0259	0.0259	104	104	75.0-120			0.110	20
1,3,5-Trimethylbenzene	0.0250	0.0258	0.0261	103	104	75.0-120			1.13	20
Vinyl chloride	0.0250	0.0266	0.0265	106	106	64.0-133			0.320	20
Xylenes, Total	0.0750	0.0758	0.0777	101	104	77.0-120			2.48	20
(S) Toluene-d8				*101*	*102*	*80.0-120*				
(S) Dibromofluoromethane				*89.3*	*89.5*	*76.0-123*				
(S) 4-Bromofluorobenzene				*97.8*	*97.5*	*80.0-120*				

L911968-07 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L911968-07 06/05/17 02:07 • (MS) R3223116-1 06/05/17 03:14 • (MSD) R3223116-2 06/05/17 03:31

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Acetone	0.125	U	8.84	9.03	70.7	72.2	100	10.0-139			2.12	25
Acrolein	0.125	U	110	110	878	884	100	10.0-160	E J5	E J5	0.660	25
Acrylonitrile	0.125	U	12.5	12.5	100	100	100	46.0-159			0.210	23
Benzene	0.0250	U	2.18	2.21	87.2	88.5	100	34.0-147			1.49	20
Bromobenzene	0.0250	U	2.17	2.19	86.6	87.8	100	51.0-137			1.32	20
Bromodichloromethane	0.0250	U	2.15	2.18	86.1	87.2	100	52.0-135			1.29	20

L911968-07 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L911968-07 06/05/17 02:07 • (MS) R3223116-1 06/05/17 03:14 • (MSD) R3223116-2 06/05/17 03:31

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Bromoform	0.0250	U	2.14	2.19	85.5	87.7	100	50.0-146			2.56	20
Bromomethane	0.0250	U	1.62	1.70	64.7	67.9	100	10.0-160			4.87	23
n-Butylbenzene	0.0250	U	2.17	2.23	86.9	89.0	100	50.0-144			2.44	20
sec-Butylbenzene	0.0250	U	2.03	2.04	81.2	81.7	100	48.0-143			0.650	20
tert-Butylbenzene	0.0250	U	2.02	2.08	81.0	83.4	100	50.0-142			2.94	20
Carbon tetrachloride	0.0250	U	2.20	2.17	88.1	86.7	100	41.0-138			1.61	20
Chlorobenzene	0.0250	U	2.24	2.25	89.6	89.8	100	52.0-141			0.320	20
Chlorodibromomethane	0.0250	U	2.29	2.28	91.5	91.1	100	54.0-142			0.370	20
Chloroethane	0.0250	U	1.91	1.96	76.5	78.3	100	23.0-160			2.40	20
2-Chloroethyl vinyl ether	0.125	U	14.5	13.9	116	111	100	10.0-160			4.41	40
Chloroform	0.0250	U	2.22	2.26	88.6	90.3	100	50.0-139			1.91	20
Chloromethane	0.0250	U	1.36	1.39	54.3	55.6	100	14.0-151			2.33	20
2-Chlorotoluene	0.0250	U	2.18	2.29	87.0	91.5	100	48.0-142			5.07	20
4-Chlorotoluene	0.0250	U	2.26	2.27	90.4	90.9	100	52.0-139			0.600	20
1,2-Dibromo-3-Chloropropane	0.0250	U	1.82	1.83	72.9	73.4	100	49.0-144			0.580	24
1,2-Dibromoethane	0.0250	U	2.31	2.31	92.3	92.2	100	54.0-140			0.0300	20
Dibromomethane	0.0250	U	2.32	2.27	92.8	90.7	100	53.0-138			2.27	20
1,2-Dichlorobenzene	0.0250	U	2.18	2.23	87.2	89.1	100	56.0-139			2.26	20
1,3-Dichlorobenzene	0.0250	U	1.92	1.98	76.9	79.1	100	50.0-141			2.82	20
1,4-Dichlorobenzene	0.0250	U	2.16	2.22	86.5	88.9	100	53.0-136			2.73	20
Dichlorodifluoromethane	0.0250	U	1.20	1.24	48.1	49.5	100	20.0-160			2.95	21
1,1-Dichloroethane	0.0250	U	2.27	2.31	90.8	92.5	100	47.0-143			1.81	20
1,2-Dichloroethane	0.0250	U	2.20	2.18	88.1	87.4	100	47.0-141			0.810	20
1,1-Dichloroethene	0.0250	U	2.24	2.29	89.7	91.5	100	31.0-148			2.00	20
cis-1,2-Dichloroethene	0.0250	U	2.27	2.32	90.6	92.7	100	43.0-142			2.27	20
trans-1,2-Dichloroethene	0.0250	U	2.09	2.16	83.6	86.5	100	36.0-141			3.39	20
1,2-Dichloropropane	0.0250	U	2.30	2.33	92.0	93.3	100	51.0-141			1.35	20
1,1-Dichloropropene	0.0250	U	2.22	2.27	88.7	90.8	100	42.0-146			2.26	20
1,3-Dichloropropane	0.0250	U	2.40	2.33	96.0	93.2	100	58.0-139			2.91	20
cis-1,3-Dichloropropene	0.0250	U	2.47	2.52	98.7	101	100	53.0-139			2.02	20
trans-1,3-Dichloropropene	0.0250	U	2.43	2.37	97.2	94.8	100	51.0-143			2.46	20
2,2-Dichloropropane	0.0250	U	2.23	2.31	89.0	92.2	100	43.0-139			3.55	20
Di-isopropyl ether	0.0250	U	2.21	2.27	88.3	90.9	100	44.0-144			2.81	20
Ethylbenzene	0.0250	U	2.18	2.23	87.3	89.3	100	42.0-147			2.32	20
Hexachloro-1,3-butadiene	0.0250	U	1.60	1.68	64.1	67.0	100	44.0-146			4.37	21
Isopropylbenzene	0.0250	U	2.12	2.19	84.9	87.5	100	48.0-141			2.91	20
p-Isopropyltoluene	0.0250	U	2.00	2.07	80.1	83.0	100	49.0-146			3.58	20
2-Butanone (MEK)	0.125	U	10.1	10.2	80.5	81.9	100	12.0-149			1.63	24
Methylene Chloride	0.0250	U	2.10	2.13	83.9	85.1	100	42.0-135			1.41	20
4-Methyl-2-pentanone (MIBK)	0.125	U	11.2	11.3	89.3	90.2	100	44.0-160			0.950	22

L911968-07 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L911968-07 06/05/17 02:07 • (MS) R3223116-1 06/05/17 03:14 • (MSD) R3223116-2 06/05/17 03:31

	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
Analyte	mg/l	mg/l	mg/l	mg/l	%	%		%			%	%
Methyl tert-butyl ether	0.0250	U	2.25	2.25	89.9	89.8	100	42.0-142			0.0900	20
Naphthalene	0.0250	U	1.45	1.50	58.0	60.0	100	42.0-146			3.33	24
n-Propylbenzene	0.0250	U	2.09	2.17	83.4	86.9	100	47.0-144			4.07	20
Styrene	0.0250	U	2.32	2.35	92.7	94.2	100	47.0-147			1.61	20
1,1,1,2-Tetrachloroethane	0.0250	U	2.13	2.18	85.2	87.3	100	52.0-140			2.43	20
1,1,2,2-Tetrachloroethane	0.0250	U	2.21	2.32	88.5	92.6	100	46.0-149			4.57	20
Tetrachloroethene	0.0250	U	2.07	2.07	82.6	82.7	100	38.0-147			0.140	20
Toluene	0.0250	U	2.12	2.08	84.7	83.3	100	42.0-141			1.72	20
1,1,2-Trichlorotrifluoroethane	0.0250	U	2.29	2.32	91.7	92.9	100	40.0-151			1.28	21
1,2,3-Trichlorobenzene	0.0250	U	1.42	1.46	56.9	58.5	100	45.0-145			2.89	22
1,2,4-Trichlorobenzene	0.0250	U	1.75	1.80	70.2	71.9	100	49.0-147			2.39	21
1,1,1-Trichloroethane	0.0250	U	2.25	2.25	90.0	89.9	100	46.0-140			0.140	20
1,1,2-Trichloroethane	0.0250	U	2.39	2.35	95.5	93.8	100	54.0-139			1.82	20
Trichloroethene	0.0250	U	2.18	2.15	87.4	86.0	100	32.0-156			1.59	20
Trichlorofluoromethane	0.0250	U	2.04	2.09	81.6	83.5	100	32.0-152			2.23	20
1,2,3-Trichloropropane	0.0250	U	2.33	2.42	93.0	96.7	100	54.0-143			3.86	21
1,2,3-Trimethylbenzene	0.0250	U	2.26	2.26	90.3	90.4	100	48.0-138			0.0800	20
1,2,4-Trimethylbenzene	0.0250	U	2.08	2.16	83.4	86.4	100	41.0-146			3.59	20
1,3,5-Trimethylbenzene	0.0250	U	2.08	2.20	83.2	88.2	100	44.0-143			5.77	20
Vinyl chloride	0.0250	U	1.57	1.64	62.8	65.4	100	24.0-153			4.10	20
Xylenes, Total	0.0750	U	6.46	6.64	86.1	88.5	100	41.0-148			2.75	20
(S) Toluene-d8					*102*	*101*		*80.0-120*				
(S) Dibromofluoromethane					*99.6*	*100*		*76.0-123*				
(S) 4-Bromofluorobenzene					*99.1*	*98.8*		*80.0-120*				

Method Blank (MB)

(MB) R3222996-3 06/02/17 12:00

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Acetone	U		0.0100	0.0500
Acrolein	U		0.00887	0.0500
Acrylonitrile	U		0.00187	0.0100
Benzene	U		0.000331	0.00100
Bromobenzene	U		0.000352	0.00100
Bromodichloromethane	U		0.000380	0.00100
Bromoform	U		0.000469	0.00100
Bromomethane	U		0.000866	0.00500
n-Butylbenzene	U		0.000361	0.00100
sec-Butylbenzene	U		0.000365	0.00100
tert-Butylbenzene	U		0.000399	0.00100
Carbon tetrachloride	U		0.000379	0.00100
Chlorobenzene	U		0.000348	0.00100
Chlorodibromomethane	U		0.000327	0.00100
Chloroethane	U		0.000453	0.00500
2-Chloroethyl vinyl ether	U		0.00301	0.0500
Chloroform	U		0.000324	0.00500
Chloromethane	U		0.000276	0.00250
2-Chlorotoluene	U		0.000375	0.00100
4-Chlorotoluene	U		0.000351	0.00100
1,2-Dibromo-3-Chloropropane	U		0.00133	0.00500
1,2-Dibromoethane	U		0.000381	0.00100
Dibromomethane	U		0.000346	0.00100
1,2-Dichlorobenzene	U		0.000349	0.00100
1,3-Dichlorobenzene	U		0.000220	0.00100
1,4-Dichlorobenzene	U		0.000274	0.00100
Dichlorodifluoromethane	U		0.000551	0.00500
1,1-Dichloroethane	U		0.000259	0.00100
1,2-Dichloroethane	U		0.000361	0.00100
1,1-Dichloroethene	U		0.000398	0.00100
cis-1,2-Dichloroethene	U		0.000260	0.00100
trans-1,2-Dichloroethene	U		0.000396	0.00100
1,2-Dichloropropane	U		0.000306	0.00100
1,1-Dichloropropene	U		0.000352	0.00100
1,3-Dichloropropane	U		0.000366	0.00100
cis-1,3-Dichloropropene	U		0.000418	0.00100
trans-1,3-Dichloropropene	U		0.000419	0.00100
2,2-Dichloropropane	U		0.000321	0.00100
Di-isopropyl ether	U		0.000320	0.00100
Ethylbenzene	U		0.000384	0.00100

Method Blank (MB)

(MB) R3222996-3 06/02/17 12:00

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Hexachloro-1,3-butadiene	U		0.000256	0.00100
Isopropylbenzene	U		0.000326	0.00100
p-Isopropyltoluene	U		0.000350	0.00100
2-Butanone (MEK)	U		0.00393	0.0100
Methylene Chloride	U		0.00100	0.00500
4-Methyl-2-pentanone (MIBK)	U		0.00214	0.0100
Methyl tert-butyl ether	U		0.000367	0.00100
Naphthalene	U		0.00100	0.00500
n-Propylbenzene	U		0.000349	0.00100
Styrene	U		0.000307	0.00100
1,1,1,2-Tetrachloroethane	U		0.000385	0.00100
1,1,2,2-Tetrachloroethane	U		0.000130	0.00100
Tetrachloroethene	U		0.000372	0.00100
Toluene	U		0.000412	0.00100
1,1,2-Trichlorotrifluoroethane	U		0.000303	0.00100
1,2,3-Trichlorobenzene	U		0.000230	0.00100
1,2,4-Trichlorobenzene	U		0.000355	0.00100
1,1,1-Trichloroethane	U		0.000319	0.00100
1,1,2-Trichloroethane	U		0.000383	0.00100
Trichloroethene	U		0.000398	0.00100
Trichlorofluoromethane	U		0.00120	0.00500
1,2,3-Trichloropropane	U		0.000807	0.00250
1,2,3-Trimethylbenzene	U		0.000321	0.00100
1,2,4-Trimethylbenzene	U		0.000373	0.00100
1,3,5-Trimethylbenzene	U		0.000387	0.00100
Vinyl chloride	U		0.000259	0.00100
Xylenes, Total	U		0.00106	0.00300
(S) Toluene-d8	*101*			*80.0-120*
(S) Dibromofluoromethane	*92.8*			*76.0-123*
(S) 4-Bromofluorobenzene	*107*			*80.0-120*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3222996-1 06/02/17 10:53 • (LCSD) R3222996-2 06/02/17 11:06

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Acetone	0.125	0.138	0.161	111	129	10.0-160			15.3	23
Acrolein	0.125	0.222	0.257	177	205	10.0-160	J4	J4	14.8	20
Acrylonitrile	0.125	0.0945	0.0959	75.6	76.7	60.0-142			1.42	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3222996-1 06/02/17 10:53 • (LCSD) R3222996-2 06/02/17 11:06

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Benzene	0.0250	0.0217	0.0218	86.9	87.2	69.0-123			0.350	20
Bromobenzene	0.0250	0.0235	0.0240	93.8	95.9	79.0-120			2.21	20
Bromodichloromethane	0.0250	0.0229	0.0226	91.5	90.4	76.0-120			1.19	20
Bromoform	0.0250	0.0204	0.0209	81.7	83.4	67.0-132			2.09	20
Bromomethane	0.0250	0.0225	0.0234	89.9	93.7	18.0-160			4.14	20
n-Butylbenzene	0.0250	0.0247	0.0255	98.8	102	72.0-126			3.17	20
sec-Butylbenzene	0.0250	0.0233	0.0241	93.0	96.3	74.0-121			3.47	20
tert-Butylbenzene	0.0250	0.0230	0.0241	91.8	96.2	75.0-122			4.72	20
Carbon tetrachloride	0.0250	0.0214	0.0224	85.7	89.5	63.0-122			4.34	20
Chlorobenzene	0.0250	0.0238	0.0241	95.3	96.3	79.0-121			1.12	20
Chlorodibromomethane	0.0250	0.0220	0.0225	88.2	89.9	75.0-125			1.96	20
Chloroethane	0.0250	0.0229	0.0225	91.7	90.2	47.0-152			1.62	20
2-Chloroethyl vinyl ether	0.125	0.105	0.105	84.4	84.1	10.0-160			0.350	22
Chloroform	0.0250	0.0223	0.0220	89.1	88.2	72.0-121			1.07	20
Chloromethane	0.0250	0.0249	0.0257	99.7	103	48.0-139			2.87	20
2-Chlorotoluene	0.0250	0.0236	0.0248	94.6	99.3	74.0-122			4.89	20
4-Chlorotoluene	0.0250	0.0236	0.0245	94.3	98.0	79.0-120			3.88	20
1,2-Dibromo-3-Chloropropane	0.0250	0.0181	0.0181	72.5	72.6	64.0-127			0.0500	20
1,2-Dibromoethane	0.0250	0.0239	0.0241	95.7	96.3	77.0-123			0.600	20
Dibromomethane	0.0250	0.0233	0.0228	93.0	91.3	78.0-120			1.93	20
1,2-Dichlorobenzene	0.0250	0.0204	0.0209	81.4	83.8	80.0-120			2.83	20
1,3-Dichlorobenzene	0.0250	0.0188	0.0191	75.1	76.5	72.0-123			1.89	20
1,4-Dichlorobenzene	0.0250	0.0227	0.0235	90.7	94.1	77.0-120			3.72	20
Dichlorodifluoromethane	0.0250	0.0406	0.0412	162	165	49.0-155	J4	J4	1.40	20
1,1-Dichloroethane	0.0250	0.0212	0.0210	84.7	84.1	70.0-126			0.690	20
1,2-Dichloroethane	0.0250	0.0224	0.0223	89.7	89.3	67.0-126			0.510	20
1,1-Dichloroethene	0.0250	0.0213	0.0217	85.4	86.7	64.0-129			1.53	20
cis-1,2-Dichloroethene	0.0250	0.0211	0.0210	84.5	84.1	73.0-120			0.450	20
trans-1,2-Dichloroethene	0.0250	0.0214	0.0213	85.7	85.3	71.0-121			0.470	20
1,2-Dichloropropane	0.0250	0.0228	0.0231	91.3	92.4	75.0-125			1.24	20
1,1-Dichloropropene	0.0250	0.0220	0.0221	88.2	88.3	71.0-129			0.100	20
1,3-Dichloropropane	0.0250	0.0244	0.0249	97.8	99.7	80.0-121			1.92	20
cis-1,3-Dichloropropene	0.0250	0.0226	0.0226	90.4	90.2	79.0-123			0.250	20
trans-1,3-Dichloropropene	0.0250	0.0228	0.0223	91.3	89.3	74.0-127			2.20	20
2,2-Dichloropropane	0.0250	0.0224	0.0219	89.4	87.7	60.0-125			1.96	20
Di-isopropyl ether	0.0250	0.0208	0.0206	83.4	82.3	59.0-133			1.26	20
Ethylbenzene	0.0250	0.0237	0.0244	94.9	97.6	77.0-120			2.80	20
Hexachloro-1,3-butadiene	0.0250	0.0190	0.0210	76.0	84.0	64.0-131			9.91	20
Isopropylbenzene	0.0250	0.0238	0.0246	95.2	98.6	75.0-120			3.50	20
p-Isopropyltoluene	0.0250	0.0213	0.0216	85.1	86.6	74.0-126			1.78	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3222996-1 06/02/17 10:53 • (LCSD) R3222996-2 06/02/17 11:06

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
2-Butanone (MEK)	0.125	0.115	0.113	92.4	90.5	37.0-158			2.07	20
Methylene Chloride	0.0250	0.0211	0.0214	84.5	85.4	66.0-121			1.03	20
4-Methyl-2-pentanone (MIBK)	0.125	0.104	0.104	82.8	83.1	59.0-143			0.370	20
Methyl tert-butyl ether	0.0250	0.0221	0.0219	88.2	87.5	64.0-123			0.830	20
Naphthalene	0.0250	0.0182	0.0200	72.9	80.1	62.0-128			9.32	20
n-Propylbenzene	0.0250	0.0236	0.0247	94.5	98.8	79.0-120			4.47	20
Styrene	0.0250	0.0229	0.0233	91.5	93.3	78.0-124			1.96	20
1,1,1,2-Tetrachloroethane	0.0250	0.0229	0.0236	91.4	94.3	75.0-122			3.06	20
1,1,2,2-Tetrachloroethane	0.0250	0.0233	0.0243	93.3	97.2	71.0-122			4.06	20
Tetrachloroethene	0.0250	0.0224	0.0229	89.7	91.7	70.0-127			2.14	20
Toluene	0.0250	0.0238	0.0236	95.3	94.6	77.0-120			0.770	20
1,1,2-Trichlorotrifluoroethane	0.0250	0.0245	0.0252	97.9	101	61.0-136			2.82	20
1,2,3-Trichlorobenzene	0.0250	0.0176	0.0197	70.2	78.7	61.0-133			11.3	20
1,2,4-Trichlorobenzene	0.0250	0.0180	0.0197	72.0	78.9	69.0-129			9.20	20
1,1,1-Trichloroethane	0.0250	0.0226	0.0223	90.3	89.1	68.0-122			1.41	20
1,1,2-Trichloroethane	0.0250	0.0241	0.0246	96.3	98.4	78.0-120			2.13	20
Trichloroethene	0.0250	0.0220	0.0216	87.9	86.5	78.0-120			1.61	20
Trichlorofluoromethane	0.0250	0.0237	0.0257	94.6	103	56.0-137			8.22	20
1,2,3-Trichloropropane	0.0250	0.0237	0.0244	94.9	97.4	72.0-124			2.59	20
1,2,3-Trimethylbenzene	0.0250	0.0248	0.0251	99.1	100	75.0-120			1.22	20
1,2,4-Trimethylbenzene	0.0250	0.0228	0.0237	91.3	94.9	75.0-120			3.82	20
1,3,5-Trimethylbenzene	0.0250	0.0234	0.0241	93.4	96.2	75.0-120			2.97	20
Vinyl chloride	0.0250	0.0243	0.0248	97.1	99.1	64.0-133			1.95	20
Xylenes, Total	0.0750	0.0716	0.0731	95.5	97.5	77.0-120			2.07	20
(S) Toluene-d8				*103*	*101*	*80.0-120*				
(S) Dibromofluoromethane				*94.3*	*94.8*	*76.0-123*				
(S) 4-Bromofluorobenzene				*102*	*105*	*80.0-120*				

L911956-06 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L911956-06 06/02/17 18:01 • (MS) R3222996-4 06/02/17 17:21 • (MSD) R3222996-5 06/02/17 17:35

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Acetone	0.125	ND	0.0887	0.0860	70.9	68.8	1	10.0-139			3.09	25
Acrolein	0.125	ND	0.273	0.281	219	225	1	10.0-160	J5	J5	2.70	25
Acrylonitrile	0.125	ND	0.0930	0.0919	74.4	73.5	1	46.0-159			1.21	23
Benzene	0.0250	ND	0.0189	0.0187	75.5	74.8	1	34.0-147			0.950	20
Bromobenzene	0.0250	ND	0.0233	0.0236	93.2	94.4	1	51.0-137			1.24	20
Bromodichloromethane	0.0250	ND	0.0222	0.0221	88.9	88.3	1	52.0-135			0.700	20

L911956-06 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L911956-06 06/02/17 18:01 • (MS) R3222996-4 06/02/17 17:21 • (MSD) R3222996-5 06/02/17 17:35

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Bromoform	0.0250	ND	0.0200	0.0207	80.2	82.7	1	50.0-146			3.09	20
Bromomethane	0.0250	ND	0.0148	0.0144	59.3	57.7	1	10.0-160			2.78	23
n-Butylbenzene	0.0250	ND	0.0270	0.0272	108	109	1	50.0-144			0.620	20
sec-Butylbenzene	0.0250	ND	0.0238	0.0239	95.0	95.8	1	48.0-143			0.790	20
tert-Butylbenzene	0.0250	ND	0.0235	0.0239	94.1	95.6	1	50.0-142			1.61	20
Carbon tetrachloride	0.0250	ND	0.0203	0.0208	79.5	81.9	1	41.0-138			2.82	20
Chlorobenzene	0.0250	ND	0.0225	0.0226	89.9	90.3	1	52.0-141			0.350	20
Chlorodibromomethane	0.0250	ND	0.0220	0.0221	88.1	88.5	1	54.0-142			0.450	20
Chloroethane	0.0250	ND	0.0170	0.0166	68.0	66.6	1	23.0-160			2.06	20
2-Chloroethyl vinyl ether	0.125	ND	ND	ND	0.000	0.000	1	10.0-160	J6	J6	0.000	40
Chloroform	0.0250	ND	0.0219	0.0215	85.2	83.7	1	50.0-139			1.74	20
Chloromethane	0.0250	ND	0.0153	0.0151	61.1	60.5	1	14.0-151			0.930	20
2-Chlorotoluene	0.0250	ND	0.0236	0.0239	94.4	95.8	1	48.0-142			1.44	20
4-Chlorotoluene	0.0250	ND	0.0236	0.0240	94.4	96.2	1	52.0-139			1.86	20
1,2-Dibromo-3-Chloropropane	0.0250	ND	0.0180	0.0182	71.9	72.7	1	49.0-144			1.14	24
1,2-Dibromoethane	0.0250	ND	0.0218	0.0218	87.4	87.3	1	54.0-140			0.0900	20
Dibromomethane	0.0250	ND	0.0206	0.0202	82.6	81.0	1	53.0-138			2.00	20
1,2-Dichlorobenzene	0.0250	ND	0.0209	0.0210	83.6	83.8	1	56.0-139			0.320	20
1,3-Dichlorobenzene	0.0250	ND	0.0181	0.0181	72.4	72.5	1	50.0-141			0.0600	20
1,4-Dichlorobenzene	0.0250	ND	0.0231	0.0234	92.5	93.7	1	53.0-136			1.33	20
Dichlorodifluoromethane	0.0250	ND	0.0333	0.0319	133	128	1	20.0-160			4.37	21
1,1-Dichloroethane	0.0250	ND	0.0195	0.0194	77.9	77.7	1	47.0-143			0.220	20
1,2-Dichloroethane	0.0250	ND	0.0202	0.0197	80.6	78.9	1	47.0-141			2.18	20
1,1-Dichloroethene	0.0250	ND	0.0169	0.0168	67.5	67.2	1	31.0-148			0.370	20
cis-1,2-Dichloroethene	0.0250	0.00271	0.0216	0.0215	75.6	75.1	1	43.0-142			0.530	20
trans-1,2-Dichloroethene	0.0250	ND	0.0162	0.0158	64.9	63.4	1	36.0-141			2.42	20
1,2-Dichloropropane	0.0250	ND	0.0218	0.0216	87.3	86.4	1	51.0-141			0.970	20
1,1-Dichloropropene	0.0250	ND	0.0180	0.0180	72.1	71.8	1	42.0-146			0.420	20
1,3-Dichloropropane	0.0250	ND	0.0232	0.0230	92.6	91.8	1	58.0-139			0.860	20
cis-1,3-Dichloropropene	0.0250	ND	0.0211	0.0209	84.4	83.7	1	53.0-139			0.890	20
trans-1,3-Dichloropropene	0.0250	ND	0.0216	0.0213	86.5	85.2	1	51.0-143			1.61	20
2,2-Dichloropropane	0.0250	ND	0.0224	0.0222	89.6	88.8	1	43.0-139			0.960	20
Di-isopropyl ether	0.0250	ND	0.0196	0.0195	78.4	78.2	1	44.0-144			0.280	20
Ethylbenzene	0.0250	ND	0.0225	0.0226	90.0	90.5	1	42.0-147			0.520	20
Hexachloro-1,3-butadiene	0.0250	ND	0.0218	0.0217	87.3	86.7	1	44.0-146			0.600	21
Isopropylbenzene	0.0250	ND	0.0238	0.0240	95.4	96.0	1	48.0-141			0.690	20
p-Isopropyltoluene	0.0250	ND	0.0212	0.0214	84.9	85.8	1	49.0-146			1.05	20
2-Butanone (MEK)	0.125	ND	0.0863	0.0872	69.0	69.7	1	12.0-149			1.00	24
Methylene Chloride	0.0250	ND	0.0178	0.0174	71.1	69.7	1	42.0-135			1.99	20
4-Methyl-2-pentanone (MIBK)	0.125	ND	0.100	0.0988	80.2	79.1	1	44.0-160			1.36	22

L911956-06 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L911956-06 06/02/17 18:01 • (MS) R3222996-4 06/02/17 17:21 • (MSD) R3222996-5 06/02/17 17:35

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Methyl tert-butyl ether	0.0250	ND	0.0210	0.0207	83.8	82.8	1	42.0-142			1.27	20
Naphthalene	0.0250	ND	0.0192	0.0195	76.7	77.9	1	42.0-146			1.58	24
n-Propylbenzene	0.0250	ND	0.0238	0.0239	95.2	95.8	1	47.0-144			0.620	20
Styrene	0.0250	ND	0.0222	0.0221	88.6	88.5	1	47.0-147			0.120	20
1,1,1,2-Tetrachloroethane	0.0250	ND	0.0232	0.0233	92.9	93.3	1	52.0-140			0.450	20
1,1,2,2-Tetrachloroethane	0.0250	ND	0.0241	0.0245	96.4	98.0	1	46.0-149			1.68	20
Tetrachloroethene	0.0250	0.0766	0.0917	0.0910	60.5	57.4	1	38.0-147			0.840	20
Toluene	0.0250	ND	0.0214	0.0211	85.7	84.4	1	42.0-141			1.50	20
1,1,2-Trichlorotrifluoroethane	0.0250	ND	0.0237	0.0235	95.0	94.0	1	40.0-151			1.05	21
1,2,3-Trichlorobenzene	0.0250	ND	0.0182	0.0182	72.7	72.8	1	45.0-145			0.110	22
1,2,4-Trichlorobenzene	0.0250	ND	0.0192	0.0195	76.8	77.9	1	49.0-147			1.40	21
1,1,1-Trichloroethane	0.0250	ND	0.0228	0.0223	87.5	85.7	1	46.0-140			1.93	20
1,1,2-Trichloroethane	0.0250	ND	0.0235	0.0231	94.2	92.5	1	54.0-139			1.77	20
Trichloroethene	0.0250	0.0347	0.0536	0.0524	75.5	70.6	1	32.0-156			2.30	20
Trichlorofluoromethane	0.0250	ND	0.0224	0.0221	89.7	88.3	1	32.0-152			1.61	20
1,2,3-Trichloropropane	0.0250	ND	0.0237	0.0234	94.7	93.8	1	54.0-143			0.960	21
1,2,3-Trimethylbenzene	0.0250	ND	0.0253	0.0255	101	102	1	48.0-138			0.610	20
1,2,4-Trimethylbenzene	0.0250	ND	0.0227	0.0230	90.9	91.8	1	41.0-146			1.02	20
1,3,5-Trimethylbenzene	0.0250	ND	0.0229	0.0233	91.5	93.4	1	44.0-143			2.09	20
Vinyl chloride	0.0250	ND	0.0167	0.0165	66.7	65.9	1	24.0-153			1.24	20
Xylenes, Total	0.0750	ND	0.0671	0.0677	89.5	90.3	1	41.0-148			0.890	20
(S) Toluene-d8					*103*	*102*		*80.0-120*				
(S) Dibromofluoromethane					*94.4*	*94.4*		*76.0-123*				
(S) 4-Bromofluorobenzene					*103*	*104*		*80.0-120*				

Abbreviations and Definitions

SDG	Sample Delivery Group.
MDL	Method Detection Limit.
RDL	Reported Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
U	Not detected at the Reporting Limit (or MDL where applicable).
RPD	Relative Percent Difference.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Rec.	Recovery.

Qualifier	Description
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
J1	Surrogate recovery limits have been exceeded; values are outside upper control limits.
J3	The associated batch QC was outside the established quality control range for precision.
J4	The associated batch QC was outside the established quality control range for accuracy.
J5	The sample matrix interfered with the ability to make any accurate determination; spike value is high.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.

ACCREDITATIONS & LOCATIONS

ESC Lab Sciences is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our "one location" design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be **YOUR LAB OF CHOICE.**
* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

State Accreditations

Alabama	40660
Alaska	UST-080
Arizona	AZ0612
Arkansas	88-0469
California	01157CA
Colorado	TN00003
Conneticut	PH-0197
Florida	E87487
Georgia	NELAP
Georgia [1]	923
Idaho	TN00003
Illinois	200008
Indiana	C-TN-01
Iowa	364
Kansas	E-10277
Kentucky [1]	90010
Kentucky [2]	16
Louisiana	AI30792
Maine	TN0002
Maryland	324
Massachusetts	M-TN003
Michigan	9958
Minnesota	047-999-395
Mississippi	TN00003
Missouri	340
Montana	CERT0086
Nebraska	NE-OS-15-05
Nevada	TN-03-2002-34
New Hampshire	2975
New Jersey–NELAP	TN002
New Mexico	TN00003
New York	11742
North Carolina	Env375
North Carolina [1]	DW21704
North Carolina [2]	41
North Dakota	R-140
Ohio–VAP	CL0069
Oklahoma	9915
Oregon	TN200002
Pennsylvania	68-02979
Rhode Island	221
South Carolina	84004
South Dakota	n/a
Tennessee [1,4]	2006
Texas	T 104704245-07-TX
Texas [5]	LAB0152
Utah	6157585858
Vermont	VT2006
Virginia	109
Washington	C1915
West Virginia	233
Wisconsin	9980939910
Wyoming	A2LA

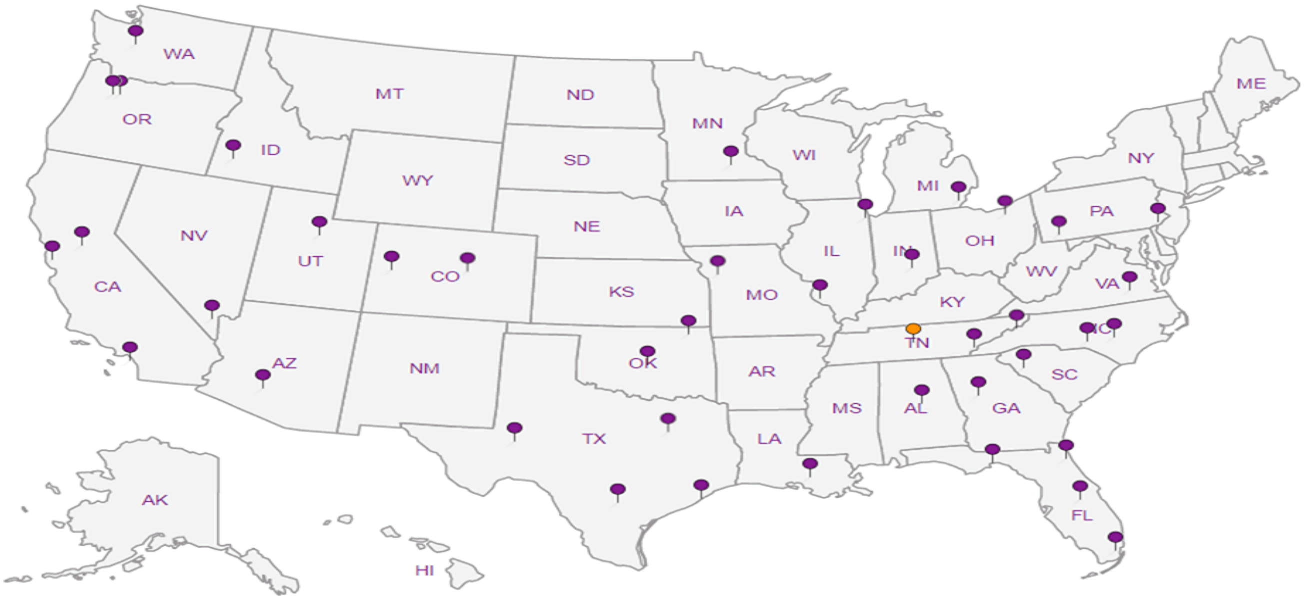
Third Party & Federal Accreditations

A2LA – ISO 17025	1461.01
A2LA – ISO 17025 [5]	1461.02
Canada	1461.01
EPA–Crypto	TN00003
AIHA-LAP,LLC	100789
DOD	1461.01
USDA	S-67674

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [n/a] Accreditation not applicable

Our Locations

ESC Lab Sciences has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. **ESC Lab Sciences performs all testing at our central laboratory.**



911936

Page 1 of 1

Terracon

Terracon Consultants, Inc.
110 12th Street North • Birmingham, AL 35203
Phone (205) 942-1289 • Fax (205) 942-1266

Laboratory: ESC
Address: 12065 Lebanon Road, Mt. Juliet, TN 37122
GAI-

D144

Project Name: Greif Property
Project #: E117003
Facility Location (City, St): Cullman, Alabama
Project Manager: Terry Bierstein
Sampler Sign/Print: Brandon Kyle Haggard

ANALYSIS REQUEST

Field Sample ID	Lab#	#CONTAINERS	Matrix: WATER	SOIL	AIR	SLUDGE	OTHER	Method Preserved: HCl	HNO_3	H_2SO_4	NaOH	ICE	unpreserved	other (specify)	Sampling: DATE	TIME	Type G=Grab C=Composite D=Discrete	BTEX☐ MTBE☐ IPE☐ Method	GRO ☐ OA-1☐ Method	TPH Low☐ MASS VPH☐ Other☐	DRO ☐ OA-2☐ TPH High☐	TN EPH☐ MASS EPH☐ Other☐	TPH ☐	Oil and Grease Method	Lead Total☐ Dissolved☐ Method	Metals Total☑ Dissolved☐ Method 6010	PAH Method	VOA ☐ VOC☑ Method 8260	PCB's Method	Pesticides, Organochlorine Method	Pesticides, Organophosphorus Method	Herbicides Method	TCLP ☐Metals only ☐VOC/SVOC ☐Full ☐Full Less Pest & Herb	Reactivity☐ Corrosivity☐ Ignitability☐	TOC Method	
MW-1		3	x					2	1						5-23-17	1538										✓		✓								01
MW-2		3	x					2	1						5-23-17	1433										✓		✓								02
MW-3		3	x					2	1						5-23-17	1303										✓		✓								03
MW-4R		3	x					2	1						5-23-17	1143										✓		✓								04
MW-6		3	x					2	1						5-23-17	1400										✓		✓								05
MW-9		3	x					2	1						5-23-17	1324										✓		✓								06
MW-10		3	x					2	1						5-23-17	1252										✓		✓								07
MW-11		3	x					2	1						5-23-17	1640										✓		✓								08
Duplicate		3	x					2	1						5-23-17											✓		✓								09
Trip Blank		1	x												5-23-17													✓								10
															TOTAL# Bottles/Analysis																					

REMARKS

	Date	Time		Date	Time
Relinquished by Sampler:	5-24-17	1400	Received by: ESC	5-24-17	1400
Relinquished by: ESC	5-24-17	1400	Received by:	5-25-17	0845
Relinquished by:			Received by Laboratory:		
Airbill No:			Temperature Received:		

2.3°c COCSI TOll

WHITE - Original YELLOW - Lab PINK - Gallet Copy

ESC LAB SCIENCES

Cooler Receipt Form

Client: GAller SDG# 911936

Cooler Received/Opened On: 5/ 25 /17 Temperature: 2.3

Received by :Jon Deboard

Signature:

Receipt Check List	NP	Yes	No
COC Seal Present / Intact?	✓		
COC Signed / Accurate?		✓	
Bottles arrive intact?		✓	
Correct bottles used?		✓	
Sufficient volume sent?		✓	
If Applicable		✓	
VOA Zero headspace?		✓	
Preservation Correct / Checked?		✓	

ESC Lab Sciences
Non-Conformance Form

Login #911936	**GALLET**	**Date:5/25/17**	**Evaluated by:Matt S**

Non-Conformance (check applicable items)

	Sample Integrity		**Chain of Custody Clarification**		
	Parameter(s) past holding time	x	Login Clarification Needed		**If Broken Container:**
	Improper temperature		Chain of custody is incomplete		Insufficient packing material around container
	Improper container type		Please specify Metals requested.		Insufficient packing material inside cooler
	Improper preservation		Please specify TCLP requested.		Improper handling by carrier (FedEx / UPS / Courie
	Insufficient sample volume.		Received additional samples not listed on coc.		Sample was frozen
	Sample is biphasic.		Sample ids on containers do not match ids on coc		Container lid not intact
	Vials received with headspace.		Trip Blank not received.		**If no Chain of Custody:**
	Broken container		Client did not "X" analysis.		Received by:
	Broken container:		Chain of Custody is missing		Date/Time:
	Sufficient sample remains				Temp./Cont. Rec./pH:
					Carrier:
					Tracking#

Login Comments: which Metals

Client informed by:		Call	x	Email		Voice Mail	Date: 5/25/17	Time: 1619
TSR Initials: jeh	Client Contact: Terry Rippstein							

Login Instructions: RCRA8

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L911936

Jimmy Hunt

From: Rippstein, Terry W. <Terry.Rippstein@terracon.com>
Sent: Thursday, May 25, 2017 4:19 PM
To: Jimmy Hunt; Haggard, Brandon K.
Subject: RE: Greif Property

RCRA 8

Thanks,
Terry

Terrell W. Rippstein, P.G.
Principal
Regional Manager

Terracon Consultants, Inc.
110 12th Street N I Birmingham, AL 35203
P 205 443 5244 I F 205 443 5302 I M 205 515 0040
Terry.Rippstein@terracon.com I terracon.com

From: Jimmy Hunt [mailto:JHunt@esclabsciences.com]
Sent: Thursday, May 25, 2017 4:18 PM
To: Rippstein, Terry W. <Terry.Rippstein@terracon.com>; Haggard, Brandon K. <Kyle.Haggard@terracon.com>
Subject: Greif Property

Terry/Kyle,
What metals do you need on the attached samples?

Thanks,

Jimmy Hunt
Technical Service Representative
Phone: 615-773-9668
Toll Free: 1-800-767-5859 ext:9668
Email: jhunt@esclabsciences.com

GMC

Goodwyn Mills Cawood

2701 1st Avenue South
Suite 100
Birmingham AL 35233

T (205) 879-4462
F (205) 879-4493

www.gmcnetwork.com

RECEIVED
JUN
LAND DIVISION

June 7, 2018

Sonja Favors, Chief
Redevelopment Section
Alabama Department of Environmental Management
P.O. Box 301463
Montgomery, AL 36130

RE: Greif Brother Facility
Major Modification Cleanup Plan Fee
ALERA #461-9496

Ms. Favors ,

Please find a check totaling $3,370.00 attached to this letter for the Major Modification Cleanup Plan Fee for the Greif Brothers Facility (ALERA #461-9496). A copy of this Modified Cleanup Plan has already been sent to Ms. Dixie Beatty for review.

If you have any questions or concerns, please contact me at (205) 949-3953 or at Crystal.Shurett@gmcnetwork.com.

Sincerely,

Crystal Shurett

Crystal Shurett
Environmental Scientist
Goodwyn, Mills, and Cawood, Inc.
Enclosures

Modified Cleanup Plan
For Greif Brothers Facility (Parcels A & B)
Cullman, Cullman County, Alabama
ALERA Site No. 461-9496

RECEIVED
MAY 2018
LAND DIVISION

ADEM
Alabama Department of Environmental Management

CULLMAN, Est 1873

Prepared on Behalf of:
City of Cullman
204 2nd Avenue NE
Cullman, AL 35055

Prepared for:
Alabama Department of Environmental Management
1400 Coliseum Boulevard
Montgomery, AL 36130

Prepared By:

GMC

2701 1st Ave S., Suite 100
Birmingham, Alabama 35233

April 23, 2018

TABLE OF CONTENTS

FIGURES

TABLES

I. Executive Summary

The former Greif Brothers Corporation (Greif) facility property, located in downtown Cullman, has a long history of industrial use. These uses include a former industrial laundry operation, canning operation, sheet metal manufacturer, and most recently, a drum manufacturing facility (Greif). A review of regulatory agency records listed this site as a large quantity hazardous waste generator and on the underground storage tank list. In August 2001 and July 2002, Environmental Resources Management (ERM) performed a Phase I Environmental Site Assessment, Limited Phase II Investigation and Phase III on the Greif facility. Through these investigations, ERM identified 12 Areas of Concern (AOC) that included soil and groundwater contamination from Aromatic/Chlorinated Solvents, Heavy Metals, and Total Petroleum Hydrocarbons (Figure 4). In 2008, the City of Cullman applied for the Greif Facility to be a part of the Voluntary Cleanup Program. In the Assessment/Cleanup Plan dated February 6, 2009, Goodwyn, Mills and Cawood (GMC) recommended remediating these areas by limited surficial soil removal, phytoremediation, filling/capping, and paving. The majority of corrective action activities and sampling was conducted between 2011 and 2014. GMC redefined the areas of concern into three larger parcels for cleanup purposes: AOC #1, AOC #2, and AOC#3 (Figure 3). AOC #1 underwent in-situ blending with sodium persulfate, enhanced with lime activation in December 2011 to February 2012. Polishing of the remaining contaminants was accomplished with phytoremediation and low-vacuum removal (micro-blower attached to well) of vapors in the soil vadose zone. AOC#2 was also treated with in-situ blending with sodium persulfate, enhanced with lime; this work was conducted in 2013-2014. Remediation at AOC#3 was also conducted during the same time via phytoremediation plots and by the installation of a vapor extraction system.

The only constituent that failed to meet the target soil cleanup level was trichloroethene in sample PA2-S1B (located in AOC#2); results indicate a level of 0.082 ppm which is greater than the goal of 0.06ppm which was established in the Assessment/Cleanup Plan dated February 6, 2009. It is anticipated that the natural degradation process will continue to reduce the concentration of trichloroethene. Arsenic, cadmium, lead, 1,1 dichloroethene (DCE), cis-1, 2-DCE, tetrachloroethene, trichloroethene, and vinyl chloride were present in various groundwater monitoring locations throughout the site in concentrations above the Corrective Action Levels/Maximum Contaminant Levels (CALs/MCLs). However, with the exception of monitoring well #6 (MW-6), constituents in all wells are below CALs/MCLs or have shown decreasing trends. MW-6 has shown an increase in daughter products such as dichloroethene and vinyl chloride due to the breakdown of trichloroethylene (TCE). The data suggests this degradation of TCE has not stagnated as of May 2017, since daughter products have increased from 2014.

GMC recommends that an environmental covenant be placed on the property to restrict groundwater use and that any area for public use be capped by two feet of clean clay material or asphalt. The plans for the former Greif facility are to convert it into a multi-use green space. The City of Cullman has designed plans for a multi-use "Depot Park." Because of the aforementioned environmental covenant and proposed future use of the site, no further remedial action is proposed at this time.

GMC believes that the executed remedial actions have successfully reduced contaminants. The environmental covenant restricting groundwater use and implementation of capping in public use areas will further prevent any contact with residual contamination on the subject site. Any low vacuum removal systems or vapor extraction systems are no longer necessary. All groundwater monitoring wells will be properly closed and/or removed. Any soil sampling or groundwater sampling, as proposed in the 2009 assessment/cleanup plan, is also no longer necessary. Additionally, any maintenance of phytoremediation plots or sampling of phytoremediation plant matter as a part of the remedial action as established in the 2009 assessment/cleanup plan, are no longer necessary.

I. Location

The subject property is located west adjacent to 601 2nd Ave NE, Cullman, Cullman County, Alabama. The site is approximately 13.81 acres (about two city blocks) and is bounded north by 8th Street NE, east by 2nd Ave NE, south by Elizabeth Street NE, and west by railroad tracks (Figure 1). The site can further be described as being in Township-10-South, Range-3-West, and Section 10 on the Cullman, Alabama 7.5 minute quadrangle map (Figure 2). The coordinates of the site are latitude N34.1817° and longitude W86.8459°. There are several structures on site including the Cullman City Garage, the Cullman Street Department and city storage, and the Cullman Police Department.

II. History

The Greif facility's property has a long history of industrial use dating back to 1917. Historical industrial companies include Bremen Manufacturing Company, Standard Industrial Laundry, Porter Knitting Mills Company, Cullman Supply Company, Acadia Planning, King Pharr Canning Company, and Raible Division Sheet Metal and Stamping Company. The most recent company, Greif Brothers Corporation, used the property to manufacture steel drum containers from 1947 to 2002. Materials in the manufacturing process include steel coils, paints, and plastic liners. The Cullman Supply Company (CUSCO), which was also owned by Greif, was a machine shop and parts warehouse that was also located on the property. CUSCO operated several different processes including saw-blade manufacturing and repair, a welding shop, a machine shop, and a parts distribution center. The machine shop housed metal cutting, milling, and surface grinding equipment. A review of regulatory agency records listed this site as a large quantity hazardous waste generator and on the underground storage tank list.

The Greif Brothers Corporation site has been divided into two parcels: A and B (Figure 3). Parcel A is approximately 12.02 acres in size and Parcel B is approximately 1.79 acres in size. Parcel A contains the majority of the former Greif facility and in November 2008 the City of Cullman applied for this site to be a part of the Voluntary Cleanup Program (ALERA #461-9496). At the time, the City of Cullman did not have ownership of Parcel B which is located west of Parcel A; rather, the property was under ownership of the railroad company CSX. However, several areas of concern were still identified on Parcel B, due to the fact that Parcels A and B are adjacent properties and share a building. These areas of concern contained constituents that include a trichloroethylene (TCE) degreaser area and oil stained soils. Parcel B was also next to a former hazardous waste storage shed. An inspection in September 2015 by a GMC representative found that Parcel B contained stained soils and an area where it appears that coal/coke residues and slag was present. It appeared that a release may have occurred during the railroad company's occupation of Parcel B. There are no manmade structures on Parcel B except for the exterior wall of the northern Greif building that is now being used as a City Garage, Water/Sewer Department, and Sanitation Department. A ditch is located between Parcel B and the railroad property that likely received stormwater during rain events. Monitoring Well #1 and #2 are located on Parcel B. In 2014 the City of Cullman purchased Parcel B; a modification to the VCP boundary of the Greif facility to include Parcel B was approved by Larry Norris at

ADEM on February 19, 2016. Parcel A has undergone remedial action, while Parcel B has not as of March 2, 2018.

III. Areas of Concern

In August 2001 and July 2002, Environmental Resources Management (ERM) performed a Phase I Environmental Site Assessment, Limited Phase II Investigation and Phase III on the Greif facility. Through these investigations, ERM identified 12 Areas of Concern (AOC) which are detailed below and map locations can be found in Figure 4.

Table 1. Areas of Concern as Defined by Environmental Resources Management ('01-'02)

AOC	**Former Use**	**Exceed Regulatory Limits**		
		Aromatic/Chlorinated Solvents	Heavy Metals	Total Petroleum Hydrocarbons
1	Scrap Metal/Equipment Storage Area		S	
2	Hazardous Material Storage Area	GW		S, GW
3	Trichloroethylene (TCE) Degreaser Area	GW	GW	
4	Oil Stained Soil	S	S	
5	Hazardous Waste Storage Area/Light Gauge Paint Room	GW	S, GW	
6	Former UST (Diesel)			
7	Former UST (Gasoline)			
8	Dry Well and Adjacent Solvent Recovery Room			
9	Basement Vault			
10	Oil Drum Storage Rack			
11	Former Hazardous Waste Storage Shed		S	
12	Former Satellite Haz. Waste Accumulation & Paint Storage	S		
GW = Groundwater; S = Soil				

According to the ERM data, AOC #2 where hazardous material was stored is of greatest concern.

In 2008, ERM, on behalf of the City of Cullman, applied for the Greif Facility to be a part of the Voluntary Cleanup Program. Soon after, Goodwyn, Mills and Cawood (GMC) was hired to manage the site's participation in the VCP and to apply for cleanup funding through the EPA. In the Assessment/Cleanup Plan dated February 6, 2009, GMC recommended remediating these areas by limited surficial soil removal, phytoremediation, filling/capping, and paving.

The Corrective Action Levels (CALs) for Constituents of Concern were approved by the Alabama Department of Environmental Management under the Voluntary Cleanup Program as the Greif Brothers Cleanup and Assessment Plan in 2009. These CALs were largely based on the Environmental Protection Agency's (EPA) Maximum Contaminant Levels (MCLs) for drinking water. The constituents of concern and their respective screening/corrective action levels are listed in Table 2 below.

Table 2. Constituents-of-Concern and ADEM determined Screening/Corrective Action Limits

	Screening/Corrective Action Levels*	
TAL Metals	**Soil (mg/Kg)**	**Water (mg/L)**
Aluminum	100,000	0.05 to 0.2
Antimony	5.0	0.006
Arsenic	11.1	0.01
Barium	1,600	2.0
Beryllium	63.0	N
Cadmium	8.0	0.005
Calcium	N	N
Chromium (Total)	38.0	0.1
Cobalt	100,000	0.3
Copper	75,908	1.3
Iron	100,000	0.3
Lead	400	0.015
Magnesium	N	N
Manganese	32,250	0.05
Mercury	613	0.002
Nickel	130	N
Potassium	N	N
Selenium	5.0	0.05
Silver	34.0	0.1
Sodium	N	N
Thallium	135	0.002
Vanadium	6,000	N
Zinc	120,000	0.18
TPH (8015B)		
TPH (gasoline range)	100	N
TPH (diesel range)	100	N
SVOC's (8270C)		
Isophorone	0.5	70.77
2-Methylnaphthalene	N	N
2-Methyphenol	15.0	1,825
Naphthalene	84.0	20.0
Fluoranthene	101	0.206
Bis(2-ethylhexyl)phthalate	180	4.8
VOC's (8260B)		
Benzene	0.03	0.005
2-Butanone	N	N
Carbon Disulfide	32.0	N
Chloroethane	6.5	N
1,1-Dichloroethane	23.0	N
1,2-Dichloroethane	0.02	0.005
1,1-Dichloroethene	0.06	0.007
Cis-1,2-dichloroethene	0.4	0.07
Trans-1,2-dichloroethene	0.7	0.10
Ethylbenzene	13.0	0.70
4-Methyl-2-Pentanone	N	N
Tetrachloroethene	0.06	0.005
Toluene	12.0	1
1,1,1-Trichloroethane	2.0	0.20
Trichloroethene	0.06	0.005
Vinyl Chloride	0.01	0.002
Xylenes (total)	210	10

*ADEM VCP Site Specific target Levels for Grief facility, Cullman, Alabama, 2009

IV. Remedial Action & Results

The majority of corrective action activities and sampling was conducted between 2011 and 2014. GMC redefined the areas of concern into three larger parcels: AOC #1 which is located in the center of the site; AOC #2 which is located in the northwest portion of the site; and AOC#3 which is located at the southern portion of the site (Figure 5). Parcel B is located to the west of these AOCs and was not included in the 2009 VCP Cleanup plan or 2011-2014 remedial action as it was not owned by the city at the time.

A. AOC #1

In December 2011 to February 2012, AOC#1 underwent in-situ blending with sodium persulfate enhanced by lime activation. Polishing of the remaining contaminants was accomplished with phytoremediation and low-vacuum removal (micro-blower attached to well) of vapors in the soil vadose zone. Phytoremediation was first initiated in 2009.

Soil:

Soil sample analyses conducted in March 2012, indicate that the sodium persulfate blending was successful in reducing contaminant concentrations in this area. Most constituents of concern concentrations were below detection limits with the exception of naphthalene in the sample labeled "West Hole," which was still below CALs (Table 3C).

Groundwater: Monitoring wells (MW) MW-9 and MW-10 are downgradient of the main source, located in AOC 1. In MW-9, volatile organic compound (VOC) concentrations show a decreasing trend. However, cis-1, 2- dichloroethene , trichloroethene, and vinyl chloride still remain above CALs/MCLs. In MW-10, the majority of the VOC concentrations decreased, with the exception of 1,1-Dichloroethene. The constituents 1,1-dichloroethene, cis-1,2-dichloroethene, tetrachloroethene, trichloroethylene, and vinyl chloride still remained above MCLs. We anticipate that concentrations of chemicals of concern in AOC 1 will decrease because the source has been eliminated and contaminants will continue to degrade due to natural attenuation. Results for these wells can be found in Table 8.

B. AOC#2

To allow access to the area needed for treatment, a structure housing the city's Sanitation/Street Department was partially demolished and the slab was removed. The area was treated by chemical oxidation (in-situ blending with sodium persulfate, enhanced with lime) and a vapor extraction system near the building has also helped reduce residual concentrations under the building slab. These remedial actions took place during 2013 and 2014.

Soil: Soil samples were collected post-treatment to determine effectiveness; samples from four (4) locations were analyzed for VOCs and RCRA 8 metals. Locations of these samples can be found in Figure 6. The only constituent that failed to meet the target soil cleanup level was trichloroethene in sample PA2-S1B; results indicate a level of 0.082 ppm which is greater than the goal of 0.06ppm. A detailed summary of the soil sample results can be found in Table 3A and 3B. It is anticipated that the natural degradation process will continue to reduce the concentration of trichloroethene.

Groundwater: Monitoring wells were installed in this area to determine the improvement of groundwater quality as a result of cleanup activities. Monitoring Wells MW-1, MW-2, MW-4, MW-4R, and

MW-6 are all located in or near AOC#2. Monitoring wells MW-1 and MW-2 are located on Parcel B. Permission to sample these wells was not granted by the railroad from 2011-2013. Data for these wells resumed in 2014, as the city was able to purchase the property from CSX. Contaminants in MW-1 and MW-2 were reduced. However a few constituents were still above remedial goals. In MW-1, Trichloroethene concentrations fell from 0.151 in 2009 to 0.0427 ppm, but are still at a level above the CALs/MCLs. Concentrations of cis-1, 2 dichloroethene, chloroethane, and vinyl chloride were all reduced in MW-2. However, arsenic, cadmium, and lead remain above CAL/MCLs. The groundwater concentrations for MW-1 and MW-2 can be found in Table 4 and 5, respectively.

MW-4 is a significant indicator of groundwater conditions in the northern portion of the Greif Brothers site. In 2007, contaminant concentrations of trichloroethene were at a historical high of 71.9 mg/l. This area was treated through in-situ chemical oxidation in 2011 and 2012 and the nearby phytoremediation plots are thought to have contributed to the continued enhanced natural degradation of contaminants in this location. After chemical treatment, a replacement well (MW-4R) was installed in the same area. During this last testing, trichloroethene concentrations were reduced to less than the method detection limit. Analyzed groundwater samples from MW-4, measured below all ADEM Remedial Goals. Results of analyses for MW-4 and MW-4R are located in Table 6 and 6B.

MW-6 is downgradient of where soils were treated with sodium persulfate. According to the data, most concentrations of VOCs in this area decreased. It is anticipated that natural attenuation will continue to reduce the concentrations of all the VOCs. MW-6 has shown an increase in daughter products such as dichloroethene and vinyl chloride due to the breakdown of trichloroethylene (TCE). The data suggests this degradation of TCE has not stagnated as of May 2017, since daughter products have increased from 2014. With the suggested environmental covenant on groundwater on this property, there is little opportunity for human exposure to these contaminants. . Results of analyses for MW-6 are located in Table 7.

C. AOC#3

Remedial actions at AOC#3 involved phytoremediation plots and by the installation of a vapor extraction system to address polycyclic aromatic hydrocarbons (PAHs) and VOCs present. Remedial actions took place during 2013 and 2014. The PAHs that were present are largely due to the storage piles of creosote railroad ties, proximity to a maintenance area, and runoff from the railroad facility. The vapor extraction system has been successful in removing VOCs in the form of vadose zone gases originating from underlying contaminants.

Soil: Soil sampling and analyses conducted in AOC#3 near the phytoremediation plot have documented reductions in VOC concentrations as a result of remedial actions. The results of soil samples analyses from AOC#3 are included in Table 3B and 9. No VOCs were detected at concentration above the laboratory reporting limits; earlier samples indicated low levels of VOCs in this area. It is expected that any residual VOCs will be decreased via natural attenuation. Seven other PAH constituents of concern were analyzed from the Greif sampling locations at the ground surface where direct contact exposure might occur. Most concentrations were less than the 2009 Region 9 Industrial Screening Level. No surface samples exceeded the benzo(a) anthracene screening level of 2.1 ppm, the benzo(k) fluoranthene screening level of 21.0 ppm, the chrysene screening level of 210 ppm, the indeno(1,2,3 cd) pyrene screening level of 2.1 ppm, or the naphthalene screening level of 18 ppm. One surface sample (PA3-S-40) exceeded the benzo(b) fluoranthene screening level of 2.1 ppm and one surface sample (PA3-S-4 at .212 ppm)exceeded the dibenzo(ah) anthracene screening level of 0.21 ppm. The benzo (1) a pyrene concentration for samples 3-5 feet below ground surface (labeled PA3-S-3 to PA3-S-5D) exceeded CALs. However, surficial samples up to 2 feet were below CALs. Soil sampling results can be found in Table 3A, 3B, and 9.

Groundwater: MW-11 is located in AOC#3. According to the latest data collected by Terracon May 2017, all remedial goals have been met and most are below detection limits.

VI. Future Use

The plans for the former Greif facility are to convert it into a multi-use green space (Figure 8). The City of Cullman has designed plans for "Depot Park," which will include a grand lawn, playground, RV camping area, vehicle parking, skate park, recreational berm, playground, multi-use trails, restrooms, and walking trails. The existing three buildings will remain for city operations. Parcel B will mostly consist of a vegetated buffer between the railroad and the park. It will also include a small portion of a recreational berm with a track, 20 feet sidewalk, and the existing city services building.

VII. Proposed Plan of Action

GMC proposes to reduce the risk of exposure to constituents of concern by capping Parcel B and any areas of concern with at least two feet of clean fill material. Soils utilized for fill will be tested to ensure that the source of fill material is free of metal concentrations no greater than 3 times background levels for the area. At the time of this submission, much of Parcel B has not undergone any remediation. Remediation for this area will consist of the aforementioned capping.

GMC also recommends that the following environmental covenant be placed on the entire property:

1) Prohibition of groundwater use and;
2) Any areas that will be used by the public must be capped by at least 2 feet of clean clay material or asphalt.

VIII. Additional Recommendations

GMC believes that the executed remedial actions have successfully reduced contaminants. The environmental covenant restricting groundwater use and implementation of capping in public use areas will further prevent any contact with residual contamination on the subject site. Any low vacuum removal systems or vapor extraction systems are no longer necessary. All groundwater monitoring wells will be properly closed and/or removed. Any soil sampling or groundwater sampling, as proposed in the 2009 assessment/cleanup plan, is also no longer necessary. Additionally, any maintenance of phytoremediation plots or sampling of phytoremediation plant matter as a part of the remedial action as established in the 2009 assessment/cleanup plan, are no longer necessary.

IX. Conclusion

Results from a final round of testing conducted in September 2014 indicated all of the cleanup goals for the soils in a major hot spot in AOC 2 had been met except one for trichloroethene, which was 0.02 parts per million above its goal. Surficial PAH concentrations in the southern phytoremediation plot area (AOC 3) appear to have decreased. The potential for human exposure at the site through direct contact has been greatly reduced as concentrations in most soil samples were at or less than the 2009 site specific target levels. The natural degradation of contaminants will continue, thus achieving the goal in the future. This indicates that the in-situ chemical oxidation remediation and vapor extraction was successful in reducing contaminants on Parcel A. Groundwater concentrations in this area, while decreasing, did not meet the goals for all of the wells. However, the natural degradation processes will continue to reduce these contaminant levels. An environmental covenant prohibiting groundwater use will help to prevent contact with any contaminants listed in this report.

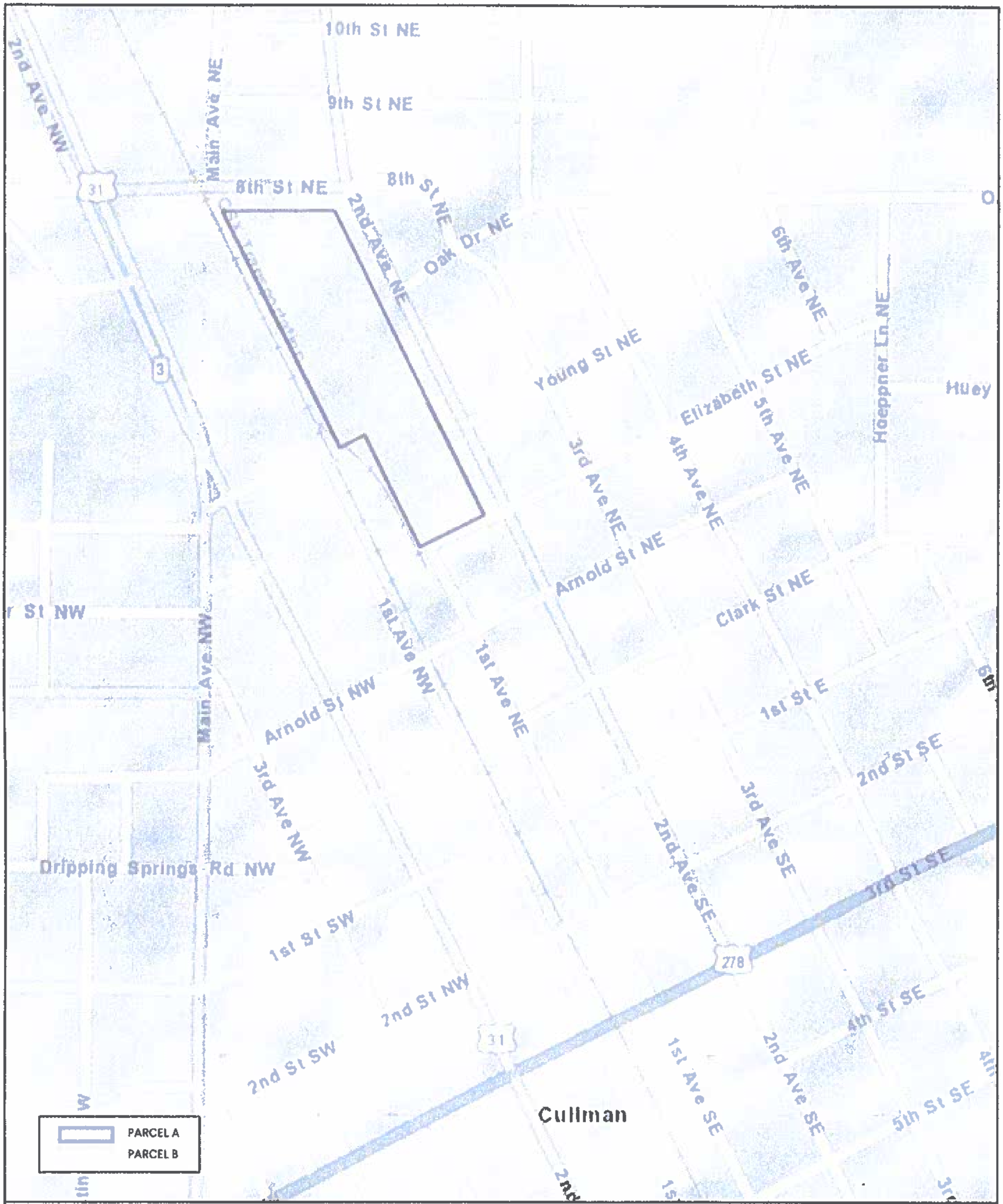
GMC believes that the executed remedial actions have successfully reduced contaminants. The capping with two feet of clean clay material or asphalt, particularly for Parcel B, and environmental covenant will further prevent contact with contamination on the subject site.

X. Signatures

I certify under penalty of law that I have personally examined and am familiar with the information submitted with this report and all attachments. I believe that all information contained herein is true, complete and accurate.

Crystal Shurett Environmental Scientist	Stuart Blackwell, P.W.S. Environmental Department Head
04/23/2018 Date	04/23/2018 Date

FIGURES



GRIEF BROTHERS

CULLMAN, CULLMAN COUNTY, ALABAMA

ESRI STREET MAP

FIGURE 1

STREET MAP

GMC #

3.2.2018

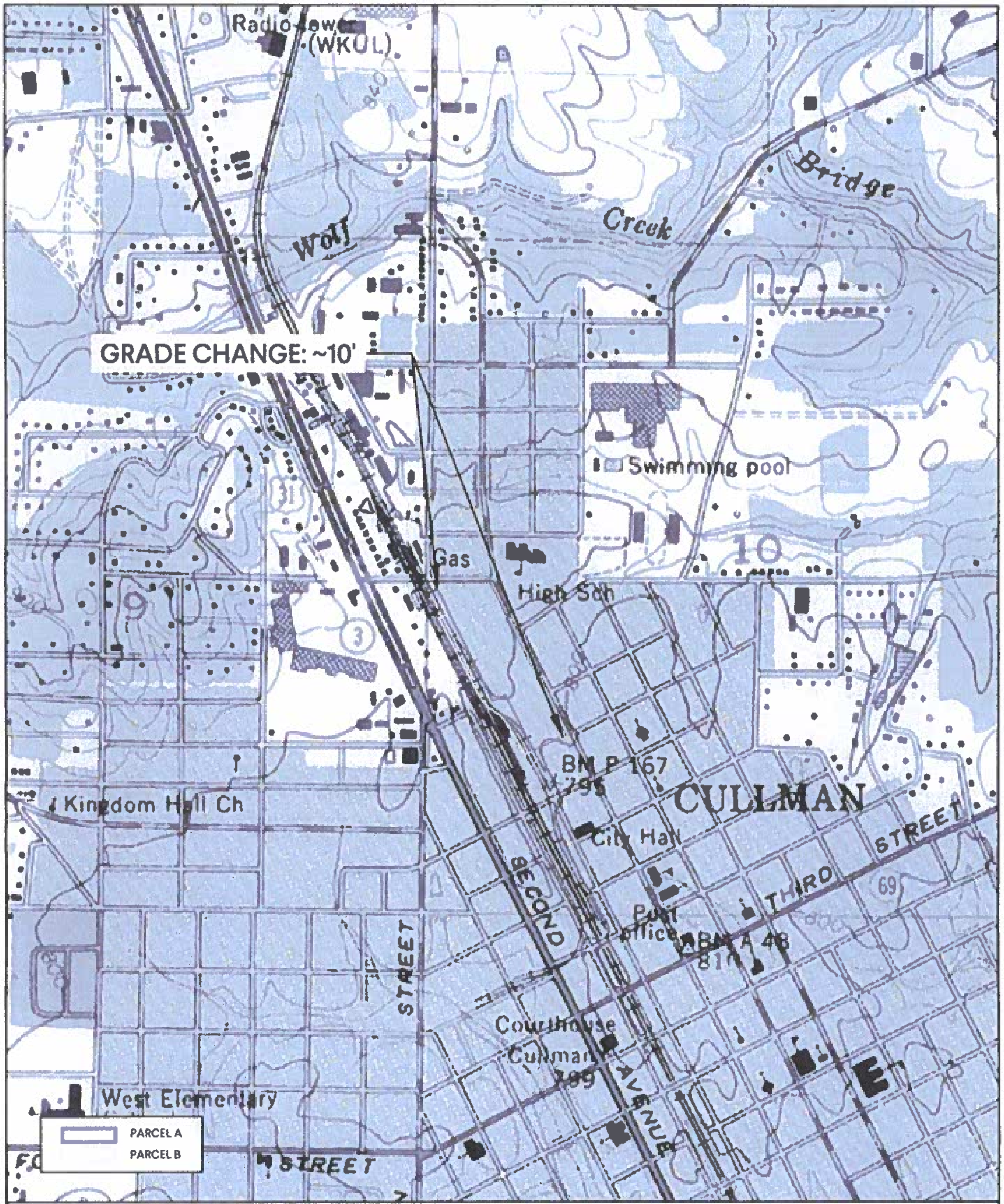
DRAWN BY: SDM

NORTH

0 250 500 1000

Scale: 1" = 500'

GMC



GRIEF BROTHERS

CULLMAN, CULLMAN COUNTY, ALABAMA

USGS, CULLMAN, AL 1957, REV 1983

FIGURE 2

USGS QUADRANGLE MAP

GMC #

3 2 2018

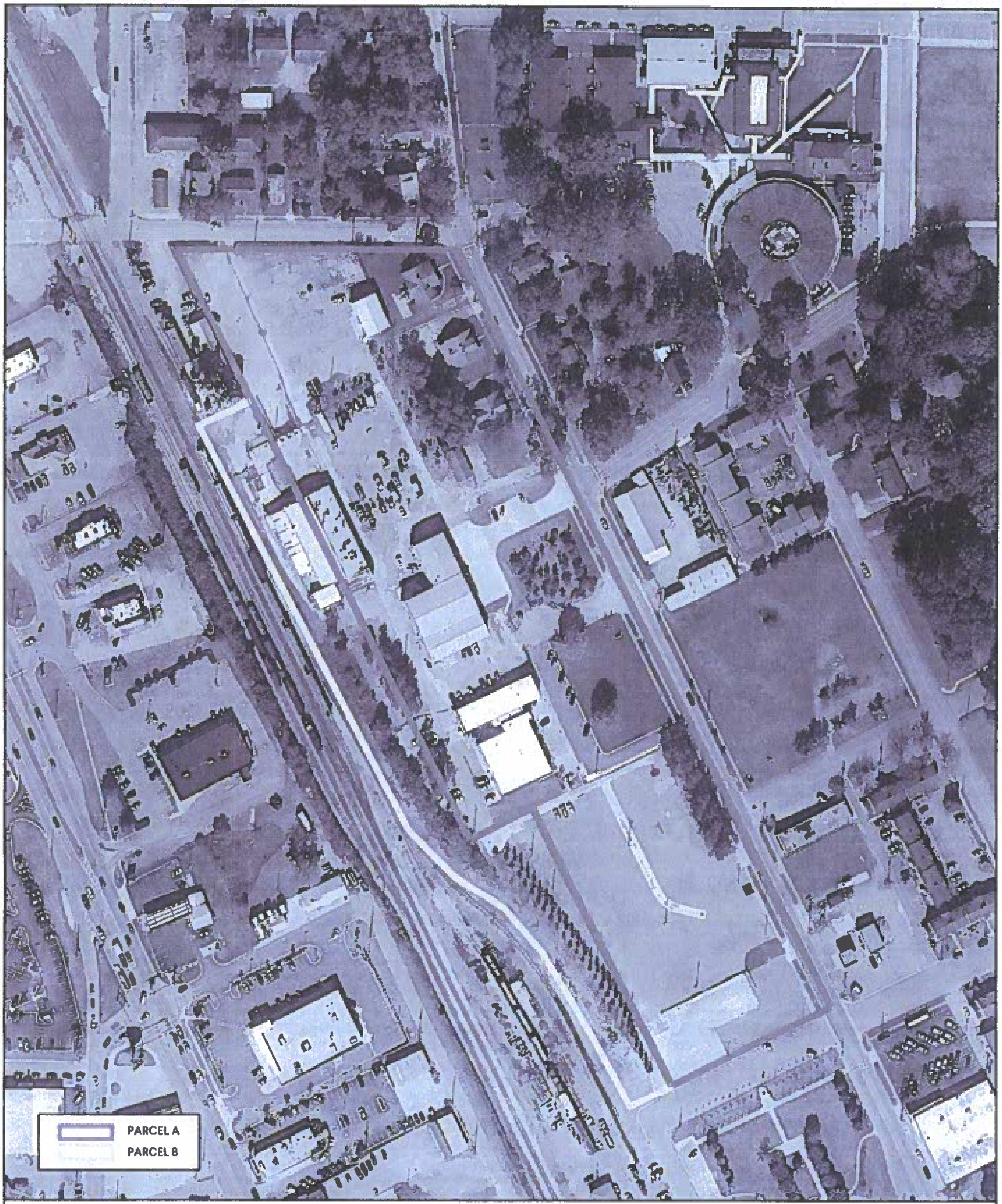
DRAWN BY: SDM

NORTH

0 500 1000 2000

Scale: 1" = 1000'

GMC



GRIEF BROTHERS

CULLMAN, CULLMAN COUNTY, ALABAMA

GOOGLE, 2/2017

FIGURE 3

AERIAL MAP

GMC #

3.2 2018

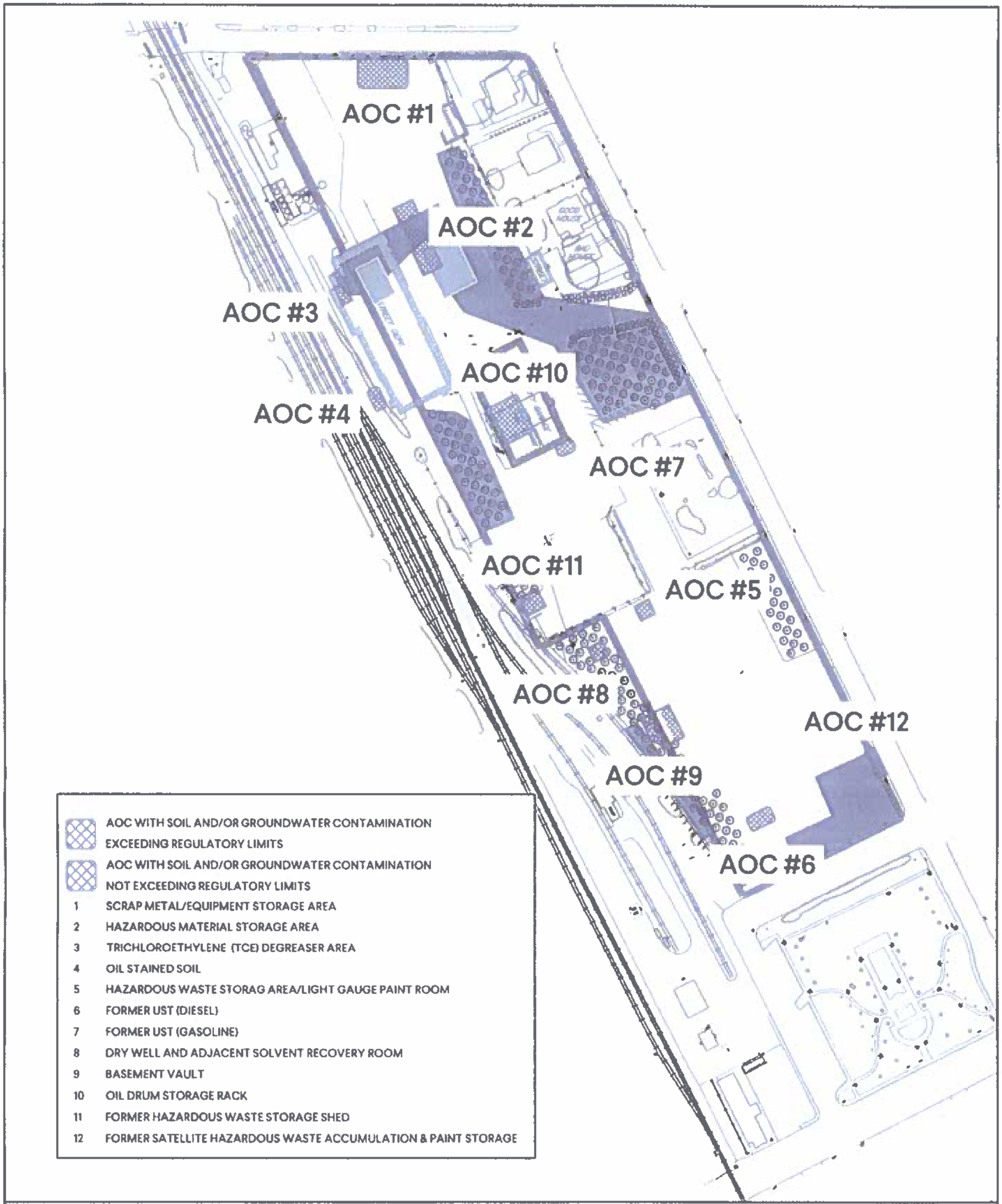
DRAWN BY: SDM

NORTH

0 100 200 400

Scale: 1" = 200'

GMC



GRIEF BROTHERS

CULLMAN, CULLMAN COUNTY, ALABAMA

GMC MASTERPLAN SITE STUDY

FIGURE 4

ERM AREAS OF CONCERN MAP

GMC #

3.2 2018

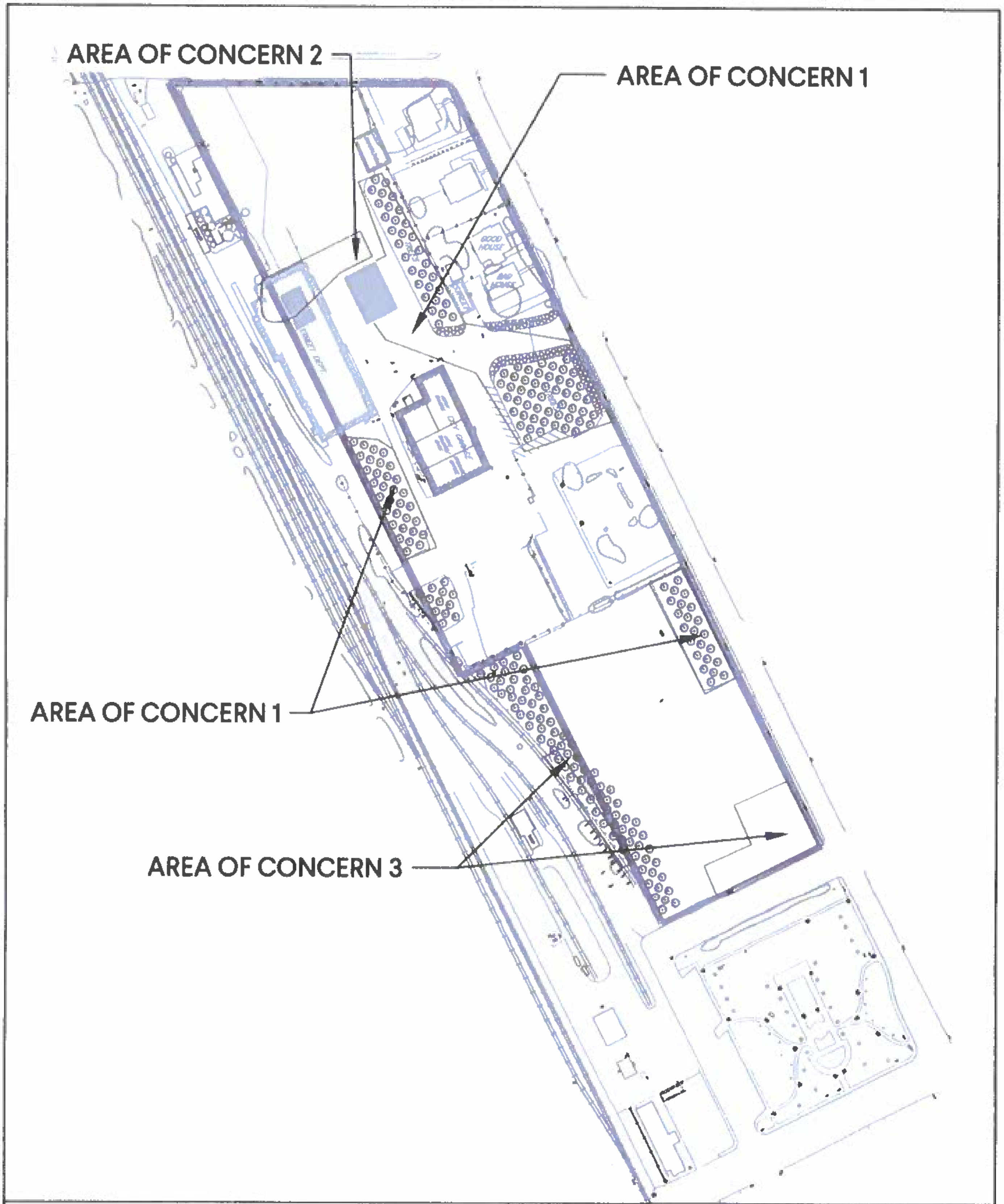
DRAWN BY: SDM

NORTH

0 100 200 400

Scale: 1" = 200'

GMC



GRIEF BROTHERS

CULLMAN, CULLMAN COUNTY, ALABAMA

GMC AREAS OF CONCERN

FIGURE 5

REMEDIAL ACTION AOC MAP

GMC #

3.2.2018

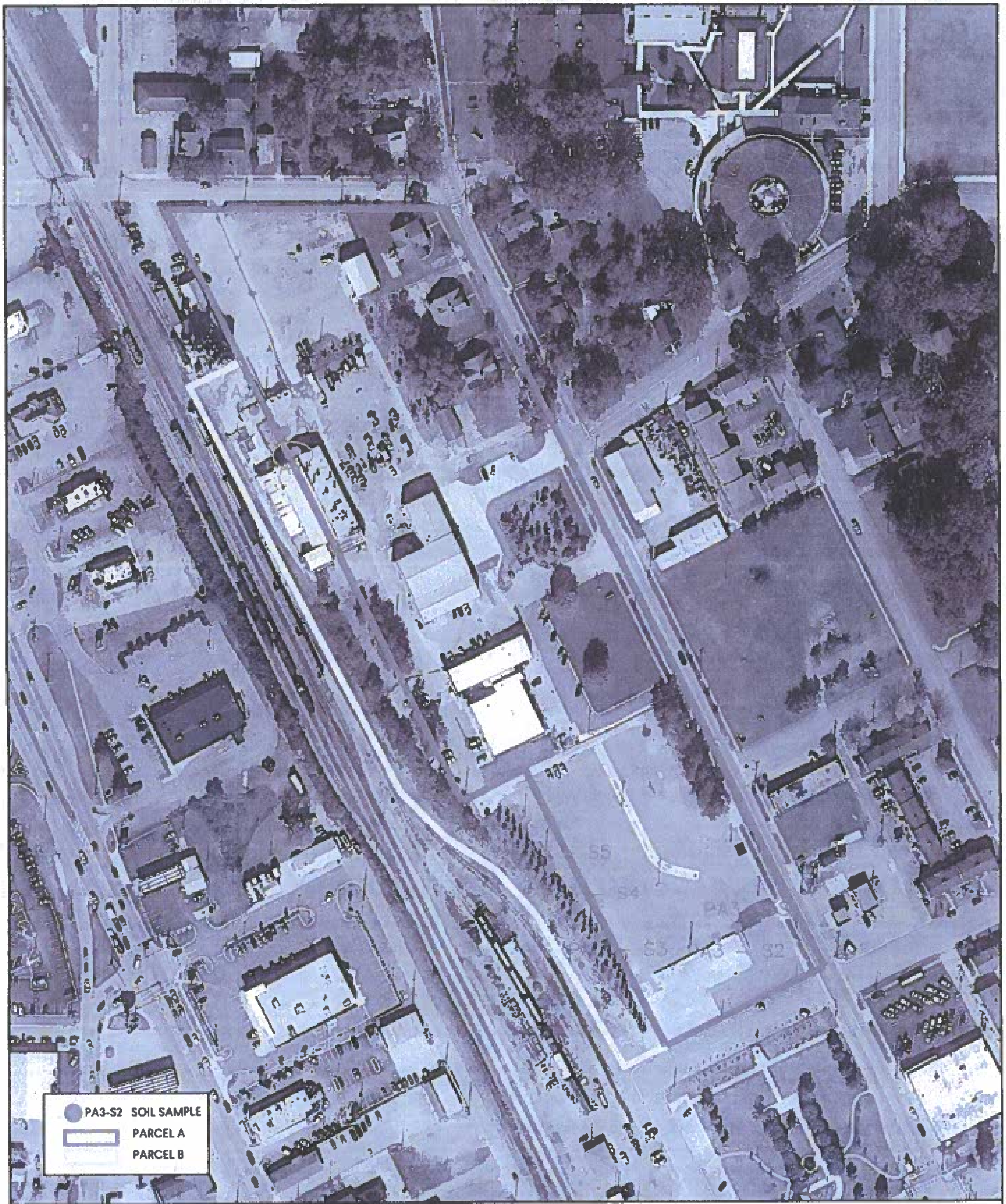
DRAWN BY: SDM

NORTH

0 150 300 600

Scale: 1" = 300'

GMC



GRIEF BROTHERS

CULLMAN, CULLMAN COUNTY, ALABAMA

GMC SOIL SAMPLING

FIGURE 6

SOIL SAMPLE MAP

GMC #

3.2.2018

DRAWN BY: SDM

NORTH

0 150 300 600

Scale: 1" = 300'

GMC

APPENDIX B

BORING LOGS

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers

Date(s): Oct 16, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: BMW-1

Drilling Contractor: Geolab Environmental Drilling

Drilling Method: Direct Push

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details	
0			Screen:	6-11 ft bgs
			Riser:	0-6 ft bgs
2		0-5FT: GW, Gravel, angular, some silt and sand, low moisture, loose, grey to brown	Sand:	4-11 ft bgs
	0-5' = 25.0		Bentonite:	0-4 ft bgs
4				
6		5-10FT: NR		
8				
		10-11FT GW, Silty Gravel, wet, loose, sheen, gray to black		
10				
12		Refusal @ 11', Monitoring well installed		
14				
16				
18				
20				
22				
24				
26				
28				
30				
32				

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers

Date(s): Oct 16, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: BMW-2

Drilling Contractor: Geolab Environmental Drilling

Drilling Method: Direct Push

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details	
0			Screen:	6-11 ft bgs
			Riser:	0-6 ft bgs
2		0-5FT: GW/SC, Gravel to 3', followed by Silty Sandy Clay, medium stiff, low moisture, orange	Sand:	4-11 ft bgs
			Bentonite:	0-4 ft bgs
4				
	5-7' = 2.0			
6		5-11FT: Same as above		
8				
10		Refusal @ 11', Monitoring well installed		
12				
14				
16				
18				
20				
22				
24				
26				
28				
30				
32				

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers

Date(s): Oct 16, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: BMW-3

Drilling Contractor: Geolab Environmental Drilling

Drilling Method: Direct Push

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details	
0			Screen:	6-11 ft bgs
			Riser:	0-6 ft bgs
2		0-5FT: GW/SC, Gravel to 3', followed by Silty Sandy Clay, medium stiff, low moisture, gray	Sand:	4-11 ft bgs
	0-5' = 2.0		Bentonite:	0-4 ft bgs
4				
6		5-11FT: SC, Silty Sandy Clay, medium stiff, low moisture, orange		
8				
10				
		Refusal @ 11', Monitoring well installed		
12				
14				
16				
18				
20				
22				
24				
26				
28				
30				
32				

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers

Date(s): Oct 16, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: BMW-4

Drilling Contractor: Geolab Environmental Drilling

Drilling Method: Direct Push

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details	
0			Screen:	4-14 ft bgs
			Riser:	0-4 ft bgs
2		0-5FT: NR	Sand:	2-14 ft bgs
			Bentonite:	0-2 ft bgs
4				
6				
	5-10' = 2.5	5-10FT: SP, Sand, loose, dry, orange		
8				
10				
12	10-14' = 0.6	10-14FT: SC, Sandy Clay, moderate moisture, soft, gray		
14				
		Refusal @ 14', Monitoring well installed		
16				
18				
20				
22				
24				
26				
28				
30				
32				

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers
Date(s): Oct 16, 2018
Logged by: Samuel Smith, P.G.
Project No.: 18-CULL01
Well/Boring Location: BMW-5
Drilling Contractor: Geolab Environmental Drilling
Drilling Method: Direct Push
Depth to Groundwater: NA
Elevations - Ground Surface:
Water Table NA
Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details	
0			Screen:	6-11 ft bgs
			Riser:	0-6 ft bgs
2		0-3FT: GW/ML Low recovery, Gravel and silt, stained, trace slag, light gray	Sand:	4-11 ft bgs
			Bentonite:	0-4 ft bgs
4				
6				
	5-10' = 8.0	3-11FT:SC, Silty Sandy Clay, medium stiff, low moisture, orange		
8				
10				
12		Refusal @ 11', Monitoring well installed		
14				
16				
18				
20				
22				
24				
26				
28				
30				
32				

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers

Date(s): Oct 17, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: BMW-6

Drilling Contractor: Geolab Environmental Drilling

Drilling Method: Direct Push

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details	
0			Screen:	7-12 ft bgs
			Riser:	0-7 ft bgs
2		0-5FT: ML, Concrete followed by Sandy Silty, low moisture, soft, orange to gray	Sand:	4-12 ft bgs
	0-5' = 1.5		Bentonite:	0-4 ft bgs
4				
6		5-10FT: SP/SM, Sand and Silty Sand, low moisture, loose, orange		
8				
10		10-12FT: Same as above		
12		Refusal @ 12', Monitoring well installed		
14				
16				
18				
20				
22				
24				
26				
28				
30				
32				

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers
Date(s): Oct 17, 2018
Logged by: Samuel Smith, P.G.
Project No.: 18-CULL01
Well/Boring Location: BMW-7
Drilling Contractor: Geolab Environmental Drilling
Drilling Method: Direct Push
Depth to Groundwater: NA
Elevations - Ground Surface:
Water Table NA
Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details	
0			Screen:	7-12 ft bgs
			Riser:	0-7 ft bgs
2		0-5FT: Gravel, very low recovery	Sand:	4-12 ft bgs
			Bentonite:	0-4 ft bgs
4				
6		5-9.5FT: SM, Silty Sand, wet, loose, gray		
	5-10' = 5.5			
8				
10		9.5-12FT: Sand, saprolitic sandstone partially cemented. Wet, orange		
12	10-12' = 1.0			
14		Refusal @ 12', Monitoring well installed		
16				
18				
20				
22				
24				
26				
28				
30				
32				

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers
Date(s): Oct 17, 2018
Logged by: Samuel Smith, P.G.
Project No.: 18-CULL01
Well/Boring Location: BMW-8
Drilling Contractor: Geolab Environmental Drilling
Drilling Method: Direct Push
Depth to Groundwater: NA
Elevations - Ground Surface:
Water Table NA
Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details	
0			Screen:	5-10 ft bgs
			Riser:	0-5 ft bgs
2		0-5FT: Gravel, very low recovery	Sand:	3-10 ft bgs
			Bentonite:	0-3 ft bgs
4				
6		5-10FT: SM, Silty Sand, very dense, low moisture, orange, gray		
	5-10' = 11.3			
8				
10				
		Refusal @ 10', Monitoring well installed		
12				
14				
16				
18				
20				
22				
24				
26				
28				
30				
32				

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers **Date(s):** Oct 17, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: BMW-9 **Drilling Contractor:**

Drilling Method: Direct Push Geolab Environmental Drilling

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details	
0			Screen:	5-15 ft bgs
			Riser:	0-5 ft bgs
2		0-5FT: GW/SM, Gravel and Silty Sand, low recovery, dry, loose, gray	Sand:	3-15 ft bgs
	0-5' = 1.9		Bentonite:	0-3 ft bgs
4				
6				
	5-10' = 1.6	5-10FT: SM/SP, Same as above to 8' followed by Sand, medium dense, trace cemented, dry, orange		
8				
10				
12	10-15' = 1.1	10-15FT: SP, Sand, wet, loose, orange		
14				
16		Refusal @ 15', Monitoring well installed		
18				
20				
22				
24				
26				
28				
30				
32				

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers **Date(s):** Oct 17, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: BMW-10 **Drilling Contractor:**

Drilling Method: Direct Push Geolab Environmental Drilling

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details	
0			Screen:	2-7 ft bgs
			Riser:	0-2 ft bgs
2		0-5FT: SM, Silty Sand, some gravel, very dense, low moisture, orange	Sand:	1-7 ft bgs
	0-5' = 0.0		Bentonite:	0-1 ft bgs
4				
6		5-7FT: SM, Same as above, sandstone rock at 6'		
	5-7' = 0.5			
8		Refusal @ 7', Monitoring well installed		
10				
12				
14				
16				
18				
20				
22				
24				
26				
28				
30				
32				

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers

Date(s): Oct 17, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: BMW-11

Drilling Contractor: Geolab Environmental Drilling

Drilling Method: Direct Push

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details	
0			Screen:	3-8 ft bgs
			Riser:	0-3 ft bgs
2		0-5FT: SM, Silty Sand, some gravel, very dense, low moisture, orange	Sand:	2-8 ft bgs
	0-5' = 1.1		Bentonite:	0-2 ft bgs
4				
6		5-7FT: SM, Same as above, sandstone rock at 7'		
	5-8' = 0.7			
8		Refusal @ 8', Monitoring well installed		
10				
12				
14				
16				
18				
20				
22				
24				
26				
28				
30				
32				

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers

Date(s): Oct 17, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: BMW-12

Drilling Contractor: Geolab Environmental Drilling

Drilling Method: Direct Push

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details	
0		0-5FT: CL, Silty Clay, little sand, very stiff, low moisture, orange 5-10FT: CL/SP, Same as above to 7', followed by Sand, partially cemented, wet from 8-9 feet, orange 10-11FT: SP, Same as above Refusal @ 11', Monitoring well installed	Screen:	6-11 ft bgs
			Riser:	0-6 ft bgs
2			Sand:	4-11 ft bgs
	0-5' = 0.4		Bentonite:	0-4 ft bgs
4				
6				
	5-10' = 1.0			
8				
10				
12				
14				
16				
18				
20				
22				
24				
26				
28				
30				
32				

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers

Date(s): Oct 17, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: BMW-13

Drilling Contractor: Geolab Environmental Drilling

Drilling Method: Direct Push

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details	
0			Screen:	6-11 ft bgs
			Riser:	0-6 ft bgs
2			Sand:	4-11 ft bgs
	0-5' = 0.0	0-5FT: CL, Silty Clay, little sand, very stiff, low moisture, orange	Bentonite:	0-4 ft bgs
4				
6				
	5-10' = 0.4	5-10FT: CL/SP, Same as above to 7', followed by Sand, partially cemented, wet from 8-9 feet, orange		
8				
10		10-11FT: SP, Same as above		
		Refusal @ 11', Monitoring well installed		
12				
14				
16				
18				
20				
22				
24				
26				
28				
30				
32				

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers

Date(s): Oct 16, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: SB-1

Drilling Contractor: Geolab Environmental Drilling

Drilling Method: Direct Push

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details
0			
2		0-5FT: GW/SM, Gravel to 2' followed by Silty Sand, wet, loose, orange to gray	
	0-5' = 21.0		
4			
6			
	5-10' = 49.0	5-11FT: SM, Silty Sand, wet, loose, orange to light gray	
8			
10			
12		Refusal @ 11', Boring terminated	
14			
16			
18			
20			
22			
24			
26			
28			
30			
32			

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers

Date(s): Oct 16, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: SB-2

Drilling Contractor: Geolab Environmental Drilling

Drilling Method: Direct Push

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details
0			
2		0-5FT: GW/SW, Gravel and Sand, low recovery, loose, dry, gray to black	
4			
6			
	5-7' = 18.0	5-10FT: SM, Silty Sand,low recovery, loose, wet, odor, light brown	
8			
10			
12		Refusal @ 10', Boring terminated	
14			
16			
18			
20			
22			
24			
26			
28			
30			
32			

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers

Date(s): Oct 16, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: SB-3

Drilling Contractor: Geolab Environmental Drilling

Drilling Method: Direct Push

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details
0			
2		0-5FT: GW/SW, Gravel and Sand, low recovery, loose, dry, odor, gray to black	
	0-5' = 60		
4			
6			
	5-10' = 120	5-10FT: CL, Silty Clay, stiff, moderate moisture, odor, orange to gray	
8			
10			
12		Refusal @ 10', Boring terminated	
14			
16			
18			
20			
22			
24			
26			
28			
30			
32			

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers

Date(s): Oct 16, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: SB-4

Drilling Contractor: Geolab Environmental Drilling

Drilling Method: Direct Push

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details
0			
2		0-5FT: GW/CL, Gravel to 3' followed by Silty Clay with some Sand, very stiff, low moisture, orange	
	0-5' = 8		
4			
6		5-10FT: CL, Same as abobe	
	5-10' = 0.0		
8			
10		Refusal @ 10', Boring terminated	
12			
14			
16			
18			
20			
22			
24			
26			
28			
30			
32			

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers **Date(s):** Oct 16, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: SB-5 **Drilling Contractor:**

Drilling Method: Direct Push Geolab Environmental Drilling

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details
0			
2		0-5FT: GW/CL, Gravel to 3' followed by Silty Clay with some Sand, very stiff, low moisture, orange	
	0-5' = 8.6		
4			
6		5-10FT: CL, Same as abobe	
	5-10' = 0.0		
8			
10		Refusal @ 10', Boring terminated	
12			
14			
16			
18			
20			
22			
24			
26			
28			
30			
32			

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers

Date(s): Oct 16, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: SB-6

Drilling Contractor: Geolab Environmental Drilling

Drilling Method: Direct Push

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details
0			
2		0-5FT: GW/SW, Gravel and sand, loose, wet, hydrocarbon odor	
	0-5' = 25		
4			
		5-10FT: GW/SW, same as above	
6			
	5-10' = 170		
8			
		Refusal @ 10', Boring terminated	
10			
12			
14			
16			
18			
20			
22			
24			
26			
28			
30			
32			

DRILLING/BORING LOG

Project: Former Greif Brothers

Date(s): Oct 16, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: SB-7

Drilling Contractor: Geolab Environmental Drilling

Drilling Method: Direct Push

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details
0		0-5FT: GW, Gravel, very low recovery	
2			
4			
		5-10FT: SC, Sandy Clay, low moisture, soft, orange	
6			
	5-10' = 1.4		
8			
10		Refusal @ 10', Boring terminated	
12			
14			
16			
18			
20			
22			
24			
26			
28			
30			
32			

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers

Date(s): Oct 16, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: SB-8

Drilling Contractor: Geolab Environmental Drilling

Drilling Method: Direct Push

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details
0			
2			
	0-5' = 50	0-5FT: GW/ML, Gravel, Sandy-Silty, stained, odor, loose, moist, gray	
4			
6			
	5-10' = 25		
8		5-10FT: SC, Sandy Clay, low moisture, soft, orange	
10			
12			
		Refusal @ 10', Boring terminated	
14			
16			
18			
20			
22			
24			
26			
28			
30			
32			

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers

Date(s): Oct 16, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: SB-9

Drilling Contractor: Geolab Environmental Drilling

Drilling Method: Direct Push

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details
0			
2		0-6FT: SM, Sandy-Silty, stained, loose, wet, gray	
4			
6			
		6-10FT: SC, Silty Sand, wet, loose orange	
8			
10			
		Refusal @ 10', Boring terminated	
12			
14			
16			
18			
20			
22			
24			
26			
28			
30			
32			

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers

Date(s): Oct 16, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: SB-10

Drilling Contractor: Geolab Environmental Drilling

Drilling Method: Direct Push

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details
0		0-9FT: GW/SC, Gravel to 2' followed by Sandy Clay, medium dense, partial cementation, low moisture, orange Refusal @ 10', Boring terminated	
2			
4			
6			
	5-9' = 6.5		
8			
10			
12			
14			
16			
18			
20			
22			
24			
26			
28			
30			
32			

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers **Date(s):** Oct 16, 2018
Logged by: Samuel Smith, P.G.
Project No.: 18-CULL01
Well/Boring Location: SB-11 **Drilling Contractor:**
Drilling Method: Direct Push Geolab Environmental Drilling
Depth to Groundwater: NA
Elevations - Ground Surface:
Water Table NA
Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details
0		0-9FT: GW/SC, Gravel to 2' followed by Sandy Clay, medium dense, partial cementation, low moisture, orange	
2			
4			
6			
	5-9' = 8.0		
8			
10		Refusal @ 10', Boring terminated	
12			
14			
16			
18			
20			
22			
24			
26			
28			
30			
32			

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers

Date(s): Oct 16, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: SB-12

Drilling Contractor: Geolab Environmental Drilling

Drilling Method: Direct Push

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details
0		0-9FT: GW/SC, Gravel to 2' followed by Sandy Clay, medium dense, partial cementation, low moisture, orange	
2			
4			
6			
	5-9' = 0.6		
8			
10			
		Refusal @ 10', Boring terminated	
12			
14			
16			
18			
20			
22			
24			
26			
28			
30			
32			

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers

Date(s): Oct 16, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: SB-13

Drilling Contractor: Geolab Environmental Drilling

Drilling Method: Direct Push

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details
0			
2		0-5FT No Recover	
4			
		5-9FT: SC, Sandy Clay, medium dense, partial cementation, low moisture, orange	
6			
	5-9' = 12.2		
8			
10			
12			
		Refusal @ 10', Boring terminated	
14			
16			
18			
20			
22			
24			
26			
28			
30			
32			

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers

Date(s): Oct 17, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: SB-14

Drilling Contractor: Geolab Environmental Drilling

Drilling Method: Direct Push

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details
0			
2		0-5FT SM, Silty Sand, wet, loose, low recovery, brown	
4			
6		5-10FT: SM, Same as above	
	5-10' = 5.5		
8			
10		10-15FT: SM/ML, Same to 12' followed by Sandy Silt, medium stiff, moderate moisture, gray	
12	10-15' = 1.0		
14		Refusal @ 15', Boring terminated	
16			
18			
20			
22			
24			
26			
28			
30			
32			

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers

Date(s): Oct 17, 2018

Logged by: Samuel Smith, P.G.

Project No.: 18-CULL01

Well/Boring Location: SB-15

Drilling Contractor: Geolab Environmental Drilling

Drilling Method: Direct Push

Depth to Groundwater: NA

Elevations - Ground Surface:

Water Table NA

Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details
0			
2		0-5FT SM, Silty Sand, wet, loose, low recovery, brown	
4			
6		5-10FT: SM, Same as above	
8			
10		10-15FT: SP, Sand, little silt, saprolitic sandstone, moderate moisture, orange, pink at 14.5'	
12	10-15' = 9.4		
14		Refusal @ 15', Boring terminated	
16			
18			
20			
22			
24			
26			
28			
30			
32			

DRILLING/BORING LOG

1 of 1

Project: Former Greif Brothers
Date(s): Oct 17, 2018
Logged by: Samuel Smith, P.G.
Project No.: 18-CULL01
Well/Boring Location: SB-16
Drilling Contractor: Geolab Environmental Drilling
Drilling Method: Direct Push
Depth to Groundwater: NA
Elevations - Ground Surface:
Water Table NA
Remarks:

Depth (bgs)	PID Results (ppm) 10.6 eV lamp	Lithologic Descriptions	Well Construction Details
0			
2		0-5FT SP, Sand, wet, low recovery, white to black	
	0-5' = 0.8		
4			
6		5-7FT: SM, Same as above	
8		Refusal @ 7', Boring terminated	
10			
12	10-15' = 9.4		
14			
16			
18			
20			
22			
24			
26			
28			
30			
32			

APPENDIX C

LABORATORY ANALYTICAL DATA REPORTS

Sutherland

Environmental Company, Inc.
2515 5th Avenue South
BIRMINGHAM, AL 35233
PHONE (205)581-9500 FAX (205)581-9504
E-Mail: suthlab@bellsouth.net

CHAIN OF CUSTODY
ANALYSIS REQUEST

SEND REPORT TO:
Name: Doug Bullock
Company: Bullock Environmental
Address:
Phone#: Cell #
E-mail:
PDF Results: yes no Fax #:

Invoice # 39921

Client P.O. # 18-Cull01

CLIENT:
PROJECT: Former Greif Bros
SAMPLER(S): (print) Sam Smith

DATE DELIVERED:

LAB ID	FIELD ID	DATE Collected	TIME Collected	SAMPLE DESCRIPTION (matrix)	ANALYSIS REQUESTED / METHOD: VOCs								Number of sample containers
199204	SB-10 5-10	10/16/18	1430	Soil	X								1
199205	SB-11 5-9		1440										
199206	SB-12 5-9		1500										
199207	SB-13 5-10		1510										
199208	BMW-6 0-5	10/17/18	830										
199209	SB-14 5-10		900										
199210	SB-14 10-15		910										
199211	SB-15 10-15		930										
199212	SB-16 0-5		945										
199213	~~SB~~-BMW-7 5-10		1010										
199214	BMW-8 5-10		1030										
199215	BMW-9 5-10		1100										

Preservative: (a)HCL, (b)HNO_3, (c)H_2SO_4, (d)NaOH, (e) $Na_2S_2O_3$, (f) H_3PO_4, (g)Zn Acetate **Preservative:**
Container type: (a) Amber, (g) Glass, (p) Plastic, (v) VOC Vial, (air) air bag **Container:**

Last revised 5/29/12

	Date	Time		Date	Time
Relinquished by Sampler: Signed:	10/17/18	1520	Received by: Signed:		
Relinquished by: Signed:			Received by: Signed:		
Relinquished by: Signed:			Received in Laboratory by: Signed:	10/17/18	3:20

Turn Around Time (please note):
Standard ✓ ***RUSH, mark below**
*3-Day *2-Day *Next Day *Same Day

Remarks:

Refrigerated upon receipt: [✓ yes] no

Sutherland

Environmental Company, Inc.
2515 5th Avenue South
BIRMINGHAM, AL 35233
PHONE (205)581-9500 FAX (205)581-9504
E-Mail: suthlab@bellsouth.net

CHAIN OF CUSTODY
ANALYSIS REQUEST

SEND REPORT TO:
Name: B,llock ENV
Company:
Address:
Phone#: Cell #
E-mail:
PDF Results: yes no Fax #:

Invoice # 39921

Client P.O. # 18-Cull01

CLIENT:
PROJECT: Former Greif Bros
SAMPLER(S): (print) Samuel Smith

DATE DELIVERED:

LAB ID	FIELD ID	DATE Collected	TIME Collected	SAMPLE DESCRIPTION (matrix)	VOCS	SVOCs	RCRA Metals						Number of sample containers
199216	BMW-10 0-5	10/17/18	1150	Soil	X								1
199217	BMW-11	↓	1230	↓	↓								↓
199218	BMW-12 5-10	↓	1300	↓	↓								↓
199219	BMW-13 5-10	↓	1400	↓	↓								↓
199220	PBSB-1	↓	1040	↓	↓	X	X						↓
199221	PBSB-2	↓	1050	↓	↓	↓	↓						↓
199222	PBSB-3	↓	1410	↓	↓	↓	↓						↓
199223	PBSB-4	↓	1420	↓	↓	↓	↓						↓
199224	PBSB-5	↓	1430	↓	↓	↓	↓						↓
199225	PBSB-6	↓	1440	↓	↓	↓	↓						↓

Preservative: (a)HCL, (b)HNO_3, (c)H_2SO_4, (d)NaOH, (e) $Na_2S_2O_3$, (f) H_3PO_4, (g)Zn Acetate **Preservative:**
Container type: (a) Amber, (g) Glass, (p) Plastic, (v) VOC Vial, (air) air bag **Container:**

Last revised 5/29/12

Relinquished by Sampler: Signed:	Date	Time	Received by: Signed:	Date	Time
	10/17/18	1520			
Relinquished by: Signed:	**Date**	**Time**	**Received by: Signed:**	**Date**	**Time**
Relinquished by: Signed:	**Date**	**Time**	**Received in Laboratory by: Signed:**	**Date**	**Time**
				10/17/18	3:20

Turn Around Time (please note):
Standard ✓ *RUSH, mark below
*3-Day *2-Day *Next Day *Same Day

Remarks:

Refrigerated upon receipt: [✓ yes] no

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 24, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101	P.O. #	18-CULL01
	Birmingham, AL 35209	Project ID:	Former Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/17/18	Analyst:	Hageman/Heard
Date Collected:	10/16-17/18	Date of Analysis:	10/20-22/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	Practical Quantitation Limit PPM
	SB-10	**SB-11**	**SB-12**	**SB-13**	**BMW-6**	
VOLATILE ORGANIC COMPOUNDS, PPM	**5-10**	**5-9**	**5-9**	**5-10**	**0-5**	
	LAB ID	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	
	199204	**199205**	**199206**	**199207**	**199208**	
Benzene	BDL	BDL	BDL	BDL	BDL	0.005
Bromobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Bromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromodichloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromoform	BDL	BDL	BDL	BDL	BDL	0.005
Bromomethane	BDL	BDL	BDL	BDL	BDL	0.005
n-Butylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
sec-Butylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
tert-Butybenzene	BDL	BDL	BDL	BDL	BDL	0.005
Carbon Tetrachloride	BDL	BDL	BDL	BDL	BDL	0.005
Chlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Chloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Chloroform	BDL	BDL	BDL	BDL	BDL	0.005
Chloromethane	BDL	BDL	BDL	BDL	BDL	0.010
2-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
4-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
Dibromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromo-3-Chloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromoethane	BDL	BDL	BDL	BDL	BDL	0.005
Dibromomethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,3-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,4-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Dichlorodifluoromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichloroethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 24, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101	P.O. #	18-CULL01
	Birmingham, AL 35209	Project ID:	Former Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/17/18	Analyst:	Hageman/Heard
Date Collected:	10/16-17/18	Date of Analysis:	10/20-22/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

VOLATILE ORGANIC COMPOUNDS, PPM	**FIELD ID** **SB-10** **5-10** **LAB ID** **199204**	**FIELD ID** **SB-11** **5-9** **LAB ID** **199205**	**FIELD ID** **SB-12** **5-9** **LAB ID** **199206**	**FIELD ID** **SB-13** **5-10** **LAB ID** **199207**	**FIELD ID** **BMW-6** **0-5** **LAB ID** **199208**	Practical Quantitation Limit PPM
1,1-Dichloroethene	BDL	BDL	BDL	BDL	BDL	0.005
cis-1,2-Dichloroethene	BDL	**0.015**	BDL	BDL	BDL	0.005
trans-1,2-Dichloroethene	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,3- Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
2,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
cis-1-3,Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
trans-1,3-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
Ethylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
Hexachlorobutadiene	BDL	BDL	BDL	BDL	BDL	0.005
Isopropylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
4-Isopropyltoluene	BDL	BDL	BDL	BDL	BDL	0.005
Methylene Chloride	BDL	BDL	BDL	BDL	BDL	0.100
Naphthalene	BDL	BDL	BDL	BDL	BDL	0.025
n-Propylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
Styrene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Tetrachloroethene	BDL	BDL	BDL	**0.010**	BDL	0.005
Toluene	BDL	BDL	BDL	BDL	BDL	0.005
1,2,3-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1-Trichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2-Trichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Trichloroethene	BDL	**0.031**	BDL	**0.030**	**0.026**	0.005
Trichlorofluoromethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 24, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101	P.O. #	18-CULL01
	Birmingham, AL 35209	Project ID:	Former Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/17/18	Analyst:	Hageman/Heard
Date Collected:	10/16-17/18	Date of Analysis:	10/20-22/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	
	SB-10	**SB-11**	**SB-12**	**SB-13**	**BMW-6**	Practical Quantitation Limit PPM
	5-10	**5-9**	**5-9**	**5-10**	**0-5**	
	LAB ID	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	
VOLATILE ORGANIC COMPOUNDS, PPM	**199204**	**199205**	**199206**	**199207**	**199208**	
1,2,3-Trichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trimethylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,3,5-Trimethylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
Vinyl Chloride	BDL	BDL	BDL	BDL	BDL	0.005
Xylenes, o,m,p	BDL	BDL	BDL	BDL	BDL	0.015
MTBE	BDL	BDL	BDL	BDL	BDL	0.005

Detection Limit is Practical Quantitation Limit
BDL = Below Detection Limit
All results expressed as PPM (mg/Kg)

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 24, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101 Birmingham, AL 35209	P.O. #	18-CULL01
		Project ID:	Former Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/17/18	Analyst:	Hageman/Heard
Date Collected:	10/17/18	Date of Analysis:	10/20/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

VOLATILE ORGANIC COMPOUNDS, PPM	FIELD ID SB-14 5-10 LAB ID 199209	FIELD ID SB-14 10-15 LAB ID 199210	FIELD ID SB-15 10-15 LAB ID 199211	FIELD ID SB-16 0-5 LAB ID 199212	FIELD ID BMW-7 5-10 LAB ID 199213	Practical Quantitation Limit PPM
Benzene	BDL	BDL	BDL	BDL	BDL	0.005
Bromobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Bromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromodichloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromoform	BDL	BDL	BDL	BDL	BDL	0.005
Bromomethane	BDL	BDL	BDL	BDL	BDL	0.005
n-Butylbenzene	BDL	BDL	BDL	BDL	**0.038**	0.005
sec-Butylbenzene	BDL	BDL	BDL	BDL	**0.006**	0.005
tert-Butybenzene	BDL	BDL	BDL	BDL	BDL	0.005
Carbon Tetrachloride	BDL	BDL	BDL	BDL	BDL	0.005
Chlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Chloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Chloroform	BDL	BDL	BDL	BDL	BDL	0.005
Chloromethane	BDL	**0.012**	BDL	BDL	BDL	0.010
2-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
4-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
Dibromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromo-3-Chloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromoethane	BDL	BDL	BDL	BDL	BDL	0.005
Dibromomethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,3-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,4-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Dichlorodifluoromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloroethane	**0.051**	BDL	BDL	BDL	**0.007**	0.005
1,2-Dichloroethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 24, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101	P.O. #	18-CULL01
	Birmingham, AL 35209	Project ID:	Former Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/17/18	Analyst:	Hageman/Heard
Date Collected:	10/17/18	Date of Analysis:	10/20/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

VOLATILE ORGANIC COMPOUNDS, PPM	**FIELD ID SB-14 5-10 LAB ID 199209**	**FIELD ID SB-14 10-15 LAB ID 199210**	**FIELD ID SB-15 10-15 LAB ID 199211**	**FIELD ID SB-16 0-5 LAB ID 199212**	**FIELD ID BMW-7 5-10 LAB ID 199213**	Practical Quantitation Limit PPM
1,1-Dichloroethene	**0.018**	BDL	BDL	BDL	BDL	0.005
cis-1,2-Dichloroethene	**0.085**	BDL	**0.026**	BDL	**0.008**	0.005
trans-1,2-Dichloroethene	**0.008**	BDL	BDL	BDL	BDL	0.005
1,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,3- Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
2,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
cis-1-3,Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
trans-1,3-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
Ethylbenzene	BDL	BDL	BDL	BDL	**0.520**	0.005
Hexachlorobutadiene	BDL	BDL	BDL	BDL	BDL	0.005
Isopropylbenzene	BDL	BDL	BDL	BDL	**0.015**	0.005
4-Isopropyltoluene	BDL	BDL	BDL	BDL	**0.025**	0.005
Methylene Chloride	BDL	BDL	BDL	BDL	BDL	0.100
Naphthalene	BDL	BDL	BDL	BDL	**0.292**	0.025
n-Propylbenzene	BDL	BDL	BDL	BDL	**0.026**	0.005
Styrene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Tetrachloroethene	BDL	BDL	BDL	BDL	BDL	0.005
Toluene	BDL	BDL	BDL	**0.007**	**0.011**	0.005
1,2,3-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1-Trichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2-Trichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Trichloroethene	**0.510**	**0.005**	**0.028**	BDL	BDL	0.005
Trichlorofluoromethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 24, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101	P.O. #	18-CULL01
	Birmingham, AL 35209	Project ID:	Former Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/17/18	Analyst:	Hageman/Heard
Date Collected:	10/17/18	Date of Analysis:	10/20/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

VOLATILE ORGANIC COMPOUNDS, PPM	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	Practical Quantitation Limit PPM
	SB-14	**SB-14**	**SB-15**	**SB-16**	**BMW-7**	
	5-10	**10-15**	**10-15**	**0-5**	**5-10**	
	LAB ID	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	
	199209	**199210**	**199211**	**199212**	**199213**	
1,2,3-Trichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trimethylbenzene	BDL	BDL	BDL	BDL	**0.128**	0.005
1,3,5-Trimethylbenzene	BDL	BDL	BDL	BDL	**0.018**	0.005
Vinyl Chloride	BDL	BDL	BDL	BDL	BDL	0.005
Xylenes, o,m,p	BDL	BDL	BDL	BDL	**0.365**	0.015
MTBE	BDL	BDL	BDL	BDL	BDL	0.005

Detection Limit is Practical Quantitation Limit
BDL = Below Detection Limit
All results expressed as PPM (mg/Kg)

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 24, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101 Birmingham, AL 35209	P.O. #	18-CULL01
		Project ID:	Former Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/17/18	Analyst:	Hageman/Heard
Date Collected:	10/17/18	Date of Analysis:	10/20-21/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

VOLATILE ORGANIC COMPOUNDS, PPM	**FIELD ID** **BMW-8** **5-10** **LAB ID** **199214**	**FIELD ID** **BMW-9** **5-10** **LAB ID** **199215**	**FIELD ID** **BMW-10** **0-5** **LAB ID** **199216**	**FIELD ID** **BMW-11** **5-7** **LAB ID** **199217**	**FIELD ID** **BMW-12** **5-10** **LAB ID** **199218**	Practical Quantitation Limit PPM
Benzene	BDL	BDL	BDL	BDL	BDL	0.005
Bromobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Bromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromodichloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromoform	BDL	BDL	BDL	BDL	BDL	0.005
Bromomethane	BDL	BDL	BDL	BDL	BDL	0.005
n-Butylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
sec-Butylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
tert-Butybenzene	BDL	BDL	BDL	BDL	BDL	0.005
Carbon Tetrachloride	BDL	BDL	BDL	BDL	BDL	0.005
Chlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Chloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Chloroform	BDL	BDL	BDL	BDL	BDL	0.005
Chloromethane	BDL	BDL	BDL	BDL	BDL	0.010
2-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
4-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
Dibromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromo-3-Chloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromoethane	BDL	BDL	BDL	BDL	BDL	0.005
Dibromomethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,3-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,4-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Dichlorodifluoromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloroethane	**0.053**	BDL	BDL	BDL	BDL	0.005
1,2-Dichloroethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 24, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101 Birmingham, AL 35209	P.O. #	18-CULL01
		Project ID:	Former Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/17/18	Analyst:	Hageman/Heard
Date Collected:	10/17/18	Date of Analysis:	10/20-21/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

VOLATILE ORGANIC COMPOUNDS, PPM	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	Practical Quantitation Limit PPM
	BMW-8 5-10	**BMW-9 5-10**	**BMW-10 0-5**	**BMW-11 5-7**	**BMW-12 5-10**	
	LAB ID	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	
	199214	**199215**	**199216**	**199217**	**199218**	
1,1-Dichloroethene	**0.061**	BDL	BDL	BDL	BDL	0.005
cis-1,2-Dichloroethene	**0.127**	BDL	BDL	BDL	BDL	0.005
trans-1,2-Dichloroethene	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,3- Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
2,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
cis-1-3,Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
trans-1,3-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
Ethylbenzene	**0.005**	BDL	BDL	BDL	BDL	0.005
Hexachlorobutadiene	BDL	BDL	BDL	BDL	BDL	0.005
Isopropylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
4-Isopropyltoluene	BDL	BDL	BDL	BDL	BDL	0.005
Methylene Chloride	BDL	BDL	BDL	BDL	BDL	0.100
Naphthalene	**0.038**	BDL	BDL	BDL	BDL	0.025
n-Propylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
Styrene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Tetrachloroethene	**0.031**	BDL	BDL	BDL	BDL	0.005
Toluene	BDL	BDL	BDL	BDL	BDL	0.005
1,2,3-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1-Trichloroethane	**0.157**	BDL	BDL	BDL	BDL	0.005
1,1,2-Trichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Trichloroethene	**0.515**	BDL	BDL	BDL	BDL	0.005
Trichlorofluoromethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 24, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101 Birmingham, AL 35209	P.O. #	18-CULL01
		Project ID:	Former Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/17/18	Analyst:	Hageman/Heard
Date Collected:	10/17/18	Date of Analysis:	10/20-21/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	
VOLATILE ORGANIC COMPOUNDS, PPM	**BMW-8 5-10**	**BMW-9 5-10**	**BMW-10 0-5**	**BMW-11 5-7**	**BMW-12 5-10**	Practical Quantitation Limit PPM
	LAB ID	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	
	199214	**199215**	**199216**	**199217**	**199218**	
1,2,3-Trichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trimethylbenzene	**0.005**	BDL	BDL	BDL	BDL	0.005
1,3,5-Trimethylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
Vinyl Chloride	**0.011**	BDL	BDL	BDL	BDL	0.005
Xylenes, o,m,p	BDL	BDL	BDL	BDL	BDL	0.015
MTBE	BDL	BDL	BDL	BDL	BDL	0.005

Detection Limit is Practical Quantitation Limit
BDL = Below Detection Limit
All results expressed as PPM (mg/Kg)

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 24, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101 Birmingham, AL 35209	P.O. #	18-CULL01
		Project ID:	Fomer Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/17/18	Analyst:	Hageman/Heard
Date Collected:	10/17/18	Date of Analysis:	10/21-22/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	
VOLATILE ORGANIC COMPOUNDS, PPM	**BMW-13 5-10**	**PBSB-1**	**PBSB-2**	**PBSB-3**	**PBSB-4**	Practical Quantitation Limit PPM
	LAB ID	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	
	199219	**199220**	**199221**	**199222**	**199223**	
Benzene	BDL	BDL	BDL	BDL	BDL	0.005
Bromobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Bromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromodichloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromoform	BDL	BDL	BDL	BDL	BDL	0.005
Bromomethane	BDL	BDL	BDL	BDL	BDL	0.005
n-Butylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
sec-Butylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
tert-Butybenzene	BDL	BDL	BDL	BDL	BDL	0.005
Carbon Tetrachloride	BDL	BDL	BDL	BDL	BDL	0.005
Chlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Chloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Chloroform	BDL	BDL	BDL	BDL	BDL	0.005
Chloromethane	BDL	BDL	BDL	BDL	BDL	0.010
2-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
4-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
Dibromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromo-3-Chloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromoethane	BDL	BDL	BDL	BDL	BDL	0.005
Dibromomethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,3-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,4-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Dichlorodifluoromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichloroethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 24, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101	P.O. #	18-CULL01
	Birmingham, AL 35209	Project ID:	Fomer Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/17/18	Analyst:	Hageman/Heard
Date Collected:	10/17/18	Date of Analysis:	10/21-22/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

VOLATILE ORGANIC COMPOUNDS, PPM	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	Practical Quantitation Limit PPM
	BMW-13 5-10	**PBSB-1**	**PBSB-2**	**PBSB-3**	**PBSB-4**	
	LAB ID	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	
	199219	**199220**	**199221**	**199222**	**199223**	
1,1-Dichloroethene	BDL	BDL	BDL	BDL	BDL	0.005
cis-1,2-Dichloroethene	BDL	BDL	BDL	BDL	BDL	0.005
trans-1,2-Dichloroethene	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,3- Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
2,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
cis-1-3,Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
trans-1,3-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
Ethylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
Hexachlorobutadiene	BDL	BDL	BDL	BDL	BDL	0.005
Isopropylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
4-Isopropyltoluene	BDL	BDL	BDL	BDL	BDL	0.005
Methylene Chloride	BDL	BDL	BDL	BDL	**0.158**	0.100
Naphthalene	BDL	BDL	BDL	BDL	BDL	0.025
n-Propylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
Styrene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Tetrachloroethene	BDL	BDL	BDL	BDL	BDL	0.005
Toluene	BDL	BDL	BDL	BDL	BDL	0.005
1,2,3-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1-Trichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2-Trichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Trichloroethene	BDL	**0.006**	BDL	BDL	BDL	0.005
Trichlorofluoromethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 24, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101 Birmingham, AL 35209	P.O. #	18-CULL01
		Project ID:	Fomer Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/17/18	Analyst:	Hageman/Heard
Date Collected:	10/17/18	Date of Analysis:	10/21-22/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

VOLATILE ORGANIC COMPOUNDS, PPM	FIELD ID BMW-13 5-10 LAB ID 199219	FIELD ID PBSB-1 LAB ID 199220	FIELD ID PBSB-2 LAB ID 199221	FIELD ID PBSB-3 LAB ID 199222	FIELD ID PBSB-4 LAB ID 199223	Practical Quantitation Limit PPM
1,2,3-Trichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trimethylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,3,5-Trimethylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
Vinyl Chloride	BDL	BDL	BDL	BDL	BDL	0.005
Xylenes, o,m,p	BDL	BDL	BDL	BDL	BDL	0.015
MTBE	BDL	BDL	BDL	BDL	BDL	0.005

Detection Limit is Practical Quantitation Limit
BDL = Below Detection Limit
All results expressed as PPM (mg/Kg)

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 24, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101 Birmingham, AL 35209	P.O. #	18-CULL01
		Project ID:	Fomer Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/17/18	Analyst:	Hageman/Heard
Date Collected:	10/17/18	Date of Analysis:	10/22/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	FIELD ID				
VOLATILE ORGANIC COMPOUNDS, PPM	PBSB-5	PBSB-6				Practical Quantitation Limit PPM
	LAB ID	LAB ID				
	199224	199225				
Benzene	BDL	BDL				0.005
Bromobenzene	BDL	BDL				0.005
Bromochloromethane	BDL	BDL				0.005
Bromodichloromethane	BDL	BDL				0.005
Bromoform	BDL	BDL				0.005
Bromomethane	BDL	BDL				0.005
n-Butylbenzene	BDL	BDL				0.005
sec-Butylbenzene	BDL	BDL				0.005
tert-Butybenzene	BDL	BDL				0.005
Carbon Tetrachloride	BDL	BDL				0.005
Chlorobenzene	BDL	BDL				0.005
Chloroethane	BDL	BDL				0.005
Chloroform	BDL	BDL				0.005
Chloromethane	BDL	BDL				0.010
2-Chlorotoluene	BDL	BDL				0.005
4-Chlorotoluene	BDL	BDL				0.005
Dibromochloromethane	BDL	BDL				0.005
1,2-Dibromo-3-Chloropropane	BDL	BDL				0.005
1,2-Dibromoethane	BDL	BDL				0.005
Dibromomethane	BDL	BDL				0.005
1,2-Dichlorobenzene	BDL	BDL				0.005
1,3-Dichlorobenzene	BDL	BDL				0.005
1,4-Dichlorobenzene	BDL	BDL				0.005
Dichlorodifluoromethane	BDL	BDL				0.005
1,1-Dichloroethane	BDL	BDL				0.005
1,2-Dichloroethane	BDL	BDL				0.005

Compound List Continued next page

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 24, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101 Birmingham, AL 35209	P.O. #	18-CULL01
		Project ID:	Fomer Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/17/18	Analyst:	Hageman/Heard
Date Collected:	10/17/18	Date of Analysis:	10/22/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

VOLATILE ORGANIC COMPOUNDS, PPM	FIELD ID	FIELD ID				Practical Quantitation Limit PPM
	PBSB-5	**PBSB-6**				
	LAB ID	**LAB ID**				
	199224	**199225**				
1,1-Dichloroethene	BDL	BDL				0.005
cis-1,2-Dichloroethene	BDL	BDL				0.005
trans-1,2-Dichloroethene	BDL	BDL				0.005
1,2-Dichloropropane	BDL	BDL				0.005
1,3- Dichloropropane	BDL	BDL				0.005
2,2-Dichloropropane	BDL	BDL				0.005
1,1-Dichloropropene	BDL	BDL				0.005
cis-1-3,Dichloropropene	BDL	BDL				0.005
trans-1,3-Dichloropropene	BDL	BDL				0.005
Ethylbenzene	BDL	BDL				0.005
Hexachlorobutadiene	BDL	BDL				0.005
Isopropylbenzene	BDL	BDL				0.005
4-Isopropyltoluene	BDL	BDL				0.005
Methylene Chloride	**0.160**	**0.133**				0.100
Naphthalene	BDL	BDL				0.025
n-Propylbenzene	BDL	BDL				0.005
Styrene	BDL	BDL				0.005
1,1,1,2-Tetrachloroethane	BDL	BDL				0.005
1,1,2,2-Tetrachloroethane	BDL	BDL				0.005
Tetrachloroethene	BDL	BDL				0.005
Toluene	**0.005**	BDL				0.005
1,2,3-Trichlorobenzene	BDL	BDL				0.005
1,2,4-Trichlorobenzene	BDL	BDL				0.005
1,1,1-Trichloroethane	BDL	BDL				0.005
1,1,2-Trichloroethane	BDL	BDL				0.005
Trichloroethene	BDL	BDL				0.005
Trichlorofluoromethane	BDL	BDL				0.005

Compound List Continued next page

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 24, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101	P.O. #	18-CULL01
	Birmingham, AL 35209	Project ID:	Fomer Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/17/18	Analyst:	Hageman/Heard
Date Collected:	10/17/18	Date of Analysis:	10/22/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

VOLATILE ORGANIC COMPOUNDS, PPM	**FIELD ID** **PBSB-5** **LAB ID** **199224**	**FIELD ID** **PBSB-6** **LAB ID** **199225**				Practical Quantitation Limit PPM
1,2,3-Trichloropropane	BDL	BDL				0.005
1,2,4-Trimethylbenzene	BDL	BDL				0.005
1,3,5-Trimethylbenzene	BDL	BDL				0.005
Vinyl Chloride	BDL	BDL				0.005
Xylenes, o,m,p	BDL	BDL				0.015
MTBE	BDL	BDL				0.005

Detection Limit is Practical Quantitation Limit
BDL = Below Detection Limit
All results expressed as PPM (mg/Kg)

MH / QAQC

ADEM # 41470
EPA Laboratory ID AL01084

Respectfully submitted,

Kevin Doriety

Kevin Doriety
Analytical Chemist

Quality Environmental Analytical Services

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 25, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101	P.O. #	18-CULL01
	Birmingham, AL 35209	Project ID:	Fomer Greif Bros

Sample Matrix:	soil	Extraction Date:	10/22/18
Date Received:	10/17/18	Analyst:	Hageman/Heard
Date Collected:	10/17/18	Date of Analysis:	10/23/18
Sample Collector:	S. Smith	Method:	***EPA Method 8270C***

SEMIVOLATILE ORGANIC COMPOUNDS

ACID AND BASE NEUTRAL EXTRACTABLE ORGANIC COMPOUNDS, PPM	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	Practical Detection Limit, PPM
	PBSB-1	**PBSB-2**	**PBSB-3**	**PBSB-4**	**PBSB-5**	
	LAB ID	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	
	199220	**199221**	**199222**	**199223**	**199224**	
Acenaphthene	**0.059**	BDL	BDL	**0.056**	BDL	0.050
Acenaphthylene	**1.050**	**0.252**	**0.149**	**0.525**	**0.191**	0.050
Anthracene	**1.080**	**0.243**	**0.208**	**0.590**	**0.168**	0.050
Benzo(a)anthracene	**2.520**	**0.244**	**0.735**	**1.300**	**0.390**	0.050
Benzo(b)fluoranthene	**6.350**	**0.580**	**0.955**	**1.880**	**0.565**	0.050
Benzo(k)fluoranthene	**3.700**	**0.515**	**0.760**	**1.840**	**0.575**	0.050
Benzo(g,h,i)perylene	**1.940**	**0.302**	**0.575**	**1.230**	**0.345**	0.050
Benzo(a)pyrene	**3.720**	**0.481**	**0.860**	**1.810**	**0.580**	0.050
Bis(2-chloroethoxy)methane	BDL	BDL	BDL	BDL	BDL	0.050
Bis(2-chloroethyl)ether	BDL	BDL	BDL	BDL	BDL	0.050
Bis(2-chloroisopropyl)ether	BDL	BDL	BDL	BDL	BDL	0.050
Bis(2-ethylhexyl)phthalate	**0.094**	**0.214**	BDL	BDL	BDL	0.050
4-bromophenyl phenyl ether	BDL	BDL	BDL	BDL	BDL	0.050
Butyl benzyl phthalate	BDL	BDL	BDL	BDL	BDL	0.050
4-Choloraniline	BDL	BDL	BDL	BDL	BDL	0.050
2-Chloronaphthalene	BDL	BDL	BDL	BDL	BDL	0.050
4-Chloro-3-methylphenol	BDL	BDL	BDL	BDL	BDL	0.050
2-Chlorophenol	BDL	BDL	BDL	BDL	BDL	0.050
4-Chlorophenyl phenyl ether	BDL	BDL	BDL	BDL	BDL	0.050
Chrysene	**3.270**	**0.540**	**0.915**	**1.830**	**0.530**	0.050
Dibenzo(a,h)anthracene	BDL	BDL	BDL	BDL	BDL	0.050
Dibenzofuran	**0.157**	BDL	**0.223**	**0.315**	BDL	0.050
Di-n-butylphthalate	BDL	BDL	BDL	BDL	BDL	0.050
1,3-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.050
1,4-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.050
1,2-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.050

Compound List Continued next page

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 25, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101 Birmingham, AL 35209	P.O. #	18-CULL01
		Project ID:	Fomer Greif Bros

Sample Matrix:	soil	Extraction Date:	10/22/18
Date Received:	10/17/18	Analyst:	Hageman/Heard
Date Collected:	10/17/18	Date of Analysis:	10/23/18
Sample Collector:	S. Smith	Method:	***EPA Method 8270C***

SEMIVOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	Practical Detection Limit, PPM
ACID AND BASE NEUTRAL EXTRACTABLE ORGANIC COMPOUNDS, PPM	**PBSB-1**	**PBSB-2**	**PBSB-3**	**PBSB-4**	**PBSB-5**	
	LAB ID	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	
	199220	**199221**	**199222**	**199223**	**199224**	
2,4-Dichlorophenol	BDL	BDL	BDL	BDL	BDL	0.050
Diethylphthalate	BDL	BDL	BDL	BDL	BDL	0.050
2,4-Dimethylphenol	BDL	BDL	BDL	BDL	BDL	0.050
Dimethylphthalate	BDL	BDL	BDL	BDL	BDL	0.050
2,4-Dinitrophenol	BDL	BDL	BDL	BDL	BDL	0.050
2,4-Dinitrotoluene	BDL	BDL	BDL	BDL	BDL	0.050
2,6-Dinitrotoluene	BDL	BDL	BDL	BDL	BDL	0.050
Di-n-octylphthalate	BDL	BDL	BDL	BDL	BDL	0.050
Fluoranthene	**2.120**	**0.388**	**1.270**	**1.790**	**0.575**	0.050
Fluorene	**0.113**	BDL	BDL	BDL	BDL	0.050
Hexachlorobenzene	BDL	BDL	BDL	BDL	BDL	0.050
Hexachlorobutadiene	BDL	BDL	BDL	BDL	BDL	0.050
Hexachlorocyclopentadiene	BDL	BDL	BDL	BDL	BDL	0.050
Hexachloroethane	BDL	BDL	BDL	BDL	BDL	0.050
Indeno(1,2,3-cd)pyrene	**1.620**	**0.256**	**0.440**	**1.030**	**0.273**	0.050
Isophorone	BDL	**0.150**	BDL	BDL	BDL	0.050
2-Methylnaphthalene	**0.223**	**0.123**	**0.398**	**0.895**	**0.074**	0.050
2-Methylphenol (o-cresol)	BDL	BDL	BDL	BDL	BDL	0.050
4-Methylphenol (p-cresol)	BDL	BDL	BDL	BDL	BDL	0.050
Naphthalene	**0.355**	**0.194**	**0.147**	**0.810**	**0.075**	0.050
2-Nitroaniline	BDL	BDL	BDL	BDL	BDL	0.050
3-Nitroaniline	BDL	BDL	BDL	BDL	BDL	0.050
4-Nitroaniline	BDL	BDL	BDL	BDL	BDL	0.050
Nitrobenzene	BDL	BDL	BDL	BDL	BDL	0.050
2-Nitrophenol	BDL	BDL	BDL	BDL	BDL	0.050
4-Nitrophenol	BDL	BDL	BDL	BDL	BDL	0.050
N-Nitrosodimethylamine	BDL	BDL	BDL	BDL	BDL	0.050
N-Nitrosodi-n-propylamine	BDL	BDL	BDL	BDL	BDL	0.050

Compound List Continued next page

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 25, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101	P.O. #	18-CULL01
	Birmingham, AL 35209	Project ID:	Fomer Greif Bros

Sample Matrix:	soil	Extraction Date:	10/22/18
Date Received:	10/17/18	Analyst:	Hageman/Heard
Date Collected:	10/17/18	Date of Analysis:	10/23/18
Sample Collector:	S. Smith	Method:	***EPA Method 8270C***

SEMIVOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	Practical Detection Limit, PPM
ACID AND BASE NEUTRAL EXTRACTABLE ORGANIC COMPOUNDS, PPM	**PBSB-1**	**PBSB-2**	**PBSB-3**	**PBSB-4**	**PBSB-5**	
	LAB ID	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	
	199220	**199221**	**199222**	**199223**	**199224**	
Pentachlorophenol	BDL	BDL	BDL	BDL	BDL	0.050
Phenanthrene	**0.377**	**0.214**	**1.340**	**1.100**	**0.240**	0.050
Phenol	BDL	BDL	BDL	BDL	BDL	0.050
Pyrene	**2.680**	**0.388**	**1.040**	**1.720**	**0.580**	0.050
1,2,4-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.050
2,4,5-Trichlorophenol	BDL	BDL	BDL	BDL	BDL	0.050
2,4,6-Trichlorophenol	BDL	BDL	BDL	BDL	BDL	0.050

BDL = Below Detection Limit, Practical
All results expressed as PPM (mg/Kg)

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 25, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101 Birmingham, AL 35209	P.O. #	18-CULL01
		Project ID:	Fomer Greif Bros

Sample Matrix:	soil	Extraction Date:	10/22/18
Date Received:	10/17/18	Analyst:	Hageman/Heard
Date Collected:	10/17/18	Date of Analysis:	10/24/18
Sample Collector:	S. Smith	Method:	***EPA Method 8270C***

SEMIVOLATILE ORGANIC COMPOUNDS

ACID AND BASE NEUTRAL EXTRACTABLE ORGANIC COMPOUNDS, PPM	**FIELD ID**					Practical Detection Limit, PPM
	PBSB-6					
	LAB ID					
	199225					
Acenaphthene	**0.107**					0.050
Acenaphthylene	BDL					0.050
Anthracene	**0.190**					0.050
Benzo(a)anthracene	**1.270**					0.050
Benzo(b)fluoranthene	**1.470**					0.050
Benzo(k)fluoranthene	**1.050**					0.050
Benzo(g,h,i)perylene	**0.630**					0.050
Benzo(a)pyrene	**1.290**					0.050
Bis(2-chloroethoxy)methane	BDL					0.050
Bis(2-chloroethyl)ether	BDL					0.050
Bis(2-chloroisopropyl)ether	BDL					0.050
Bis(2-ethylhexyl)phthalate	BDL					0.050
4-bromophenyl phenyl ether	BDL					0.050
Butyl benzyl phthalate	BDL					0.050
4-Choloraniline	BDL					0.050
2-Chloronaphthalene	BDL					0.050
4-Chloro-3-methylphenol	BDL					0.050
2-Chlorophenol	BDL					0.050
4-Chlorophenyl phenyl ether	BDL					0.050
Chrysene	**1.570**					0.050
Dibenzo(a,h)anthracene	BDL					0.050
Dibenzofuran	**0.371**					0.050
Di-n-butylphthalate	BDL					0.050
1,3-Dichlorobenzene	BDL					0.050
1,4-Dichlorobenzene	BDL					0.050
1,2-Dichlorobenzene	BDL					0.050

Compound List Continued next page

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 25, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101 Birmingham, AL 35209	P.O. #	18-CULL01
		Project ID:	Fomer Greif Bros

Sample Matrix:	soil	Extraction Date:	10/22/18
Date Received:	10/17/18	Analyst:	Hageman/Heard
Date Collected:	10/17/18	Date of Analysis:	10/24/18
Sample Collector:	S. Smith	Method:	***EPA Method 8270C***

SEMIVOLATILE ORGANIC COMPOUNDS

ACID AND BASE NEUTRAL EXTRACTABLE ORGANIC COMPOUNDS, PPM	**FIELD ID**					Practical Detection Limit, PPM
	PBSB-6					
	LAB ID					
	199225					
2,4-Dichlorophenol	BDL					0.050
Diethylphthalate	BDL					0.050
2,4-Dimethylphenol	BDL					0.050
Dimethylphthalate	BDL					0.050
2,4-Dinitrophenol	BDL					0.050
2,4-Dinitrotoluene	BDL					0.050
2,6-Dinitrotoluene	BDL					0.050
Di-n-octylphthalate	BDL					0.050
Fluoranthene	**1.770**					0.050
Fluorene	**0.064**					0.050
Hexachlorobenzene	BDL					0.050
Hexachlorobutadiene	BDL					0.050
Hexachlorocyclopentadiene	BDL					0.050
Hexachloroethane	BDL					0.050
Indeno(1,2,3-cd)pyrene	**0.525**					0.050
Isophorone	BDL					0.050
2-Methylnaphthalene	**1.060**					0.050
2-Methylphenol (o-cresol)	BDL					0.050
4-Methylphenol (p-cresol)	BDL					0.050
Naphthalene	**1.060**					0.050
2-Nitroaniline	BDL					0.050
3-Nitroaniline	BDL					0.050
4-Nitroaniline	BDL					0.050
Nitrobenzene	BDL					0.050
2-Nitrophenol	BDL					0.050
4-Nitrophenol	BDL					0.050
N-Nitrosodimethylamine	BDL					0.050
N-Nitrosodi-n-propylamine	BDL					0.050

Compound List Continued next page

Quality Environmental Analytical Services

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 25, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101	P.O. #	18-CULL01
	Birmingham, AL 35209	Project ID:	Fomer Greif Bros

Sample Matrix:	soil	Extraction Date:	10/22/18
Date Received:	10/17/18	Analyst:	Hageman/Heard
Date Collected:	10/17/18	Date of Analysis:	10/24/18
Sample Collector:	S. Smith	Method:	***EPA Method 8270C***

SEMIVOLATILE ORGANIC COMPOUNDS

ACID AND BASE NEUTRAL EXTRACTABLE ORGANIC COMPOUNDS, PPM	**FIELD ID**					Practical Detection Limit, PPM
	PBSB-6					
	LAB ID					
	199225					
Pentachlorophenol	BDL					0.050
Phenanthrene	**1.540**					0.050
Phenol	BDL					0.050
Pyrene	**1.560**					0.050
1,2,4-Trichlorobenzene	BDL					0.050
2,4,5-Trichlorophenol	BDL					0.050
2,4,6-Trichlorophenol	BDL					0.050

BDL = Below Detection Limit, Practical
All results expressed as PPM (mg/Kg)

MHL / QAQC

EPA Laboratory ID AL01084

Respectfully submitted,

Kevin Doriety

Kevin Doriety
Analytical Chemist

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 25, 2018
Attention:	Mr. Doug Bullock	Reference #	39921
Address:	2811 Crescent Ave. Ste 101	P.O. #	18-CULL01
	Birmingham, AL 35209	Project ID:	Former Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/17/18	Analyst:	Kevin Doriety
Date Collected:	10/17/18	Date of Analysis:	10/25/18
Sample Collector:	S. Smith	Method:	***EPA Method 6010B/ Hg: 7471A***

METALLIC ANALYTES

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	
	PBSB-1	**PBSB-2**	**PBSB-3**	**PBSB-4**	**PBSB-5**	**PBSB-6**	
Analyte, mg/Kg as Total	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	Detection Limit,mg/Kg
	199220	**199221**	**199222**	**199223**	**199224**	**199225**	
Arsenic	**28**	**16**	BDL	**34**	**8.3**	**47**	1.0
Barium	**92**	**90**	**317**	**187**	**90**	**170**	1.0
Cadmium	**6.1**	BDL	**1.2**	BDL	**1.1**	**1.5**	1.0
Chromium	**21**	**50**	**5.8**	**117**	**7.1**	**8.0**	1.0
Lead	**195**	**122**	**129**	**173**	**66**	**226**	1.0
Mercury	BDL	BDL	BDL	BDL	BDL	BDL	0.01
Selenium	BDL	**11**	BDL	**5.1**	BDL	**2.9**	1.0
Silver	BDL	BDL	BDL	BDL	BDL	BDL	1.0

BDL = Below Detection Limit
Detection Limit is Reporting Limit
All results expressed as PPM mg/Kg of total analyte

ATL / QAQC

EPA Laboratory ID AL01084

Respectfully submitted,

Kevin Doriety

Kevin Doriety
Analytical Chemist

Quality Environmental Analytical Services

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
BIRMINGHAM, AL 35233
PHONE (205)581-9500 FAX (205)581-9504
E-Mail: suthlab@bellsouth.net

CHAIN OF CUSTODY
ANALYSIS REQUEST

Client P.O. # 18-CULL01

SEND REPORT TO: **Invoice #** 39917

Name: Doug Bullock
Company: Bullock Environmental
Address:

Phone#: Cell #
E-mail: yes Pl
PDF Results: yes no Fax #:

CLIENT:

PROJECT: Fmr Greif Bros

SAMPLER(S): (print) Samuel Smith

DATE DELIVERED:

					ANALYSIS REQUESTED / METHOD								
LAB ID	FIELD ID	DATE Collected	TIME Collected	SAMPLE DESCRIPTION (matrix)	VOCs								Number of sample containers
199165	SB-1 0-5	10/16/18	0830	Soil	X								1
199166	SB-3 0-5	↓	910	↓	↓								↓
199167	SB-4 0-5		945										
199168	SB-2 5-7		1015										
199169	SB-5 0-5		1045										
199170	BMW-3 0-5		1110										
199171	SB-6 0-5		1120										
199172	BMW4 5-10		1145										
199173	BMW5 5-10		1300										
199174	SB-8 0-5		1315										
199175	SB-9 0-5		1330										
199176	SB-7 5-7	↓	1400	↓	↓								

Preservative: (a)HCL, (b)HNO$_3$, (c)H$_2$SO$_4$, (d)NaOH, (e) Na$_2$S$_2$O$_3$, (f) H$_3$PO$_4$, (g)Zn Acetate **Preservative:**

Container type: (a) Amber, (g) Glass, (p) Plastic, (v) VOC Vial, (air) air bag **Container:**

Last revised 5/29/12

	Date	Time		Date	Time
Relinquished by Sampler: Signed:	10/16/18	1400	Received by: Signed:		
Relinquished by: Signed:	10/16/18	1526	Received by: Signed:		
Relinquished by: Signed:			Received in Laboratory by: Signed:	10/16/18	3:20

Turn Around Time (please note):

Standard ✓ ***RUSH, mark below** ____

*3-Day *2-Day *Next Day *Same Day

Remarks:

Refrigerated upon receipt: [✓ yes] no

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
BIRMINGHAM, AL 35233
PHONE (205)581-9500 FAX (205)581-9504
E-Mail: suthlab@bellsouth.net

CHAIN OF CUSTODY ANALYSIS REQUEST

SEND REPORT TO:
Name: Doug Bullock
Company: Bullock
Address:
Phone#: Cell #
E-mail:
PDF Results: [✓ yes] no
Fax #:
Invoice #

Client P.O. # 18-CUL01

CLIENT:
PROJECT: Former Greit Bros
SAMPLER(S): (print) Sam Smith

DATE DELIVERED:

LAB ID	FIELD ID	DATE Collected	TIME Collected	SAMPLE DESCRIPTION (matrix)	ANALYSIS REQUESTED / METHOD								Number of sample containers
					VOCs								
199177	BMW-2 5-8'	10/16/18	1010	Soil	x								1

Preservative: (a)HCL, (b)HNO$_3$, (c)H$_2$SO$_4$, (d)NaOH, (e) Na$_2$S$_2$O$_3$, (f) H$_3$PO$_4$, (g)Zn Acetate **Preservative:**
Container type: (a) Amber, (g) Glass, (p) Plastic, (v) VOC Vial, (air) air bag **Container:**

Last revised 5/29/12

Relinquished by Sampler: Signed: for Sam Smith	Date 10/16/18	Time 1400	Received by: Signed:	Date	Time
Relinquished by: Signed:	Date	Time	Received by: Signed:	Date	Time
Relinquished by: Signed:	Date	Time	Received in Laboratory by: Signed:	Date 10/16/18	Time 3:26

Turn Around Time (please note):
Standard ____ ***RUSH, mark below** ____
*3-Day *2-Day *Next Day *Same Day
Remarks:

Refrigerated upon receipt: yes no

Subject: Re: Revised COC for Former Greif Bros project

From: Samuel Smith (sam.smith@bullockenvironmental.com)

To: suthlab@bellsouth.net;

Date: Wednesday, October 17, 2018 10:52 AM

BMW-2 is 1010 the other is 1400

Sent from my iPhone

On Oct 17, 2018, at 10:39 AM, Sutherland Env <suthlab@bellsouth.net> wrote:

> I will need the times they were sampled also.
>
> Thanks!
> Sutherland Environmental Co.
> 2515 5th Ave. South
> Birmingham, AL 35233
> (205) 581-9500
>
> ---
>
> **From:** Samuel Smith <sam.smith@bullockenvironmental.com>
> **To:** Sutherland Env <suthlab@bellsouth.net>
> **Sent:** Tuesday, October 16, 2018 4:09 PM
> **Subject:** Re: Revised COC for Former Greif Bros project
>
> Yes that is correct I'll get someone to sign it tomorrow thank you
>
> Sent from my iPhone
>
> \> On Oct 16, 2018, at 4:04 PM, Sutherland Env <suthlab@bellsouth.net> wrote:
> \>
> \> Hey Sam - Here is the revised COC. Please confirm that everything is correct, sign the second page and send back to me.
> \>
> \> Thanks so much!
> \> Ashley Bragan Sutherland Environmental Co.
> \> 2515 5th Ave. South
> \> Birmingham, AL 35233
> \> (205) 581-9500
>
> \> <Revised COC Bullock.pdf>

Subject: Re: 39917 Fmr Greif Bros
From: Sam Smith (sam.smith@bullockenvironmental.com)
To: suthlab@bellsouth.net;
Date: Monday, October 22, 2018 9:13 AM

Yes that is correct, Thank you for your help with this.

Samuel A. Smith, P.G.
Senior Project Geologist
bullock environmental, llc
2811 crescent avenue, suite 101
birmingham, alabama 35209
main: 205.876.1715
direct: 205.876.1718
mobile: 205.383.7045
sam.smith@bullockenvironmental.com

> On Oct 22, 2018, at 9:10 AM, Sutherland Env <suthlab@bellsouth.net> wrote:
>
> I am changing Field ID BMW-2 5-7 to SB-2 5-7 per what you have on the sample jar. Please confirm that is correct.
>
> Thanks,
> Ashley
> Sutherland Environmental Co.
> 2515 5th Ave. South
> Birmingham, AL 35233
> (205) 581-9500
>
> ---
>
> **From:** Sam Smith <sam.smith@bullockenvironmental.com>
> **To:** Sutherland Env <suthlab@bellsouth.net>
> **Sent:** Monday, October 22, 2018 8:33 AM
> **Subject:** Re: 39917 Fmr Greif Bros
>
> There are two BMW-2's. I think one of these is an error. 199168 and 199177 are the lab sample IDs. Can you look at the lids and see if its obvious which one is an error? If you need me to I can come down there and look at them.
>
> Thanks
>
> Samuel A. Smith, P.G.
> Senior Project Geologist
> bullock environmental, llc
> 2811 crescent avenue, suite 101
> birmingham, alabama 35209
> main: 205.876.1715
> direct: 205.876.1718
> mobile: 205.383.7045
> sam.smith@bullockenvironmental.com

On Oct 19, 2018, at 2:21 PM, Sutherland Env <suthlab@bellsouth.net> wrote:

Sutherland Environmental Co.
2515 5th Ave. South
Birmingham, AL 35233
(205) 581-9500
<39917 Fmr Greif Bros.pdf>

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client: Bullock Environmental, LLC
Attention: Mr. Doug Bullock
Address: 2811 Crescent Ave. Ste 101
Birmingham, AL 35209

Report Date: October 18, 2018
Reference # 39917
P.O. # 18-CULL01
Project ID: Fmr Greif Bros

Sample Matrix: soil
Date Received: 10/16/18
Date Collected: 10/16/18
Sample Collector: S. Smith

Analytical
Analyst: Hageman/Heard
Date of Analysis: 10/17/18
Method: ***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

VOLATILE ORGANIC COMPOUNDS, PPM	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	Practical Quantitation Limit PPM
	SB-1	**SB-3**	**SB-4**	**SB-2**	**SB-5**	
	0-5	**0-5**	**0-5**	**5-7**	**0-5**	
	LAB ID	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	
	199165	**199166**	**199167**	**199168**	**199169**	
Benzene	BDL	BDL	BDL	BDL	BDL	0.005
Bromobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Bromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromodichloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromoform	BDL	BDL	BDL	BDL	BDL	0.005
Bromomethane	BDL	BDL	BDL	BDL	BDL	0.005
n-Butylbenzene	BDL	BDL	BDL	**0.500**	BDL	0.005
sec-Butylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
tert-Butybenzene	BDL	BDL	BDL	BDL	BDL	0.005
Carbon Tetrachloride	BDL	BDL	BDL	BDL	BDL	0.005
Chlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Chloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Chloroform	BDL	BDL	BDL	BDL	BDL	0.005
Chloromethane	BDL	BDL	BDL	BDL	BDL	0.010
2-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
4-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
Dibromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromo-3-Chloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromoethane	BDL	BDL	BDL	BDL	BDL	0.005
Dibromomethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,3-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,4-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Dichlorodifluoromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichloroethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client: Bullock Environmental, LLC
Attention: Mr. Doug Bullock
Address: 2811 Crescent Ave. Ste 101
Birmingham, AL 35209

Report Date: October 18, 2018
Reference # 39917
P.O. # 18-CULL01
Project ID: Fmr Greif Bros

Sample Matrix: soil
Date Received: 10/16/18
Date Collected: 10/16/18
Sample Collector: S. Smith

Analytical
Analyst: Hageman/Heard
Date of Analysis: 10/17/18
Method: ***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

VOLATILE ORGANIC COMPOUNDS, PPM	**FIELD ID SB-1 0-5 LAB ID 199165**	**FIELD ID SB-3 0-5 LAB ID 199166**	**FIELD ID SB-4 0-5 LAB ID 199167**	**FIELD ID SB-2 5-7 LAB ID 199168**	**FIELD ID SB-5 0-5 LAB ID 199169**	Practical Quantitation Limit PPM
1,1-Dichloroethene	BDL	BDL	BDL	BDL	BDL	0.005
cis-1,2-Dichloroethene	**0.184**	**0.102**	**0.008**	**0.053**	**0.156**	0.005
trans-1,2-Dichloroethene	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,3- Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
2,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
cis-1-3,Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
trans-1,3-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
Ethylbenzene	BDL	**0.196**	BDL	**0.157**	BDL	0.005
Hexachlorobutadiene	BDL	BDL	BDL	BDL	BDL	0.005
Isopropylbenzene	BDL	**0.009**	BDL	**0.152**	BDL	0.005
4-Isopropyltoluene	BDL	BDL	BDL	**0.065**	BDL	0.005
Methylene Chloride	BDL	**0.122**	BDL	BDL	BDL	0.005
Naphthalene	BDL	BDL	BDL	**1.640**	**0.080**	0.100
n-Propylbenzene	BDL	**0.021**	BDL	**0.400**	BDL	0.025
Styrene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Tetrachloroethene	BDL	BDL	BDL	BDL	**0.048**	0.005
Toluene	BDL	**0.005**	BDL	**0.200**	BDL	0.005
1,2,3-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1-Trichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2-Trichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Trichloroethene	**1.950**	**0.173**	**0.011**	BDL	**0.345**	0.005
Trichlorofluoromethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 18, 2018
Attention:	Mr. Doug Bullock	Reference #	39917
Address:	2811 Crescent Ave. Ste 101 Birmingham, AL 35209	P.O. #	18-CULL01
		Project ID:	Fmr Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/16/18	Analyst:	Hageman/Heard
Date Collected:	10/16/18	Date of Analysis:	10/17/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

VOLATILE ORGANIC COMPOUNDS, PPM	**FIELD ID SB-1 0-5 LAB ID 199165**	**FIELD ID SB-3 0-5 LAB ID 199166**	**FIELD ID SB-4 0-5 LAB ID 199167**	**FIELD ID SB-2 5-7 LAB ID 199168**	**FIELD ID SB-5 0-5 LAB ID 199169**	Practical Quantitation Limit PPM
1,2,3-Trichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trimethylbenzene	BDL	**0.214**	BDL	**2.170**	**0.012**	0.005
1,3,5-Trimethylbenzene	BDL	**0.050**	BDL	**0.740**	BDL	0.005
Vinyl Chloride	BDL	BDL	BDL	**0.038**	BDL	0.005
Xylenes, o,m,p	BDL	**1.210**	BDL	**1.050**	BDL	0.015
MTBE	BDL	BDL	BDL	BDL	BDL	0.005

Detection Limit is Practical Quantitation Limit
BDL = Below Detection Limit
All results expressed as PPM (mg/Kg)

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 18, 2018
Attention:	Mr. Doug Bullock	Reference #	39917
Address:	2811 Crescent Ave. Ste 101 Birmingham, AL 35209	P.O. #	18-CULL01
		Project ID:	Fmr Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/16/18	Analyst:	Hageman/Heard
Date Collected:	10/16/18	Date of Analysis:	10/17-18/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	
VOLATILE ORGANIC COMPOUNDS, PPM	**BMW-3 0-5**	**SB-6 0-5**	**BMW-4 5-10**	**BMW-5 5-10**	**SB-8 0-5**	Practical Quantitation Limit PPM
	LAB ID 199170	**LAB ID 199171**	**LAB ID 199172**	**LAB ID 199173**	**LAB ID 199174**	
Benzene	BDL	BDL	BDL	BDL	BDL	0.005
Bromobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Bromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromodichloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromoform	BDL	BDL	BDL	BDL	BDL	0.005
Bromomethane	BDL	BDL	BDL	BDL	BDL	0.005
n-Butylbenzene	BDL	**0.009**	BDL	BDL	BDL	0.005
sec-Butylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
tert-Butybenzene	BDL	BDL	BDL	BDL	BDL	0.005
Carbon Tetrachloride	BDL	BDL	BDL	BDL	BDL	0.005
Chlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Chloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Chloroform	BDL	BDL	BDL	BDL	BDL	0.005
Chloromethane	BDL	BDL	BDL	BDL	BDL	0.010
2-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
4-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
Dibromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromo-3-Chloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromoethane	BDL	BDL	BDL	BDL	BDL	0.005
Dibromomethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,3-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,4-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Dichlorodifluoromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichloroethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 18, 2018
Attention:	Mr. Doug Bullock	Reference #	39917
Address:	2811 Crescent Ave. Ste 101 Birmingham, AL 35209	P.O. #	18-CULL01
		Project ID:	Fmr Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/16/18	Analyst:	Hageman/Heard
Date Collected:	10/16/18	Date of Analysis:	10/17-18/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

VOLATILE ORGANIC COMPOUNDS, PPM	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	Practical Quantitation Limit PPM
	BMW-3 0-5	**SB-6 0-5**	**BMW-4 5-10**	**BMW-5 5-10**	**SB-8 0-5**	
	LAB ID	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	
	199170	**199171**	**199172**	**199173**	**199174**	
1,1-Dichloroethene	BDL	BDL	BDL	BDL	BDL	0.005
cis-1,2-Dichloroethene	BDL	BDL	BDL	**0.015**	**0.009**	0.005
trans-1,2-Dichloroethene	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,3- Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
2,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
cis-1-3,Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
trans-1,3-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
Ethylbenzene	BDL	BDL	BDL	BDL	**0.136**	0.005
Hexachlorobutadiene	BDL	BDL	BDL	BDL	BDL	0.005
Isopropylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
4-Isopropyltoluene	BDL	BDL	BDL	BDL	BDL	0.005
Methylene Chloride	BDL	BDL	BDL	BDL	BDL	0.100
Naphthalene	BDL	**0.044**	BDL	**0.031**	**0.045**	0.025
n-Propylbenzene	BDL	**0.005**	BDL	BDL	**0.005**	0.005
Styrene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Tetrachloroethene	BDL	BDL	BDL	BDL	BDL	0.005
Toluene	BDL	BDL	BDL	BDL	BDL	0.005
1,2,3-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1-Trichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2-Trichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Trichloroethene	BDL	BDL	BDL	**0.230**	**0.007**	0.005
Trichlorofluoromethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 18, 2018
Attention:	Mr. Doug Bullock	Reference #	39917
Address:	2811 Crescent Ave. Ste 101 Birmingham, AL 35209	P.O. #	18-CULL01
		Project ID:	Fmr Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/16/18	Analyst:	Hageman/Heard
Date Collected:	10/16/18	Date of Analysis:	10/17-18/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

	FIELD ID	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	
VOLATILE ORGANIC COMPOUNDS, PPM	**BMW-3 0-5**	**SB-6 0-5**	**BMW-4 5-10**	**BMW-5 5-10**	**SB-8 0-5**	Practical Quantitation Limit PPM
	LAB ID	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	
	199170	**199171**	**199172**	**199173**	**199174**	
1,2,3-Trichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trimethylbenzene	BDL	**0.005**	BDL	**0.014**	**0.033**	0.005
1,3,5-Trimethylbenzene	BDL	BDL	BDL	BDL	**0.005**	0.005
Vinyl Chloride	BDL	BDL	BDL	BDL	BDL	0.005
Xylenes, o,m,p	BDL	BDL	BDL	BDL	**0.060**	0.015
MTBE	BDL	BDL	BDL	BDL	BDL	0.005

Detection Limit is Practical Quantitation Limit
BDL = Below Detection Limit
All results expressed as PPM (mg/Kg)

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 18, 2018
Attention:	Mr. Doug Bullock	Reference #	39917
Address:	2811 Crescent Ave. Ste 101 Birmingham, AL 35209	P.O. #	18-CULL01
		Project ID:	Fmr Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/16/18	Analyst:	Hageman/Heard
Date Collected:	10/16/18	Date of Analysis:	10/18/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

VOLATILE ORGANIC COMPOUNDS, PPM	**FIELD ID** **SB-9** **0-5** **LAB ID** **199175**	**FIELD ID** **SB-7** **5-7** **LAB ID** **199176**	**FIELD ID** **BMW-2** **5-8** **LAB ID** **199177**			Practical Quantitation Limit PPM
Benzene	BDL	BDL	BDL			0.005
Bromobenzene	BDL	BDL	BDL			0.005
Bromochloromethane	BDL	BDL	BDL			0.005
Bromodichloromethane	BDL	BDL	BDL			0.005
Bromoform	BDL	BDL	BDL			0.005
Bromomethane	BDL	BDL	BDL			0.005
n-Butylbenzene	BDL	BDL	BDL			0.005
sec-Butylbenzene	BDL	BDL	BDL			0.005
tert-Butybenzene	BDL	BDL	BDL			0.005
Carbon Tetrachloride	BDL	BDL	BDL			0.005
Chlorobenzene	BDL	BDL	BDL			0.005
Chloroethane	BDL	BDL	BDL			0.005
Chloroform	BDL	BDL	BDL			0.005
Chloromethane	BDL	BDL	BDL			0.010
2-Chlorotoluene	BDL	BDL	BDL			0.005
4-Chlorotoluene	BDL	BDL	BDL			0.005
Dibromochloromethane	BDL	BDL	BDL			0.005
1,2-Dibromo-3-Chloropropane	BDL	BDL	BDL			0.005
1,2-Dibromoethane	BDL	BDL	BDL			0.005
Dibromomethane	BDL	BDL	BDL			0.005
1,2-Dichlorobenzene	BDL	BDL	BDL			0.005
1,3-Dichlorobenzene	BDL	BDL	BDL			0.005
1,4-Dichlorobenzene	BDL	BDL	BDL			0.005
Dichlorodifluoromethane	BDL	BDL	BDL			0.005
1,1-Dichloroethane	BDL	BDL	BDL			0.005
1,2-Dichloroethane	BDL	BDL	BDL			0.005

Compound List Continued next page

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client: Bullock Environmental, LLC
Attention: Mr. Doug Bullock
Address: 2811 Crescent Ave. Ste 101
Birmingham, AL 35209

Report Date: October 18, 2018
Reference # 39917
P.O. # 18-CULL01
Project ID: Fmr Greif Bros

Sample Matrix: soil
Date Received: 10/16/18
Date Collected: 10/16/18
Sample Collector: S. Smith

Analytical
Analyst: Hageman/Heard
Date of Analysis: 10/18/18
Method: ***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

VOLATILE ORGANIC COMPOUNDS, PPM	**FIELD ID** **SB-9** **0-5** **LAB ID** **199175**	**FIELD ID** **SB-7** **5-7** **LAB ID** **199176**	**FIELD ID** **BMW-2** **5-8** **LAB ID** **199177**			Practical Quantitation Limit PPM
1,1-Dichloroethene	BDL	BDL	BDL			0.005
cis-1,2-Dichloroethene	BDL	BDL	BDL			0.005
trans-1,2-Dichloroethene	BDL	BDL	BDL			0.005
1,2-Dichloropropane	BDL	BDL	BDL			0.005
1,3- Dichloropropane	BDL	BDL	BDL			0.005
2,2-Dichloropropane	BDL	BDL	BDL			0.005
1,1-Dichloropropene	BDL	BDL	BDL			0.005
cis-1-3,Dichloropropene	BDL	BDL	BDL			0.005
trans-1,3-Dichloropropene	BDL	BDL	BDL			0.005
Ethylbenzene	BDL	BDL	BDL			0.005
Hexachlorobutadiene	BDL	BDL	BDL			0.005
Isopropylbenzene	BDL	BDL	BDL			0.005
4-Isopropyltoluene	BDL	BDL	BDL			0.005
Methylene Chloride	BDL	BDL	BDL			0.005
Naphthalene	BDL	BDL	BDL			0.100
n-Propylbenzene	BDL	BDL	BDL			0.025
Styrene	BDL	BDL	BDL			0.005
1,1,1,2-Tetrachloroethane	BDL	BDL	BDL			0.005
1,1,2,2-Tetrachloroethane	BDL	BDL	BDL			0.005
Tetrachloroethene	BDL	BDL	BDL			0.005
Toluene	BDL	BDL	BDL			0.005
1,2,3-Trichlorobenzene	BDL	BDL	BDL			0.005
1,2,4-Trichlorobenzene	BDL	BDL	BDL			0.005
1,1,1-Trichloroethane	BDL	BDL	BDL			0.005
1,1,2-Trichloroethane	BDL	BDL	BDL			0.005
Trichloroethene	BDL	BDL	BDL			0.005
Trichlorofluoromethane	BDL	BDL	BDL			0.005

Compound List Continued next page

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 18, 2018
Attention:	Mr. Doug Bullock	Reference #	39917
Address:	2811 Crescent Ave. Ste 101 Birmingham, AL 35209	P.O. #	18-CULL01
		Project ID:	Fmr Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/16/18	Analyst:	Hageman/Heard
Date Collected:	10/16/18	Date of Analysis:	10/18/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

VOLATILE ORGANIC COMPOUNDS, PPM	FIELD ID	FIELD ID	FIELD ID			Practical Quantitation Limit PPM
	SB-9 **0-5**	**SB-7** **5-7**	**BMW-2** **5-8**			
	LAB ID	**LAB ID**	**LAB ID**			
	199175	**199176**	**199177**			
1,2,3-Trichloropropane	BDL	BDL	BDL			0.005
1,2,4-Trimethylbenzene	BDL	BDL	BDL			0.005
1,3,5-Trimethylbenzene	BDL	BDL	BDL			0.005
Vinyl Chloride	BDL	BDL	BDL			0.005
Xylenes, o,m,p	BDL	BDL	BDL			0.015
MTBE	BDL	BDL	BDL			0.005

Detection Limit is Practical Quantitation Limit
BDL = Below Detection Limit
All results expressed as PPM (mg/Kg)

/ QAQC

ADEM # 41470
EPA Laboratory ID AL01084

Respectfully submitted,

Kevin Doriety

Kevin Doriety
Analytical Chemist

CHAIN OF CUSTODY
ANALYSIS REQUEST

Invoice # 39916

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
BIRMINGHAM, AL 35233
PHONE (205)581-9500 FAX (205)581-9504
E-Mail: suthlab@bellsouth.net

SEND REPORT TO:
Name: Doug Bullock
Company: Bullock Environmental
Address:
Phone#: Cell #
E-mail: yes please
PDF Results: yes no Fax #:

Client P.O. # 18-Cull01

CLIENT:

PROJECT: Former Greif Bros

SAMPLER(S): (print) Samuel Smith

DATE DELIVERED:

					ANALYSIS REQUESTED / METHOD								
LAB ID	FIELD ID	DATE Collected	TIME Collected	SAMPLE DESCRIPTION (matrix)	VOCs								Number of sample containers
199160	SB-6 5-10	10/16/18	1220	Soil	X								1
199161	SB-3 5-10	↓	940	↓	↓								↓
199162	BMW-1 0-5		810										
199163	SB-1 5-10		840										
199164	SB-8 5-10		1300										
				Preservative:									Last revised 5/29/12
				Container:									

Preservative: (a)HCL, (b)HNO$_3$, (c)H$_2$SO$_4$, (d)NaOH, (e) Na$_2$S$_2$O$_3$, (f) H$_3$PO$_4$, (g)Zn Acetate
Container type: (a) Amber, (g) Glass, (p) Plastic, (v) VOC Vial, (air) air bag

	Date	Time		Date	Time
Relinquished by Sampler: Signed:	10/16/18	1400	Received by: Signed:		
Relinquished by: Signed:	10/16/18	1526	Received by: Signed:		
ished by:			Received in Laboratory by: Signed: Braggan	10/16/18	3:26

Turn Around Time (please note):
Standard ____ *RUSH, mark below
*3-Day [✓ *2-Day] *Next Day *Same Day

Remarks:

Refrigerated upon receipt: [✓ yes] no

Sutherland

Environmental Company, Inc.

2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 18, 2018
Attention:	Mr. Doug Bullock	Reference #	39916
Address:	2811 Crescent Ave. Ste 101	P.O. #	18-CULL01
	Birmingham, AL 35209	Project ID:	Former Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/16/18	Analyst:	Hageman/Heard
Date Collected:	10/16/18	Date of Analysis:	10/17-18/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

VOLATILE ORGANIC COMPOUNDS, PPM	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	Practical Quantitation Limit PPM
	SB-6 5-10'	**SB-3 5-10'**	**BMW-1 0-5'**	**SB-1 5-10'**	**SB-8 5-10'**	
	LAB ID	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	
	199160	**199161**	**199162**	**199163**	**199164**	
Benzene	BDL	BDL	BDL	BDL	BDL	0.005
Bromobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Bromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromodichloromethane	BDL	BDL	BDL	BDL	BDL	0.005
Bromoform	BDL	BDL	BDL	BDL	BDL	0.005
Bromomethane	BDL	BDL	BDL	BDL	BDL	0.005
n-Butylbenzene	**0.233**	**0.006**	BDL	BDL	BDL	0.005
sec-Butylbenzene	BDL	BDL	BDL	BDL	BDL	0.005
tert-Butybenzene	BDL	BDL	BDL	BDL	BDL	0.005
Carbon Tetrachloride	BDL	BDL	BDL	BDL	BDL	0.005
Chlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Chloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Chloroform	BDL	BDL	BDL	BDL	BDL	0.005
Chloromethane	BDL	BDL	BDL	BDL	BDL	0.005
2-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
4-Chlorotoluene	BDL	BDL	BDL	BDL	BDL	0.005
Dibromochloromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromo-3-Chloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dibromoethane	BDL	BDL	BDL	BDL	BDL	0.005
Dibromomethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,3-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,4-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
Dichlorodifluoromethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichloroethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 18, 2018
Attention:	Mr. Doug Bullock	Reference #	39916
Address:	2811 Crescent Ave. Ste 101 Birmingham, AL 35209	P.O. #	18-CULL01
		Project ID:	Former Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/16/18	Analyst:	Hageman/Heard
Date Collected:	10/16/18	Date of Analysis:	10/17-18/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

VOLATILE ORGANIC COMPOUNDS, PPM	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	Practical Quantitation Limit PPM
	SB-6 5-10'	**SB-3 5-10'**	**BMW-1 0-5'**	**SB-1 5-10'**	**SB-8 5-10'**	
	LAB ID 199160	**LAB ID 199161**	**LAB ID 199162**	**LAB ID 199163**	**LAB ID 199164**	
1,1-Dichloroethene	BDL	BDL	BDL	BDL	BDL	0.005
cis-1,2-Dichloroethene	BDL	**1.420**	**0.015**	**0.535**	**0.199**	0.005
trans-1,2-Dichloroethene	BDL	BDL	BDL	BDL	BDL	0.005
1,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,3- Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
2,2-Dichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,1-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
cis-1-3,Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
trans-1,3-Dichloropropene	BDL	BDL	BDL	BDL	BDL	0.005
Ethylbenzene	**0.007**	BDL	BDL	BDL	BDL	0.005
Hexachlorobutadiene	BDL	BDL	BDL	BDL	BDL	0.005
Isopropylbenzene	**0.118**	BDL	BDL	**0.025**	BDL	0.005
4-Isopropyltoluene	BDL	BDL	BDL	BDL	BDL	0.005
Methylene Chloride	BDL	**0.137**	**0.139**	BDL	BDL	0.100
Naphthalene	**11.500**	**0.025**	BDL	BDL	**0.028**	0.025
n-Propylbenzene	**0.245**	BDL	BDL	**0.071**	BDL	0.005
Styrene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Tetrachloroethene	BDL	BDL	BDL	BDL	BDL	0.005
Toluene	**0.006**	**0.013**	BDL	BDL	BDL	0.005
1,2,3-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	0.005
1,1,1-Trichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
1,1,2-Trichloroethane	BDL	BDL	BDL	BDL	BDL	0.005
Trichloroethene	BDL	**3.250**	**0.020**	**5.570**	**0.790**	0.005
Trichlorofluoromethane	BDL	BDL	BDL	BDL	BDL	0.005

Compound List Continued next page

Sutherland
Environmental Company, Inc.
2515 5th Avenue South
Birmingham, AL 35233
205-581-9500

Client:	Bullock Environmental, LLC	Report Date:	October 18, 2018
Attention:	Mr. Doug Bullock	Reference #	39916
Address:	2811 Crescent Ave. Ste 101 Birmingham, AL 35209	P.O. #	18-CULL01
		Project ID:	Former Greif Bros

Sample Matrix:	soil	Analytical	
Date Received:	10/16/18	Analyst:	Hageman/Heard
Date Collected:	10/16/18	Date of Analysis:	10/17-18/18
Sample Collector:	S. Smith	Method:	***EPA Method 8260B***

VOLATILE ORGANIC COMPOUNDS

VOLATILE ORGANIC COMPOUNDS, PPM	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	**FIELD ID**	Practical Quantitation Limit PPM
	SB-6 5-10'	**SB-3 5-10'**	**BMW-1 0-5'**	**SB-1 5-10'**	**SB-8 5-10'**	
	LAB ID	**LAB ID**	**LAB ID**	**LAB ID**	**LAB ID**	
	199160	**199161**	**199162**	**199163**	**199164**	
1,2,3-Trichloropropane	BDL	BDL	BDL	BDL	BDL	0.005
1,2,4-Trimethylbenzene	BDL	**0.042**	BDL	**0.282**	BDL	0.005
1,3,5-Trimethylbenzene	BDL	**0.009**	BDL	**0.228**	BDL	0.005
Vinyl Chloride	BDL	**0.029**	BDL	**0.015**	BDL	0.005
Xylenes, o,m,p	**0.018**	BDL	BDL	BDL	BDL	0.015
MTBE	BDL	BDL	BDL	BDL	BDL	0.005

Detection Limit is Practical Quantitation Limit
BDL = Below Detection Limit
All results expressed as PPM (mg/Kg)

/ QAQC

ADEM # 41470
EPA Laboratory ID AL01084

Respectfully submitted,

Kevin Doriety

Kevin Doriety
Analytical Chemist

APPENDIX D

VISL CALCULATOR

Site-specific VISL Results
Commercial Equation Inputs

*** Inputted values different from Commercial defaults are highlighted.**
Output generated   07JAN2019:15:23:09

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	0.1
LT (lifetime) yr	70	70
TR (target risk) unitless	1.0E-06	1.0E-06

Commercial Vapor Intrusion Screening Levels (VISL)

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN; H = HEAST; W = see RSL user guide Section 2.3.5; E = see RSL user guide Section 2.3.6; S = see RSL user's guide Section 5.

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} > $C_{i,a}$,Target?)	Is Chemical Sufficiently Volatile and Toxic to Pose Inhalation Risk Via Vapor Intrusion from Groundwater Source? (C_{hc} > $C_{i,a}$,Target?)	Target Indoor Air Concentration (TCR=1E-06 or THQ=0.1) MIN($C_{ia,c}$,$C_{ia,nc}$) ($\mu g/m^3$)	Toxicity Basis
Dichloroethane, 1,1-	75-34-3	Yes	Yes	Yes	Yes	7.67E+00	CA
Dichloroethylene, 1,1-	75-35-4	Yes	Yes	Yes	Yes	8.76E+01	NC
Dichloroethylene, 1,2-cis-	156-59-2	Yes	No	No Inhal. Tox. Info	No Inhal. Tox. Info		
Naphthalene	91-20-3	Yes	Yes	Yes	Yes	3.61E-01	CA
Tetrachloroethylene	127-18-4	Yes	Yes	Yes	Yes	1.75E+01	NC
Trichloroethane, 1,1,1-	71-55-6	Yes	Yes	Yes	Yes	2.19E+03	NC
Trichloroethylene	79-01-6	Yes	Yes	Yes	Yes	8.76E-01	NC
Trimethylbenzene, 1,2,4-	95-63-6	Yes	Yes	Yes	Yes	2.63E+01	NC
Trimethylbenzene, 1,3,5-	108-67-8	Yes	Yes	Yes	Yes	2.63E+01	NC
Vinyl Chloride	75-01-4	Yes	Yes	Yes	Yes	2.79E+00	CA

Commercial Vapor Intrusion Screening Levels (VISL)

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN; H = HEAST; W = see RSL user guide Section 2.3.5; E = see RSL user guide Section 2.3.6; S = see RSL user's guide Section 5.

Chemical	Target Sub-Slab and Near-source Soil Gas Concentration (TCR=1E-06 or THQ=0.1) C_{sg},Target (μg/m^3)	Target Groundwater Concentration (TCR=1E-06 or THQ=0.1) C_{gw},Target (μg/L)	Is Target Groundwater Concentration < MCL? (C_{gw} < MCL?)	Pure Phase Vapor Concentration C_{vp}\ (25 ℃)\ (μg/m^3)	Maximum Groundwater Vapor Concentration C_{hc}\ (μg/m^3)	Temperature for Maximum Groundwater Vapor Concentration (℃)	Lower Explosive Limit LEL (% by volume)
Dichloroethane, 1,1-	2.56E+02	3.34E+01	--	1.21E+09	1.16E+09	25	5.40
Dichloroethylene, 1,1-	2.92E+03	8.21E+01	No (7)	3.13E+09	2.58E+09	25	6.50
Dichloroethylene, 1,2-cis-				1.04E+09	1.07E+09	25	3.00
Naphthalene	1.20E+01	2.01E+01	--	5.86E+05	5.58E+05	25	0.90
Tetrachloroethylene	5.84E+02	2.42E+01	No (5)	1.65E+08	1.49E+08	25	
Trichloroethane, 1,1,1-	7.30E+04	3.11E+03	No (200)	8.90E+08	9.07E+08	25	8.00
Trichloroethylene	2.92E+01	2.18E+00	Yes (5)	4.88E+08	5.15E+08	25	8.00
Trimethylbenzene, 1,2,4-	8.76E+02	1.04E+02	--	1.36E+07	1.44E+07	25	0.90
Trimethylbenzene, 1,3,5-	8.76E+02	7.33E+01	--	1.60E+07	1.73E+07	25	1.00
Vinyl Chloride	9.29E+01	2.45E+00	No (2)	1.00E+10	1.00E+10	25	3.60

Commercial Vapor Intrusion Screening Levels (VISL)

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN; H = HEAST; W = see RSL user guide Section 2.3.5; E = see RSL user guide Section 2.3.6; S = see RSL user's guide Section 5.

Chemical	LEL Ref	IUR $(ug/m^3)^{-1}$	IUR Ref	RfC (mg/m^3)	RfC Ref	Mutagenic Indicator	Carcinogenic VISL TCR=1E-06 $C_{ia,c}$ $(\mu g/m^3)$	Noncarcinogenic VISL THQ=0.1 $C_{ia,nc}$ $(\mu g/m^3)$
Dichloroethane, 1,1-	CRC89	1.60E-06	C			No	7.67E+00	
Dichloroethylene, 1,1-	CRC89			2.00E-01	I	No		8.76E+01
Dichloroethylene, 1,2-cis-	CRC89					No		
Naphthalene	CRC89	3.40E-05	C	3.00E-03	I	No	3.61E-01	1.31E+00
Tetrachloroethylene		2.60E-07	I	4.00E-02	I	No	4.72E+01	1.75E+01
Trichloroethane, 1,1,1-	CRC89			5.00E+00	I	No		2.19E+03
Trichloroethylene	CRC89	4.10E-06	I	2.00E-03	I	Mut	2.99E+00	8.76E-01
Trimethylbenzene, 1,2,4-	CRC89			6.00E-02	I	No		2.63E+01
Trimethylbenzene, 1,3,5-	CRC89			6.00E-02	I	No		2.63E+01
Vinyl Chloride	CRC89	4.40E-06	I	1.00E-01	I	Mut	2.79E+00	4.38E+01

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	IUR (ug/m³)⁻¹	IUR Ref	Chronic RfC (mg/m³)
Dichloroethane, 1,1-	75-34-3	224	5.15E+01	6.71E-06		1.60E-06	C	
Dichloroethylene, 1,1-	75-35-4	406	4.33E+02		4.95E-01			2.00E-01
Dichloroethylene, 1,2-cis-	156-59-2	5900						
Naphthalene	91-20-3	75	1.35E+00	3.74E-06	1.03E-01	3.40E-05	C	3.00E-03
Tetrachloroethylene	127-18-4	14	1.01E+01	2.15E-07	5.78E-02	2.60E-07	I	4.00E-02
Trichloroethane, 1,1,1-	71-55-6	239	1.68E+02		7.67E-03			5.00E+00
Trichloroethylene	79-01-6	4590	1.85E+03	6.18E-04	2.11E+02	4.10E-06	I	2.00E-03
Trimethylbenzene, 1,2,4-	95-63-6	116	2.92E+01		1.11E-01			6.00E-02
Trimethylbenzene, 1,3,5-	108-67-8	33	1.18E+01		4.50E-02			6.00E-02
Vinyl Chloride	75-01-4	1020	1.16E+03	4.16E-04	2.65E+00	4.40E-06	I	1.00E-01
**Sum*				*1.04E-03*	*2.14E+02*			

Chemical	RfC Ref	Temperature (℃)\ for Groundwater Vapor Concentration	Mutagen?
Dichloroethane, 1,1-		25	No
Dichloroethylene, 1,1-	IRIS	25	No
Dichloroethylene, 1,2-cis-		25	No
Naphthalene	IRIS	25	No
Tetrachloroethylene	IRIS	25	No
Trichloroethane, 1,1,1-	IRIS	25	No
Trichloroethylene	IRIS	25	Mut
Trimethylbenzene, 1,2,4-	IRIS	25	No
Trimethylbenzene, 1,3,5-	IRIS	25	No
Vinyl Chloride	IRIS	25	Mut
**Sum*			

Chemical Properties
Output generated 07JAN2019:15:23:09

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	MW Ref	Vapor Pressure VP (mm Hg)	VP Ref	S (mg/L)	S Ref	MCL (ug/L)
Dichloroethane, 1,1-	75-34-3	Yes	Yes	98.96	PHYSPROP	2.27E+02	PHYSPROP	5.04E+03	PHYSPROP	
Dichloroethylene, 1,1-	75-35-4	Yes	Yes	96.94	PHYSPROP	6.00E+02	PHYSPROP	2.42E+03	PHYSPROP	7
Dichloroethylene, 1,2-cis-	156-59-2	Yes	No	96.94	PHYSPROP	2.00E+02	PHYSPROP	6.41E+03	PHYSPROP	70
Naphthalene	91-20-3	Yes	Yes	128.18	PHYSPROP	8.50E-02	PHYSPROP	3.10E+01	PHYSPROP	
Tetrachloroethylene	127-18-4	Yes	Yes	165.83	PHYSPROP	1.85E+01	PHYSPROP	2.06E+02	PHYSPROP	5
Trichloroethane, 1,1,1-	71-55-6	Yes	Yes	133.41	PHYSPROP	1.24E+02	PHYSPROP	1.29E+03	PHYSPROP	200
Trichloroethylene	79-01-6	Yes	Yes	131.39	PHYSPROP	6.90E+01	PHYSPROP	1.28E+03	PHYSPROP	5
Trimethylbenzene, 1,2,4-	95-63-6	Yes	Yes	120.20	PHYSPROP	2.10E+00	PHYSPROP	5.70E+01	PHYSPROP	
Trimethylbenzene, 1,3,5-	108-67-8	Yes	Yes	120.20	PHYSPROP	2.48E+00	PHYSPROP	4.82E+01	PHYSPROP	
Vinyl Chloride	75-01-4	Yes	Yes	62.50	PHYSPROP	2.98E+03	EPI	8.80E+03	PHYSPROP	2

Chemical	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	D_{ia} \ (cm^2/s)	D_{ia} \ Ref	D_{iw} \ (cm^2/s)	D_{iw} \ Ref	Normal Boiling Point BP (K)
Dichloroethane, 1,1-	5.62E-03	2.30E-01	PHYSPROP	2.30E-01	8.36E-02	WATER9 (U.S. EPA, 2001)	1.06E-05	WATER9 (U.S. EPA, 2001)	330.55
Dichloroethylene, 1,1-	2.61E-02	1.07E+00	PHYSPROP	1.07E+00	8.63E-02	WATER9 (U.S. EPA, 2001)	1.10E-05	WATER9 (U.S. EPA, 2001)	304.85
Dichloroethylene, 1,2-cis-	4.08E-03	1.67E-01	PHYSPROP	1.67E-01	8.84E-02	WATER9 (U.S. EPA, 2001)	1.13E-05	WATER9 (U.S. EPA, 2001)	333.25
Naphthalene	4.40E-04	1.80E-02	PHYSPROP	1.80E-02	6.05E-02	WATER9 (U.S. EPA, 2001)	8.38E-06	WATER9 (U.S. EPA, 2001)	491.05
Tetrachloroethylene	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
Trichloroethane, 1,1,1-	1.72E-02	7.03E-01	PHYSPROP	7.03E-01	6.48E-02	WATER9 (U.S. EPA, 2001)	9.60E-06	WATER9 (U.S. EPA, 2001)	347.15
Trichloroethylene	9.85E-03	4.03E-01	PHYSPROP	4.03E-01	6.87E-02	WATER9 (U.S. EPA, 2001)	1.02E-05	WATER9 (U.S. EPA, 2001)	360.35
Trimethylbenzene, 1,2,4-	6.16E-03	2.52E-01	PHYSPROP	2.52E-01	6.07E-02	WATER9 (U.S. EPA, 2001)	7.92E-06	WATER9 (U.S. EPA, 2001)	442.45
Trimethylbenzene, 1,3,5-	8.77E-03	3.59E-01	PHYSPROP	3.59E-01	6.02E-02	WATER9 (U.S. EPA, 2001)	7.84E-06	WATER9 (U.S. EPA, 2001)	437.85
Vinyl Chloride	2.78E-02	1.14E+00	PHYSPROP	1.14E+00	1.07E-01	WATER9 (U.S. EPA, 2001)	1.20E-05	WATER9 (U.S. EPA, 2001)	259.85

Chemical Properties
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Chemical	BP Ref	Critical Temperature TC (K)	TC Ref	Enthalpy of vaporization at the normal boiling point $\Delta H_{v,b}$\ (cal/mol)	$\Delta H_{v,b}$\ Ref	K_{oc}\ (cm^3/g)	K_{oc}\ Ref	Lower Explosive Limit LEL (% by volume)	LEL Ref
Dichloroethane, 1,1-	PHYSPROP	5.23E+02	CRC89	6895.31	CRC89	31.82	EPI	5.40	CRC89
Dichloroethylene, 1,1-	PHYSPROP	4.82E+02	YAWS	6247.61	CRC89	31.82	EPI	6.50	CRC89
Dichloroethylene, 1,2-cis-	PHYSPROP	5.36E+02	CRC89	7217.97	CRC89	39.6	EPI	3.00	CRC89
Naphthalene	PHYSPROP	7.48E+02	CRC89	10373.00	Weast	1544	EPI	0.90	CRC89
Tetrachloroethylene	PHYSPROP	6.20E+02	YAWS	8288.00	Weast	94.94	EPI		
Trichloroethane, 1,1,1-	PHYSPROP	5.45E+02	YAWS	7136.00	Weast	43.89	EPI	8.00	CRC89
Trichloroethylene	PHYSPROP	5.71E+02	YAWS	7505.00	Weast	60.7	EPI	8.00	CRC89
Trimethylbenzene, 1,2,4-	PHYSPROP	6.49E+02	CRC89	9368.80	TOXNET	614.3	EPI	0.90	CRC89
Trimethylbenzene, 1,3,5-	PHYSPROP	6.37E+02	CRC89	9321.00	TOXNET	602.1	EPI	1.00	CRC89
Vinyl Chloride	PHYSPROP	4.25E+02	CRC89	4971.32	CRC89	21.73	EPI	3.60	CRC89

Site-specific VISL Results
Commercial Equation Inputs

*** Inputted values different from Commercial defaults are highlighted.**
Output generated 07JAN2019:15:25:08

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	0.1
LT (lifetime) yr	70	70
TR (target risk) unitless	1.0E-06	1.0E-06

Commercial Vapor Intrusion Screening Levels (VISL)

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN; H = HEAST; W = see RSL user guide Section 2.3.5; E = see RSL user guide Section 2.3.6; S = see RSL user's guide Section 5.

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} > $C_{i,a}$,Target?)	Is Chemical Sufficiently Volatile and Toxic to Pose Inhalation Risk Via Vapor Intrusion from Groundwater Source? (C_{hc} > $C_{i,a}$,Target?)	Target Indoor Air Concentration (TCR=1E-06 or THQ=0.1) MIN($C_{ia,c}$,$C_{ia,nc}$) (μg/m^3)	Toxicity Basis
Dichloroethane, 1,1-	75-34-3	Yes	Yes	Yes	Yes	7.67E+00	CA
Dichloroethylene, 1,1-	75-35-4	Yes	Yes	Yes	Yes	8.76E+01	NC
Dichloroethylene, 1,2-cis-	156-59-2	Yes	No	No Inhal. Tox. Info	No Inhal. Tox. Info		
Naphthalene	91-20-3	Yes	Yes	Yes	Yes	3.61E-01	CA
Tetrachloroethylene	127-18-4	Yes	Yes	Yes	Yes	1.75E+01	NC
Trichloroethane, 1,1,1-	71-55-6	Yes	Yes	Yes	Yes	2.19E+03	NC
Trichloroethylene	79-01-6	Yes	Yes	Yes	Yes	8.76E-01	NC
Trimethylbenzene, 1,2,4-	95-63-6	Yes	Yes	Yes	Yes	2.63E+01	NC
Trimethylbenzene, 1,3,5-	108-67-8	Yes	Yes	Yes	Yes	2.63E+01	NC
Vinyl Chloride	75-01-4	Yes	Yes	Yes	Yes	2.79E+00	CA

Commercial Vapor Intrusion Screening Levels (VISL)

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN; H = HEAST; W = see RSL user guide Section 2.3.5; E = see RSL user guide Section 2.3.6; S = see RSL user's guide Section 5.

Chemical	Target Sub-Slab and Near-source Soil Gas Concentration (TCR=1E-06 or THQ=0.1) C_{sg},Target ($\mu g/m^3$)	Target Groundwater Concentration (TCR=1E-06 or THQ=0.1) C_{gw},Target ($\mu g/L$)	Is Target Groundwater Concentration < MCL? (C_{gw} < MCL?)	Pure Phase Vapor Concentration C_{vp}\ (25 ℃)\ ($\mu g/m^3$)	Maximum Groundwater Vapor Concentration C_{hc}\ ($\mu g/m^3$)	Temperature for Maximum Groundwater Vapor Concentration (℃)	Lower Explosive Limit LEL (% by volume)
Dichloroethane, 1,1-	2.56E+02	3.34E+01	--	1.21E+09	1.16E+09	25	5.40
Dichloroethylene, 1,1-	2.92E+03	8.21E+01	No (7)	3.13E+09	2.58E+09	25	6.50
Dichloroethylene, 1,2-cis-				1.04E+09	1.07E+09	25	3.00
Naphthalene	1.20E+01	2.01E+01	--	5.86E+05	5.58E+05	25	0.90
Tetrachloroethylene	5.84E+02	2.42E+01	No (5)	1.65E+08	1.49E+08	25	
Trichloroethane, 1,1,1-	7.30E+04	3.11E+03	No (200)	8.90E+08	9.07E+08	25	8.00
Trichloroethylene	2.92E+01	2.18E+00	Yes (5)	4.88E+08	5.15E+08	25	8.00
Trimethylbenzene, 1,2,4-	8.76E+02	1.04E+02	--	1.36E+07	1.44E+07	25	0.90
Trimethylbenzene, 1,3,5-	8.76E+02	7.33E+01	--	1.60E+07	1.73E+07	25	1.00
Vinyl Chloride	9.29E+01	2.45E+00	No (2)	1.00E+10	1.00E+10	25	3.60

Commercial Vapor Intrusion Screening Levels (VISL)

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN; H = HEAST; W = see RSL user guide Section 2.3.5; E = see RSL user guide Section 2.3.6; S = see RSL user's guide Section 5.

Chemical	LEL Ref	IUR $(ug/m^3)^{-1}$	IUR Ref	RfC (mg/m^3)	RfC Ref	Mutagenic Indicator	Carcinogenic VISL TCR=1E-06 $C_{ia,c}$ $(\mu g/m^3)$	Noncarcinogenic VISL THQ=0.1 $C_{ia,nc}$ $(\mu g/m^3)$
Dichloroethane, 1,1-	CRC89	1.60E-06	C			No	7.67E+00	
Dichloroethylene, 1,1-	CRC89			2.00E-01	I	No		8.76E+01
Dichloroethylene, 1,2-cis-	CRC89					No		
Naphthalene	CRC89	3.40E-05	C	3.00E-03	I	No	3.61E-01	1.31E+00
Tetrachloroethylene		2.60E-07	I	4.00E-02	I	No	4.72E+01	1.75E+01
Trichloroethane, 1,1,1-	CRC89			5.00E+00	I	No		2.19E+03
Trichloroethylene	CRC89	4.10E-06	I	2.00E-03	I	Mut	2.99E+00	8.76E-01
Trimethylbenzene, 1,2,4-	CRC89			6.00E-02	I	No		2.63E+01
Trimethylbenzene, 1,3,5-	CRC89			6.00E-02	I	No		2.63E+01
Vinyl Chloride	CRC89	4.40E-06	I	1.00E-01	I	Mut	2.79E+00	4.38E+01

Commercial Vapor Intrusion Risk
Output generated 07JAN2019:15:25:08

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	IUR (ug/m^3)$^{-1}$	IUR Ref	Chronic RfC (mg/m^3)
Dichloroethane, 1,1-	75-34-3	224	5.15E+01	6.71E-06		1.60E-06	C	
Dichloroethylene, 1,1-	75-35-4	406	4.33E+02		4.95E-01			2.00E-01
Dichloroethylene, 1,2-cis-	156-59-2	454						
Naphthalene	91-20-3	71	1.28E+00	3.54E-06	9.72E-02	3.40E-05	C	3.00E-03
Tetrachloroethylene	127-18-4	14	1.01E+01	2.15E-07	5.78E-02	2.60E-07	I	4.00E-02
Trichloroethane, 1,1,1-	71-55-6	239	1.68E+02		7.67E-03			5.00E+00
Trichloroethylene	79-01-6	311	1.25E+02	4.19E-05	1.43E+01	4.10E-06	I	2.00E-03
Trimethylbenzene, 1,2,4-	95-63-6	80	2.01E+01		7.67E-02			6.00E-02
Trimethylbenzene, 1,3,5-	108-67-8	33	1.18E+01		4.50E-02			6.00E-02
Vinyl Chloride	75-01-4	256	2.91E+02	1.04E-04	6.64E-01	4.40E-06	I	1.00E-01
**Sum*				*1.57E-04*	*1.57E+01*			

Chemical	RfC Ref	Temperature (℃)\ for Groundwater Vapor Concentration	Mutagen?
Dichloroethane, 1,1-		25	No
Dichloroethylene, 1,1-	IRIS	25	No
Dichloroethylene, 1,2-cis-		25	No
Naphthalene	IRIS	25	No
Tetrachloroethylene	IRIS	25	No
Trichloroethane, 1,1,1-	IRIS	25	No
Trichloroethylene	IRIS	25	Mut
Trimethylbenzene, 1,2,4-	IRIS	25	No
Trimethylbenzene, 1,3,5-	IRIS	25	No
Vinyl Chloride	IRIS	25	Mut
**Sum*			

Chemical Properties
Output generated 07JAN2019:15:25:08

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	MW Ref	Vapor Pressure VP (mm Hg)	VP Ref	S (mg/L)	S Ref	MCL (ug/L)
Dichloroethane, 1,1-	75-34-3	Yes	Yes	98.96	PHYSPROP	2.27E+02	PHYSPROP	5.04E+03	PHYSPROP	
Dichloroethylene, 1,1-	75-35-4	Yes	Yes	96.94	PHYSPROP	6.00E+02	PHYSPROP	2.42E+03	PHYSPROP	7
Dichloroethylene, 1,2-cis-	156-59-2	Yes	No	96.94	PHYSPROP	2.00E+02	PHYSPROP	6.41E+03	PHYSPROP	70
Naphthalene	91-20-3	Yes	Yes	128.18	PHYSPROP	8.50E-02	PHYSPROP	3.10E+01	PHYSPROP	
Tetrachloroethylene	127-18-4	Yes	Yes	165.83	PHYSPROP	1.85E+01	PHYSPROP	2.06E+02	PHYSPROP	5
Trichloroethane, 1,1,1-	71-55-6	Yes	Yes	133.41	PHYSPROP	1.24E+02	PHYSPROP	1.29E+03	PHYSPROP	200
Trichloroethylene	79-01-6	Yes	Yes	131.39	PHYSPROP	6.90E+01	PHYSPROP	1.28E+03	PHYSPROP	5
Trimethylbenzene, 1,2,4-	95-63-6	Yes	Yes	120.20	PHYSPROP	2.10E+00	PHYSPROP	5.70E+01	PHYSPROP	
Trimethylbenzene, 1,3,5-	108-67-8	Yes	Yes	120.20	PHYSPROP	2.48E+00	PHYSPROP	4.82E+01	PHYSPROP	
Vinyl Chloride	75-01-4	Yes	Yes	62.50	PHYSPROP	2.98E+03	EPI	8.80E+03	PHYSPROP	2

Chemical Properties

Output generated 07JAN2019:15:25:08

Chemical	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	D_{ia} \ (cm^2/s)	D_{ia} \ Ref	D_{iw} \ (cm^2/s)	D_{iw} \ Ref	Normal Boiling Point BP (K)
Dichloroethane, 1,1-	5.62E-03	2.30E-01	PHYSPROP	2.30E-01	8.36E-02	WATER9 (U.S. EPA, 2001)	1.06E-05	WATER9 (U.S. EPA, 2001)	330.55
Dichloroethylene, 1,1-	2.61E-02	1.07E+00	PHYSPROP	1.07E+00	8.63E-02	WATER9 (U.S. EPA, 2001)	1.10E-05	WATER9 (U.S. EPA, 2001)	304.85
Dichloroethylene, 1,2-cis-	4.08E-03	1.67E-01	PHYSPROP	1.67E-01	8.84E-02	WATER9 (U.S. EPA, 2001)	1.13E-05	WATER9 (U.S. EPA, 2001)	333.25
Naphthalene	4.40E-04	1.80E-02	PHYSPROP	1.80E-02	6.05E-02	WATER9 (U.S. EPA, 2001)	8.38E-06	WATER9 (U.S. EPA, 2001)	491.05
Tetrachloroethylene	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
Trichloroethane, 1,1,1-	1.72E-02	7.03E-01	PHYSPROP	7.03E-01	6.48E-02	WATER9 (U.S. EPA, 2001)	9.60E-06	WATER9 (U.S. EPA, 2001)	347.15
Trichloroethylene	9.85E-03	4.03E-01	PHYSPROP	4.03E-01	6.87E-02	WATER9 (U.S. EPA, 2001)	1.02E-05	WATER9 (U.S. EPA, 2001)	360.35
Trimethylbenzene, 1,2,4-	6.16E-03	2.52E-01	PHYSPROP	2.52E-01	6.07E-02	WATER9 (U.S. EPA, 2001)	7.92E-06	WATER9 (U.S. EPA, 2001)	442.45
Trimethylbenzene, 1,3,5-	8.77E-03	3.59E-01	PHYSPROP	3.59E-01	6.02E-02	WATER9 (U.S. EPA, 2001)	7.84E-06	WATER9 (U.S. EPA, 2001)	437.85
Vinyl Chloride	2.78E-02	1.14E+00	PHYSPROP	1.14E+00	1.07E-01	WATER9 (U.S. EPA, 2001)	1.20E-05	WATER9 (U.S. EPA, 2001)	259.85

Chemical Properties
Output generated 07JAN2019:15:25:08

Chemical	BP Ref	Critical Temperature TC (K)	TC Ref	Enthalpy of vaporization at the normal boiling point $\Delta H_{v,b}$\ (cal/mol)	$\Delta H_{v,b}$\ Ref	K_{oc}\ (cm^3/g)	K_{oc}\ Ref	Lower Explosive Limit LEL (% by volume)	LEL Ref
Dichloroethane, 1,1-	PHYSPROP	5.23E+02	CRC89	6895.31	CRC89	31.82	EPI	5.40	CRC89
Dichloroethylene, 1,1-	PHYSPROP	4.82E+02	YAWS	6247.61	CRC89	31.82	EPI	6.50	CRC89
Dichloroethylene, 1,2-cis-	PHYSPROP	5.36E+02	CRC89	7217.97	CRC89	39.6	EPI	3.00	CRC89
Naphthalene	PHYSPROP	7.48E+02	CRC89	10373.00	Weast	1544	EPI	0.90	CRC89
Tetrachloroethylene	PHYSPROP	6.20E+02	YAWS	8288.00	Weast	94.94	EPI		
Trichloroethane, 1,1,1-	PHYSPROP	5.45E+02	YAWS	7136.00	Weast	43.89	EPI	8.00	CRC89
Trichloroethylene	PHYSPROP	5.71E+02	YAWS	7505.00	Weast	60.7	EPI	8.00	CRC89
Trimethylbenzene, 1,2,4-	PHYSPROP	6.49E+02	CRC89	9368.80	TOXNET	614.3	EPI	0.90	CRC89
Trimethylbenzene, 1,3,5-	PHYSPROP	6.37E+02	CRC89	9321.00	TOXNET	602.1	EPI	1.00	CRC89
Vinyl Chloride	PHYSPROP	4.25E+02	CRC89	4971.32	CRC89	21.73	EPI	3.60	CRC89

APPENDIX E

JOHNSON STINGER MODEL
(Using Site-Specific Soil & Groundwater Data)

Vinyl Chloride-Maximum

Model Input

Site Name/Run Number: Example, Run 1

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**
Source medium		Source	Groundwater				
Groundwater concentration	(ug/L)	Cmedium	1020		NA		
Depth below grade to water table	(m)	Ls	0.50		Vary - 50	NA	WARNING
Average groundwater temperature	(°C)	Ts	22	25	3 - 25		
Calc: Source vapor concentration	(ug/m3)	Cs	1077447				
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.011%				

Chemical:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Chemical Name		Chem	Vinyl Chloride				
CAS No.		CAS	75-01-4				
Toxicity Factors							
Unit risk factor	$(ug/m^3)^{-1}$	IUR	4.40E-06	4.40E-06	NA	NA	
Mutagenic compound		Mut	VC	NA	NA	NA	
Reference concentration	(mg/m^3)	RfC	1.00E-01	1.00E-01	NA	NA	

Chemical Properties:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Pure component water solubility	(mg/L)	S	8.80E+03	8.80E+03	NA	NA	
Henry's Law Constant @ 25°C	$(atm\text{-}m^3/mol)$	Hc	2.78E-02	2.78E-02	NA	NA	
Calc: Henry's Law Constant @ 25°C	(dimensionless)	Hr	1.14E+00	1.14E+00			
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	1.06E+00	1.15E+00			
Diffusivity in air	(cm2/s)	Dair	1.07E-01	1.07E-01	NA	NA	
Diffusivity in water	(cm2/s)	Dwater	1.20E-05	1.20E-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**

Building setting		Bldg_Setting	Commercial	Commercial		
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade		
Depth below grade to base of foundation	(m)	Lb	0.20	0.20	0.1 - 2.44	NA
Foundation thickness	(m)	Lf	0.20	0.20	0.1 - 0.25	NA
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00
Enclosed space floor area	(m2)	Abf	1500.00	1500.00	80-1000	NA
Enclosed space mixing height	(m)	Hb	3.00	3.00	2.13 - 3.05	NA
Indoor air exchange rate	(1 / hr)	ach	1.50	1.50	.3-4.1	NA
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24
Calc: Building ventilation rate	(m3/hr)	Qb	6750.00	6750.00	NA	0.30
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	20.25	20.25	NA	NA

Model Input

Site Name/Run Number: Example, Run 1

Chemical Name: Vinyl Chloride CAS No. 75-01-4

Depth below grade to water table: 0.50 meters

Vadose zone characteristics:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Stratum A (Top of soil profile):							
Stratum A SCS soil type		SCS_A	Clay				
Stratum A thickness (from surface)	(m)	hSA	2.00				
Stratum A total porosity	(-)	nSA	0.459	0.459	NA	0.20	
Stratum A water-filled porosity	(-)	nwSA	0.400	0.215	0.098 - 0.33	0.25	WARNING
Stratum A bulk density	(g/cm^3)	rhoSA	1.600	1.430	NA	0.05	WARNING
Stratum B (Soil layer below Stratum A):							
Stratum B SCS soil type		SCS_B	Not Present				
Stratum B thickness	(m)	hSB					ERROR
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				ERROR
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	0.815	0.815	NA	NA	
Capillary zone total porosity	(-)	ncz	0.459	0.459	NA	0.20	
Capillary zone water filled porosity	(-)	nwcz	0.412	0.412	NA	0.24	

Exposure Parameters:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Target risk for carcinogens	(-)	Target_CR	1.00E-06	1.00E-06	NA	NA	
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	

Range is based on the r
values, as reported in th

Model Output

Site Name/Run Number: Example, Run 1

Chemical Name: Vinyl Chloride CAS No. 75-01-4

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**8.2E-06**	7.6E-06 - 8.3E-06	**1.3E-05**	1.2E-05 - 1.3E-05

Predicted Indoor Air Concentration	Units	Symbol	Value	Range	Default	Default Range
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**8.9E+00**	8.2E+00 - 8.9E+00	**1.4E+01**	1.3E+01 - 1.4E+01
	(ppbv)		**3.5E+00**	3.2E+00 - 3.5E+00	**5.5E+00**	4.9E+00 - 5.5E+00

Predicted Vapor Conc. Beneath Foundation	Units	Symbol	Value	Range	Default	Default Range
Subslab vapor concentration	(ug/m3)	**Css**	**3.0E+03**	1.8E+02 - 8.2E+04	**4.7E+03**	1.3E+05 - 1.4E+05
	(ppbv)		**1.2E+03**	7.0E+01 - 3.2E+04	**1.8E+03**	4.9E+04 - 5.5E+04

Diffusive Transport Upward Through Vadose Zone	Units	Symbol	Value	Range	Default	Default Range
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	4.4E-05	-	4.6E-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	2.2E-05	-	2.2E-05	-
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	3.0E-05	-	4.8E-05	-

Critical Parameters		Symbol	Value	Range	Default	Default Range
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	8.3E-06	-	1.3E-05	
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	1.7E+05	5.6E+03 - 2.8E+06	1.6E+03	5.3E+01 - 2.6E+04
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

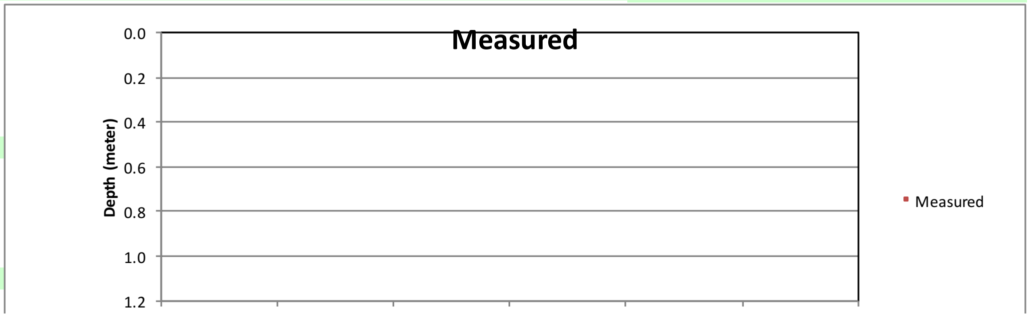
Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Concentration versus Depth Profile



Model Output

Site Name/Run Number: Example, Run 1

Chemical Name: Vinyl Chloride CAS No. 75-01-4

Risk Calculations	Units	Symbol	Value	Range	Default	Range
Risk-Based Target Screening Levels	Scenario: Commercial					
Target risk for carcinogens	(-)	Target_CR	1E-06	-	1E-06	-
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**2.10E-01**	-	**2.10E-01**	-
	(ppbv)		**8.22E-02**	-	**8.22E-02**	-
Target groundwater concentration	**(ug/L)**	**Target_GW**	**2.41E+01**	**2.4E+01 - 2.6E+01**	**1.40E+01**	**1.5E+01 - 1.7E+01**
Incremental Risk Estimates						
Incremental cancer risk from vapor intrusion	**(-)**	**Cancer_Risk**	**3.19E-06**	**3.0E-06 - 3.2E-06**	**5.07E-06**	**4.5E-06 - 5.1E-06**
Hazard quotient from vapor intrusion	**(-)**	**HQ**	**2.03E-02**	**1.9E-02 - 2.0E-02**	**3.22E-02**	**2.9E-02 - 3.2E-02**

TCE-Maximum

Model Input

Site Name/Run Number: Example, Run 1

[Use English / Metric Converter]

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**
Source medium		Source	Groundwater				
Groundwater concentration	(ug/L)	Cmedium	4590		NA		
Depth below grade to water table	(m)	Ls	0.50		Vary - 50	NA	WARNING
Average groundwater temperature	(^{o}C)	Ts	22	25	3 - 25		
Calc: Source vapor concentration	(ug/m3)	Cs	1616660				
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.331%				

Chemical:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
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**
Pure component water solubility	(mg/L)	S	1.28E+03	1.28E+03	NA	NA	
Henry's Law Constant @ 25^{o}C	$(atm\text{-}m^{3}/mol)$	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	3.52E-01	4.07E-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**

Building setting		Bldg_Setting	Commercial	Commercial		
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade		
Depth below grade to base of foundation	(m)	Lb	0.20	0.20	0.1 - 2.44	NA
Foundation thickness	(m)	Lf	0.20	0.20	0.1 - 0.25	NA
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00
Enclosed space floor area	(m2)	Abf	1500.00	1500.00	80-1000	NA
Enclosed space mixing height	(m)	Hb	3.00	3.00	2.13 - 3.05	NA
Indoor air exchange rate	(1 / hr)	ach	1.50	1.50	.3-4.1	NA
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24
Calc: Building ventilation rate	(m3/hr)	Qb	6750.00	6750.00	NA	0.30
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	20.25	20.25	NA	NA

Model Input

Site Name/Run Number: Example, Run 1

Chemical Name: Trichloroethylene CAS No. 79-01-6

Depth below grade to water table: 0.50 meters

Vadose zone characteristics:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Stratum A (Top of soil profile):							
Stratum A SCS soil type		SCS_A	Clay				
Stratum A thickness (from surface)	(m)	hSA	2.00				
Stratum A total porosity	(-)	nSA	0.459	0.459	NA	0.20	
Stratum A water-filled porosity	(-)	nwSA	0.400	0.215	0.098 - 0.33	0.25	WARNING
Stratum A bulk density	(g/cm^3)	rhoSA	1.600	1.430	NA	0.05	WARNING
Stratum B (Soil layer below Stratum A):							
Stratum B SCS soil type		SCS_B	Not Present				
Stratum B thickness	(m)	hSB					ERROR
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				ERROR
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	0.815	0.815	NA	NA	
Capillary zone total porosity	(-)	ncz	0.459	0.459	NA	0.20	
Capillary zone water filled porosity	(-)	nwcz	0.412	0.412	NA	0.24	

Exposure Parameters:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Target risk for carcinogens	(-)	Target_CR	1.00E-06	1.00E-06	NA	NA	
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	

Model Output

Site Name/Run Number: Example, Run 1

Chemical Name: Trichloroethylene **CAS No. 79-01-6**

Range is based on the r
values, as reported in th

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**6.8E-06**	6.4E-06 - 6.8E-06	**1.1E-05**	1.0E-05 - 1.1E-05

Predicted Indoor Air Concentration	Units	Symbol	Value	Range	Default	Default Range
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**1.1E+01**	1.0E+01 - 1.1E+01	**1.8E+01**	1.6E+01 - 1.8E+01
	(ppbv)		**2.1E+00**	1.9E+00 - 2.1E+00	**3.3E+00**	3.0E+00 - 3.3E+00

Predicted Vapor Conc. Beneath Foundation	Units	Symbol	Value	Range	Default	Default Range
Subslab vapor concentration	(ug/m3)	**Css**	**3.7E+03**	2.2E+02 - 1.0E+05	**6.0E+03**	1.6E+05 - 1.8E+05
	(ppbv)		**6.9E+02**	4.1E+01 - 1.9E+04	**1.1E+03**	3.0E+04 - 3.3E+04

Diffusive Transport Upward Through Vadose Zone	Units	Symbol	Value	Range	Default	Default Range
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	3.3E-05	-	3.0E-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	2.0E-05	-	1.9E-05	-
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	2.5E-05	-	4.1E-05	-

Critical Parameters		Symbol	Value	Range	Default	Default Range
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	6.8E-06	-	1.1E-05	
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	2.2E+05	7.5E+03 - 3.7E+06	2.5E+03	8.2E+01 - 4.1E+04
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

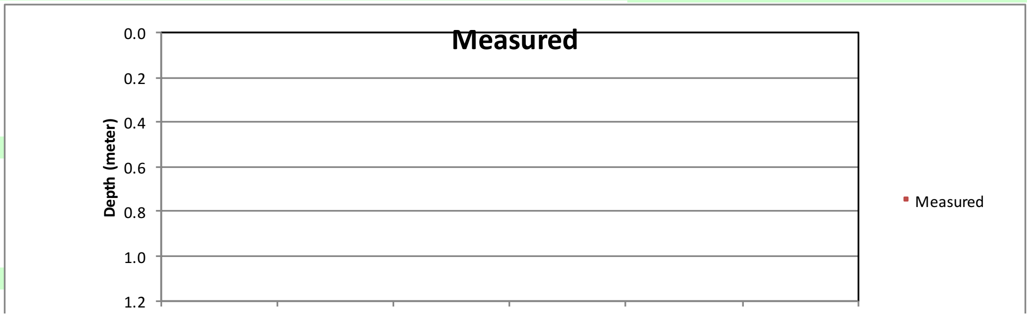
Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Concentration versus Depth Profile



Model Output

Site Name/Run Number: Example, Run 1

Chemical Name: Trichloroethylene **CAS No. 79-01-6**

Risk Calculations	Units	Symbol	Value	Range	Default	Range
Risk-Based Target Screening Levels	**Scenario: Commercial**					
Target risk for carcinogens	(-)	Target_CR	1E-06	-	1E-06	-
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**2.05E+00**	-	**2.05E+00**	-
	(ppbv)		**3.82E-01**	-	**3.82E-01**	-
Target groundwater concentration	**(ug/L)**	**Target_GW**	**8.52E+02**	**8.5E+02 - 9.1E+02**	**4.54E+02**	**5.2E+02 - 5.8E+02**
Incremental Risk Estimates						
Incremental cancer risk from vapor intrusion	**(-)**	**Cancer_Risk**	**1.43E-05**	**1.3E-05 - 1.4E-05**	**2.33E-05**	**2.1E-05 - 2.3E-05**
Hazard quotient from vapor intrusion	**(-)**	**HQ**	**1.26E+00**	**1.2E+00 - 1.3E+00**	**2.05E+00**	**1.8E+00 - 2.1E+00**

PCE-Maximum

Model Input

Site Name/Run Number: Example, Run 1

Use English / Metric Converter

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**
Source medium		Source	Groundwater				
Groundwater concentration	(ug/L)	Cmedium	14		NA		
Depth below grade to water table	(m)	Ls	0.50		Vary - 50	NA	WARNING
Average groundwater temperature	(°C)	Ts	22	25	3 - 25		
Calc: Source vapor concentration	(ug/m3)	Cs	8706				
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.005%				

Chemical:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
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**
Pure component water solubility	(mg/L)	S	2.06E+02	2.06E+02	NA	NA	
Henry's Law Constant @ 25°C	$(atm\text{-}m^3/mol)$	Hc	1.77E-02	1.77E-02	NA	NA	
Calc: Henry's Law Constant @ 25°C	(dimensionless)	Hr	7.24E-01	7.24E-01			
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	6.22E-01	7.31E-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**

Building setting		Bldg_Setting	Commercial	Commercial		
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade		
Depth below grade to base of foundation	(m)	Lb	0.20	0.20	0.1 - 2.44	NA
Foundation thickness	(m)	Lf	0.20	0.20	0.1 - 0.25	NA
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00
Enclosed space floor area	(m2)	Abf	1500.00	1500.00	80-1000	NA
Enclosed space mixing height	(m)	Hb	3.00	3.00	2.13 - 3.05	NA
Indoor air exchange rate	(1 / hr)	ach	1.50	1.50	.3-4.1	NA
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24
Calc: Building ventilation rate	(m3/hr)	Qb	6750.00	6750.00	NA	0.30
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	20.25	20.25	NA	NA

Model Input

Site Name/Run Number: Example, Run 1

Chemical Name: Tetrachloroethylene CAS No. 127-18-4

Depth below grade to water table: 0.50 meters

Vadose zone characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag
Stratum A (Top of soil profile):							
Stratum A SCS soil type		SCS_A	Clay				
Stratum A thickness (from surface)	(m)	hSA	2.00				
Stratum A total porosity	(-)	nSA	0.459	0.459	NA	0.20	
Stratum A water-filled porosity	(-)	nwSA	0.400	0.215	0.098 - 0.33	0.25	WARNING
Stratum A bulk density	(g/cm^3)	rhoSA	1.600	1.430	NA	0.05	WARNING
Stratum B (Soil layer below Stratum A):							
Stratum B SCS soil type		SCS_B	Not Present				
Stratum B thickness	(m)	hSB					ERROR
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				ERROR
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	0.815	0.815	NA	NA	
Capillary zone total porosity	(-)	ncz	0.459	0.459	NA	0.20	
Capillary zone water filled porosity	(-)	nwcz	0.412	0.412	NA	0.24	

Exposure Parameters:	Units	Symbol	Value	Default	Potential Span	CV	Flag
Target risk for carcinogens	(-)	Target_CR	1.00E-06	1.00E-06	NA	NA	
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

Range is based on the r
values, as reported in th

Model Output

Site Name/Run Number: Example, Run 1

Chemical Name: Tetrachloroethylene CAS No. 127-18-4

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**4.6E-06**	4.4E-06 - 4.6E-06	**7.4E-06**	6.9E-06 - 7.4E-06

Predicted Indoor Air Concentration	Units	Symbol	Value	Range	Default	Default Range
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**4.0E-02**	3.8E-02 - 4.0E-02	**6.4E-02**	6.0E-02 - 6.4E-02
	(ppbv)		**5.9E-03**	5.7E-03 - 5.9E-03	**9.5E-03**	8.8E-03 - 9.5E-03

Predicted Vapor Conc. Beneath Foundation	Units	Symbol	Value	Range	Default	Default Range
Subslab vapor concentration	(ug/m3)	**Css**	**1.3E+01**	8.0E-01 - 3.8E+02	**2.1E+01**	6.0E+02 - 6.4E+02
	(ppbv)		**2.0E+00**	1.2E-01 - 5.7E+01	**3.2E+00**	8.8E+01 - 9.5E+01

Diffusive Transport Upward Through Vadose Zone	Units	Symbol	Value	Range	Default	Default Range
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	2.3E-05	-	2.2E-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	1.3E-05	-	1.2E-05	-
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	1.7E-05	-	2.7E-05	-

Critical Parameters		Symbol	Value	Range	Default	Default Range
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	4.6E-06	-	7.4E-06	
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	3.2E+05	1.1E+04 - 5.4E+06	3.4E+03	1.1E+02 - 5.6E+04
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

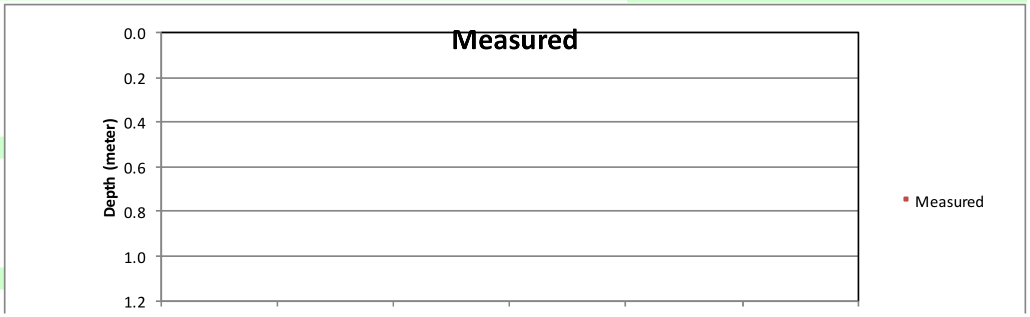
Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Concentration versus Depth Profile



Model Output

Site Name/Run Number: Example, Run 1

Chemical Name: Tetrachloroethylene CAS No. 127-18-4

Risk Calculations	Units	Symbol	Value	Range	Default	Range
Risk-Based Target Screening Levels Scenario: Commercial						
Target risk for carcinogens	(-)	Target_CR	1E-06	-	1E-06	-
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**4.72E+01**	-	**4.72E+01**	-
	(ppbv)		**6.96E+00**	-	**6.96E+00**	-
Target groundwater concentration	**(ug/L)**	**Target_GW**	**1.65E+04**	**1.6E+04 - 1.7E+04**	**8.77E+03**	**1.0E+04 - 1.1E+04**
Incremental Risk Estimates						
Incremental cancer risk from vapor intrusion	**(-)**	**Cancer_Risk**	**8.49E-10**	**8.1E-10 - 8.5E-10**	**1.36E-09**	**1.3E-09 - 1.4E-09**
Hazard quotient from vapor intrusion	**(-)**	**HQ**	**2.29E-04**	**2.2E-04 - 2.3E-04**	**3.66E-04**	**3.4E-04 - 3.7E-04**

Maximum concentration surrounding building.

Model Input **Site Name/Run Number:** Example, Run 1

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**
Source medium		Source	Groundwater				
Groundwater concentration	(ug/L)	Cmedium	757		NA		
Depth below grade to water table	(m)	Ls	0.50		Vary - 50	NA	WARNING
Average groundwater temperature	(°C)	Ts	22	25	3 - 25		
Calc: Source vapor concentration	(ug/m3)	Cs	799635				
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.008%				

Chemical:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Chemical Name		Chem	Vinyl Chloride				
CAS No.		CAS	75-01-4				
Toxicity Factors							
Unit risk factor	$(ug/m^3)^{-1}$	IUR	4.40E-06	4.40E-06	NA	NA	
Mutagenic compound		Mut	VC	NA	NA	NA	
Reference concentration	(mg/m^3)	RfC	1.00E-01	1.00E-01	NA	NA	

Chemical Properties:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Pure component water solubility	(mg/L)	S	8.80E+03	8.80E+03	NA	NA	
Henry's Law Constant @ 25°C	$(atm\text{-}m^3/mol)$	Hc	2.78E-02	2.78E-02	NA	NA	
Calc: Henry's Law Constant @ 25°C	(dimensionless)	Hr	1.14E+00	1.14E+00			
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	1.06E+00	1.15E+00			
Diffusivity in air	(cm2/s)	Dair	1.07E-01	1.07E-01	NA	NA	
Diffusivity in water	(cm2/s)	Dwater	1.20E-05	1.20E-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**

Building setting		Bldg_Setting	Commercial	Commercial		
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade		
Depth below grade to base of foundation	(m)	Lb	0.20	0.20	0.1 - 2.44	NA
Foundation thickness	(m)	Lf	0.20	0.20	0.1 - 0.25	NA
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00
Enclosed space floor area	(m2)	Abf	1500.00	1500.00	80-1000	NA
Enclosed space mixing height	(m)	Hb	3.00	3.00	2.13 - 3.05	NA
Indoor air exchange rate	(1 / hr)	ach	1.50	1.50	.3-4.1	NA
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24
Calc: Building ventilation rate	(m3/hr)	Qb	6750.00	6750.00	NA	0.30
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	20.25	20.25	NA	NA

Model Input

Site Name/Run Number: Example, Run 1

Chemical Name: Vinyl Chloride CAS No. 75-01-4

Depth below grade to water table: 0.50 meters

Vadose zone characteristics:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Stratum A (Top of soil profile):							
Stratum A SCS soil type		SCS_A	Clay				
Stratum A thickness (from surface)	(m)	hSA	2.00				
Stratum A total porosity	(-)	nSA	0.459	0.459	NA	0.20	
Stratum A water-filled porosity	(-)	nwSA	0.400	0.215	0.098 - 0.33	0.25	WARNING
Stratum A bulk density	(g/cm^3)	rhoSA	1.600	1.430	NA	0.05	WARNING
Stratum B (Soil layer below Stratum A):							
Stratum B SCS soil type		SCS_B	Not Present				
Stratum B thickness	(m)	hSB					ERROR
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				ERROR
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	0.815	0.815	NA	NA	
Capillary zone total porosity	(-)	ncz	0.459	0.459	NA	0.20	
Capillary zone water filled porosity	(-)	nwcz	0.412	0.412	NA	0.24	

Exposure Parameters:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Target risk for carcinogens	(-)	Target_CR	1.00E-06	1.00E-06	NA	NA	
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	

Model Output

Site Name/Run Number: Example, Run 1

Range is based on the r
values, as reported in th

Chemical Name: Vinyl Chloride CAS No. 75-01-4

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**8.2E-06**	7.6E-06 - 8.3E-06	**1.3E-05**	1.2E-05 - 1.3E-05

Predicted Indoor Air Concentration	Units	Symbol	Value	Range	Default	Default Range
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**6.6E+00**	6.1E+00 - 6.6E+00	**1.0E+01**	9.3E+00 - 1.1E+01
	(ppbv)		**2.6E+00**	2.4E+00 - 2.6E+00	**4.1E+00**	3.6E+00 - 4.1E+00

Predicted Vapor Conc. Beneath Foundation	Units	Symbol	Value	Range	Default	Default Range
Subslab vapor concentration	(ug/m3)	**Css**	**2.2E+03**	1.3E+02 - 6.1E+04	**3.5E+03**	9.3E+04 - 1.1E+05
	(ppbv)		**8.6E+02**	5.2E+01 - 2.4E+04	**1.4E+03**	3.6E+04 - 4.1E+04

Diffusive Transport Upward Through Vadose Zone	Units	Symbol	Value	Range	Default	Default Range
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	4.4E-05	-	4.6E-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	2.2E-05	-	2.2E-05	-
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	3.0E-05	-	4.8E-05	-

Critical Parameters		Symbol	Value	Range	Default	Default Range
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	8.3E-06	-	1.3E-05	
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	1.7E+05	5.6E+03 - 2.8E+06	1.6E+03	5.3E+01 - 2.6E+04
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

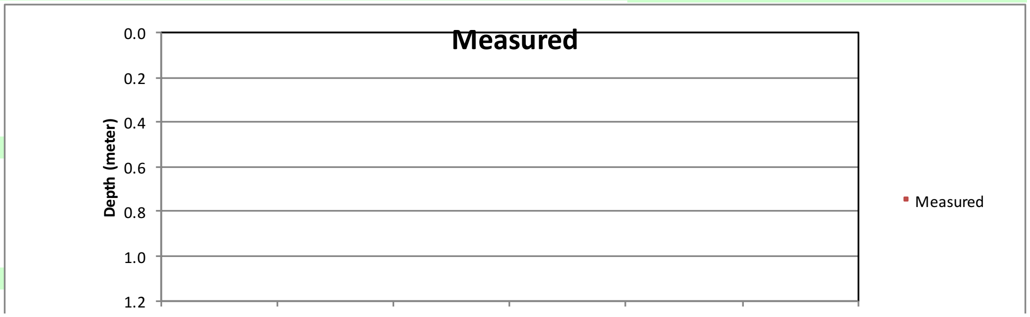
Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Concentration versus Depth Profile



Model Output **Site Name/Run Number:** Example, Run 1

Chemical Name: Vinyl Chloride CAS No. 75-01-4

Risk Calculations	Units	Symbol	Value	Range	Default	Range
Risk-Based Target Screening Levels Scenario: Commercial						
Target risk for carcinogens	(-)	Target_CR	1E-06	-	1E-06	-
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**2.10E-01**	-	**2.10E-01**	-
	(ppbv)		**8.22E-02**	-	**8.22E-02**	-
Target groundwater concentration	**(ug/L)**	**Target_GW**	**2.41E+01**	**2.4E+01 - 2.6E+01**	**1.40E+01**	**1.5E+01 - 1.7E+01**
Incremental Risk Estimates						
Incremental cancer risk from vapor intrusion	**(-)**	**Cancer_Risk**	**2.37E-06**	**2.2E-06 - 2.4E-06**	**3.76E-06**	**3.3E-06 - 3.8E-06**
Hazard quotient from vapor intrusion	**(-)**	**HQ**	**1.51E-02**	**1.4E-02 - 1.5E-02**	**2.39E-02**	**2.1E-02 - 2.4E-02**

Maximum concentration surrounding building

Model Input **Site Name/Run Number:** Example, Run 1

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**
Source medium		Source	Groundwater				
Groundwater concentration	(ug/L)	Cmedium	599		NA		
Depth below grade to water table	(m)	Ls	0.50		Vary - 50	NA	WARNING
Average groundwater temperature	(°C)	Ts	22	25	3 - 25		
Calc: Source vapor concentration	(ug/m3)	Cs	210976				
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.043%				

Chemical:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
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**
Pure component water solubility	(mg/L)	S	1.28E+03	1.28E+03	NA	NA	
Henry's Law Constant @ 25°C	$(atm\text{-}m^3/mol)$	Hc	9.85E-03	9.85E-03	NA	NA	
Calc: Henry's Law Constant @ 25°C	(dimensionless)	Hr	4.03E-01	4.03E-01			
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	3.52E-01	4.07E-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**

Building setting		Bldg_Setting	Commercial	Commercial		
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade		
Depth below grade to base of foundation	(m)	Lb	0.20	0.20	0.1 - 2.44	NA
Foundation thickness	(m)	Lf	0.20	0.20	0.1 - 0.25	NA
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00
Enclosed space floor area	(m2)	Abf	1500.00	1500.00	80-1000	NA
Enclosed space mixing height	(m)	Hb	3.00	3.00	2.13 - 3.05	NA
Indoor air exchange rate	(1 / hr)	ach	1.50	1.50	.3-4.1	NA
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24
Calc: Building ventilation rate	(m3/hr)	Qb	6750.00	6750.00	NA	0.30
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	20.25	20.25	NA	NA

Model Input **Site Name/Run Number:** Example, Run 1

Chemical Name: Trichloroethylene CAS No. 79-01-6

Depth below grade to water table: 0.50 meters

Vadose zone characteristics:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Stratum A (Top of soil profile):							
Stratum A SCS soil type		SCS_A	Clay				
Stratum A thickness (from surface)	(m)	hSA	2.00				
Stratum A total porosity	(-)	nSA	0.459	0.459	NA	0.20	
Stratum A water-filled porosity	(-)	nwSA	0.400	0.215	0.098 - 0.33	0.25	WARNING
Stratum A bulk density	(g/cm^3)	rhoSA	1.600	1.430	NA	0.05	WARNING
Stratum B (Soil layer below Stratum A):							
Stratum B SCS soil type		SCS_B	Not Present				
Stratum B thickness	(m)	hSB					ERROR
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				ERROR
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	0.815	0.815	NA	NA	
Capillary zone total porosity	(-)	ncz	0.459	0.459	NA	0.20	
Capillary zone water filled porosity	(-)	nwcz	0.412	0.412	NA	0.24	

Exposure Parameters:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Target risk for carcinogens	(-)	Target_CR	1.00E-06	1.00E-06	NA	NA	
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	

Model Output

Site Name/Run Number: Example, Run 1

Range is based on the r
values, as reported in t

Chemical Name: Trichloroethylene CAS No. 79-01-6

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**6.8E-06**	6.4E-06 - 6.8E-06	**1.1E-05**	1.0E-05 - 1.1E-05

Predicted Indoor Air Concentration	Units	Symbol	Value	Range	Default	Default Range
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**1.4E+00**	1.4E+00 - 1.4E+00	**2.3E+00**	2.1E+00 - 2.3E+00
	(ppbv)		**2.7E-01**	2.5E-01 - 2.7E-01	**4.4E-01**	3.9E-01 - 4.4E-01

Predicted Vapor Conc. Beneath Foundation	Units	Symbol	Value	Range	Default	Default Range
Subslab vapor concentration	(ug/m3)	**Css**	**4.8E+02**	2.9E+01 - 1.4E+04	**7.8E+02**	2.1E+04 - 2.3E+04
	(ppbv)		**8.9E+01**	5.4E+00 - 2.5E+03	**1.5E+02**	3.9E+03 - 4.4E+03

Diffusive Transport Upward Through Vadose Zone	Units	Symbol	Value	Range	Default	Default Range
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	3.3E-05	-	3.0E-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	2.0E-05	-	1.9E-05	-
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	2.5E-05	-	4.1E-05	-

Critical Parameters		Symbol	Value	Range	Default	Default Range
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	6.8E-06	-	1.1E-05	
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	2.2E+05	7.5E+03 - 3.7E+06	2.5E+03	8.2E+01 - 4.1E+04
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

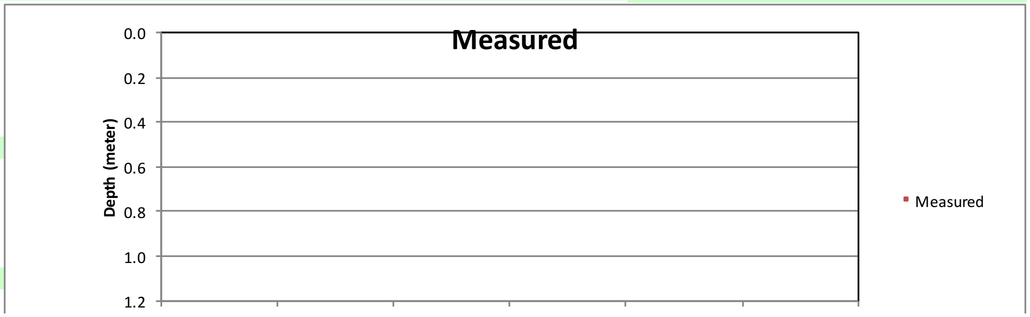
Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Concentration versus Depth Profile



Model Output

Site Name/Run Number: Example, Run 1

Chemical Name: Trichloroethylene **CAS No. 79-01-6**

Risk Calculations	Units	Symbol	Value	Range	Default	Range
Risk-Based Target Screening Levels	**Scenario: Commercial**					
Target risk for carcinogens	(-)	Target_CR	1E-06	-	1E-06	-
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**2.05E+00**	-	**2.05E+00**	-
	(ppbv)		**3.82E-01**	-	**3.82E-01**	-
Target groundwater concentration	**(ug/L)**	**Target_GW**	**8.52E+02**	**8.5E+02 - 9.1E+02**	**4.54E+02**	**5.2E+02 - 5.8E+02**
Incremental Risk Estimates						
Incremental cancer risk from vapor intrusion	**(-)**	**Cancer_Risk**	**1.87E-06**	**1.8E-06 - 1.9E-06**	**3.04E-06**	**2.7E-06 - 3.0E-06**
Hazard quotient from vapor intrusion	**(-)**	**HQ**	**1.65E-01**	**1.5E-01 - 1.6E-01**	**2.67E-01**	**2.4E-01 - 2.7E-01**

Model Input

Site Name/Run Number: Example, Run 1

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**
Source medium		Source	Groundwater				
Groundwater concentration	(ug/L)	Cmedium	14		NA		
Depth below grade to water table	(m)	Ls	0.50		Vary - 50	NA	WARNING
Average groundwater temperature	(^{o}C)	Ts	22	25	3 - 25		
Calc: Source vapor concentration	(ug/m3)	Cs	8706				
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.005%				

Chemical:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
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**
Pure component water solubility	(mg/L)	S	2.06E+02	2.06E+02	NA	NA	
Henry's Law Constant @ 25^{o}C	(atm-m^{3}/mol)	Hc	1.77E-02	1.77E-02	NA	NA	
Calc: Henry's Law Constant @ 25^{o}C	(dimensionless)	Hr	7.24E-01	7.24E-01			
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	6.22E-01	7.31E-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**

Building setting		Bldg_Setting	Commercial	Commercial		
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade		
Depth below grade to base of foundation	(m)	Lb	0.20	0.20	0.1 - 2.44	NA
Foundation thickness	(m)	Lf	0.20	0.20	0.1 - 0.25	NA
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00
Enclosed space floor area	(m2)	Abf	1500.00	1500.00	80-1000	NA
Enclosed space mixing height	(m)	Hb	3.00	3.00	2.13 - 3.05	NA
Indoor air exchange rate	(1 / hr)	ach	1.50	1.50	.3-4.1	NA
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24
Calc: Building ventilation rate	(m3/hr)	Qb	6750.00	6750.00	NA	0.30
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	20.25	20.25	NA	NA

Model Input

Site Name/Run Number: Example, Run 1

Chemical Name: Tetrachloroethylene CAS No. 127-18-4

Depth below grade to water table: 0.50 meters

Vadose zone characteristics:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Stratum A (Top of soil profile):							
Stratum A SCS soil type		SCS_A	Clay				
Stratum A thickness (from surface)	(m)	hSA	2.00				
Stratum A total porosity	(-)	nSA	0.459	0.459	NA	0.20	
Stratum A water-filled porosity	(-)	nwSA	0.400	0.215	0.098 - 0.33	0.25	WARNING
Stratum A bulk density	(g/cm^3)	rhoSA	1.600	1.430	NA	0.05	WARNING
Stratum B (Soil layer below Stratum A):							
Stratum B SCS soil type		SCS_B	Not Present				
Stratum B thickness	(m)	hSB					ERROR
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				ERROR
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	0.815	0.815	NA	NA	
Capillary zone total porosity	(-)	ncz	0.459	0.459	NA	0.20	
Capillary zone water filled porosity	(-)	nwcz	0.412	0.412	NA	0.24	

Exposure Parameters:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Target risk for carcinogens	(-)	Target_CR	1.00E-06	1.00E-06	NA	NA	
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

Model Output **Site Name/Run Number:** Example, Run 1

Chemical Name: Tetrachloroethylene CAS No. 127-18-4

Range is based on the r
values, as reported in th

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**4.6E-06**	4.4E-06 - 4.6E-06	**7.4E-06**	6.9E-06 - 7.4E-06

Predicted Indoor Air Concentration	Units	Symbol	Value	Range	Default	Default Range
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**4.0E-02**	3.8E-02 - 4.0E-02	**6.4E-02**	6.0E-02 - 6.4E-02
	(ppbv)		**5.9E-03**	5.7E-03 - 5.9E-03	**9.5E-03**	8.8E-03 - 9.5E-03

Predicted Vapor Conc. Beneath Foundation	Units	Symbol	Value	Range	Default	Default Range
Subslab vapor concentration	(ug/m3)	**Css**	**1.3E+01**	8.0E-01 - 3.8E+02	**2.1E+01**	6.0E+02 - 6.4E+02
	(ppbv)		**2.0E+00**	1.2E-01 - 5.7E+01	**3.2E+00**	8.8E+01 - 9.5E+01

Diffusive Transport Upward Through Vadose Zone	Units	Symbol	Value	Range	Default	Default Range
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	2.3E-05	-	2.2E-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	1.3E-05	-	1.2E-05	-
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	1.7E-05	-	2.7E-05	-

Critical Parameters		Symbol	Value	Range	Default	Default Range
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	4.6E-06	-	7.4E-06	
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	3.2E+05	1.1E+04 - 5.4E+06	3.4E+03	1.1E+02 - 5.6E+04
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

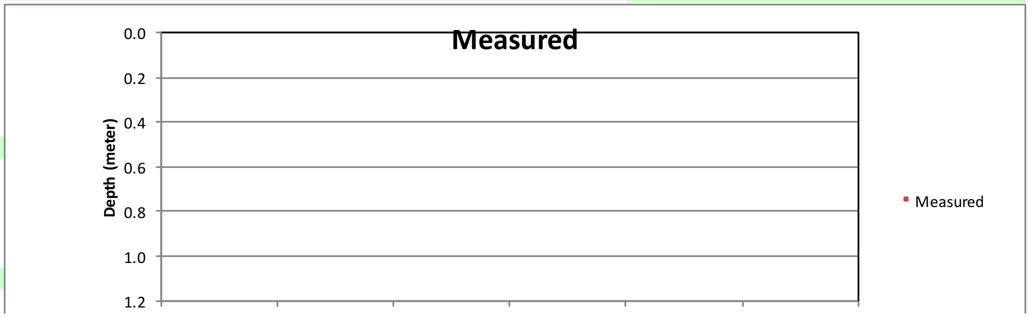
Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Concentration versus Depth Profile



Model Output

Site Name/Run Number: Example, Run 1

Chemical Name: Tetrachloroethylene **CAS No. 127-18-4**

Risk Calculations	Units	Symbol	Value	Range	Default	Range
Risk-Based Target Screening Levels	**Scenario: Commercial**					
Target risk for carcinogens	(-)	Target_CR	1E-06	-	1E-06	-
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**4.72E+01**	-	**4.72E+01**	-
	(ppbv)		**6.96E+00**	-	**6.96E+00**	-
Target groundwater concentration	**(ug/L)**	**Target_GW**	**1.65E+04**	**1.6E+04 - 1.7E+04**	**8.77E+03**	**1.0E+04 - 1.1E+04**
Incremental Risk Estimates						
Incremental cancer risk from vapor intrusion	**(-)**	**Cancer_Risk**	**8.49E-10**	**8.1E-10 - 8.5E-10**	**1.36E-09**	**1.3E-09 - 1.4E-09**
Hazard quotient from vapor intrusion	**(-)**	**HQ**	**2.29E-04**	**2.2E-04 - 2.3E-04**	**3.66E-04**	**3.4E-04 - 3.7E-04**

Model Input

Site Name/Run Number: Example, Run 1

Use English / Metric Converter

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**
Source medium		Source	Groundwater				
Groundwater concentration	(ug/L)	Cmedium	71		NA		
Depth below grade to water table	(m)	Ls	0.50		Vary - 50	NA	WARNING
Average groundwater temperature	(°C)	Ts	22	25	3 - 25		
Calc: Source vapor concentration	(ug/m3)	Cs	1036				
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.177%				

Chemical:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Chemical Name		Chem	Naphthalene				
CAS No.		CAS	91-20-3				
Toxicity Factors							
Unit risk factor	$(ug/m^3)^{-1}$	IUR	3.40E-05	3.40E-05	NA	NA	
Mutagenic compound		Mut	No	NA	NA	NA	
Reference concentration	(mg/m^3)	RfC	3.00E-03	3.00E-03	NA	NA	

Chemical Properties:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Pure component water solubility	(mg/L)	S	3.10E+01	3.10E+01	NA	NA	
Henry's Law Constant @ 25°C	$(atm\text{-}m^3/mol)$	Hc	4.40E-04	4.40E-04	NA	NA	
Calc: Henry's Law Constant @ 25°C	(dimensionless)	Hr	1.80E-02	1.80E-02			
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	1.46E-02	1.82E-02			
Diffusivity in air	(cm2/s)	Dair	6.05E-02	6.05E-02	NA	NA	
Diffusivity in water	(cm2/s)	Dwater	8.38E-06	8.38E-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**

Building setting		Bldg_Setting	Commercial	Commercial		
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade		
Depth below grade to base of foundation	(m)	Lb	0.20	0.20	0.1 - 2.44	NA
Foundation thickness	(m)	Lf	0.20	0.20	0.1 - 0.25	NA
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00
Enclosed space floor area	(m2)	Abf	1500.00	1500.00	80-1000	NA
Enclosed space mixing height	(m)	Hb	3.00	3.00	2.13 - 3.05	NA
Indoor air exchange rate	(1 / hr)	ach	1.50	1.50	.3-4.1	NA
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24
Calc: Building ventilation rate	(m3/hr)	Qb	6750.00	6750.00	NA	0.30
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	20.25	20.25	NA	NA

Model Input

Site Name/Run Number: Example, Run 1

Chemical Name: Naphthalene CAS No. 91-20-3

Depth below grade to water table: 0.50 meters

Vadose zone characteristics:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Stratum A (Top of soil profile):							
Stratum A SCS soil type		SCS_A	Clay				
Stratum A thickness (from surface)	(m)	hSA	2.00				
Stratum A total porosity	(-)	nSA	0.459	0.459	NA	0.20	
Stratum A water-filled porosity	(-)	nwSA	0.400	0.215	0.098 - 0.33	0.25	WARNING
Stratum A bulk density	(g/cm^3)	rhoSA	1.600	1.430	NA	0.05	WARNING
Stratum B (Soil layer below Stratum A):							
Stratum B SCS soil type		SCS_B	Not Present				
Stratum B thickness	(m)	hSB					ERROR
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				ERROR
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	0.815	0.815	NA	NA	
Capillary zone total porosity	(-)	ncz	0.459	0.459	NA	0.20	
Capillary zone water filled porosity	(-)	nwcz	0.412	0.412	NA	0.24	

Exposure Parameters:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Target risk for carcinogens	(-)	Target_CR	1.00E-06	1.00E-06	NA	NA	
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

Range is based on the r
values, as reported in th

Model Output

Site Name/Run Number: Example, Run 1

Chemical Name: Naphthalene CAS No. 91-20-3

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**4.1E-05**	2.9E-05 - 4.1E-05	**6.9E-05**	4.2E-05 - 7.1E-05

Predicted Indoor Air Concentration	Units	Symbol	Value	Range	Default	Default Range
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**4.2E-02**	3.0E-02 - 4.3E-02	**7.2E-02**	4.3E-02 - 7.4E-02
	(ppbv)		**8.1E-03**	5.8E-03 - 8.2E-03	**1.4E-02**	8.2E-03 - 1.4E-02

Predicted Vapor Conc. Beneath Foundation	Units	Symbol	Value	Range	Default	Default Range
Subslab vapor concentration	(ug/m3)	**Css**	**1.4E+01**	8.6E-01 - 3.0E+02	**2.4E+01**	4.3E+02 - 7.4E+02
	(ppbv)		**2.7E+00**	1.6E-01 - 5.8E+01	**4.6E+00**	8.2E+01 - 1.4E+02

Diffusive Transport Upward Through Vadose Zone	Units	Symbol	Value	Range	Default	Default Range
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	1.5E-04	-	2.6E-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	-	1.3E-04	-
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	1.5E-04	-	2.6E-04	-

Critical Parameters		Symbol	Value	Range	Default	Default Range
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	4.2E-05	-	7.1E-05	
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	4.8E+04	1.6E+03 - 8.1E+05	2.8E+03	9.3E+01 - 4.7E+04
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

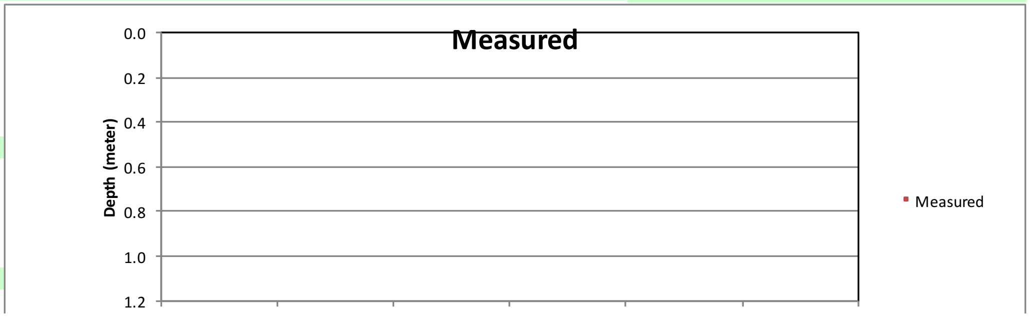
Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Concentration versus Depth Profile



Model Output **Site Name/Run Number:** Example, Run 1

Chemical Name: Naphthalene CAS No. 91-20-3

Risk Calculations	Units	Symbol	Value	Range	Default	Range
Risk-Based Target Screening Levels Scenario: Commercial						
Target risk for carcinogens	(-)	Target_CR	1E-06	-	1E-06	-
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**3.61E-01**	-	**3.61E-01**	-
	(ppbv)		**6.88E-02**	-	**6.88E-02**	-
Target groundwater concentration	**(ug/L)**	**Target_GW**	**6.04E+02**	**6.0E+02 - 8.4E+02**	**2.86E+02**	**3.5E+02 - 6.0E+02**
Incremental Risk Estimates						
Incremental cancer risk from vapor intrusion	**(-)**	**Cancer_Risk**	**1.18E-07**	**8.4E-08 - 1.2E-07**	**1.99E-07**	**1.2E-07 - 2.0E-07**
Hazard quotient from vapor intrusion	**(-)**	**HQ**	**3.23E-03**	**2.3E-03 - 3.3E-03**	**5.47E-03**	**3.3E-03 - 5.6E-03**

Model Input

Site Name/Run Number: Example, Run 1

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**
Source medium		Source	Groundwater				
Groundwater concentration	(ug/L)	Cmedium	33		NA		
Depth below grade to water table	(m)	Ls	0.50		Vary - 50	NA	WARNING
Average groundwater temperature	(°C)	Ts	22	25	3 - 25		
Calc: Source vapor concentration	(ug/m3)	Cs	9810				
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.061%				

Chemical:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Chemical Name		Chem	Trimethylbenzene, 1,3,5-				
CAS No.		CAS	108-67-8				
Toxicity Factors							
Unit risk factor	$(ug/m^3)^{-1}$	IUR	Not Available	Not Available	NA	NA	
Mutagenic compound		Mut	No	NA	NA	NA	
Reference concentration	(mg/m^3)	RfC	6.00E-02	6.00E-02	NA	NA	

Chemical Properties:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Pure component water solubility	(mg/L)	S	4.82E+01	4.82E+01	NA	NA	
Henry's Law Constant @ 25°C	$(atm\text{-}m^3/mol)$	Hc	8.77E-03	8.77E-03	NA	NA	
Calc: Henry's Law Constant @ 25°C	(dimensionless)	Hr	3.59E-01	3.59E-01			
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	2.97E-01	3.62E-01			
Diffusivity in air	(cm2/s)	Dair	6.02E-02	6.02E-02	NA	NA	
Diffusivity in water	(cm2/s)	Dwater	7.84E-06	7.84E-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**

Building setting		Bldg_Setting	Commercial	Commercial		
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade		
Depth below grade to base of foundation	(m)	Lb	0.20	0.20	0.1 - 2.44	NA
Foundation thickness	(m)	Lf	0.20	0.20	0.1 - 0.25	NA
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00
Enclosed space floor area	(m2)	Abf	1500.00	1500.00	80-1000	NA
Enclosed space mixing height	(m)	Hb	3.00	3.00	2.13 - 3.05	NA
Indoor air exchange rate	(1 / hr)	ach	1.50	1.50	.3-4.1	NA
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24
Calc: Building ventilation rate	(m3/hr)	Qb	6750.00	6750.00	NA	0.30
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	20.25	20.25	NA	NA

Model Input

Site Name/Run Number: Example, Run 1

Chemical Name: Trimethylbenzene, 1,3,5- **CAS No. 108-67-8**

Depth below grade to water table: 0.50 meters

Vadose zone characteristics:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Stratum A (Top of soil profile):							
Stratum A SCS soil type		SCS_A	Clay				
Stratum A thickness (from surface)	(m)	hSA	2.00				
Stratum A total porosity	(-)	nSA	0.459	0.459	NA	0.20	
Stratum A water-filled porosity	(-)	nwSA	0.400	0.215	0.098 - 0.33	0.25	WARNING
Stratum A bulk density	(g/cm^3)	rhoSA	1.600	1.430	NA	0.05	WARNING
Stratum B (Soil layer below Stratum A):							
Stratum B SCS soil type		SCS_B	Not Present				
Stratum B thickness	(m)	hSB					ERROR
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				ERROR
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	0.815	0.815	NA	NA	
Capillary zone total porosity	(-)	ncz	0.459	0.459	NA	0.20	
Capillary zone water filled porosity	(-)	nwcz	0.412	0.412	NA	0.24	

Exposure Parameters:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Target risk for carcinogens	(-)	Target_CR	1.00E-06	1.00E-06	NA	NA	
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

Model Output

Site Name/Run Number: Example, Run 1

Chemical Name: Trimethylbenzene, 1,3,5- **CAS No. 108-67-8**

Range is based on the r
values, as reported in th

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**6.1E-06**	5.7E-06 - 6.1E-06	**9.7E-06**	8.9E-06 - 9.7E-06

Predicted Indoor Air Concentration	Units	Symbol	Value	Range	Default	Default Range
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**5.9E-02**	5.6E-02 - 6.0E-02	**9.5E-02**	8.7E-02 - 9.5E-02
	(ppbv)		**1.2E-02**	1.1E-02 - 1.2E-02	**1.9E-02**	1.8E-02 - 1.9E-02

Predicted Vapor Conc. Beneath Foundation	Units	Symbol	Value	Range	Default	Default Range
Subslab vapor concentration	(ug/m3)	**Css**	**2.0E+01**	1.2E+00 - 5.6E+02	**3.2E+01**	8.7E+02 - 9.5E+02
	(ppbv)		**4.0E+00**	2.4E-01 - 1.1E+02	**6.4E+00**	1.8E+02 - 1.9E+02

Diffusive Transport Upward Through Vadose Zone	Units	Symbol	Value	Range	Default	Default Range
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	2.9E-05	-	2.6E-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-05	-	1.6E-05	-
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	2.2E-05	-	3.6E-05	-

Critical Parameters		Symbol	Value	Range	Default	Default Range
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	6.1E-06	-	9.7E-06	
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	2.5E+05	8.4E+03 - 4.2E+06	2.8E+03	9.4E+01 - 4.7E+04
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

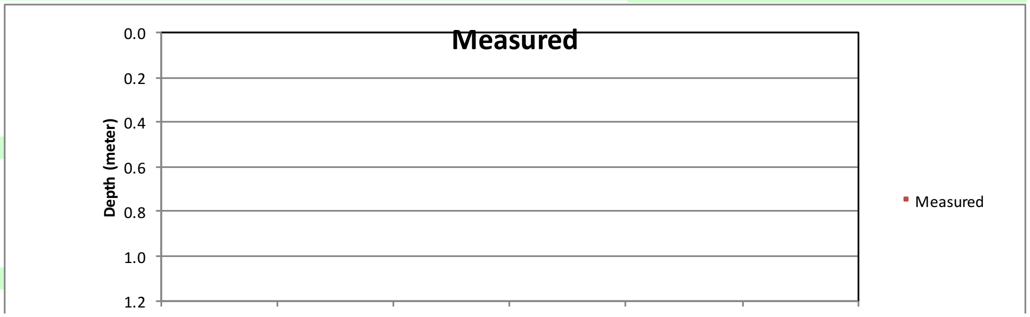
Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Concentration versus Depth Profile



Model Output **Site Name/Run Number:** Example, Run 1

Chemical Name: Trimethylbenzene, 1,3,5- CAS No. 108-67-8

Risk Calculations	Units	Symbol	Value	Range	Default	Range
Risk-Based Target Screening Levels	Scenario: Commercial					
Target risk for carcinogens	(-)	Target_CR	1E-06	-	1E-06	-
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**2.63E+02**	-	**2.63E+02**	-
	(ppbv)		**5.35E+01**	-	**5.35E+01**	-
Target groundwater concentration	**(ug/L)**	**Target_GW**	**1.46E+05**	**1.5E+05 - 1.5E+05**	**7.49E+04**	**9.1E+04 - 1.0E+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**	**2.26E-04**	**2.1E-04 - 2.3E-04**	**3.61E-04**	**3.3E-04 - 3.6E-04**

Model Input

Site Name/Run Number: Example, Run 1

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**
Source medium		Source	Groundwater				
Groundwater concentration	(ug/L)	Cmedium	80		NA		
Depth below grade to water table	(m)	Ls	0.50		Vary - 50	NA	WARNING
Average groundwater temperature	(°C)	Ts	22	25	3 - 25		
Calc: Source vapor concentration	(ug/m3)	Cs	16697				
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.123%				

Chemical:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Chemical Name		Chem	Trimethylbenzene, 1,2,4-				
CAS No.		CAS	95-63-6				
Toxicity Factors							
Unit risk factor	(ug/m^3)$^{-1}$	IUR	Not Available	Not Available	NA	NA	
Mutagenic compound		Mut	No	NA	NA	NA	
Reference concentration	(mg/m^3)	RfC	6.00E-02	6.00E-02	NA	NA	

Chemical Properties:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Pure component water solubility	(mg/L)	S	5.70E+01	5.70E+01	NA	NA	
Henry's Law Constant @ 25°C	(atm-m^3/mol)	Hc	6.16E-03	6.16E-03	NA	NA	
Calc: Henry's Law Constant @ 25°C	(dimensionless)	Hr	2.52E-01	2.52E-01			
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	2.09E-01	2.54E-01			
Diffusivity in air	(cm2/s)	Dair	6.07E-02	6.07E-02	NA	NA	
Diffusivity in water	(cm2/s)	Dwater	7.92E-06	7.92E-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**

Building setting		Bldg_Setting	Commercial	Commercial		
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade		
Depth below grade to base of foundation	(m)	Lb	0.20	0.20	0.1 - 2.44	NA
Foundation thickness	(m)	Lf	0.20	0.20	0.1 - 0.25	NA
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00
Enclosed space floor area	(m2)	Abf	1500.00	1500.00	80-1000	NA
Enclosed space mixing height	(m)	Hb	3.00	3.00	2.13 - 3.05	NA
Indoor air exchange rate	(1 / hr)	ach	1.50	1.50	.3-4.1	NA
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24
Calc: Building ventilation rate	(m3/hr)	Qb	6750.00	6750.00	NA	0.30
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	20.25	20.25	NA	NA

Model Input

Site Name/Run Number: Example, Run 1

Chemical Name: Trimethylbenzene, 1,2,4- **CAS No. 95-63-6**

Depth below grade to water table: 0.50 meters

Vadose zone characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag
Stratum A (Top of soil profile):							
Stratum A SCS soil type		SCS_A	Clay				
Stratum A thickness (from surface)	(m)	hSA	2.00				
Stratum A total porosity	(-)	nSA	0.459	0.459	NA	0.20	
Stratum A water-filled porosity	(-)	nwSA	0.400	0.215	0.098 - 0.33	0.25	WARNING
Stratum A bulk density	(g/cm^3)	rhoSA	1.600	1.430	NA	0.05	WARNING
Stratum B (Soil layer below Stratum A):							
Stratum B SCS soil type		SCS_B	Not Present				
Stratum B thickness	(m)	hSB					ERROR
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				ERROR
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	0.815	0.815	NA	NA	
Capillary zone total porosity	(-)	ncz	0.459	0.459	NA	0.20	
Capillary zone water filled porosity	(-)	nwcz	0.412	0.412	NA	0.24	

Exposure Parameters:	Units	Symbol	Value	Default	Potential Span	CV	Flag
Target risk for carcinogens	(-)	Target_CR	1.00E-06	1.00E-06	NA	NA	
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

Model Output

Site Name/Run Number: Example, Run 1

Range is based on the r
values, as reported in th

Chemical Name: Trimethylbenzene, 1,2,4- **CAS No. 95-63-6**

Source to Indoor Air Attenuation Factor	**Units**	**Symbol**	**Value**	**Range**	**Default**	**Default Range**
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**6.9E-06**	6.5E-06 - 6.9E-06	**1.1E-05**	1.0E-05 - 1.1E-05

Predicted Indoor Air Concentration	**Units**	**Symbol**	**Value**	**Range**	**Default**	**Default Range**
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**1.2E-01**	1.1E-01 - 1.2E-01	**1.9E-01**	1.7E-01 - 1.9E-01
	(ppbv)		**2.3E-02**	2.2E-02 - 2.3E-02	**3.8E-02**	3.4E-02 - 3.8E-02

Predicted Vapor Conc. Beneath Foundation	**Units**	**Symbol**	**Value**	**Range**	**Default**	**Default Range**
Subslab vapor concentration	(ug/m3)	**Css**	**3.8E+01**	2.3E+00 - 1.1E+03	**6.2E+01**	1.7E+03 - 1.9E+03
	(ppbv)		**7.8E+00**	4.7E-01 - 2.2E+02	**1.3E+01**	3.4E+02 - 3.8E+02

Diffusive Transport Upward Through Vadose Zone	**Units**	**Symbol**	**Value**	**Range**	**Default**	**Default Range**
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	3.2E-05	-	2.6E-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	2.0E-05	-	1.9E-05	-
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	2.5E-05	-	4.1E-05	-

Critical Parameters		**Symbol**	**Value**	**Range**	**Default**	**Default Range**
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	6.9E-06	-	1.1E-05	
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	2.3E+05	7.7E+03 - 3.9E+06	2.8E+03	9.3E+01 - 4.7E+04
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

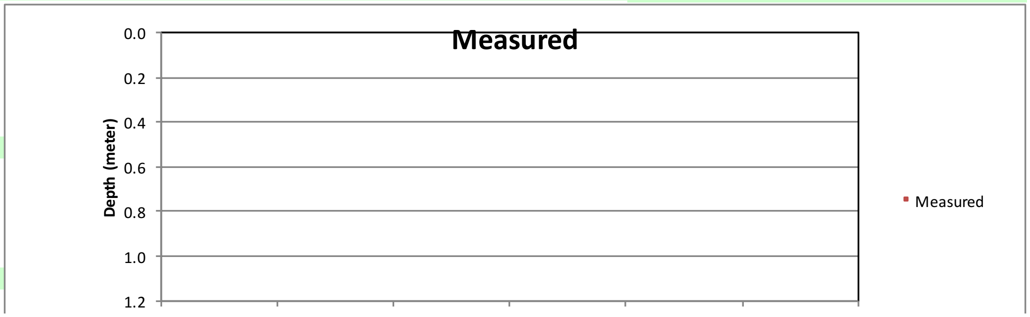
Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Concentration versus Depth Profile



Model Output

Site Name/Run Number: Example, Run 1

Chemical Name: Trimethylbenzene, 1,2,4- **CAS No. 95-63-6**

Risk Calculations	**Units**	**Symbol**	**Value**	**Range**	**Default**	**Range**
Risk-Based Target Screening Levels	**Scenario: Commercial**					
Target risk for carcinogens	(-)	Target_CR	1E-06	-	1E-06	-
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**2.63E+02**	-	**2.63E+02**	-
	(ppbv)		**5.35E+01**	-	**5.35E+01**	-
Target groundwater concentration	**(ug/L)**	**Target_GW**	**1.83E+05**	**1.8E+05 - 1.9E+05**	**9.30E+04**	**1.1E+05 - 1.3E+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**	**4.38E-04**	**4.1E-04 - 4.4E-04**	**7.06E-04**	**6.4E-04 - 7.1E-04**

Model Input

Site Name/Run Number: Example, Run 1

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**
Source medium		Source	Groundwater				
Groundwater concentration	(ug/L)	Cmedium	239		NA		
Depth below grade to water table	(m)	Ls	0.50		Vary - 50	NA	WARNING
Average groundwater temperature	(°C)	Ts	22	25	3 - 25		
Calc: Source vapor concentration	(ug/m3)	Cs	148653				
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.017%				

Chemical:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Chemical Name		Chem	Trichloroethane, 1,1,1-				
CAS No.		CAS	71-55-6				
Toxicity Factors							
Unit risk factor	$(ug/m^3)^{-1}$	IUR	Not Available	Not Available	NA	NA	
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**
Pure component water solubility	(mg/L)	S	1.29E+03	1.29E+03	NA	NA	
Henry's Law Constant @ 25°C	$(atm\text{-}m^3/mol)$	Hc	1.72E-02	1.72E-02	NA	NA	
Calc: Henry's Law Constant @ 25°C	(dimensionless)	Hr	7.03E-01	7.03E-01			
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	6.22E-01	7.11E-01			
Diffusivity in air	(cm2/s)	Dair	6.48E-02	6.48E-02	NA	NA	
Diffusivity in water	(cm2/s)	Dwater	9.60E-06	9.60E-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**

Building setting		Bldg_Setting	Commercial	Commercial		
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade		
Depth below grade to base of foundation	(m)	Lb	0.20	0.20	0.1 - 2.44	NA
Foundation thickness	(m)	Lf	0.20	0.20	0.1 - 0.25	NA
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00
Enclosed space floor area	(m2)	Abf	1500.00	1500.00	80-1000	NA
Enclosed space mixing height	(m)	Hb	3.00	3.00	2.13 - 3.05	NA
Indoor air exchange rate	(1 / hr)	ach	1.50	1.50	.3-4.1	NA
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24
Calc: Building ventilation rate	(m3/hr)	Qb	6750.00	6750.00	NA	0.30
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	20.25	20.25	NA	NA

Model Input

Site Name/Run Number: Example, Run 1

Chemical Name: Trichloroethane, 1,1,1- **CAS No.** 71-55-6

Depth below grade to water table: 0.50 meters

Vadose zone characteristics:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Stratum A (Top of soil profile):							
Stratum A SCS soil type		SCS_A	Clay				
Stratum A thickness (from surface)	(m)	hSA	2.00				
Stratum A total porosity	(-)	nSA	0.459	0.459	NA	0.20	
Stratum A water-filled porosity	(-)	nwSA	0.400	0.215	0.098 - 0.33	0.25	WARNING
Stratum A bulk density	(g/cm^3)	rhoSA	1.600	1.430	NA	0.05	WARNING
Stratum B (Soil layer below Stratum A):							
Stratum B SCS soil type		SCS_B	Not Present				
Stratum B thickness	(m)	hSB					ERROR
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				ERROR
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	0.815	0.815	NA	NA	
Capillary zone total porosity	(-)	ncz	0.459	0.459	NA	0.20	
Capillary zone water filled porosity	(-)	nwcz	0.412	0.412	NA	0.24	

Exposure Parameters:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Target risk for carcinogens	(-)	Target_CR	1.00E-06	1.00E-06	NA	NA	
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

Range is based on the r
values, as reported in th

Model Output

Site Name/Run Number: Example, Run 1

Chemical Name: **Trichloroethane, 1,1,1-** **CAS No. 71-55-6**

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**5.6E-06**	5.3E-06 - 5.6E-06	**9.0E-06**	8.3E-06 - 9.0E-06

Predicted Indoor Air Concentration	Units	Symbol	Value	Range	Default	Default Range
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**8.3E-01**	7.9E-01 - 8.4E-01	**1.3E+00**	1.2E+00 - 1.3E+00
	(ppbv)		**1.5E-01**	1.5E-01 - 1.5E-01	**2.5E-01**	2.3E-01 - 2.5E-01

Predicted Vapor Conc. Beneath Foundation	Units	Symbol	Value	Range	Default	Default Range
Subslab vapor concentration	(ug/m3)	**Css**	**2.8E+02**	1.7E+01 - 7.9E+03	**4.5E+02**	1.2E+04 - 1.3E+04
	(ppbv)		**5.1E+01**	3.1E+00 - 1.5E+03	**8.2E+01**	2.3E+03 - 2.5E+03

Diffusive Transport Upward Through Vadose Zone	Units	Symbol	Value	Range	Default	Default Range
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	2.8E-05	-	2.8E-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-05	-	1.5E-05	-
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	2.1E-05	-	3.3E-05	-

Critical Parameters		Symbol	Value	Range	Default	Default Range
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	5.6E-06	-	9.0E-06	
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	2.6E+05	8.7E+03 - 4.3E+06	2.6E+03	8.7E+01 - 4.4E+04
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

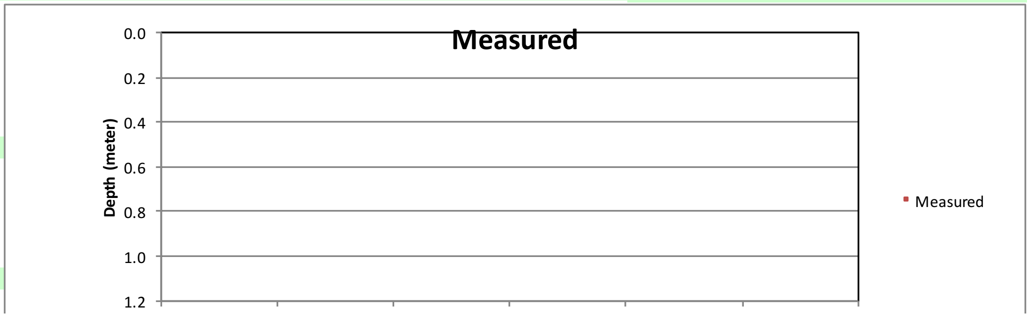
Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Concentration versus Depth Profile



Model Output

Site Name/Run Number: Example, Run 1

Chemical Name: Trichloroethane, 1,1,1- **CAS No. 71-55-6**

Risk Calculations	Units	Symbol	Value	Range	Default	Range
Risk-Based Target Screening Levels **Scenario: Commercial**						
Target risk for carcinogens	(-)	Target_CR	1E-06	-	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**	-
	(ppbv)		**4.02E+03**	-	**4.02E+03**	-
Target groundwater concentration	**(ug/L)**	**Target_GW**	**6.27E+06**	**6.3E+06 - 6.6E+06**	**3.43E+06**	**3.9E+06 - 4.3E+06**
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**	**3.81E-05**	**3.6E-05 - 3.8E-05**	**6.10E-05**	**5.6E-05 - 6.1E-05**

Model Input

Site Name/Run Number: Example, Run 1

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**
Source medium		Source	Groundwater				
Groundwater concentration	(ug/L)	Cmedium	406		NA		
Depth below grade to water table	(m)	Ls	0.50		Vary - 50	NA	WARNING
Average groundwater temperature	(°C)	Ts	22	25	3 - 25		
Calc: Source vapor concentration	(ug/m3)	Cs	392781				
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.013%				

Chemical:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Chemical Name		Chem	Dichloroethylene, 1,1-				
CAS No.		CAS	75-35-4				
Toxicity Factors							
Unit risk factor	$(ug/m^3)^{-1}$	IUR	Not Available	Not Available	NA	NA	
Mutagenic compound		Mut	No	NA	NA	NA	
Reference concentration	(mg/m^3)	RfC	2.00E-01	2.00E-01	NA	NA	

Chemical Properties:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Pure component water solubility	(mg/L)	S	2.42E+03	2.42E+03	NA	NA	
Henry's Law Constant @ 25°C	$(atm\text{-}m^3/mol)$	Hc	2.61E-02	2.61E-02	NA	NA	
Calc: Henry's Law Constant @ 25°C	(dimensionless)	Hr	1.07E+00	1.07E+00			
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	9.67E-01	1.08E+00			
Diffusivity in air	(cm2/s)	Dair	8.63E-02	8.63E-02	NA	NA	
Diffusivity in water	(cm2/s)	Dwater	1.10E-05	1.10E-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**

Building setting		Bldg_Setting	Commercial	Commercial		
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade		
Depth below grade to base of foundation	(m)	Lb	0.20	0.20	0.1 - 2.44	NA
Foundation thickness	(m)	Lf	0.20	0.20	0.1 - 0.25	NA
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00
Enclosed space floor area	(m2)	Abf	1500.00	1500.00	80-1000	NA
Enclosed space mixing height	(m)	Hb	3.00	3.00	2.13 - 3.05	NA
Indoor air exchange rate	(1 / hr)	ach	1.50	1.50	.3-4.1	NA
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24
Calc: Building ventilation rate	(m3/hr)	Qb	6750.00	6750.00	NA	0.30
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	20.25	20.25	NA	NA

Model Input

Site Name/Run Number: Example, Run 1

Chemical Name: Dichloroethylene, 1,1- CAS No. 75-35-4

Depth below grade to water table: 0.50 meters

Vadose zone characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag
Stratum A (Top of soil profile):							
Stratum A SCS soil type		SCS_A	Clay				
Stratum A thickness (from surface)	(m)	hSA	2.00				
Stratum A total porosity	(-)	nSA	0.459	0.459	NA	0.20	
Stratum A water-filled porosity	(-)	nwSA	0.400	0.215	0.098 - 0.33	0.25	WARNING
Stratum A bulk density	(g/cm^3)	rhoSA	1.600	1.430	NA	0.05	WARNING
Stratum B (Soil layer below Stratum A):							
Stratum B SCS soil type		SCS_B	Not Present				
Stratum B thickness	(m)	hSB					ERROR
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				ERROR
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	0.815	0.815	NA	NA	
Capillary zone total porosity	(-)	ncz	0.459	0.459	NA	0.20	
Capillary zone water filled porosity	(-)	nwcz	0.412	0.412	NA	0.24	

Exposure Parameters:	Units	Symbol	Value	Default	Potential Span	CV	Flag
Target risk for carcinogens	(-)	Target_CR	1.00E-06	1.00E-06	NA	NA	
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

Range is based on the r
values, as reported in th

Model Output

Site Name/Run Number: Example, Run 1

Chemical Name: Dichloroethylene, 1,1- CAS No. 75-35-4

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**6.8E-06**	6.4E-06 - 6.8E-06	**1.1E-05**	9.8E-06 - 1.1E-05

Predicted Indoor Air Concentration	Units	Symbol	Value	Range	Default	Default Range
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**2.7E+00**	2.5E+00 - 2.7E+00	**4.3E+00**	3.9E+00 - 4.3E+00
	(ppbv)		**6.8E-01**	6.3E-01 - 6.8E-01	**1.1E+00**	9.7E-01 - 1.1E+00

Predicted Vapor Conc. Beneath Foundation	Units	Symbol	Value	Range	Default	Default Range
Subslab vapor concentration	(ug/m3)	**Css**	**8.9E+02**	5.4E+01 - 2.5E+04	**1.4E+03**	3.9E+04 - 4.3E+04
	(ppbv)		**2.3E+02**	1.4E+01 - 6.3E+03	**3.6E+02**	9.7E+03 - 1.1E+04

Diffusive Transport Upward Through Vadose Zone	Units	Symbol	Value	Range	Default	Default Range
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	3.6E-05	-	3.7E-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	1.8E-05	-	1.8E-05	-
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	2.5E-05	-	4.0E-05	-

Critical Parameters		Symbol	Value	Range	Default	Default Range
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	6.8E-06	-	1.1E-05	
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	2.1E+05	6.9E+03 - 3.4E+06	2.0E+03	6.6E+01 - 3.3E+04
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

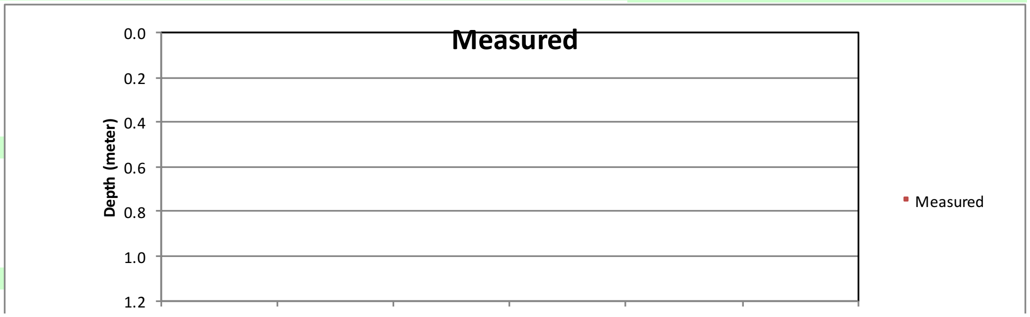
Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Concentration versus Depth Profile



Model Output

Site Name/Run Number: Example, Run 1

Chemical Name: Dichloroethylene, 1,1- **CAS No. 75-35-4**

Risk Calculations	Units	Symbol	Value	Range	Default	Range
Risk-Based Target Screening Levels	**Scenario: Commercial**					
Target risk for carcinogens	(-)	Target_CR	1E-06	-	1E-06	-
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**8.76E+02**	-	**8.76E+02**	-
	(ppbv)		**2.21E+02**	-	**2.21E+02**	-
Target groundwater concentration	**(ug/L)**	**Target_GW**	**1.33E+05**	**1.3E+05 - 1.4E+05**	**7.50E+04**	**8.3E+04 - 9.2E+04**
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**	**3.05E-03**	**2.9E-03 - 3.1E-03**	**4.86E-03**	**4.4E-03 - 4.9E-03**

Model Input

Site Name/Run Number: Example, Run 1

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**
Source medium		Source	Groundwater				
Groundwater concentration	(ug/L)	Cmedium	224		NA		
Depth below grade to water table	(m)	Ls	0.50		Vary - 50	NA	WARNING
Average groundwater temperature	(°C)	Ts	22	25	3 - 25		
Calc: Source vapor concentration	(ug/m3)	Cs	45865				
Calc: % of pure component saturated vapor concentration	(%)	%Sat	0.004%				

Chemical:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Chemical Name		Chem	Dichloroethane, 1,1-				
CAS No.		CAS	75-34-3				
Toxicity Factors							
Unit risk factor	$(ug/m^3)^{-1}$	IUR	1.60E-06	1.60E-06	NA	NA	
Mutagenic compound		Mut	No	NA	NA	NA	
Reference concentration	(mg/m^3)	RfC	Not Available	Not Available	NA	NA	

Chemical Properties:	**Units**	**Symbol**	**Value**	**Default**	**Potential Span**	**CV**	**Flag**
Pure component water solubility	(mg/L)	S	5.04E+03	5.04E+03	NA	NA	
Henry's Law Constant @ 25°C	(atm-m^3/mol)	Hc	5.62E-03	5.62E-03	NA	NA	
Calc: Henry's Law Constant @ 25°C	(dimensionless)	Hr	2.30E-01	2.30E-01			
Calc: Henry's Law Constant @ system temperature	(dimensionless)	Hs	2.05E-01	2.32E-01			
Diffusivity in air	(cm2/s)	Dair	8.36E-02	8.36E-02	NA	NA	
Diffusivity in water	(cm2/s)	Dwater	1.06E-05	1.06E-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**

Building setting		Bldg_Setting	Commercial	Commercial		
Foundation type		Found_Type	Slab-on-grade	Slab-on-grade		
Depth below grade to base of foundation	(m)	Lb	0.20	0.20	0.1 - 2.44	NA
Foundation thickness	(m)	Lf	0.20	0.20	0.1 - 0.25	NA
Fraction of foundation area with cracks	(-)	eta	0.001	0.001	0.00019-0.0019	1.00
Enclosed space floor area	(m2)	Abf	1500.00	1500.00	80-1000	NA
Enclosed space mixing height	(m)	Hb	3.00	3.00	2.13 - 3.05	NA
Indoor air exchange rate	(1 / hr)	ach	1.50	1.50	.3-4.1	NA
Qsoil/Qbuilding	(-)	Qsoil_Qb	0.0030	0.0030	0.0001 - 0.05	1.24
Calc: Building ventilation rate	(m3/hr)	Qb	6750.00	6750.00	NA	0.30
Calc: Average vapor flow rate into building	(m3/hr)	Qsoil	20.25	20.25	NA	NA

Model Input

Site Name/Run Number: Example, Run 1

Chemical Name: Dichloroethane, 1,1- CAS No. 75-34-3

Depth below grade to water table: 0.50 meters

Vadose zone characteristics:	Units	Symbol	Value	Default	Potential Span	CV	Flag
Stratum A (Top of soil profile):							
Stratum A SCS soil type		SCS_A	Clay				
Stratum A thickness (from surface)	(m)	hSA	2.00				
Stratum A total porosity	(-)	nSA	0.459	0.459	NA	0.20	
Stratum A water-filled porosity	(-)	nwSA	0.400	0.215	0.098 - 0.33	0.25	WARNING
Stratum A bulk density	(g/cm^3)	rhoSA	1.600	1.430	NA	0.05	WARNING
Stratum B (Soil layer below Stratum A):							
Stratum B SCS soil type		SCS_B	Not Present				
Stratum B thickness	(m)	hSB					ERROR
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				ERROR
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	0.815	0.815	NA	NA	
Capillary zone total porosity	(-)	ncz	0.459	0.459	NA	0.20	
Capillary zone water filled porosity	(-)	nwcz	0.412	0.412	NA	0.24	

Exposure Parameters:	Units	Symbol	Value	Default	Potential Span	CV	Flag
Target risk for carcinogens	(-)	Target_CR	1.00E-06	1.00E-06	NA	NA	
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

Range is based on the r
values, as reported in th

Model Output

Site Name/Run Number: Example, Run 1

Chemical Name: Dichloroethane, 1,1- CAS No. 75-34-3

Source to Indoor Air Attenuation Factor	Units	Symbol	Value	Range	Default	Default Range
Groundwater to indoor air attenuation coefficient	**(-)**	**alpha**	**9.5E-06**	8.7E-06 - 9.5E-06	**1.6E-05**	1.4E-05 - 1.6E-05

Predicted Indoor Air Concentration	Units	Symbol	Value	Range	Default	Default Range
Indoor air concentration due to vapor intrusion	(ug/m3)	**Cia**	**4.3E-01**	4.0E-01 - 4.3E-01	**7.2E-01**	6.2E-01 - 7.2E-01
	(ppbv)		**1.1E-01**	9.8E-02 - 1.1E-01	**1.8E-01**	1.5E-01 - 1.8E-01

Predicted Vapor Conc. Beneath Foundation	Units	Symbol	Value	Range	Default	Default Range
Subslab vapor concentration	(ug/m3)	**Css**	**1.4E+02**	8.7E+00 - 4.0E+03	**2.4E+02**	6.2E+03 - 7.2E+03
	(ppbv)		**3.6E+01**	2.1E+00 - 9.8E+02	**5.9E+01**	1.5E+03 - 1.8E+03

Diffusive Transport Upward Through Vadose Zone	Units	Symbol	Value	Range	Default	Default Range
Effective diffusion coefficient through Stratum A	(cm2/sec)	DeffA	4.4E-05	-	3.6E-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	2.8E-05	-	2.6E-05	-
Effective diffusion coefficient through unsaturated zone	(cm2/sec)	DeffT	3.5E-05	-	5.8E-05	-

Critical Parameters		Symbol	Value	Range	Default	Default Range
α for diffusive transport from source to building with dirt floor foundation	(-)	A_Param	9.5E-06	-	1.6E-05	
Pe (Peclet Number) for transport through the foundation (advection / diffusion)	(-)	B_Param	1.7E+05	5.6E+03 - 2.8E+06	2.0E+03	6.8E+01 - 3.4E+04
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

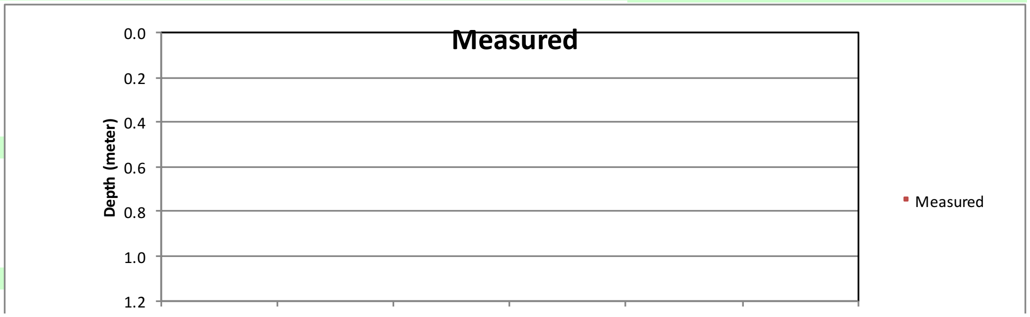
Advection is the dominant mechanism across the foundation.
Diffusion through soil is the overall rate limiting process.

Critical Parameters

Hb, Ls, DeffT, ach

Non-Critical Parameters

Concentration versus Depth Profile



Model Output

Site Name/Run Number: Example, Run 1

Chemical Name: Dichloroethane, 1,1- CAS No. 75-34-3

Risk Calculations	Units	Symbol	Value	Range	Default	Range
Risk-Based Target Screening Levels Scenario: Commercial						
Target risk for carcinogens	(-)	Target_CR	1E-06	-	1E-06	-
Target hazard quotient for noncarcinogens	(-)	Target_HQ	1	-	1	-
Target indoor air concentration	**(ug/m3)**	**Target_IA**	**7.67E+00**	-	**7.67E+00**	-
	(ppbv)		**1.89E+00**	-	**1.89E+00**	-
Target groundwater concentration	**(ug/L)**	**Target_GW**	**3.96E+03**	**3.9E+03 - 4.3E+03**	**2.10E+03**	**2.4E+03 - 2.7E+03**
Incremental Risk Estimates						
Incremental cancer risk from vapor intrusion	**(-)**	**Cancer_Risk**	**5.66E-08**	**5.2E-08 - 5.7E-08**	**9.39E-08**	**8.2E-08 - 9.4E-08**
Hazard quotient from vapor intrusion	**(-)**	**HQ**	**No RfC Available**	**Available - No RfC A**	**No RfC Available**	**Available - No RfC Av**

APPENDIX F

SOIL MANAGEMENT PLAN

bullock environmental, llc 2811 crescent avenue, suite 101, birmingham, alabama 35209 t 205.876.1715 f 205.443.9413

December 4, 2018

Mr. Tom Charney
Risk Management Officer
City of Cullman
204 2nd Ave NE
Cullman, AL 35055

Subject: **Soil Management Plan**
Former Greif Brothers Facility (Parcels A & B)
409 Second Avenue NE
Cullman, Cullman County, Alabama
Alabama Voluntary Cleanup Site #: 461-9496
Bullock Environmental, LLC Project #: 18-CULL01

Dear Mr. Charney:

Bullock Environmental, LLC (Bullock) presents the following Soil Management Plan in advance of potential grading activities to be completed at the above-referenced property (the "Site"). This plan details the process for removing onsite soil from designated areas of the Site, stockpiling the material on the Site, and managing excavated areas and materials generated from such excavations.

As described in the *Modified Cleanup Plan and Risk Assessment* report prepared on behalf of The City of Cullman and submitted to the Alabama Department of Environmental Management (ADEM), certain chemical of concern (COCs) were detected in onsite soil at concentrations exceeding applicable screening values (RSLs) published by the Environmental Protection Agency (EPA) and endorsed by ADEM. These COCs include the following.

The analytical data for the soil samples collected during this assessment were compared to the RSLs for industrial soil established by the EPA (revised May 2018). TCE was detected above the EPA-established RSL of 1.9 mg/kg in three soil samples (two from boring SB-1 and one sample from SB-3) located in the vicinity of former monitoring well MW-4. Those TCE concentrations ranged from 1.95 mg/kg (SB-1, -0-5') to 5.57 mg/kg (SB-1, 5-10'). It is notable that the material encountered in each of these locations was primarily gravel (with less surface area than native silty clay material), which could skew the results downward (i.e., surrounding soil may contain equal or higher concentrations).

TCE was also detected in four additional locations at concentrations exceeding the residential RSL of 0.41 mg/kg. Those concentrations were detected in soil borings SB-5, SB-8, SB-14, and BMW-8 with levels ranging from 0.345 mg/kg (SB-5) to 0.79 mg/kg (SB-8). BMW-8 and SB-14 are located adjacent to the former machine shop and TCE mixing tanks while SB-5 and SB-8 are located south of the original position of MW-4 (previously identified as the hazardous material storage area). Naphthalene was also detected in one soil sample (SB-6) at a concentration of 11.5 mg/kg, above the residential screening value (3.8 mg/kg).

With regard to the shallow soil samples collected on Parcel B, laboratory analytical results yielded the following at concentrations exceeding EPA industrial RSLs:

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- Arsenic was detected in five of the six shallow soil samples at concentrations exceeding the EPA RSL of 3.0 mg/kg in five of the six borings advanced in this area with concentrations ranging from 8.3 mg/kg (PBSB-5) to 47 mg/kg (PBSB-6);
- Total chromium was detected in five of the six shallow soil samples at concentrations exceeding the EPA RSL of 6.3 mg/kg in five of the six borings advanced in this area with concentrations ranging from 7.1 mg/kg (PBSB-5) to 117 mg/kg (PBSB-4); and
- Benzo(a)pyrene was detected above its associated RSL of 2.1 mg/kg in one soil sample (PBSB-1) at a concentration of 3.72 mg/kg.

Bullock notes that numerous additional compounds were present above their associated residential RSLs in the soil samples collected from Parcel B. These included chromium (PBSB-3), benzo(a)anthracene (PBSB-1, PBSB-4, and PBSB-6), benzo(a)pyrene (PBSB-2 through PBSB-6), benzo(b)fluoranthene (PBSB-1, PBSB-4, and PBSB-6), dibenzofuran (PBSB-1, PBSB-3, and PBSB-4), and indeno(1,2,3-cd)pyrene (PBSB-1).
In light of the detected concentrations of COCs in soil at concentrations exceeding applicable RSLs, handling and management of soil during future site preparation activities should be conducted as follows.

Handling of Soil During Excavation Activities

Onsite personnel should don Level D personal protective equipment (PPE) to minimize contact with potentially affected media. Beyond the standard PPE required for construction sites (hard hats, safety glasses, steel-toed boots, etc.), workers who handle the soil should do so with protective gloves, including but not limited to standard work gloves or impermeable material such as latex or nitrile. To minimize potential ingestion of particulates, field personnel should have on hand a water truck to maintain adequate moisture on the ground surface to mitigate fugitive dust.

It is also possible that workers may be exposed to vapors from subsurface soil sources in excavations extending more than one foot below grade in the designated Parcel A areas. Before advancing such excavations, onsite personnel shall measure organic vapors in ambient air with a photo-ionization detector or similar device suitable for the detection of both chlorinated and non-chlorinated VOCs. The excavation workers should also have dedicated personnel onsite to continue the measurement of such vapor concentrations throughout the course of the excavation work.

If vapor concentrations in ambient air exceed the action level of 10 parts per million (ppm) sustained for ten minutes within the designated work zone, field personnel will cease work until a determination is made regarding the need to upgrade PPE to include respiratory protection.

Management and/or Disposal of Soil During and Following Excavation Work

Onsite grading activities which may result in the generation of potentially regulated solid waste should include measures for segregation, analysis, and determination of its character by a representative designated by The City of Cullman. Evaluation of the waste characteristics may require laboratory analysis. In such cases, the representative designated by the City of Cullman will collect appropriate composite waste samples in accordance with ADEM Solid Waste Branch requirements and deliver them under chain-of-custody to an ADEM-approved laboratory for analysis. Upon receipt of the analytical results, the representative for The City of Cullman will make recommendations regarding the management of the material (i.e. retain onsite or transport offsite under an ADEM-approved Solid Waste Profile).

The material, once excavated, should be stockpiled in a designated area on the Site and covered with polyethylene until it is returned to designated excavation areas or managed as a waste in accordance with ADEM Solid Waste regulations. Onsite personnel are to maintain the polyethylene cover on the stockpiled soil and ensure it remains intact through daily inspections. This process should continue until all material is transferred back designated areas (through grading and placement detailed in construction plans) or transported offsite under an ADEM-approved Solid Waste Profile..

If you have any questions regarding the information presented above, please feel free to contact us at your convenience.

Sincerely,

BULLOCK ENVIRONMENTAL, LLC

Douglas A. Bullock, CHMM
Principal

cc: ADEM Redevelopment Section (Appendix F of Modified Cleanup Plan)